FINAL

Environmental Assessment

and

Finding of No Significant Impact

North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project

Photo courtesy of Michael Love & Associates

Shasta and Tehama Counties, California

January 2020

Project Proponent and Federal Lead Agency for NEPA
U.S. Fish and Wildlife Service
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080

Finding of No Significant Impact
North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project

Lead Federal Agency:
U.S. Fish and Wildlife Service
2800 Cottage Way, Room W-2605
Sacramento, CA 95825

The U.S. Fish and Wildlife Service (USFWS) proposes to grant funds, under the authority of the Central Valley Project Improvement Act's (CVPIA) Anadromous Fish Restoration Program (AFRP) and / or use other federal or state funds to implement a fish passage improvement project with willing landowners in the Battle Creek watershed. The project involves barrier removal and stream enhancements to restore fish passage to the upper limits of North Fork Battle Creek.

In 1999, a memorandum of understanding (MOU) was signed between the National Marine Fisheries Service (NMFS), U.S. Bureau of Reclamation, USFWS, California Department of Fish and Wildlife (CDFW) and Pacific Gas and Electric (PG&E), where parties agreed to pursue what came to be called the Battle Creek Salmon and Steelhead Restoration Project (BCRP). The BCRP is a cooperative, proactive undertaking by the public, interested parties, the Greater Battle Creek Watershed Working Group, state and federal agencies and PG&E to restore the anadromous fishery in the Battle Creek watershed. Upon completion, the BCRP will restore approximately 42 miles of habitat in Battle Creek and an additional six miles of habitat in its tributaries while minimizing the loss of clean and renewable energy produced by the hydroelectric project.

In 2005, a *Final Environmental Impact Statement / Environmental Impact Report* was issued for the BCRP describing impacts associated with specific restoration efforts (Jones and Stokes 2005). The BCRP involves modifications to Battle Creek hydroelectric facilities located on North Fork Battle Creek, South Fork Battle Creek and Baldwin Creek, including removing five diversions dams and two canal systems; constructing fish screens and ladders on three diversion dams; constructing a powerhouse bypass and two powerhouse tailrace connectors (to prevent the mixing of North Fork Battle Creek and South Fork Battle Creek waters); and constructing a fish barrier weir (to protect a trout hatchery from diseases carried by anadromous fish). Other elements include increasing instream flows; dedicating water rights for instream purposes at dam removal sites; and implementing adaptive management to ensure fisheries objectives are met. One of the components of the BCRP was the construction of the Eagle Canyon Diversion Dam Fish Screens and Fish Ladders which was completed in 2012. The Eagle Canyon Diversion Dam is located between the proposed action's two project sites. The Eagle Canyon Fish Ladder will be fully operational upon completion of this proposed action.

Two natural barriers, the Upper and Lower Barrier Sites, consisting of large boulders that originated from the canyon walls, have formed boulder jumbles in the creek that are preventing the passage of salmonids at all flows. The proposed action will provide access to an additional 4.36 stream miles of high-quality habitat along North Fork Battle Creek for winter-run and spring-run Chinook salmon and steelhead, with an additional 3.64 stream miles of moderate-quality habitat for steelhead made available by the BCRP. Fish passage improvement has been identified as priority actions in the CVPIA PEIS, AFRP Final Restoration Plan and CALFED's Ecosystem Restoration Plan, as well as several CDFW publications and plans.

The USFWS is the lead agency under the National Environmental Policy Act (NEPA).

Documents reviewed in the preparation of this Finding of No Significant Impact (FONSI) include:

- CVPIA Programmatic Environmental Impact Statement (PEIS)
- AFRP Final Restoration Plan
- Environmental Assessment (EA): North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project
- Eagle Canyon Fish Passage Improvements in Battle Creek: Lower and Upper Barrier Sites Final Designs
- Intra-USFWS Section 7 Evaluation Form
- Section 7 Programmatic Biological Opinion from NMFS
- Intra-USFWS Section 106 Consultation Compliance Memo

These documents are incorporated by reference, as described in 40 CFR 1508.13.

Alternatives

Several alternatives were described and discussed by the North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project Technical Advisory Committee for the two sites including:

Lower Barrier

1. Removal of Constricting Boulders (proposed action)
2. Pool and Chute Fishway
3. No Action

The proposed action was selected for the Lower Barrier Site because it provides suitable passage conditions over a range of flows and requires minimal inspection, maintenance and repairs.

Upper Barrier

1. Nature-Like Channel Regrade (proposed action)
2. Vertical Slot Fishway with Exit Tunnel
3. Super Active Baffle with High-Flow Channel Regrade
4. No Action

The proposed action was selected for the Upper Barrier Site because it provides suitable passage conditions over a range of flows and requires minimal inspection, maintenance and repairs.

Environmental Impacts

Based upon information contained in the EA, we have determined this federal action would not significantly affect the quality of the human environment. The basis for a FONSI is as follows:

As a result of formal consultation under the Endangered Species Act and inclusion of project design features / resource protection measures into the proposed action, short-term adverse impacts to federally listed or special-status species may occur, however long-term benefits would be realized. The short-term adverse effects would not significantly affect the recovery of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon or Central Valley steelhead. No adverse impacts to designated critical habitats are expected. The short-term negative impacts are minimal compared to the potential net increase in production due to the restored access to an additional 4.36 stream miles of high-quality habitat along North Fork Battle Creek for winter-run and spring-run Chinook salmon and steelhead, along with an additional 3.64 stream miles of moderate-quality habitat for steelhead.

1. Short-term, minor impacts to wildlife and fisheries may occur from implementing activities related to the fish passage improvement. However, resource protection measures have been incorporated into the proposed action to minimize effects. The intent of this project is to improve salmonid fish passage conditions. The proposed activities would remediate the current passage impediments by removing the natural boulder barriers in the project area.
2. The proposed action is not expected to have long-term adverse effects on wildlife or fisheries. The passage impediments will be removed and the replanting of impacted vegetation will ensure that the action does not result in a net loss of terrestrial habitat.
3. Resource protection measures have been incorporated into the project as project design features to minimize adverse effects on air quality, biological resources, cultural and tribal cultural resources, hazardous and toxic materials, hydrology and water quality, and soils and geology. The proposed action is expected to have no negative impact on flooding potential.
4. The proposed action is not expected to have adverse effects on wetlands or floodplains pursuant to Executive Orders 11990 and 11988.
5. Neither short- nor long-term adverse effects on human health or the environment, nor disproportionate adverse effects to low-income or minority populations are expected, pursuant to Executive Order 12898.

6. Based on field surveys and a cultural resources evaluation, the project would have no adverse effect on cultural resources. However, unknown subsurface cultural resources could be impacted during ground-disturbing activities associated with the proposed project. In the event subsurface cultural remains over 50 years of age are encountered during ground-disturbing activities, all work will cease at the general area of discovery and the USFWS regional archaeologist, or other lead agency archaeologist, will be notified immediately.

In addition to analyzing effects on biological and cultural resources, the EA evaluated the following aspects of the physical and human environment for potential significant effects as a result of the proposed action alternative:

- Aesthetics
- Agriculture Resources
- Air Quality
- Cumulative Impacts
- Environmental Justice
- Greenhouse Gas Emissions
- Hazardous and Toxic Materials
- Hydrology and Water Quality
- Land Use Planning
- Mineral Resources
- Noise
- Population Growth and Housing
- Public Health and Hazards
- Public Services
- Recreation
- Soils and Geology
- Transportation and Traffic

Project design features to minimize environmental effects were incorporated into the proposed action alternative to reduce impacts to a level below significance for those issues for which potentially negative impacts were anticipated.

Public Review and Comment

An initial public scoping notice was published in the legal sections of the Red Bluff Daily News and the Redding Record Searchlight on January 8, 2019. No public comments were received. A draft EA was mailed to the three adjacent landowners on September 18, 2019. A second public scoping notice was sent to the Greater Battle Creek Watershed Working Group on September 25, 2019 and published in the legal sections of the Red Bluff Daily News and the Redding Record Searchlight on September 27, 2019. Several comments were received and addressed in the final EA.

Conclusion

Therefore, the USFWS, as lead federal agency for the proposed AFRP funding of the North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project, has determined that the proposal does not constitute a major federal action significantly affecting the quality of the human environment under the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969 (as amended). As such, an Environmental Impact Statement is not required. An EA has been prepared in support of this finding and is available upon request to the U.S. Fish and Wildlife Service, Red Bluff Fish and Wildlife Office, 10950 Tyler Road, Red Bluff, CA 96080.

Donald Ratcliff, Central Valley Supervisor

4/16/2020
Date

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List of Acronyms and Abbreviations

AFRP	Anadromous Fish Restoration Program
APCD	Tehama County Air Pollution Control District
APE	Area of Potential Effect
AQMD	Air Quality Management District
BCRP	Battle Creek Salmon and Steelhead Restoration Project
BMP	Best Management Practice
CA	State of California
CALFED	CALFED Bay-Delta Program
CARB	California Air Resources Board
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulation
cfs	Cubic Feet per Second
CH	Critical Habitat
CH4	Methane
CHP	California Highway Patrol
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
CO2	Carbon Dioxide
CSA	Cotton, Shires and Associates
CVPIA	Central Valley Project Improvement Act
dbh	Diameter at Breast Height
DDT	Dichlorodiphenyltrichloroethane
DOORS	Diesel Off-Road On-Line Reporting System
DPS	Distinct Population Segment
DTSC	California Department of Toxic Substances Control
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Study
EPA	U.S. Environmental Protection Agency
ERP	Ecosystem Restoration Program
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FDCs	Flow Duration Curves
FONSI	Finding of No Significant Impact
fps	Feet per Second
GHG	Greenhouse Gas
GPS	Global Positioning System
HEC-RAS	Hydrologic Engineering Center River Analysis System
LBS	Lower Barrier Site
LEQ	Energy-Equivalent Level
MLA	Michael Love & Associates
MOU	Memorandum of Understanding
N2O	Nitrous Oxide
NAHC	Native American Heritage Commission
NEIC	Northeast Information Center
NEPA	National Environmental Policy Act
NFBC	North Fork Battle Creek
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NSVAB	Northern Sacramento Valley Air Basin
OHWM	Ordinary High Water Mark
PCE	Primary Constituent Element
PEIS	Programmatic Environmental Impact Statement
PERP	Portable Equipment Registration Program

PG&E	Pacific Gas & Electric
PM10	Particulate Matter less than 10 Microns in Diameter
psi	pound-force per square inch
RPM	Resource Protection Measure
RWQCB	Central Valley Regional Water Quality Control Board
SCAQMD	Shasta County Air Quality Management District
SR	State Route
Sub Terra	Sub Terra Consulting
SWPPP	Storm Water Pollution Prevention Plan
TAC	Project Technical Advisory Committee
TCAPCD	Tehama County Air Pollution Control District
TES	Tehama Environmental Solutions, Inc.
UBS	Upper Barrier Site
USACE	U.S. Army Corps of Engineers
Reclamation	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Project Title:

North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project

Lead Agency Name and Address:

The U.S. Fish and Wildlife Service (USFWS) is the lead agency under the National Environmental Policy Act (NEPA). Contact information for the lead agency is listed below:

U.S. Fish and Wildlife Service

Ms. Laurie Earley, Supervisory Fish Biologist
Red Bluff Fish and Wildlife Office
10950 Tyler Road
Red Bluff, CA 96080
(530) 527-3043, ext. 262
laurie_earley@fws.gov

Project Location:

The project is located within Eagle Canyon on North Fork Battle Creek and Digger Creek, at approximately 15 river miles upstream of the confluence with the Sacramento River, west of Manton, in Shasta and Tehama Counties, California (Figure 1). Specifically, the project is located in Sections 24, 25, and 36, Township 30 North, Range 1 West, Mount Diablo Base and Meridian; within the 7.5-minute United States Geological Survey (USGS) Shingletown quadrangle map (Figure 2). The project includes the potential work areas for the two fish barrier modification sites including potential staging areas and access roads (Figure 3).

General Plan Designation:

There are two parcels to the north of Eagle Canyon in Shasta County and two parcels south of the canyon in Tehama County. The Shasta County parcels are in the Eastern Upland Planning area boundary and the General Plan designation for the parcels is Rural Residential (RB). The General Plan land use designation for the two Tehama County parcels within the project site is Upland Agriculture (U-A).

Zoning:

One Shasta County parcel is zoned Unclassified (U) and the second parcel is split-zoned Unclassified / Habitat Protection (U), (HA). The Tehama County parcels are zoned Agricultural / Upland District (AG-1).

1.0 Introduction

1.1 Overview

Under the authority of the Central Valley Project Improvement Act (CVPIA), USFWS has developed an Anadromous Fish Restoration Program (AFRP) with the broad goal of doubling natural production of anadromous fish (those that spawn in fresh water but spend their adult life in salt water) in the rivers and streams of the Central Valley.

The Battle Creek Watershed is a focal area for restoring populations of Chinook salmon and steelhead in the Sacramento River Basin. In 1999, a memorandum of understanding (MOU) was signed between the National Marine Fisheries Service (NMFS), U.S. Bureau of Reclamation (Reclamation), USFWS, California Department of Fish and Wildlife (CDFW) and Pacific Gas and Electric (PG&E), where parties agreed to pursue what came to be called the Battle Creek Salmon and Steelhead Restoration Project (BCRP). The BCRP is a cooperative, proactive undertaking by the public, interested parties, the Greater Battle Creek Watershed Working Group, state and federal agencies and PG&E to restore the anadromous fishery in the Battle Creek watershed. Upon completion, the BCRP will restore approximately 42 miles of habitat in Battle Creek and an additional six miles of habitat in its tributaries while minimizing the loss of clean and renewable energy produced by the hydroelectric project.

The AFRP and other ecosystem restoration programs have recommended a fish passage improvement project (hereafter referred to as project, proposed project or proposed action) in the Battle Creek watershed. The objective of the project is to work with willing landowners to modify two natural fish passage barriers on North Fork Battle Creek to allow three federally listed salmonid species access to optimal habitat that will be made available through the BCRP. Improving fish passage at these sites will restore anadromous fish access to historic spawning, rearing and holding stream habitat. The project is being funded by the USFWS through the AFRP and other federal and state funds including the Proposition 50 CALFED Ecosystem Restoration Program.

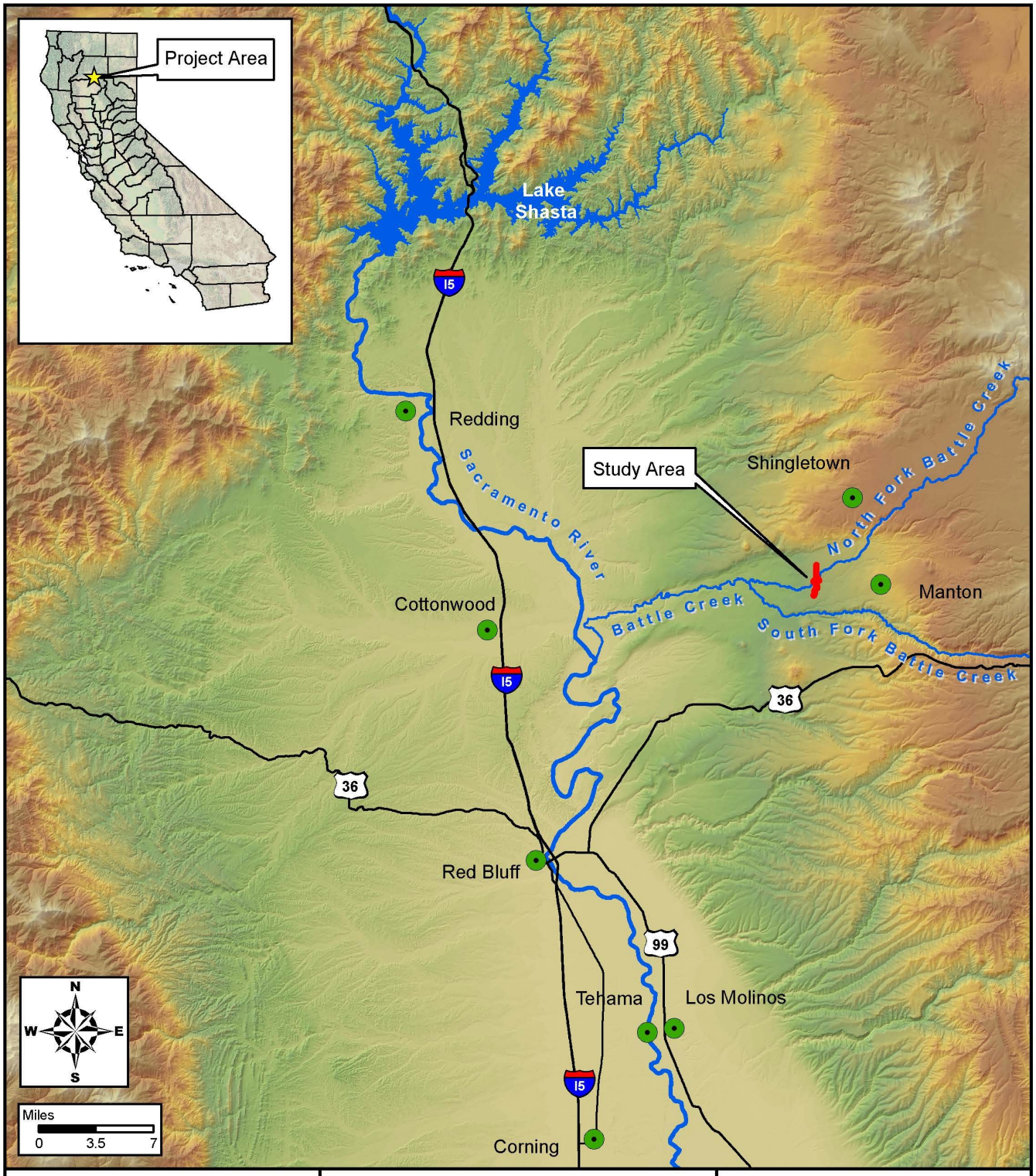
1.2 Purpose of This Document

This Environmental Assessment (EA) was prepared by Tehama Environmental Solutions, Inc. (TES) under agreement number F18AP00099 with the USFWS. The EA has been prepared to comply with NEPA (42 U.S.C. 4331 et seq.) The USFWS is the lead agency under NEPA.

The purpose of this EA, under NEPA, is to determine whether the proposed action would result in significant effects on the environment which would then require the preparation of an Environmental Impact Statement (EIS), or alternatively, whether the level of effects on the environment are such that a Finding of No Significant Impact (FONSI) can be supported by the federal lead agency. This EA describes the environmental resources in the project area, analyzes the effects of the proposed action and a No Action alternative on the environment, and proposes avoidance and minimization measures as design features to reduce any effects to less than significant levels.

1.3 Project Location

The proposed project is located within Eagle Canyon on the North Fork Battle Creek and Digger Creek, at approximately 15 river miles upstream of the confluence with the Sacramento River, west of Manton, in Shasta and Tehama Counties, California (Figure 1). Specifically, the project is located in Sections 24, 25, and 36, Township 30 North, Range 1 West, Mount Diablo Base and Meridian; within the 7.5-minute United States Geological Survey (USGS) Shingletown quadrangle map (Figure 2). The project area includes the potential work areas for the two barrier modification sites including potential staging areas and access roads (Figure 3).



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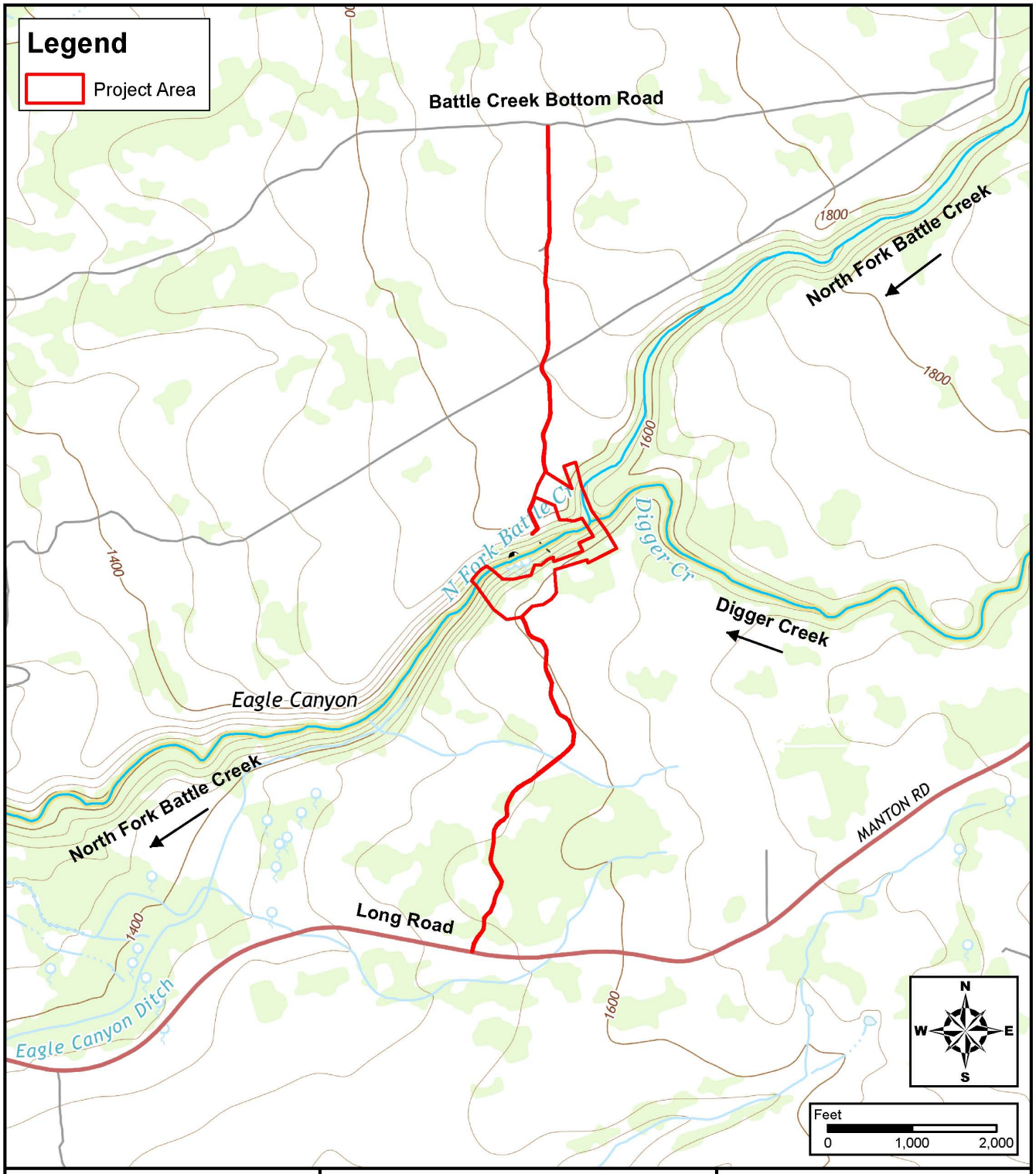
North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project

Shasta and Tehama Counties, California

March 2019

FIGURE 1
Site Vicinity Map



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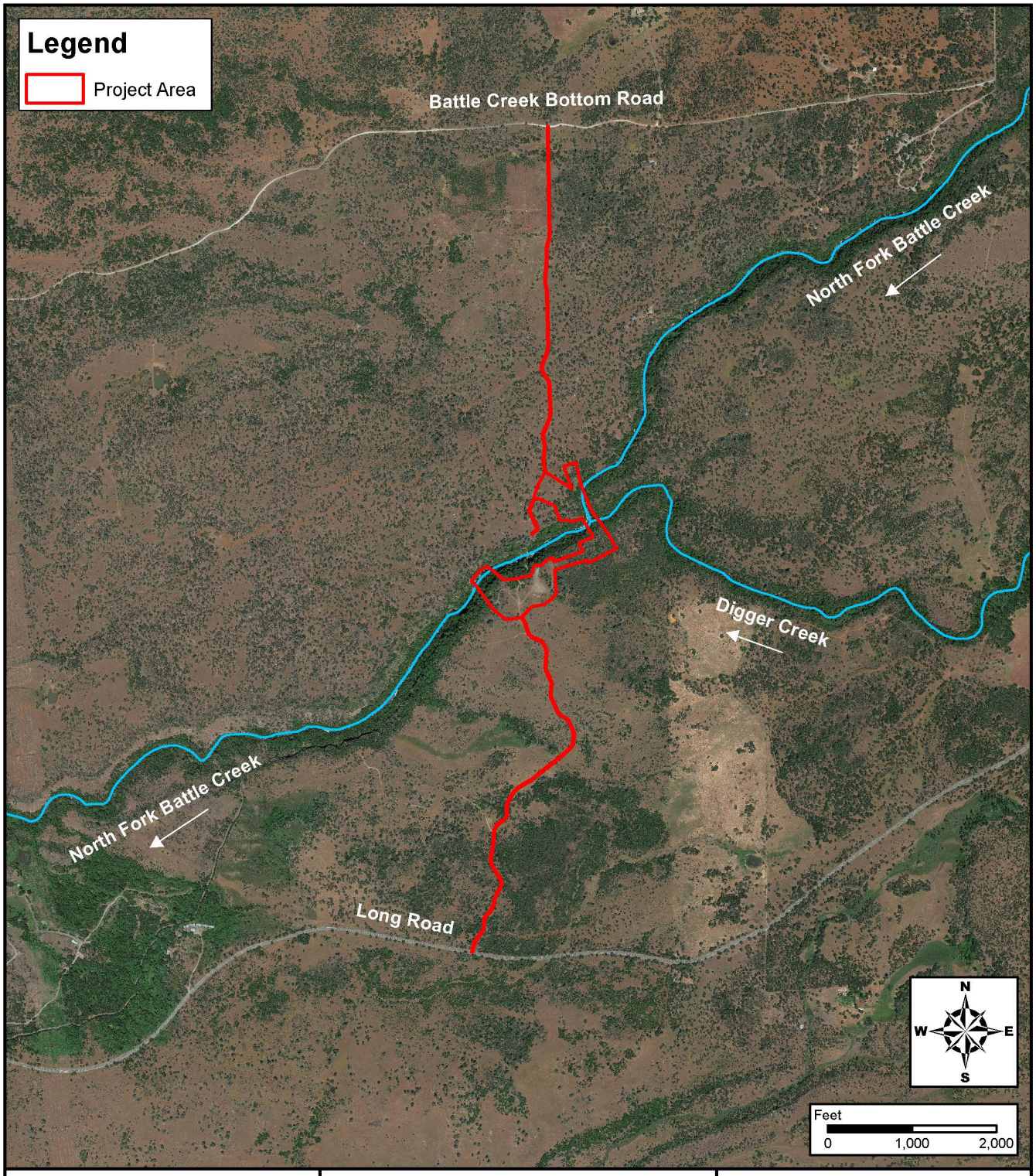
Shasta and Tehama Counties, California

March 2019

FIGURE 2

Site Location Map

SOURCE: USGS, 7.5 Minute, California-Tehama Co., SHINGLETOWN QUADRANGLE



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North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project

Shasta and Tehama Counties, California

March 2019

FIGURE 3

Site Aerial Photo

PHOTO SOURCE: Google Earth, 5/25/2017

Figure 4. Aerial View of the Lower Barrier. Photo date: March 01, 2016. Photo courtesy of Michael Love and Associates.

Figure 5. View of the Lower Barrier, Looking Upstream. Photo date: February 29, 2016. Photo courtesy of Michael Love and Associates.

Figure 6. View of the Lower Barrier, Looking Downstream. Photo date: June 15, 2015. Photo courtesy of Michael Love and Associates.

Figure 7. Aerial Vew of the Upper Barrier, Looking Upstream. Photo date: June 08, 2016. Photo courtesy of Michael Love and Associates.

Figure 8. View of the Upper Barrier, Looking Downstream. Photo date: June 15, 2015. Photo courtesy of Michael Love and Associates.

Figure 9. View of the Upper Barrier, Looking Upstream. Photo date: June 15, 2015. Photo courtesy of Michael Love and Associates.

Figure 10. View of North Fork Battle Creek Canyon Looking Southeast. The upland terrace can be seen in the background. Photo date: August 15, 2018

Figure 11. View of South Upland Terrace, Looking South. Site is in the vicinity of where the crane would be positioned for the Lower Barrier site. Photo date: August 22, 2018.

Figure 12. View of the Groundwater Seep Wetland, Looking Southeast. The feature is composed of seeps and waterfalls on the south canyon wall. Photo date: August 22, 2018.

1.4 Purpose and Need for Action

NEPA regulations require the federal lead agency to describe the underlying purpose and need to which the agency is responding, when considering a project. The information in this section addresses both of these requirements by providing information as to why USFWS is considering the proposed project.

Purpose

The purpose of the proposed action is to modify two natural fish passage barriers on North Fork Battle Creek to allow three federally listed salmonid species access to optimal habitat that will be made available through the BCRP. The two barriers are composed of large boulders and have been documented as complete barriers to upstream salmonid fish migration.

Need

Battle Creek is an important tributary to the Sacramento River, especially for the recovery of salmonids in California's Central Valley. Several restoration actions and projects have been underway in Battle Creek, focusing on habitat for three federally listed species of salmonids including endangered winter-run Chinook salmon *(Oncorhynchus tshawytscha)*, threatened spring-run Chinook salmon and threatened steelhead *(Oncorhynchus mykiss)* (National Marine Fisheries Service et al. 1999). Additionally, a 100-year-old hydroelectric system of dams, canals, and powerhouses operates in the Battle Creek watershed. PG&E currently owns these power generation facilities. The restoration actions and projects have worked to obtain a way for power generation to occur while also providing adequate temperatures and flows needed to restore populations of salmonids within the creek.

The purpose of the BCRP is to restore 42 miles of habitat in Battle Creek and 6 miles in the tributaries, while minimizing the loss of renewable energy. The Battle Creek Hydroelectric Project, consists of multiple dams, diversions, canals, and powerhouses, of which eight dams fall within the BCRP area. In order to achieve the goals of the BCRP, five dams will be removed and new fish screens and ladders will be constructed at the remaining three dams. Additionally, water transfers between North Fork Battle Creek and South Fork Battle Creek will be eliminated and PG&E will provide higher instream flows. The agreement for the BCRP occurred with the signing of the 1999 MOU (National Marine Fisheries Service et al. 1999) between NMFS, Reclamation, USFWS, CDFW, and PG&E.

Natural barriers have been documented to be present within the Battle Creek watershed (Thomas R. Payne and Associates 1991, 1998; Brown and Newton 2002; Earley 2016). The MOU included fish passage conditions in the monitoring section of the document (National Marine Fisheries Service et al. 1999). Additionally, it noted that an adaptive management plan was needed for the BCRP. The draft adaptive management plan was finished in 2004 and was intended to be used to guide monitoring and to make further adjustments to PG&E operations (Terraqua Inc. 2004). The Battle Creek adaptive management plan broke the goal into three objectives: population, habitat and passage. Passage Objective 3 explained the adaptive management approach to address the natural barriers within Battle Creek (Terraqua Inc. 2004). The objective is to provide reliable upstream passage of adult salmon and steelhead to their appropriate habitat over natural obstacles within the BCRP area, while maintaining an appropriate level of spatial separation among the runs (Terraqua Inc. 2004). The objective listed the monitoring approaches, the trigger events, response, response limits, reporting and responsibilities. If an obstacle impedes salmonids from accessing preferred habitat, the response stated that the barrier should be modified, and if it could not be modified, water acquisition was the next option (Terraqua Inc. 2004). It was listed that the resource agencies were responsible for either providing or seeking funding to complete the monitoring and any possible modifications needed (Terraqua Inc. 2004).

It is important to provide access above Eagle Canyon Dam, as this reach has been identified as the optimal habitat for winter-run Chinook salmon. Two barriers have been documented to prevent passage (Brown and Newton 2002; Bottaro et al. 2013; Earley 2016), one below Eagle Canyon Dam, herein referred to as the Lower Barrier Site

(LBS) located at stream mile 5.06, and one above the dam, referred to as the Upper Barrier Site (UBS) located at stream mile 5.41. Both sites are located within Eagle Canyon, which is a small slot canyon (Cotton, Shires and Associates, Inc. 2017). The barriers consist of large boulders that need to be physically modified in order to provide fish passage. Previous efforts by CDFW in 1997 and 2012 have failed to improve passage at the LBS and no attempts have been made to modify the UBS.

As a result of the needs identified above, the objectives for this proposed project are to:

- increase water depth at low fish passage flows,
- reduce channel velocity,
- reduce vertical drops,
- increase existing pools or create new pools,
- reduce the overall slope of the channel, and
- create variable swim paths.

1.5 Battle Creek Technical Team

The project is being implemented by the USFWS in cooperation with willing private landowners and the project Technical Advisory Committee (TAC). The TAC includes representatives from USFWS, NMFS, CDFW, Central Valley Regional Water Quality Control Board (RWQCB), U.S. Army Corps of Engineers (USACE) and several private consulting firms.

1.6 Regulatory Framework

In addition to NEPA, the proposed project is subject to a variety of federal, state and local laws, regulations and policies as identified in Section 6 Compliance with Environmental Laws and Regulations of this document. The proposed project will require several federal, state, and local agency permits and approvals prior to implementation (Table 1).

Table 1. Required Permits and Approvals

PERMITS AND APPROVALS	AGENCY
FEDERAL	
Clean Water Act Section 404 Permit	U.S. Army Corps of Engineers
Endangered Species Act Section 7 Consultation	National Marine Fisheries Service & U.S. Fish and Wildlife Service
STATE	
Clean Water Act Section 401 Water Quality Certification	Central Valley Region Water Quality Control Board
California Endangered Species Act	California Department of Fish and Wildlife
Construction General Stormwater Permit	California State Water Resources Control Board
Lake or Streambed Alteration Agreement	California Department of Fish and Wildlife
National Historic Preservation Act Section 106 Consultation	California Office of Historic Preservation
National Pollution Discharge Elimination System Dewatering And Other Low Threat Discharges To Surface Waters Permit*	Central Valley Regional Water Quality Control Board
LOCAL	
Shasta County Fugitive Dust Permit	Shasta County Air Quality Management District
Tehama County Fugitive Dust Permit	Tehama County Air Pollution Control District
Building and Grading Permits**	Tehama County Public Works
Building and Grading Permits**	Shasta County Resource Management Department

* May be required depending on the method of dewatering proposed.
** May be required.

2.0 Proposed Action and Alternatives

2.1 Alternative Development

Multiple alternatives were identified and evaluated as possible long-term fish passage solutions for both barrier sites. These alternatives are documented in an *Alternatives Analysis Report* that was prepared for the project (Michael Love & Associates 2017a). The alternatives were analyzed based on numerous factors including fish passage, operations and maintenance, location and condition of existing dam, stream characteristics, stream hydrology, biological criteria and economics. The project was developed by the TAC as a collaborative effort with participation from many different disciplines represented by state and federal public and private entities.

2.2 Lower Barrier Site

The two alternatives that were described and discussed by the TAC for the LBS included:

1. Removal of Constricting Boulders (proposed action)
2. Pool and Chute Fishway

The proposed action was selected for the Lower Barrier Site because it provides suitable passage conditions over a range of flows and requires minimal inspection, maintenance and repairs.

2.2.1 Alternative 1 – Proposed Action

TAC members agreed that the preferred alternative would modify the existing channel in the vicinity of the primary drop through removal of boulders to improve fish passage conditions. Michael Love & Associates (MLA) was contracted by CDFW to prepare designs to the 100 percent level (Appendix A) along with a *Basis of Design Memorandum* (Michael Love & Associates 2017b).

Design Overview

The existing LBS primary drop is a narrow chute that drops into the shallow and narrow pool (Pool 4). Boulders on the south bank and the bedrock wall on the north bank constrict both the chute and pool. The constriction creates conditions for extreme turbulence and high velocities across the entire wetted channel and throughout the water column. The extreme turbulence is likely a primary condition that blocks fish passage.

The LBS design includes removing approximately 190 cubic yards of boulders and a minor amount of bedrock. This involves removing boulders (B71, B131, B72), Complex boulders and additional boulders within Pool 4 and the primary drop chute. The rock would be lifted out of the canyon and disposed of at the top of the canyon rim or hauled offsite. Removing the large boulders, along with some minor bedrock modification, would widen the primary drop, create multiple pathways for fish to ascend, and widen Pool 4, which would create more pool volume. Reducing the constriction and increasing the pool volume should result in less turbulence, decreased velocity, and additional holding areas for fish.

As part of the boulder removal, the design includes the creation of two new chutes (referred to as the north and south chutes) that extend upstream of Pool 4. The north chute is intended to provide a low-flow passage path while at higher flows the south chute is anticipated to have better passage conditions. The north chute is anticipated to be constructed within bedrock. Therefore, it is anticipated that the construction would be able to meet the design dimensions for the chute, as presented in the design drawings. The north chute is a trapezoidal channel with a bottom width of approximately two feet and a depth of at least one foot. The side slopes would vary.

The profile includes two grade breaks. The initial slope, extending upstream from Pool 4, is approximately 80 percent and eight feet long. Although steep, it is anticipated that this lower section would be backwatered by Pool 4 under most flow conditions. The middle section of the north chute has a slope that is approximately 25 percent and is approximately 19 feet long. Although this is still steep, passage over similar features downstream of the LBS within Eagle Canyon exist and provide passage. The final section is approximately 11 feet long and has no slope. Field adjustments may be made based on conditions revealed during rock removal.

The south chute is shorter than the north chute but has similar design characteristics. The material comprising the south chute is unknown (boulders verses bedrock), and field adjustments may be required. The general approach is to construct the chute with a minimum 2.5 feet width and with a minimum depth of one foot. Like the north chute, there are two profile grade breaks. The downstream section, extending from Pool 4, has a slope of 80 percent and is approximately eight feet long. The lower section is anticipated to be backwatered at most flows. The middle section has an approximate slope of 25 percent and is approximately eight feet long. The upstream section is approximately eight feet long and has a 10 percent slope. Pool 4 is anticipated to double or triple in width. This increased width would create low-velocity areas for fish to approach the primary drop and stage their attempt to move upstream.

Construction

Site access is extremely limited to the LBS. A crane (removal system) would be used to deliver materials and equipment to the site and to remove rock from the site. The lifting capabilities of such systems varies, but 8,000 pounds is a conservative estimate.

Prior to beginning the rock removal process, rockfall hazards would be mitigated. This would likely involve scaling off smaller rocks and anchoring in-place, with rock bolts, larger rocks that are at risk of falling during construction. The *Engineering Geologic Investigation Technical Memorandum* (Cotton, Shires and Associates, Inc. 2016) provides additional rock stability details.

Rock would be removed by first drilling holes into the boulders and bedrock and then using hydraulic rock splitters, or other techniques to break the rock into pieces that are small enough to be lifted by the removal system. No blasting will occur. Existing trees in the stream riparian area, along the canyon walls, and up on the canyon rim would need to be removed and / or limbed to accommodate the removal system. This includes trimming the trees present along the south bank of Battle Creek at the LBS.

A dewatering system would be installed to bypass streamflow around the worksite. This may not need to be installed until the larger boulders that are outside of the wetted channel are removed. It is assumed that the water bypass would be installed in mid-summer when flows are close to the minimum bypass flow of 35 cubic feet per second (cfs). Materials for the dewatering system may be brought in by the removal system or by helicopter.

The project schedule is dependent on acquiring all environmental permits and landowner agreements, and favorable stream flows in mid-summer. It is anticipated that construction of one of the barrier sites will occur in 2020 and the other barrier site will occur in 2021. If all environmental permits and landowner agreements are not acquired, or if mid-summer stream flows are too high to accommodate the stream diversion system, the project schedule may be delayed for one to several construction seasons.

Anticipated Fish Passage Performance

An existing conditions two-dimensional hydraulic model based on the 90 percent design drawings was developed and executed using a wide range of flows. The water surface profiles flows would increase from 35 cfs (low fish passage design flow) to 382 cfs (high fish passage design flow). To assess the change in flow conditions associated with rock removal, maps of a hydraulic model output were created for existing and proposed conditions for 35 cfs, 120 cfs, 250 cfs, 382 cfs and 1,600 cfs.

At the low passage design flow of 35 cfs, the north chute provides sufficient depth for passage, while the south chute does not. At all other flows the south chute provides sufficient depth and lower water velocities, making it the preferred passage route. At flows from 35 cfs to 250 cfs, the analysis predicts that even smaller, weaker swimming Chinook salmon could swim through the north chute and south chute, respectively. Based on the spring-run Chinook length data provide by USFWS for Battle Creek, 90 to 100 percent of the fish would be able to swim through one of the two chutes at flows between 35 cfs and 250 cfs. At the high passage design flow of 382 cfs, only the larger (top 30 percentile) Chinook salmon are predicted to have the swimming abilities to burst through the velocities in the south chute, while the north chute would be too swift for any fish to pass. This design is considered to provide passage from 35 cfs to 250 cfs, while larger salmon and steelhead would be able to pass at even higher flows.

Expected Design Life

The LBS design is anticipated to function as constructed for an indefinite period, which could be for hundreds of years. The exact life expectancy is uncertain and dependent on future rockfall. Rockfall may occur at any time, and can be triggered by strong ground shaking from earthquakes. In most cases, maintenance in the form of rock removal could restore fish passage functionality.

Anticipated Maintenance Requirements

The LBS design would likely require little to no debris or sediment removal. There is the possibility that a large log or other woody debris could become lodged between rocks in an orientation that creates undesirable passage conditions, requiring removal. This has occurred at other locations within North Fork Battle Creek.

Access for inspection and maintenance would be along the south bank of the channel. Improved site access, from the flume catwalk down to the channel, could be installed if desired and acceptable to PG&E. Removal of debris or demolition of rock fallen into the channel needing to be removed would be infrequent, but would likely need to occur during the low-flow season, after the fish migration period. Therefore, it may be difficult to perform timely maintenance.

The LBS design has a low susceptibility to rockfall hazards. In the event that rocks do fall into the channel after construction, they would likely only cause minor changes to fish passage hydraulics and could even improve passage conditions. There is the potential for very large boulders to fall onto the chute or into the pool, creating undesirable passage conditions that require repair in the form of rock removal.

The LBS is generally not susceptible to damage from boulders that could be mobilized by flow. Flows that mobilize them are likely infrequent and involve extreme depths and velocities. Boulders in transport during these events are expected to pass through the LBS without coming to rest, similar to existing conditions. The design is also not considered susceptible to scour. Field observations of the channel upstream of the project suggest that the channel bed is primarily bedrock, with some large boulders. This material is anticipated to be stable and resistant to scour and headcutting, extending to the next upstream boulder drop.

If a large boulder were to move or fall into the channel reach and create undesirable fish passage conditions, then removal of the boulder would be necessary. Depending on the size, location and orientation of the boulder, several methods could be used to break the rock into small pieces rather than remove it completely. If removal from the canyon is necessary, then large equipment (e.g. crane) would be necessary.

Post-Construction Monitoring

<u>As-built Survey</u>

Immediately following construction, or as construction is finalized, a survey of flow paths and other key channel elements could be completed. This would form the basis for follow up surveys. Due to the relatively high flows and dangerous conditions in the channel much of the year, follow up surveys would be conducted during the low-

flow period. The follow up surveys should focus on the same key flow paths and channel elements and capture any new developments.

Startup Monitoring

Channel adjustments around existing boulders in response to the implemented project is most likely to occur following the first several high-flow events. During the year following construction, the site could be inspected following each major flow event (> 1,000 cfs) and any changes to the site configuration and flow patterns be noted. In addition to visual inspection, time-lapse cameras could be installed at the LBS to document passage conditions at various flows. This monitoring could be extended if there are only a few high-flow events during the first year, or if channel adjustments are noted.

Biological Monitoring

Monitoring for fish migration through the project site would help indicate whether it is successful. Adult Chinook salmon and steelhead currently reach Pool 2 at the LBS. The monitoring could include field spawning and snorkel surveys upstream and downstream of the LBS to document passage success. Another means to document passage conditions is through implementing a study plan that challenges individual fish to pass through the site. This may involve transport and release of radio-tagged adult Chinook salmon immediately downstream of the site and monitoring their passage attempts. This could be conducted across a range of flows.

Inspection and Maintenance

After the first year, site inspection may occur less frequently, possibly only after the high-flow season. The inspection would be focused on identifying any debris that has accumulated and potentially negatively impacts to passage conditions. It would also be used to identify any rockfall or boulder shifting / scour that has changed passage conditions.

Design Limitations and Uncertainties

The complexity of the LBS and nature of the selected approach for restoring fish passage introduces several notable design limitations and uncertainties for the LBS project. The primary limitation is with respect to the unknown subsurface conditions, boulder interactions related to stability, and presence, or lack of bedrock. The design, as presented, is based on the best available data and observations from multiple site visits. The data were captured and site visits occurred during varying flow conditions. Boulders were individually studied and their relationship with adjacent boulders noted, but uncertainty remains with how the boulders would behave once the removal process begins and what additional boulders or bedrock may be exposed once the surface boulders are removed.

For example, during the last site visit, of many to the LBS, a new sieve had formed in a location that had previously appeared comprised of interlocked boulders, cobbles and gravel. The sieve formed near the upstream end of the south chute, allowing flow to be conveyed under boulder B75, among others. Although this new sieve did not result in a design change, it demonstrates the unpredictable nature of the project site.

Related to the above discussion, the actual final dimensions of Pool 4 after construction may be smaller than shown in the design drawings. This may result for a couple of reasons. First, the interdependence of indicated boulders to be removed may be significant enough that removal of the boulders could cause the south bank to become unstable. There are many boulders outside the approximate limits of grading that have diameters in the tens of feet that should remain in place. Second, the boulders that are indicated to be removed may not go as deep as indicated by the finish grade contours. This is less of a concern because any in-situ boulder buried under the current boulders could be modified or removed to meet the design intent.

Construction of the two chutes is also related to the unknown subsurface concerns. It is assumed that the north chute would be constructed within bedrock. If the bedrock is not present, then the chute would need to be

constructed through boulders, which may be less stable and require more field adjustments during construction than bedrock. The south channel would be constructed into an unknown material (boulder or bedrock). It is assumed that the chute would be constructed out of boulders, either in-situ or placed. The long-term stability of the chute is uncertain.

Substantial instability in the upstream end of the channel modification could cause upstream channel adjustments in the form of headcutting. Although this is a possibility, it is anticipated that any headcut would be arrested by existing large boulders or bedrock. If a headcut propagates upstream, potential exists for an increase in the water surface drop at the next upstream boulder constriction, potentially degrading passage conditions. If field conditions encountered during construction differ than those assumed in design, field modifications may need to be made.

The design condition hydraulics also cause uncertainty. The hydraulics are complex and subtle differences between the design condition and the final project configuration could negatively affect fish passage hydraulics, especially turbulence. A lower water level in Pool 4 than anticipated would also require fish to navigate a higher overall water surface drop to reach Pool 5. Care would be taken during construction to avoid excess removal of boulders at the downstream end of Pool 4 to ensure the anticipated backwater from Pool 4 is achieved.

Although these uncertainties exist, the design intent is clear and field adjustments during construction can mitigate these uncertainties to the extent practical. Additional hydraulic analysis by the fish passage engineer during construction may be needed to characterize resulting conditions associated with contemplated field changes. During construction, it would be essential for the contractor to work directly with the fish passage engineer on a daily basis so that field adjustments can be made that would result in the best project possible.

2.2.2 No Action Alternative

Under this alternative, no changes would occur to the LBS. Upstream fish passage would continue being impeded by the existing boulder barrier. Optimal upstream habitat would continue to be inaccessible to anadromous fish, including several federally listed species. The potential contribution to recovery of these species would not occur.

2.2.3 Alternatives Considered but Dismissed

The following additional alternative that was developed in the alternatives analysis and considered by the TAC was dismissed due to the following reasons.

Alternative 2 - Pool and Chute Fishway

This alternative would inherently require more inspection and maintenance throughout year, and would require rehabilitation from time to time. Lack of maintenance and rehabilitation could jeopardize passage over one or more migration seasons, detracting from efforts to restore salmon populations within North Fork Battle Creek.

2.3 Upper Barrier Site

The four alternatives that were described and discussed by the TAC for the UBS included:

1. Nature-Like Channel Regrade (proposed action)
2. Vertical Slot Fishway with Exit Tunnel
3. Super Active Baffle with High-Flow Channel Regrade

The preferred (Alternative 1) was selected for the UBS because it provides suitable passage conditions over a range of flows and requires minimal inspection, maintenance and repairs.

2.3.1 Alternative 1 – Proposed Action

TAC members agreed that the preferred alternative would involve:

A nature-like channel regrade to provide passage over the existing primary drop. It would involve removal of boulders to a set grade followed by placing boulders, and possibly shaping exposed bedrock along the channel bed to create a step-pool and cascade-type channel. Rock placement and size of water surface drops are based on similar types of channel reaches in North Fork Battle Creek that have been considered passable for adult salmon and steelhead. MLA was contracted by CDFW to prepare designs to the 100 percent level (Appendix A) along with a *Basis of Design Memorandum* (Michael Love & Associates 2017b).

Design Overview

The design objective is to regrade the channel to create hydraulic conditions that are within the swimming and leaping abilities of the target fish at passage design flows. The regrade and typical boulder arrangements for the UBS design were based on a reference reach approach, which is similar to the stream simulation design approach described in California Department of Fish and Game (2009).

For the UBS design, reference reaches within North Fork Battle Creek that have a similar overall slope (ten percent), and are considered suitable for fish passage at some or all migration flows, were studied from the ground and using aerial photography techniques. The primary reference reach is located between Eagle Canyon Diversion Dam and Digger Creek. A secondary reference reach, a short distance downstream of the LBS, was also studied. The reference reach observations indicate how hydraulic controlling structures form and remain relatively stable, which becomes the basis for the regrade design. The reference reaches are comprised of boulder steps and cascades.

The UBS design requires the removal of approximately 720 cubic yards of boulder material, and potentially some bedrock. Most of the rock would be lifted out of the canyon and disposed of at the top of the canyon rim or hauled offsite. The remainder of the material would be reused to construct the new regraded channel. The regraded channel extends approximately 55 feet upstream and downstream of the existing primary drop, is located along the right side of the canyon (looking downstream), and overcomes approximately 11 vertical feet. The overall slope is approximately ten percent. Five channel-spanning rock structures, herein referred to as hydraulic structures, would control the channel grade and the water surface profile. The hydraulic structures include boulder steps and bedrock chutes, which are similar to reference reach structures. The hydraulic structures create water surface drops between two and three feet in height. Each hydraulic structure is designed with three different flow paths, each with specific elevations or specific relationships to other defined flow path elevations, including vertical tolerances.

The purpose of the different flowline elevations is to create variable swimming paths. As flows increase, some paths may become less favorable for passage while others improve. To ensure that the hydraulic structure functions as designed, each structure must have its voids sealed with smaller material so that water does not pipe through the structure. There are two design configurations for boulder steps: Type A) boulder constriction and Type B) boulder double slot. Type C refers to bedrock chutes. It is important to note that the layout presented is considered conceptual. The layout is based on the best information available during design. Much is unknown with respect to the subsurface boulder and bedrock layout. The different hydraulic structure “types” are to be used as a guide to fit field conditions during construction. Regardless of the final plan layout of the hydraulic structures, they must still perform the role of grade and water surface control, and therefore the flowline elevations still apply.

The Type A and Type B hydraulic structures assume the placement of large rock up to 8,000 pounds, which have diameters between four and five feet. When feasible, in-situ boulders and bedrock should be used. The drawings have already indicated several in-situ boulders specifically to remain: boulders B14, B15, B30, B63 and B59. In-situ boulders may need to be modified to help meet the specified flowline elevations and overall design intent.

The Type A hydraulic structure (boulder constrictor) includes placing two properly shaped "constriction" boulders against one another to create a narrow slot that allows a limited amount of flow-through. "Footer" rocks are placed below the constriction boulders, as needed, to limit scour and support the boulders. In many cases, the footer rocks may be in-situ boulders shaped to serve as footers. "Buttress" rocks are placed on the downstream side of the constriction rocks to hold them in place. This hydraulic structure can create two to three feet of drop across it.

The Type B hydraulic structure (boulder double slot) is designed with a relatively flat "sill" boulder placed lower than the "keystone" boulders flanking it. A taller "dividing" boulder is placed upstream of the sill boulder to split the flow. As a result, water begins to draw down as it goes around the dividing boulder, before spilling into a receiving pool. This spreads the water surface drop over a longer distance so that fish can leap onto the sill boulder and swim through the remaining water surface drop. The sill boulder creates a three- to four-foot-wide broad crested weir that creates more hydraulic capacity than the boulder constriction structure. The overall water surface drop across this structure could be up to three feet, with the drop spread out as described above. Buttress rocks and footer rocks are also used to give the structure stability. Below each hydraulic structure flowline, a pool would be constructed. The pool's minimum residual depth would be two feet.

The Type C hydraulic structure (bedrock chute) would be used in the event that bedrock is encountered with suitable elevations to create the flowlines. The bedrock would be shaped to create multiple chutes each having approximately two feet of drop across them. The chute lengths would vary depending on site conditions, but could be as short as five feet in length. The flowline elevation of each chute would vary such that there would be low-flow, mid-flow, and high-flow passageways for fish. A pool would be constructed below the bedrock chutes with a minimum residual depth of two feet. Between the hydraulic structures, the channel bed would include large boulders either placed or in-situ.

The channel should be rough and additional pools may be necessary. Pool 6 is located at the downstream end of the channel regrade. Pool 6 was selected as the downstream transition because it is believed that fish can navigate the lower section of the UBS over a wide range of flows, including the fish passage design flows (Michael Love & Associates 2016b). In addition, Pool 6 is adequate in size and depth to dissipate the flow's energy downstream of the channel regrade, and it provides numerous places for fish to hold and stage before swimming upstream. Additionally, during large infrequent flow events (i.e. 1,600 cfs to a 100-year flow), Pool 6 backwaters the upstream channel due to boulder constrictions surrounding it. This backwater would reduce the velocities and forces acting on the boulders placed within the regraded reach upstream of Pool 6 (Michael Love & Associates 2016b).

Pool 9 is located at the upstream end of the channel regrade. Extending the channel regrade further upstream was evaluated but dismissed because it would require the removal of additional large boulders and, due to the overall slope of the existing channel, would require a much longer regrade channel reach. Pool 9 provides ample volume for fish to recover after navigating the UBS channel regrade.

Lastly, a small concrete weir structure would be built downstream of the regraded channel. The purpose of the weir structure is to keep water from flowing out of the secondary alignment corridor under low to moderate flows. This would improve the flow and fish passage conditions within the secondary alignment corridor under these flow conditions.

Construction

Construction techniques are covered in detail in previously completed documents (SR Diversified, LLC 2016a, 2016b; Michael Love & Associates 2017b). For reference, a summary is provided here.

Construction at the UBS would be extremely challenging given limited site access and rockfall hazards. It is envisioned that worker site access would be via an improved foot trail down to the site from the western rim of the canyon. Construction access for importing equipment, removing rock, and moving and placing boulders in

the channel would be through the use of either a skyline yarding system or a crane. A skyline yarding system could be installed with the boom on the western rim downstream of the Digger Creek confluence and the other end anchored to bedrock on the northern canyon wall located upstream of the UBS. A crane may be used instead of a yarding system, with it placed as close to the western rim as possible. A crane would allow for more maneuverability and control for rock removal and rock placement during construction, which is a key component of the design.

Prior to construction, rockfall hazards would be mitigated using various techniques described above for the LBS. It is not known if the large block of basalt, referred to in the geologic report (Cotton, Shires and Associates, Inc. 2016) as the "wave," would need to be stabilized for construction safety. This block is upstream of the regrade but potentially in the vicinity of a coffer dam for site dewatering.

A streamflow bypass system would need to be installed prior to rock demolition, although some rock may be removed in the dry prior to dewatering to establish a route with suitable grade to lay the pipes. The bypass system would likely include a coffer dam placed upstream of the regraded channel constructed of super-sandbags, a water-filled bladder or other materials that span the entire canyon wall to wall. The water would be bypassed in a gravity fed pipe around the entire work area. This may require moving the pipe several times during the course of construction. Installation could involve use of a helicopter to bring in the pipe segments and super sandbags.

Rock would be removed by first drilling holes into the boulders and bedrock and then either using hydraulic rock splitters or other techniques to break the rock into pieces small enough to be lifted by the removal system. No blasting will occur. Once the subgrade is daylighted, it may need to be manipulated to build the hydraulic structures. The hydraulic structures would be built using a combination of moving boulders into position using the yarding or crane system and using existing rock left in-place and potentially split to the desired size and shape. Rock used to build the structure could be salvaged during the splitting of larger rock during the demolition phase, providing some control as to the size and shape of the boulder. These rocks may be temporarily stockpiled in the canyon or may need to be lifted out and stored above the canyon before being lowered back down and into place.

Building the hydraulic structures would require close coordination between the resident fish passage engineer and the contractor to achieve the desired conditions. It is assumed that the yarding system or crane used for the project would have a minimum lifting capacity of 8,000 pounds, but having a higher lift capacity would provide more flexibility in building the hydraulic structures.

Michael Love & Associates (2017) presented a detailed analysis of the stability of the UBS design and concluded that hydraulic conditions within the channel regrade reach are not expected to mobilize the four- to five-foot diameter boulders used to construct the hydraulic structures. The Michael Love & Associates (2017) methods only consider the hydraulic forces necessary to mobilize the boulders forming the structures. Boulder mobility due to collapse of a structure from downstream erosion or impacts from another boulder were not evaluated. Additionally, the methods may underestimate the vertical forces (uplift) associated with the turbulent hydraulics within the regraded channel.

Therefore, a conservative approach would be taken to construct the hydraulic structures, and the largest rock that can be practically moved into the desired positions would be used. In addition, boulder shape would be considered. Boulders that are more block-like are less prone to rolling and provide more surface area in contact with adjacent rock, and therefore may be more stable.

The project schedule is dependent on acquiring all environmental permits and landowner agreements, and favorable stream flows in mid-summer. It is anticipated that construction of one of the barrier sites will occur in 2020 and the other barrier site will occur in 2021. If all environmental permits and landowner agreements are

not acquired, or if mid-summer stream flows are too high to accommodate the stream diversion system, the project schedule may be delayed for one to several construction seasons.

Anticipated Fish Passage Performance

A hydraulic model based on the 90 percent design drawings was developed and executed using a wide range of flows. Unlike the LBS, the UBS's complex layout of boulders and sieves made development of an existing conditions two-dimensional hydraulic model infeasible (Michael Love & Associates 2016b). Therefore, a pre- and post-construction comparison based on model results cannot be made. The selected swim path when the flow is 35 cfs and 120 cfs are nearly identical. Starting at the downstream end, the fish moves up the river left side of the channel and through the most left bedrock chute. Upstream of the bedrock chute, the fish moves laterally to the river right side of the channel and navigates the remainder of the reach on this side of the channel. Results show that the maximum exhaustion at 35 cfs is 37 percent and occurs at the downstream end of the reach. Other features do not cause the fish to exceed 20 percent exhaustion. At 120 cfs, the maximum exhaustion is 49 percent and occurs near the downstream end of the channel, but the fish experiences a similar exhaustion near Station 45 and several times exceeds 20 percent exhaustion. At the high fish passage design flow (293 cfs), the swim path is a similar path as described above. The maximum exhaustion occurs near Station 45, at 85 percent. The fish regularly exceeds 50 percent exhaustion, but is able to recover between efforts due to slow water between hydraulic structures.

Potential fish passage conditions were evaluated at 500 cfs, which is greater than the high design flow, to see if the regraded channel may still provide hydraulic conditions suitable for passage. According to the approach applied for this project, a 40 centimeter (cm) Chinook can navigate the channel. The maximum exhaustion occurred at the upstream end of the channel, as the fish crosses Pool 9. The velocity within this section of the channel is more a result of the existing boulder configuration at the head of Pool 9 than the configuration of new hydraulic structures. Further, a less direct path across Pool 9 could have been selected, routing the fish through slower water. Regardless, the findings with respect to velocity and its effect on fish are promising.

The ground and water surface profiles along the selected fish swim path for each analyzed passage flow indicate that the design is working as intended where there are water surface drops across hydraulic structures approximately two to three feet in height. The depth over all features appears to meet the depth criterion (0.5 feet). The minimum pool depth criterion (two feet) also appears to be met. No swim path was digitized for 1,600 cfs flow because it is believed that fish are not able to reach the regraded channel due to extreme velocities and turbulence occurring immediately downstream, and throughout Eagle Canyon.

The average water surface slope across the regraded channel reach gradually decreases as the flow increases, and the slope is always less than the overall channel bed slope (approximately ten percent). The average and minimum depth meet design criteria (0.5 feet) for all flows. Although there was not a velocity criterion set for this project, the maximum velocities are well within the short burst capabilities of salmon and steelhead. The maximum velocities occur at hydraulic structures and are short in length.

Finally, the minimum Chinook salmon evaluated was 40 cm, which passed through the evaluation reach for flows between 35 cfs and 500 cfs. Fish passage was not assessed at the 1,600 cfs flow.

Expected Design Life

The UBS design is anticipated to function as constructed for an indefinite period. The exact life expectancy is uncertain and dependent on the stability of the constructed hydraulic structures in the regraded channel and future rockfall. If structures break-apart during high flows, this could negatively affect fish passage conditions. Rockfall may occur at any time, and can be triggered by strong ground shaking from earthquakes. In most cases, maintenance in the form of rock removal could restore fish passage functionality.

Anticipated Maintenance Requirements

The UBS design would likely require little to no debris or sediment removal. There is the possibility that a large log or other woody debris could get jammed between rocks in an orientation that creates undesirable passage conditions, requiring removal. This has occurred at other locations within North Fork Battle Creek. If a log needs to be removed, it could be accomplished by hand crews. Analyses suggest that the hydraulic structures constructed in the regraded channel would be stable during extreme flows. However, the hydraulic environment is difficult to fully characterize. If the hydraulic structures break apart during high flows and do not reform, then fish passage conditions could degrade, requiring mobilization of a crane or yarding system to reconstruct the hydraulic structures or implement other fish passage improvements.

There is a higher likelihood of rocks falling into the channel at the UBS than at the LBS. In the event that rocks do fall into the channel after construction, they would likely only cause minor changes to fish passage hydraulics and could even improve passage conditions. The UBS is generally not susceptible to damage from boulders that could be mobilized. Flows that mobilize them are likely infrequent and involve extreme depths and velocities. Boulders in transport during these events would likely pass through the UBS without coming to rest. The design is also not considered susceptible to scour, except in the event that small sieves are formed under boulders due to scour, potentially degrading low-flow passage conditions.

If a large boulder were to move into the channel reach and create undesirable fish passage conditions, then removal of the boulder would be necessary. Depending on the size, location and orientation of the boulder, several methods could be used to break-up the rock rather than remove it completely from the canyon. If removal from the canyon is necessary, then large equipment (e.g. crane) would be necessary. This is not anticipated to occur frequently, if at all.

Access for inspection and maintenance would remain primitive after construction. Improved site access could be installed, if desired and approved by the landowner. Other means for inspection could include unmanned aerial vehicle photography techniques.

Post-Construction Monitoring

<u>As-built Survey</u>

As-built surveys would be conducted using the same methods as described above for the LBS.

<u>Startup Monitoring</u>

Startup monitoring would be conducted using the same methods as described above for the LBS.

<u>Biological Monitoring</u>

Biological monitoring would be conducted using the same methods as described above for the LBS.

Inspection and Maintenance

After the first year, site inspection may occur less frequently, possibly only after the high-flow season. The inspection would focus on noting any shifting in boulders forming the hydraulic controls and identifying any debris that has accumulated and is potentially negatively impacting passage conditions. It would also be used to identify any rockfall that has changed passage conditions. Establishing photo monitoring points would be a useful tool for conducting the inspections.

Design Limitations and Uncertainties

The complexity of the UBS and nature of the selected approach for restoring fish passage introduces several notable design limitations and uncertainties for the UBS project. The primary limitation is with respect to the unknown subsurface conditions, boulder interactions related to stability, and presence, or lack-of bedrock. The

design, as presented, is based on the best available data and observations from multiple site visits. The data were captured and site visits occurred during varying flow conditions. Boulders were individually studied and their relationship with adjacent boulders noted, but uncertainty remains with how the boulders would behave once the removal process begins and what additional boulders or bedrock may be exposed once the surface boulders are removed.

Several boulders have been specifically identified to remain, even though they are within the regrade footprint. In most cases, only a portion of the identified boulder is visible, often only the top. Assumptions were made as to the size of the boulder beyond the visible limits. If these assumptions are proved inaccurate during construction, then field adjustments would be necessary.

During construction, controlling the placement of large boulders accurately would be very important but uncertainty remains as to whether the equipment can achieve this in a timely manner. Placement of boulders may require several attempts with a single boulder or several attempts with multiple boulders to get the contact and elevations desired so that the design intent is met.

The stability of the hydraulic structures was mentioned above, but should be reiterated here. The analysis concluded that the large boulders used to construct the structures should remain stable, even under very high flow events, but uncertainty does exist. If a structure should fail, the remaining structures, especially the ones upstream, may be in danger of failing as well.

There is the possibility that, at the lowest flows, water could leak through the placed boulders around boulder B63 and drain into the large sieve that connects to Pool 6. This could result in inadequate flow and depth over the downstream-most hydraulic structure. Care would need to be given to seal voids between boulders in this location.

The channel hydraulics are based on a rating curve developed for Pool 6 (downstream boundary condition) constructed through direct observations and surveys. Although the design engineer believes that the rating curve is based on sound principles, the Pool 6 water surface may not behave as anticipated. Based on hydraulic analysis results, minor fluctuations in the behavior of Pool 6 should be mute. But if there is a large shift in the behavior of Pool 6, then there could be consequences for the regraded channel, primarily associated with hydraulic structure stability. A large shift would likely be caused by a large boulder moving downstream of, or near Pool 6. Although this is assumed to have a low likelihood of occurring, removing the upstream boulders for the project may have unforeseen consequences to the stability of the downstream boulders. Although these uncertainties exist, the design intent is clear and field adjustments during construction could mitigate these uncertainties to the extent practical. Additional hydraulic analysis by the fish passage engineer during construction may be needed to characterize resulting conditions associated with contemplated field changes. During construction, it would be essential for the contractor to work directly with the fish passage engineer on a daily basis so that field adjustments could be made that would result in the best project possible.

2.3.2 No Action Alternative

Under this alternative, no changes would occur to the UBS. Upstream fish passage would continue being impeded by the existing boulder barrier.

2.3.3 Alternatives Considered but Dismissed

The following additional alternatives, that were developed in the alternatives analysis and considered by the TAC, were dismissed due to the following reasons.

Alternative 2 - Vertical Slot Fishway with Exit Tunnel

There is substantial risk of damage from rockfall under this alternative and the risk is rated as "High." It has the highest anticipated need for frequent debris removal due to accumulation of debris on the trash rack and in the vertical slots. It would require more inspection and maintenance throughout the year, and would require rehabilitation from time to time. Lack of maintenance and rehabilitation could jeopardize passage over one or more migration seasons, detracting from efforts to restore salmon and steelhead populations within North Fork Battle Creek.

Alternative 3 - Super Active Baffle with High-Flow Channel Regrade

The fishway under this alternative has a "Moderate to High" risk of damage from rockfall. Rockfall onto the concrete fishway would likely cause damage and require repairs. The anticipated need for frequent removal of debris, given that it is in the middle of the channel and has sidewalls and baffles that are prone to catching woody debris, gives it a rating of "High." Given that the fishway is in the middle of the channel and close to areas with high risk of rockfall, it is anticipated that the concrete structure and steel baffles would need periodic rehabilitation and repair, likely more frequently than the other alternatives. It would require more inspection and maintenance throughout the year, and would require rehabilitation from time to time. Lack of maintenance and rehabilitation could jeopardize passage over one or more migration seasons, detracting from efforts to restore salmon and steelhead populations within North Fork Battle Creek.

2.4 Requirements and Design Features Incorporated into the Proposed Action

The project includes a number of Resource Protection Measures (RPMs) that were developed to protect sensitive resources that could potentially be impacted by the project and are hereby incorporated into the project description and plans. These RPMs and project components are summarized below:

- **AIR-1:** Fugitive Dust Permits will be obtained from the Tehama County Air Pollution Control District (TCAPCD) and Shasta County Air Quality Management District (SCAQMD).

  AIR-2: All construction equipment will be maintained in proper tune according to manufacturer's specifications.

  To the extent feasible, the use of diesel construction equipment meeting the California Air Resources Board's (CARB) 1996 or newer certification standard for off-road heavy-duty diesel engines will be maximized.

  If required by the TCAPCD or SCAQMD, verify that owners or operators of vehicles are registered with the California Air Resources Board Diesel Off-Road On-Line Reporting System (DOORS) program: (www.arb.ca.gov/msprog/ordiesel/ordiesel.htm). The DOORS program assists fleet owners in reporting their off-road diesel vehicle inventories to reduce vehicle emissions, as required by the In-Use Off-Road Diesel Regulation.

  If required by the TCAPCD or SCAQMD, verify that owners or operators of portable engines and certain other types of equipment are registered under the California Air Resources Board's Statewide Portable Equipment Registration Program (PERP) in order to operate their equipment throughout California without having to obtain individual permits from local air districts: (www.arb.ca.gov/portable/portable.htm).
- **VEGETATION-1:** Disturbance to existing vegetation will be avoided or minimized to the extent possible. Prior to the onset of construction, a vegetation removal plan will be submitted to the USFWS for review and approval.
- **VEGETATION-2:** A revegetation plan will be prepared to replace impacted vegetation by a measure of quantity and quality equal to, or exceeding impacts of the project using appropriate native plant species.
- **VEGETATION-3:** Disturbing streamside woody vegetation that is present within the project area associated with Battle Creek and Digger Creek shall be avoided to the extent possible. For streamside woody vegetation

that cannot be avoided, appropriate avoidance and minimization measures will need to be developed during the environmental permit processes with CDFW, NMFS and other regulatory agencies.

All disturbed streamside woody vegetation shall be revegetated following the completion of construction activities.

- **VEGETATION-4:** Impacts to trees will be avoided to the extent possible. Native trees greater than 16-inch diameter at breast height (dbh) with defects (snags, cavities, leaning toward stream channel, nests, late seral characteristics) and native trees greater than 36-inch dbh will be retained, to the extent possible. Impacts to trees that cannot be avoided will be minimized by limbing rather than cutting vegetation to the ground in order to promote regrowth.
- **VEGETATION-5:** All heavy equipment shall be thoroughly cleaned prior to mobilization onsite to remove any soil, weed seeds and plant parts in order to reduce the importation and spread of invasive exotic plant species.
- **VEGETATION-6:** Only certified weed-free straw shall be used for erosion control or other purposes to reduce the importation and spread of invasive exotic plant species.
- **VEGETATION-7:** An appropriately-timed preconstruction survey will be conducted to identify and map Butte County fritillary plants / colonies within the project area.
- **VEGETATION-8:** To the extent possible, a minimum 30-foot protective buffer will be established around Butte County fritillary plants / colonies that occur on the canyon edges / plateau, which might be subject to impacts relating to vegetation disturbance, equipment and materials staging, equipment operation, and placement of rocks removed from the canyon. Orange plastic barrier fencing will be used to mark the outer boundaries of the minimum 30-foot protective buffer established around each Butte County fritillary subpopulation.
- **VEGETATION-9:** For any proposed access trails extending downslope to the creek, a route will be delineated that will avoid Butte County fritillary plants to the maximum extent possible, and will require the least amount of disturbance to soil and woody vegetation. Plastic flagging and / or plastic orange barrier fencing will be used to define the route and boundaries of allowable pedestrian traffic.
- **VEGETATION-10:** Educate those involved with project implementation regarding Butte County fritillary and other sensitive botanical resources present. All participants will be made aware of the purpose and locations of the orange plastic barrier fences. Photographs of Butte County fritillary plants, flowers and mature fruits will be provided to all workers who walk or operate machinery / equipment in the project area.
- **VEGETATION-11:** No smoking will be allowed on the construction site or within the project area, for fire prevention purposes.
- **VEGETATION-12:** Road improvement activities shall be conducted in such a manner that disturbances are confined to the already disturbed road prism.
- **VEGETATION-13:** Vehicle traffic will be limited to the existing disturbed road prism. The condition of the road post-project will be coordinated with the landowners and all measures will be taken to return the road to pre-project conditions. Truck passing and parking areas will be established in areas away from populations of wooly meadowfoam and seasonal wetlands. Truck passing areas will be clearly mapped in the field with high visibility fencing or flagging and all construction personnel will be made aware of the sensitive resources and avoidance measures. Orange barrier fencing will be placed around the seasonal wetlands and wooly meadowfoam populations.
- **FISH-1:** NMFS shall be consulted to 1) develop appropriate Central Valley Steelhead and Central Valley Spring-run Chinook Salmon avoidance and minimization measures, and 2) determine whether an Endangered Species Act Section 7 take permit will be required for the project.

- **FISH-2:** Construction outside of the stream channel could start as early as July 1, based upon permits receipt, permit conditions, and / or consultation terms and conditions. For fisheries protection, instream work will occur between July 1 and September 30. Instream work could start sooner if CDFW, in coordination with NMFS determines that adult spring-run Chinook salmon are no longer present based on environmental conditions, proper installation of an exclusionary weir and real-time passage data. Instream work could be extended to October 14, if environmental conditions, which will preclude juvenile steelhead and spring-run Chinook salmon emigration or adult steelhead / fall-run Chinook salmon immigration, are expected to persist. Instream work outside of the July 1 to September 30 work window must be approved by CDFW and NMFS on a case-by-case basis with details on how take will be avoided and / or minimized. For work within the channel and banks, fish rescue efforts (herding fish, netting / seining, electrofishing, etc.) will be required prior to the onset of any dewatering of the area. Dewatering will be coordinated with CDFW to ensure that adequate staff are available, and onsite during dewatering efforts.
- **FISH-3:** All construction debris (concrete, metal, etc.) from the fish passage improvement-related construction activities shall be removed from the active stream channel post-construction.
- **FISH-4:** Prior to construction, exclusionary fish netting or other CDFW approved exclusionary structure and / or other mechanism(s) shall be installed upstream and / or downstream of the construction area as determined by CDFW. USFWS, in coordination and consultation with NMFS and CDFW, will ensure that qualified fish biologists are onsite to implement fish rescue operations through the use of herding, seining and / or electrofishing, etc., if necessary. Best professional determination will be used to decide which method(s) of rescue and location of exclusionary structure and / or other mechanism(s) is most appropriate. Biologists will first try to haze and herd fish out of the fish exclusion area. If fish biologists determine that the use of electrofishing is necessary for the efficient and successful removal of fish, USFWS biologists with electrofishing certification will strictly follow the NMFS electrofishing guidelines (National Marine Fisheries Service 2000) will be strictly followed. The fish rescue team will be comprised of fishery biologists with professional experience using seines and electrofishing equipment.
- **FISH-5:** Adequate erosion and pollution control measures shall be taken to ensure that sediment, turbidity, petroleum products or other harmful chemicals do not enter Battle Creek, wetlands or other aquatic sites as a result of construction activities. Standard Best Management Practices (BMPs) shall be incorporated into the project designs.
- **FISH-6:** Best Management Practices (BMPs) will be developed and implemented to ensure that wet concrete does not enter Battle Creek, wetlands or other aquatic sites during construction.
- **FISH-7:** All water pumps used during construction shall be screened to meet CDFW and NMFS criteria, unless deemed unnecessary by CDFW and NMFS (i.e. if water was being diverted from an off-channel pool). The refueling of pumps will occur away from the wetted area / channel. If pumps are using fuel, they will be outfitted with a spill kit.
- **FISH-8:** All dewatering and rewatering activities will be conducted slowly, in order to minimize disturbance to fish and will be carefully coordinated with CDFW.
- **FISH-9:** While Pacific lamprey are not expected to occur within the project site, all reasonable measures will be taken to minimize impacts to lamprey, including spending more time at the area as it becomes dewatered (and they are moving out of the mud, chasing the water as it recedes), and possibly electroshocking.
- **WILDLIFE-1:** Any tree removal, vegetation clearing, or the onset of potentially disturbing construction activities shall occur between September 1 and January 1 (outside of the nesting season for raptors with potential to occur within, or in the vicinity of the project site). NOTE: Also see measure WILDLIFE-5.

  If tree removal, vegetation clearing, or the onset of potentially disturbing construction activities must occur during the nesting season, a raptor nesting survey of the construction area and adjacent suitable habitat shall be conducted by a qualified biologist no more than ten (10) days prior to the initiation of the onset of these activities or as appropriate survey protocols require. If active raptor nests are found to be present, tree

removal, vegetation clearing and the onset of potentially disturbing construction activities shall be suspended until a qualified biologist, in consultation with CDFW and / or USFWS can establish an appropriate protective buffer area to minimize impacts to the nesting raptors. No construction activities shall commence within the buffer area until the qualified biologist determines that the young birds have fledged or the nest is no longer active.

Construction activities shall occur continuously (not including weekends) until the end of the nesting season to discourage raptors from initiating nesting. If construction activities cease for more than ten (10) consecutive days (including weekends), all construction activities shall cease until CDFW can be consulted to determine if a subsequent raptor nesting survey must be performed.

Active or inactive nests are not to be disturbed or removed as a result of construction activities per Fish and Game Code Section 3503.5.

- **WILDLIFE-2:** The USFWS shall be consulted to 1) develop appropriate avoidance and minimization measures, and 2) determine whether an Endangered Species Act Section 7 take permit will be required for the project.

  Project activities shall avoid direct impacts to seasonal wetlands or other large branchiopod (fairy shrimp, tadpole shrimp) habitats.

  High-visibility fencing shall be installed in areas where equipment will be working near any large branchiopod habitat.

  No road grading or road improvements shall be allowed in or, where feasible, near large branchiopod habitats.

  All transporters of potentially hazardous materials (fuel, oil, cement, etc.) will be notified as to the presence of potential large branchiopod habitats, and be required to inspect their vehicles prior to entry and exit of the project site to prevent accidental discharge.

  All vehicular traffic will be restricted to stay within the designated work boundaries. The work boundaries will be flagged or fenced and identified on construction drawings to limit equipment and personnel to the minimum area necessary to perform the project work and minimize impacts to wetland habitat.

- **WILDLIFE-3:** Prior to work in aquatic habitats, water bodies shall be surveyed by a qualified biologist to determine if any western pond turtles are present. If any individuals of these species are found, a qualified and permitted biologist shall determine and implement appropriate relocation procedures, in coordination with CDFW. The site shall be checked daily by trained construction workers prior to work commencing, including underneath vehicles and equipment that will be used. If special-status species are found, they will be moved by a qualified and permitted biologist to an area of safety out of harm's way.

- **WILDLIFE-4:** Within ten (10) calendar days prior to the onset of potentially disturbing construction activities, a burrowing owl burrow survey of the construction area and adjacent suitable habitat shall be conducted by a qualified biologist. If active burrowing owl burrows are found to be present, the onset of potentially disturbing construction activities shall be suspended until a qualified biologist, in consultation with CDFW, can establish an appropriate protective buffer area to minimize impacts to the roosting birds. No construction activities shall commence within the buffer area until the qualified biologist determines that the burrow is no longer active.

- **WILDLIFE-5:** Any tree removal, vegetation clearing, or the onset of potentially disturbing construction activities shall occur between August 1 and March 1 (outside of the nesting season for grasshopper sparrow, yellow-breasted chat, loggerhead shrike, yellow warbler and other nesting migratory birds). Note: Also see measure WILDLIFE-1.

  If tree removal, vegetation clearing, or the onset of potentially disturbing construction activities must occur during the nesting season, a nesting survey of the construction area and adjacent suitable habitat shall be conducted by a qualified biologist no more than ten (10) days prior to the initiation of the onset of these activities. If active bird nests are found to be present, tree removal, vegetation clearing and the onset of

potentially disturbing construction activities shall be suspended until a qualified biologist, in consultation with CDFW, can establish an appropriate protective buffer area to minimize impacts to the nesting birds. No construction activities shall commence within the buffer area until the qualified biologist determines that the young birds have fledged or the nest is no longer active.

Construction activities shall occur continuously (not including weekends) until the end of the nesting season to discourage avian species from initiating nesting. If construction activities cease for more than ten (10) consecutive days (including weekends), all construction activities shall cease until CDFW can be consulted to determine if a subsequent nesting bird survey must be performed.

Active nests are not to be disturbed or removed as a result of construction activities per Fish and Game Code Section 3503.

- **WILDLIFE-6:** Prior to any vegetation removal or disturbance to rock cliffs with cracks, an attempt will be made by a qualified biologist to determine if pallid bats, spotted bats, western red bats or western mastiff bats are roosting in the area to be removed / disturbed.

  If pallid bats, spotted bats, western red bats or western mastiff bats are found to be roosting within the area to be removed / disturbed, these activities shall be suspended until a qualified biologist, in consultation with CDFW, can establish appropriate measures to minimize impacts to these species.
- **WILDLIFE-7:** To the extent possible, all direct disturbance to identified bat roosts shall occur between August 31 and May 1, in order to minimize the likelihood of injuring or killing juvenile bats during the period when they are still unable to fly.
- **WILDLIFE-8:** To the extent possible, the removal of trees or branches with defects (cavities, cracks, exfoliating bark, etc.) that provide potential bat roosting or bird roosting / nesting habitat will be avoided.
- **WILDLIFE-9:** As appropriate, revegetation efforts will incorporate tree and vine species that are known to be used by western red bats for roosting including, but not limited to white alder *(Alnus rhombifolia)*, California sycamore *(Platanus racemosa)*, pipevine *(Aristolochia californica*) and California grape *(Vitis californica)*.
- **WILDLIFE-10:** Potential ringtail denning habitat exists within the project area in the form of hollow trees and rock talus. Prior to construction, a biologist will inspect the project site for signs of denning.

  If ringtails are found to be denning, construction activities will be suspended until a qualified biologist, in consultation with CDFW, can establish appropriate measures to protect ringtail.
- **WILDLIFE-11:** A qualified biologist (biological monitor) shall regularly inspect construction-related activities to ensure that no unnecessary disturbance to special-status species and / or their associated habitats occurs. The biological monitor shall have the authority to stop all activities that may result in such disturbance until appropriate corrective measures have been completed. The biologist will also be required to report any unauthorized take to CDFW, USFWS and / or NMFS immediately.
- **WILDLIFE-12:** A construction worker education program shall be implemented that includes an explanation of all special-status animal species, identification, avoidance measures, and federal and state laws that protect the species. This shall include, at a minimum, those species listed in the environmental documents.
- **WILDLIFE-13:** Appropriate measures will be used to avoid the spread of aquatic invasive species such as zebra / quagga mussels, New Zealand mudsnails and chytrid fungus to and from the project area according to the current CDFW Aquatic Invasive Species Disinfection / Decontamination Protocols (Northern Region) and the current USFWS Red Bluff Fish and Wildlife Office Anadromous Fish Restoration Program Hazard Analysis Critical Control Point Plan.
- **WILDLIFE-14:** All food-related trash will be disposed of in closed containers and removed from the project area daily during the construction period. Construction personnel will not feed or otherwise attract wildlife to the project area.
- **WILDLIFE-15:** No pets will be allowed within the project area.

- **WILDLIFE-16:** While foothill yellow-legged frogs are not expected to occur within the project site, prior to work in aquatic habitats, water bodies shall be surveyed by a qualified biologist to determine if any foothill yellow-legged frogs are present. If any foothill yellow-legged frogs are found, a qualified and permitted biologist shall determine and implement appropriate relocation procedures, in coordination with CDFW. The site shall be checked daily by trained construction workers prior to work commencing, including underneath vehicles and equipment that will be used. If foothill yellow-legged frogs are found, they will be moved by a qualified and permitted biologist to an area of safety out of harm's way.
- **WETLAND-1:** Project activities will avoid impacts to wetlands and other aquatic habitats to the extent possible.
- **WETLAND-2:** High-visibility fencing will be installed in areas where equipment will be working near any wetlands or other aquatic habitats that are not to be disturbed.
- **WETLAND-3:** Construction crews will be informed about the importance of avoiding sensitive areas, including wetlands.
- **WETLAND-4:** A Clean Water Act Section 404 Permit will be obtained from the U.S. Army Corps of Engineers and a Clean Water Act Section 401 Certification will be obtained from the Central Valley Regional Water Quality Control Board (RWQCB).
- **CULTURAL-1:** Prior to construction, a cultural resource specialist will flag any potentially sensitive cultural resource areas to be avoided.
- **CULTURAL-2:** While the Eagle Canyon Can Dump does not qualify for the National Register of Historic Places, it will be avoided. If it cannot be avoided, an Extended Phase 1 inventory will take place. An Extended Phase 1 investigation will consist of a more detailed site record documentation, and include compilation of a detailed site map and an inventory of individual refuse items by type, size, function, make and manufacture, modifications, and associations.
- **CULTURAL-3:** In the event subsurface archaeological resources are encountered during ground-disturbing activities, all work will cease at the general area of discovery and the USFWS regional archaeologist, or other lead agency archaeologist, will be notified immediately. A field exam by a professional archaeologist may be required and further steps for resource protection will be implemented, including mitigation and consultation with the Native American Indian community if human remains are encountered (following Native American Graves Protection and Repatriation Act procedures). Work may proceed on other parts of the project site while mitigation for historical, unique archaeological or tribal resources is being carried out.
- **HAZ-1**: A designated concrete washout area will be located at least 100 feet from any high water mark within adjacent waterways and from any wetlands and will be developed and used following the U.S. EPA Stormwater BMP for a Concrete Washout.
- **HAZ-2:** Measures WATER-3 through WATER-6 associated with potential petroleum product spills will be fully implemented.
- **HAZ-3:** Construction equipment and materials shall not be stored or stockpiled in the creek channel, and shall be stored at least 50 feet from the top of the stream bank or any wetlands or other aquatic sites.
- **WATER-1:** All construction shall be conducted in the summer / early fall during the low flow period. Any work within the channel and banks, outside of this instream work window must be isolated from flowing water and dewatering will be required.
- **WATER-2:** Monitoring of water turbidity and settleable materials shall be conducted in accordance with the Clean Water Act Section 401 Certification through consultation with the RWQCB.
- **WATER-3:** All equipment and machinery that contains fuel, oil or other petroleum products used during construction related activities shall be checked for petroleum leaks immediately prior to being mobilized to the project site and again each day prior to use.

- **WATER-4:** All equipment refueling and / or maintenance shall take place within a secondary containment structure and, when feasible, a minimum of 100 feet away from Battle Creek, wetlands or other aquatic sites.
- **WATER-5:** An emergency spill kit and absorbent oil booms will be onsite during construction activities.
- **WATER-6:** All equipment operations within the channel and banks of Battle Creek will be required to use readily biodegradable hydraulic oil.
- **WATER-7:** A dewatering permit will be obtained from the RWQCB, if deemed necessary based on the dewatering methods used.
- **WATER-8:** Helicopter delivery of all materials including wet and dry concrete materials, will use a helicopter route that minimizes the length of time spent over open water areas of Battle Creek and will be delivered to the site in sealed protective containers such as intermediate bulk containers (IBCs) designed for containment of dry flowable chemical materials or fluids. Helicopter staging and delivery areas will be isolated from the adjacent upland, wetland and stream areas through use of silt barriers.
- **WATER-9:** Transfer of cement and mixing of concrete will be performed in a containment berm or cell and will occur only during dry weather. Cement stored on site will be in containers or covered at all times. Any equipment to be cleaned of concrete will be washed in / over a sealed protective container. Concrete wash water and any excess concrete will be collected in containers such as flexible or rigid IBCs and removed from the site.
- **WATER-10:** In the event that any concrete materials are spilled onsite, it shall be immediately cleaned up and transferred to an IBC. Any operations resulting in spills will be immediately stopped. Modifications will be made to prevent spills, prior to resuming operations.
- **WATER-11:** Concrete will be placed in dry conditions to the maximum extent feasible. Areas where concrete is to be placed within ten feet of water, will be isolated from the creek with silt and turbidity barriers. If concrete is to be placed underwater, it will be fully contained in formwork extending above the water level and will be installed by tremie methods. Water displaced by the tremie placement will be pumped to a dewatering storage system. Pumping will be used to maintain a positive flow gradient toward the area of work (away from the creek), and pumped water will be discharged to the dewatering storage system.
- **WATER-12:** A water quality protection plan will be prepared by the contractor that includes concrete / cement measures and shall be approved by the project engineer prior to the start of any construction-related activities, including mobilization of materials to the project site.
- **SOIL/GEO-1:** After ground-disturbing activities are complete, all disturbed areas (outside of the active stream channel) shall be seeded with native plant species and mulched as described in the revegetation plan.
- **SOIL/GEO-2:** Construction of all project actions shall comply with RWQCB Basin Plan Objectives. Standard BMPs will be incorporated into the project designs and / or the Storm Water Pollution Prevention Plan (SWPPP), if required.
- **SOIL/GEO-3:** If the total disturbance area is greater than one acre, a Notice of Intent will be submitted to the State Water Resources Control Board to obtain coverage under the National Pollution Discharge Elimination System General Permit for Discharges of Stormwater Associated with Construction Activity.
- **SOIL/GEO-4:** Geologic hazards from rockfall will be mitigated by removing (scaling), shotcrete or securing (rock bolts) to potential rockfall or selecting locations for infrastructure away from known or anticipated rockfall hazards.

3.0 Affected Environment

This section describes the existing condition and trend of issue-related elements of the human environment that may be affected by implementing the proposed action or the No Action alternative.

3.1 Environmental Resources not Considered in Detail

3.1.1 Agricultural Resources

The proposed action would have no effect on agricultural resources in the area. No Prime Farmland, Unique Farmland, or Farmland of Statewide Importance is present within or near the project site.

3.1.2 Environmental Justice

The proposed action would have no effect on environmental justice. The proposed action involves reconstruction of a fish passage structure which would have no effect on the fair and equitable treatment of people.

3.1.3 Land Use Planning

The proposed action would have no effect on land use planning in the area. The proposed action would have no impact on any surrounding land or land uses.

3.1.4 Mineral Resources

The proposed action would have no effect on mineral resources in the area.

3.1.5 Population Growth and Housing

The proposed action would have no effect on population growth or housing in the area.

3.1.6 Public Health and Hazards

The proposed action would have no effect on public health or hazards in the area.

3.1.7 Public Services

The proposed action would have no effect on public services. There are no public services associated with the proposed action.

3.2 Affected Environment

3.2.1 Aesthetics

The project is located within Eagle Canyon on North Fork Battle Creek and possesses very high scenic values. It is located on the western volcanic slopes of Mount Lassen along the border of northern Tehama and southern Shasta Counties. North Fork Battle Creek flows through privately owned lands. Views of the project area are constrained by topography and vegetation. The creek channel is deeply cut, with 100- to 200-foot near-vertical slopes rising from the channel in many sections. Public roadways in the North Fork Battle Creek vicinity include Highway 44, Wilson Hill Road, Battle Creek Bottom Road, Wildcat Road and Manton Road. Access roads to the project area are private and gated, limiting public access and views of the project area. The project area is not visible from the nearest public campground, Camp Latieze, located in Manton. North Fork Battle Creek and the project area are not visible from any nearby communities. The nearest residential receptors are located over three miles from the project area. The project site is not included in a National Wild and Scenic Rivers System management plan. The project is not located within a state scenic highway.

3.2.2 Air Quality

The project area climate is characterized by hot, dry summers and cool, wet winters. During the summer months from mid-April to mid-October, significant precipitation is unlikely and temperatures range from daily maximums exceeding 100° Fahrenheit (°F) to evening lows in the high 50s and low 60s. During the winter, highs are typically in the 60s with lows in the 30s. Wind direction is primarily along the valley due to the channeling effect of the mountains to either side of the Sacramento Valley. During the summer months, surface air movement is from the south, particularly during the afternoon hours. During the winter months, wind direction is more variable.

The 1977 federal Clean Air Act requires the U.S. Environmental Protection Agency to identify National Ambient Air Quality Standards to protect public health and welfare. Tehama and Shasta Counties are part of the Northern Sacramento Valley Air Basin (NSVAB), and are under the jurisdiction of the Tehama County Air Pollution Control District (TCAPCD) and Shasta County Air Quality Management District (SCAQMD).

Within Tehama County, the TCAPCD is responsible for adopting and enforcing controls on stationary sources of air pollutants through its permit and inspection programs. Other TCAPCD responsibilities include monitoring air quality, regulating agricultural burning, preparation of clean air plans and responding to air quality complaints from citizens. Based on 2018 California Air Resources Board (CARB) data, Tehama County is currently in attainment or unclassified status for all national criteria pollutant standards. 2017 CARB data shows that Tehama County is a nonattainment area for state standards for ozone and particulate matter less than 10 microns in diameter (PM_{10}).

Within Shasta County, the SCAQMD functions as professional staff to the Air Pollution Control Board regarding rule development and potential industrial and commercial development. It also processes commercial and industrial applications to construct emission devices and issues Permits to Operate which are renewed on an annual basis. Based on 2018 CARB data, Shasta County is currently in attainment or unclassified status for all national criteria pollutant standards. 2017 CARB data shows that Shasta County is a nonattainment area for state standards for ozone.

Proximity to sensitive receptors is a concern in air quality analyses. A sensitive receptor is a location where human populations, particularly children, seniors, and sick individuals, are present and where there is a reasonable expectation of continuous human exposure to pollutants. The project is not located near a school, hospital, senior housing or residences.

Climate Change and Greenhouse Gases

Along with natural causes, increases in GHG emissions occur through burning coal, natural gas, oil, and gasoline. GHG emissions may include carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

Regional sources of GHG emissions in the project area vicinity include traffic along State Route (SR) 36, Long Road, Battle Creek Bottom Road and other local roadways; electricity generation; and stationary sources from various commercial and industrial properties. It is estimated that combined LBS and UBS construction activities would generate 857 metric tons of CO_2 equivalencies over the construction period; approximately 60 (LBS) and 99 (UBS) total working days.

3.2.3 Biological Resources

3.2.3.1 Vegetation and Plant Communities

Vegetation in the project area was characterized by species composition and habitat association. Major plant communities include Annual Grassland / Herbland, Chaparral, Blue Oak Woodland / Savannah, and Mixed Foothill Woodland (Figure 13). Owing to prevalence of bedrock and general lack of soils along North Fork

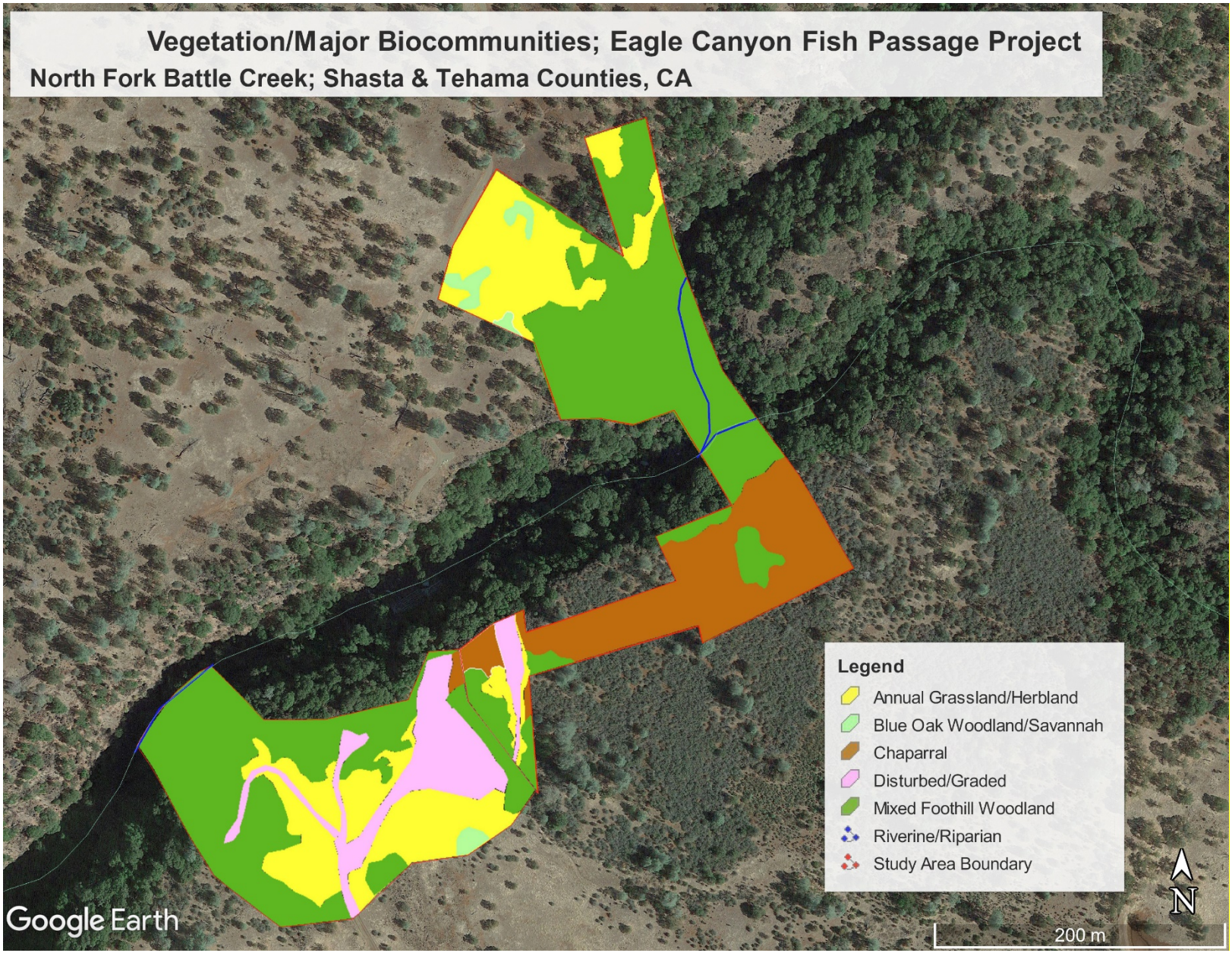


Figure 13. Vegetation / Major Biocommunities Map

Battle and Digger Creeks, woody riparian species and herbaceous wetland vegetation is generally lacking. General characteristics and species composition for each are as follows:

Annual Grassland / Herbland

This plant community dominates upland sites on the terrace / plains and slopes on both sides of the canyons of North Fork Battle and Digger Creeks. It comprises the understory of Blue Oak Woodland / Savannah, and openings and edges of Mixed Foothill Woodland and Chaparral. Species composition varies by location. On better-developed, deeper soils this community corresponds to the *Bromus (diandrus, hordeaceus)-Brachypodium distachyon* Semi-natural Herbaceous Stands, *Festuca perennis* Semi-natural Herbaceous Stand, or *Avena (barbata, fatua)* Semi-natural Herbaceous Stand (Sawyer et al. 2009). Thinner rockier soils support the *Lasthenia californica-Plantago erecta-Festuca microstachys* Herbaceous Alliance. Non-native annual grasses observed include silver European hairgrass *(Aira caryophyllea)*, slender wild-oat *(Avena barbata)*, false brome *(Brachypodium distachyon)*, small rattlesnake grass *(Briza minor)*, soft chess *(Bromus hordeaceus)*, foxtail chess *(Bromus madritensis)*, poverty brome *(Bromus sterilis)*, ripgut brome *(Bromus diandrus)*, hedgehog dogtail *(Cynosurus echinatus)*, annual rye *(Festuca perennis)*, rattail fescue *(Festuca myuros)*, medusahead *(Elymus caput-medusae)*, nitgrass *(Gastridium phleoides)* and Mediterranean barley *(Hordeum marinum ssp. gussoneanum)*. Native grasses include small fescue *(Festuca microstachys)*, annual hairgrass *(Deschampsia danthonioides)* and three-awn *(Aristida oligantha)*. One-sided bluegrass *(Poa secunda ssp. secunda)* and California melic *(Melica californica)* were also observed. Native annual forbs include California plantain *(Plantago erecta)*, blow-wives *(Achyrachaena mollis)*, fiddleneck *(Amsinckia intermedia)*, valley tassels *(Castilleja attenuata)*, Fitch's spikeweed *(Centromadia fitchii)*, purple clarkia *(Clarkia purpurea)*, Fremont's tidy-tips *(Layia fremontii)*, California goldfields *(Lasthenia californica)*, shiny peppergrass *(Lepidium nitidum)*, wand lessingia *(Lessingia virgata)*, bird's-eye gilia *(Gilia tricolor)*, q-tips *(Micropus californicus)*, marigold navarretia *(Navarretia tagetina)*, downy navarretia *(Navarretia pubescens)*, hoary popcorn-flower *(Plagiobothrys canescens)*, common popcorn-flower *(Plagiobothrys nothofulvus)*, dwarf-stonecrop *(Sedella pumila)*, foothill clover *(Trifolium ciliolatum)*, cowbag clover *(Trifolium depauperatum)*, deceptive clover *(Trifolium bifidum var. decipiens)*, white-tipped clover *(Trifolium variegatum)*, tomcat clover *(Trifolium wildenovii)*, small-head clover *(Trifolium microcephalum)*, johnnytuck *(Triphysaria eriantha)* and others. Native geophytes include white onion *(Allium amplectans)*, yellow Mariposa lily *(Calochortus luteus)*, narrow-leaved soaproot *(Chlorogalum angustifolium)*, wavy-leaved soaproot *(Chlorogalum pomeridianum)*, blue dicks *(Dichelostemma capitatum)*, round-toothed ookow *(Dichelostemma multiflorum)*, and white triteleia *(Triteleia hyacinthina)*. Non-native forbs observed include hedge parsley *(Torrilis arvensis, Torrilis nodosa)*, yellow star-thistle *(Centaurea solstitialis)*, long-beaked hawkbit *(Leontodon saxatilis)*, filaree *(Erodium cicutarium, Erodium botrys)*, smooth cat's-ear *(Hypochaeris glabra)*, bur clover *(Medicago polymorpha)*, grasspink *(Petrorhagia dubia)*, hop clover *(Trifolium dubium)*, rose clover *(Trifolium hirtum)*, sessile-headed clover *(Trifolium glomeratum)*, dove's-foot geranium *(Geranium molle)*, smartweed *(Polygonum aviculare)*, sandspurrey *(Spergularia sp.)* and others.

Chaparral

Chaparral is associated with portions of the relatively level terrace on the southern side of the canyon in the eastern portion of the project area. Chaparral intergrades with Blue Oak Woodland / Savannah, Mixed Foothill Woodland and Annual Grassland. Depending on the site, vegetation corresponds to the *Ceanothus cuneatus* Shrubland Alliance (Sawyer et al. 2009). This bio-community / vegetation type is characterized by a dense, closed canopy of shrub species, generally dominated by buckbrush *(Ceanothus cuneatus)*; in places this species forms an almost pure stand. Depending on site, other shrubs observed include holly-leaved redberry *(Rhamnus illicifolia)*, California flannel-bush *(Fremontodendron californicum)*, big manzanita *(Arctostaphylos manzanita ssp. manzanita)*, sticky-leaved manzanita *(Arctostaphylos viscida ssp. viscida)*, skunkbush *(Rhus aromatica)*, poison oak *(Toxicodendron diversilobum)* and yerba santa *(Eriodictyon californicum)*. Chaparral honeysuckle *(Lonicera interrupta)* and chaparral clematis *(Clematis lasiantha)* are also present. Where the canopy is completely closed,

the herbaceous understory is sparsely vegetated with some grass and herb species shared in common with the surrounding Annual Grassland / Herbland, and with the Blue Oak Woodland / Savannah and Mixed Foothill Woodland communities.

Blue Oak Woodland / Savannah

This woodland type occurs on the level terrace / plains along both the north and south access roads. Blue Oak Woodland / Savanna intergrades with Annual Grassland / Herbland, which comprises the herbaceous layer. In areas, it also intergrades with Mixed Foothill Woodland and Chaparral. Depending on the site, the vegetation corresponds to the *Quercus douglasii* Woodland Alliance (Sawyer et al. 2009). In addition to blue oak *(Quercus douglasii),* tree species observed in this mapped vegetation type include scattered interior live oak *(Quercus wislizenii)*, foothill pine *(Pinus sabiniana)*, and California juniper *(Juniperus californica)*. Where present, shrub species include buckbrush, holly-leaved redberry, skunkbrush, poison oak and occasional others shared with surrounding Chaparral and Mixed Foothill Woodland communities.

Mixed Foothill Woodland

This woodland type occurs along the canyon edge, slopes and walls, as well as scattered sites on the relatively level terrace / plains along the south access road. Mixed Foothill Woodland intergrades with Blue Oak Woodland / Savannah and Chaparral. In comparison to the latter, the canopy is dense and mostly closed. Depending on the site, the vegetation corresponds to the *Quercus chrysolepis* Forest Alliance and / or to the *Quercus wislizenii* Woodland Alliance (Sawyer et al. 2009). In addition to blue oak, interior live oak, and canyon live oak *(Quercus chrysolepis)*, trees observed include California bay *(Umbellularia californica)*, foothill pine, occasional California black oak *(Quercus kelloggii)*, California juniper, and on the north-facing slope in the canyon, California nutmeg *(Torreya californica)*. Along the immediate edge of North Fork Battle and Digger Creeks, occasional white alder *(Alnus rhombifolia)* occurs. Shrubs observed include buckbrush, deerbrush *(Ceanothus integerrimus)*, holly-leaved redberry, hoary coffeeberry *(Frangula californica ssp.tomentella)*, California snowbell *(Styrax redivivus)*, Lemmon's keckiella *(Keckiella lemmonii)*, western redbud *(Cercis occidentalis)*, California flannel-bush, California buckeye *(Aesculus californica)*, big manzanita, sticky-leaved manzanita, skunkbush, poison oak, common snowberry *(Symphoricarpos albus var. laevigatus)* and yerba santa. Chaparral honeysuckle and chaparral clematis are also present. Composition of the herbaceous layer varies by site. Annual grasses and herbs include many in common with surrounding Annual Grassland / Herbland (see description). Mixed Foothill Woodland has greater diversity of native perennial herbs than do surrounding Annual Grassland, Chaparral and Blue Oak Woodland / Savannah types. Native grasses observed include Torrey's melic *(Melica torreyana)*, California melic, one-sided bluegrass, and needlegrass *(Nassella sp.)*. Commonly observed perennial forbs include purple sanicle *(Sanicula bipinnatifida)*, Pacific sanicle *(Sanicula crassicaulis)*, Hartweg's tauschia *(Tauschia hartwegii)*, California pipevine *(Aristolochia californica)*, large-flowered wooly sunflower *(Eriophyllum lanatum ssp. grandiflorum)*, Jepson's barberry *(Berberis aquifolium)*, hound's-tongue *(Cynoglossum grande)*, bastard toadflax *(Comandra umbellata)*, yellow star-lily *(Calochortus monophyllus)*, Sierra fawn-lily *(Erythronium multiscapideum)*, California bird's-foot fern *(Pellaea mucronata)*, gold-back fern *(Pentagramma triangularis)*, red larkspur *(Delphinium nudicaule)*, western buttercup *(Ranunculus occidentalis)*, narrow-leaved climbing-bedstraw *(Galium porrigens var. tenue)* and twining ookow *(Dichelostemma volubile)*. Thin soils and crevices on bedrock support Hansen's spike-moss *(Selaginella hansenii)*, canyon live-forever *(Dudleya cymosa)* and broad-leaved stonecrop *(Sedum spathulifolium)*.

Mixed Riparian Woodland / Scrub

This plant community / vegetation type is typically associated with streams in the vicinity. Within the project area however, the boulder-congested bed and nearly vertical bedrock banks of North Fork Battle and Digger Creeks are mostly devoid of soil and are barren of hydrophytic vegetation. There is no discernable signature on aerial photos separating a mappable riparian vegetation type. Mixed Foothill Woodland dominates the lower canyon walls and boulder banks, where the latter are vegetated. Since access and safety issues precluded pedestrian survey and direct observation of the banks and lower walls of Eagle Canyon (particularly the LBS), precise

characterization of woody and herbaceous riparian species was not possible. Based on limited observations, woody riparian vegetation appears to be comprised mainly of a few scattered white alder. Other species observed along the riparian corridor include California grape *(Vitis californica)*, edible fig *(Ficus carica),* Himalayan blackberry *(Rubus armeniacus)*, California blackberry *(Rubus urisinus)*, chain-fern *(Woodwardia fimbriata)* and hedge-nettle *(Stachys sp.)*. The remainder of woody and herbaceous species observed along the lower canyon walls and stream appear to be those shared in common with the surrounding upland Mixed Foothill Woodland type.

Seasonal Wetland

Seasonal wetland vegetation is associated with a few scattered depressions and swales that occur along the margins of the northern and southern access roads and with a few sites on and near the graded staging areas. These were not mapped separately. Vegetation is dominated by marginally hydrophytic non-native grasses, including Mediterranean barley and annual rye. Sub-dominant species include some of those associated with nearby vernal pools, including annual hairgrass *(Deschampsia danthonioides)*, toadrush *(Juncus bufonius)*, Oregon wooly-marbles *(Psilocarphus oregonus)*, cut-leaved plantain *(Plantago coronopus)*, elongate plantain *(Plantago elongata)*, water pygmyweed *(Crassula aquatica)*, stalked popcorn-flower *(Plagiobothrys stipitatus)*, Fremont's goldfields *(Lasthenia fremontii)*, cowbag clover, white-tipped clover, Sacramento Valley pogogyne *(Pogogyne zyziphoroides)*, purselane speedwell *(Veronica peregrina ssp. xalapensis)*, hyssop loosestrife *(Lythrum hyssopifolium)* and others. The rare wooly meadowfoam *(Limnanthes floccosa ssp. floccosa*; California Native Plant Society [CNPS] Rank 4.2) was encountered in several of these seasonal wetlands.

Invasive Species

Invasive species encountered in the study area include yellow star-thistle, milk-thistle *(Silybum marianum)*, Klamathweed *(Hypericum perforatum)*, Himalayan blackberry and edible fig. All of these species are well-established in the region. There are several other species that are spreading in the region, but which were not observed in the study area, including, but not limited to goatgrasses *(Aegilops cylindrica, Aegilops triuncialis)*, puncture vine *(Tribulus terrestris)* and stinkweed *(Dittrichia graveolens)*.

Field surveys were conducted on April 5 and 10, 2018 (Dittes and Guardino Consulting 2018). The surveys were performed with the aid of a map with the project study area boundary on an aerial photo-base. An intuitive-controlled survey was performed within the study area. All areas subject to potential disturbance were assessed, along with a minimal 30-foot buffer. This included the LBS and UBS in the stream, potential staging areas, and two graded dirt access roads, one entering the study area from the north, the other from the south. Because of safety concerns and access constraints imposed by extremely steep canyon walls, large boulders and swift water, each of the two in-channel barrier sites were not completely surveyed. Habitat and vegetation within bed-and-bank were inspected with the aid of quality color photographs from a remote-controlled drone, provided by MLA. These aerial images show that the boulder and bedrock substrates within the bed and bank of North Fork Battle Creek are mostly devoid of vegetation at both barrier locations.

During these surveys, sub-populations of fritillary *(Fritillaria)* species were encountered that were past flower and thereby not identifiable to the level necessary to make determination of significance. All other plants encountered were identifiable to the necessary level. All plant species encountered were identified to the taxonomic level necessary to determine legal status and scientific significance. Plants not readily identified in the field were identified later in the lab. Scientific names follow Baldwin et al. (2012); common names follow Janeway (2013). Plant species encountered during the field surveys are listed in Appendix B.

An evaluation of the potential presence of special-status plant species is included in Appendix C. Based on the results of the evaluation in Appendix C, further evaluation was conducted of the potential impacts of the proposed project on those species with the potential to occur within, or near the proposed project site (Dittes and Guardino Consulting 2018). Based on that further evaluation, the following special-status plant species, or

designated Critical Habitats (CH) are known to, or may occur within the project area, and could potentially be significantly impacted by the proposed project:

- Butte County Fritillary *(Fritillaria eastwoodiae)*
- Wooly Meadowfoam *(Limnanthes floccosa ssp. floccosa)*

No federal or state listed plant species were encountered and suitable habitat for them is lacking (Dittes and Guardino Consulting 2018).

Butte County Fritillary

Butte County fritillary was positively identified at several locations in the study area on the terrace / plain edge and north-facing slope on the south side of Digger Creek and North Fork Battle Creek in the eastern portion of the project study area during the April 5, 2018 field survey. Plants identified as checkered fritillary *(Fritillaria affinis)* and scarlet fritillary *(Fritillaria recurva)* were also encountered on that day. The timing of surveys was such that numerous fritillary subpopulations, comprising thousands of individuals were encountered post-flowering on that day and on the second day of survey (April 10, 2018). Identification to species was not possible for the vast majority of fritillary plants encountered. A total of 55 Global Positioning System (GPS)-mapped locations of *Fritillaria sp.* were encountered in the study area. The number of plants at each of these locations ranges from a few individuals to swaths of several hundred. Butte County fritillary is known from 234 extant, and one possibly extirpated CNDDB occurrences in Butte, El Dorado, Nevada, Placer, Shasta, Tehama and Yuba Counties, and in Oregon. It occurs on 42 USGS 7.5-minute quadrangles. This species has been assigned a California Native Plant Society (CNPS) Rank of 3.2, meaning more information is needed (regarding taxonomy), and it is fairly endangered in California. It is thought that Tehama and Shasta County populations represent a different, as yet undescribed species. This has been supported by recent molecular studies (Dittes and Guardino Consulting 2018). It has been suggested that Butte County fritillary might appropriately be changed to a CNPS Rank of 1.B (California Native Plant Society 2018). It has been assigned a State Rank of S3 and Global Rank of G3Q meaning it is "Vulnerable". Butte County fritillary is threatened from logging, development, vehicles, road maintenance, recreation activities, altered fire regimes, erosion, non-native plants and over-shading (California Native Plant Society 2018). Throughout it range, it is associated with chaparral, cismontane woodland and openings in lower coniferous forest communities. In the project area it is associated with Mixed Foothill Woodland community, mostly on shaded slopes within the canyons, under trees and at the bases of topographic ledges and rock outcrops. There are a few colonies under the driplines of trees in the Blue Oak Woodland / Savannah and the edges of Chaparral.

Wooly Meadowfoam

Wooly meadowfoam was encountered at several locations along reaches of both the north and south access roads. Some of these colonies are situated within the southeast portion of the construction site study area. Colonies ranged from a few individuals to several dozen; one colony included approximately 200 plants. This species is known from 54 extant occurrences in Butte, Lake, Lassen, Napa, Shasta, Siskiyou, Tehama and Trinity Counties in California, and in Oregon. It occurs on 39 USGS quadrangles. This species has been assigned a CNPS Rank of 4.2, meaning it is uncommon and fairly endangered in California. It has been assigned a State Rank of S3, meaning it is vulnerable in California; with a Global Rank of G4T4 meaning it is deemed apparently secure, considering occurrences outside of California. Wooly meadowfoam is threatened by grazing, road widening, and potentially by development and non-native plant species (California Native Plant Society 2018). Throughout its range, it is associated with vernally moist habitats, including seasonal wetlands and vernal pools in chaparral, cismontane woodland and annual grassland communities. In the study area, wooly meadowfoam is associated with seasonal wetland vegetation in shallow swales, ephemeral drainages and seasonally-wet depressions.

3.2.3.2 Wildlife

Six habitat types generally occur within the study area as defined by the California Wildlife-Habitat Relationships classification system (Mayer and Laudenslayer 1988). The habitat types include: Blue Oak-Foothill Pine, Mixed Chaparral, Annual Grassland, Barren, Riverine and Montane Hardwood (Figure 14). The wildlife that potentially inhabit the area are those species that would normally be expected to use these habitats for food, shelter and cover within the general region (Sacramento Valley foothills).

A biological survey was conducted by TES staff on April 1, 2018, May 30, 2018, June 23, 2018, August 15, 2018 and August 22, 2018. The project study area included the entire project footprint, as well as a varying surrounding buffer area. The surveys were conducted by walking and / or driving portions of the study area that were accessible and recording direct wildlife observations. Observations were made using the unaided eye, binoculars and identification of vocalizations. Other methods included observations of animal tracks, scat and bird feathers. No protocol-level wildlife surveys were conducted.

In addition, to survey for bat species, two Pettersson DX-500 full spectrum, ultrasound, acoustical recording devices were deployed at four different locations in order to sample montane hardwood and chaparral habitats. A total of 19 detector-nights (one detector for one night) were sampled during the nights of May 30 and 31, 2018, June 1, 2 and 20, 2018, and August 15, 16, 17, 18, 19, 20 and 21, 2018. The survey was performed at a time of year that was favorable for detection of all bat species that could potentially occur at the site. The sampling occurred from approximately twenty minutes after sunset to twenty minutes before sunrise. Once recorded, the potential bat calls were then analyzed using SonoBat™ 4.2 software to identify calls to the species level. Individual calls were then manually vetted to arrive at the final species list. A list of all wildlife species observed during site surveys is included as Appendix D.

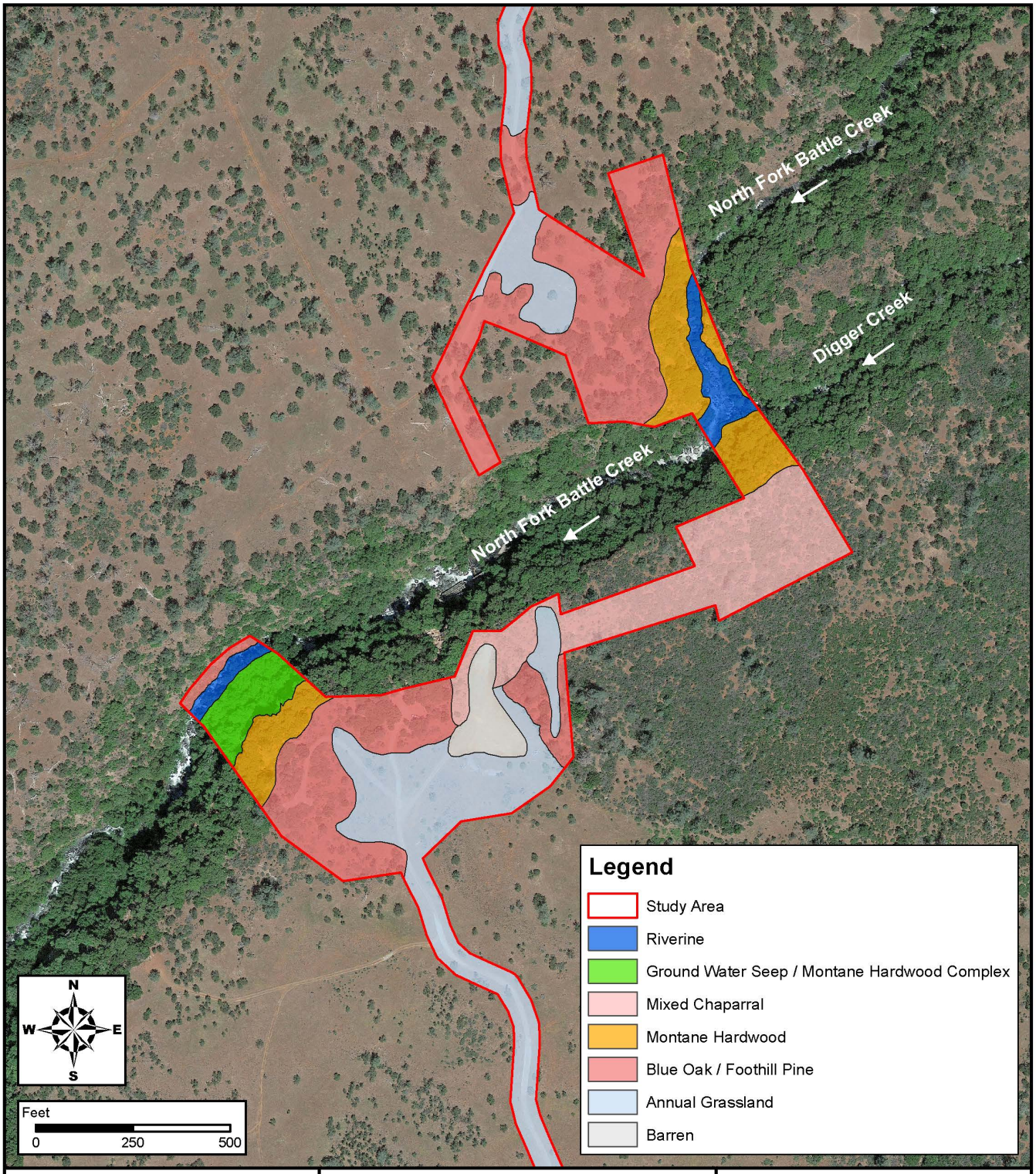
An evaluation of the potential presence of special-status faunal species is included in Appendix E. For the purposes of this evaluation, special-status species are defined as:

a) Those species listed by USFWS or NMFS as Endangered, Threatened, Proposed as Endangered or Threatened, Candidate to become Proposed or Species of Concern.
b) Those species listed by CDFW as Endangered, Threatened, Candidate for listing as Endangered or Threatened, Species of Special Concern or Fully Protected.

Special-status designations for faunal species are depicted in Appendix D. Designations were based on the most recent version of the special animals list (California Department of Fish and Wildlife 2018a).

Based on the results of the evaluation in Appendix E, the Biological Resources Evaluation (Tehama Environmental Solutions Inc. 2019a) further evaluated the potential impacts of the proposed project on those species with the potential to occur within, or near the proposed project site. Based on that further evaluation, the following special-status wildlife species, groups of species or designated CH are known to, likely to or may occur within the project area, and could potentially be significantly impacted by the proposed project:

- Western Pond Turtle *(Emys marmorata)*
- Grasshopper Sparrow *(Ammodramus savannarum)*
- Golden Eagle *(Aquila chrysaetos)*
- Long-eared Owl *(Asio otus)*
- Burrowing Owl *(Athene cunicularia)*
- White-tailed Kite *(Elanus caeruleus)*
- American Peregrine Falcon *(Falco peregrinus anatum)*
- Bald Eagle *(Haliaeetus leucocephalus)*
- Yellow-breasted Chat *(Icteria virens)*
- Loggerhead Shrike *(Lanius ludovicianus)*
- Yellow Warbler *(Setophaga petechia)*



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North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project

Shasta and Tehama Counties, California

March 2019

California Wildlife Habitat Relationships Map

PHOTO SOURCE: Google Earth, 5/25/2017

Figure 14. California Wildlife Habitat Relationships Map

- Other Nesting Raptors
- Other Nesting Migratory Birds
- Vernal Pool Fairy Shrimp *(Branchinecta lynchi)*
- Vernal Pool Tadpole Shrimp *(Lepidurus packardi)*
- Pallid Bat *(Antrozous pallidus)*
- Ringtail *(Bassariscus astutus)*
- Spotted Bat *(Euderma maculatum)*
- Western Mastiff Bat *(Eumops perotis)*
- Western Red Bat *(Lasiurus blossevillii)*

Two of these species (vernal pool fairy shrimp and vernal pool tadpole shrimp) are federally listed as Threatened or Endangered. CH for two of these species is not located within the project site. Under Section 7 of the ESA, federal agencies are required to consult with the USFWS regarding impacts from a proposed action to listed species or species proposed for listing, and their designated CH. A *Biological Assessment* (Tehama Environmental Solutions 2019b) has been prepared for the proposed project and consultation with the USFWS has been completed.

Western Pond Turtle

The western pond turtle is designated as a CDFW Species of Special Concern. Population declines are attributed to impacts to nesting habitat, nest and juvenile predation by non-native aquatic species, human-induced predator population increases and historic human overexploitation (Jennings and Hayes 1994). This species inhabits quiet waters of ponds, lakes, streams, etc., where there are rocks or logs for basking and safe underwater retreat areas (Stebbins 1972). They are closely tied to water except when females move overland to lay eggs or when either sex may move overland to upland sites to overwinter. They may overwinter on land or in water but are thought to be more likely to overwinter in water when inhabiting pond habitats. Egg-laying typically occurs in May and June but can occur from late April to early August, while overwintering generally begins in October or November (Jennings and Hayes 1994). Hatchlings are thought to overwinter in the nest and emerge to migrate to aquatic habitats the following spring (Jennings and Hayes 1994). Western pond turtles were not observed in North Fork Battle Creek during previous surveys (Jones and Stokes 2001), or within the study area during TES surveys. They may have been detected upstream of Eagle Canyon Dam during surveys conducted for a fish passage construction project (P. Herrera pers. comm.). While only marginal habitat is present within the project area due to the shaded nature of the canyon, based on the fact that western pond turtles may have been detected during prior field surveys, this species may potentially occur within the project area.

Grasshopper Sparrow

The grasshopper sparrow is a CDFW Species of Special Concern. Reported potential threats to the species include urbanization, expansion of vineyards and fire suppression, if these lead to grassland conversion (Shuford and Gardali 2008). The grasshopper sparrow is more likely to be found in large tracts of habitat than in small ones. Minimum area requirements are approximately 100 hectares (247 acres) in Maine and 30 hectares (74 acres) in Illinois. In general, grasshopper sparrows in California prefer short to middle-height, moderately open grasslands with scattered shrubs (Shuford and Gardali 2008). The breeding season for this species extends from mid-March to August. This species builds nests domed with grasses and forbs with a side entrance, in a slight depression in the ground, hidden at the base of an overhanging clump of grasses or forbs, with the rim approximately level to the ground (Shuford and Gardali 2008). The grasshopper sparrow diet is roughly 63 percent animal matter (mainly grasshoppers) and 37 percent vegetable (plants / seeds), and they forage primarily on the ground (bare ground is critical microhabitat for effective foraging) or from low vegetation (Shuford and Gardali 2008). Grasshopper sparrows may nest within the project area within suitable habitat such as the grasslands located adjacent to the access haul roads and within the staging areas. The species was not observed during TES site surveys.

Golden Eagle

The golden eagle is designated as a Fully Protected Species under the California Fish and Game Code and is protected by the Bald and Golden Eagle Protection Act. This species has declined near human population centers (Remsen 1978). The loss and alteration of grasslands, shooting, and human disturbance at nest sites are reported to have contributed to the decline of the species (Remsen 1978). The golden eagle is a permanent resident throughout California, except in the center of the Central Valley, although it winters in this area (Zeiner et al. 1990a). Golden eagles typically inhabit rolling foothills, mountainous areas, sage-juniper flats, and deserts (Zeiner et al. 1990a). It breeds from late January through August, peaking from March through July, and nests on cliffs and in large trees near open areas. Golden eagles often maintain alternative nest sites and old nests are often reused (Zeiner et al. 1990a). The golden eagle needs open areas for hunting and their diet consists mostly of lagomorphs and rodents, but also includes other mammals, reptiles, birds and some carrion (Zeiner et al. 1990a). Golden eagles may nest within the study area due to suitable nesting habitat in the form of cliffs within the canyon. No nesting activity is known to exist in the general area however the potential still exists for new nesting territories to become established. The species was not observed during TES site surveys, however golden eagles were observed in Eagle Canyon during prior surveys (Jones and Stokes 2001) and construction monitoring (P. Herrera pers. comm.).

Long-eared Owl

The long-eared owl is designated as a Species of Special Concern by CDFW. Declines in long-eared owl populations have been attributed to destruction of lowland riparian woodland habitats, however other unknown factors such as automobile collisions and human harassment may also be contributing factors (Remsen 1978). This species nests and roosts in riparian, live oak or other thickets with small, densely-canopied trees, and primarily hunts in open areas for rodents, as well as birds, smaller owls and other vertebrates (Zeiner et al. 1990a). Breeding occurs from early March to late July (Zeiner et al. 1990a). Long-eared owls may nest in the riparian / streamside areas or dense upland woodlands within and near the project area. This species was not observed during TES site surveys.

Burrowing Owl

The burrowing owl is a CDFW Species of Special Concern. Population declines are attributed to conversion of grassland to agriculture, other habitat destruction and poisoning of ground squirrels (Remsen 1978). Collisions with automobiles may also be a significant cause of mortality. Burrowing owls are yearlong residents of open, dry grassland, desert habitats and open shrub stages of pinyon-juniper and ponderosa pine habitats. This species eats mostly insects, small mammals, reptiles, birds and carrion. They use ground squirrel burrows or other burrows for roosting and nesting cover, or they may dig their own burrow in soft soil. Burrowing owls are not likely to nest within, or immediately near the project area due to the fact that the project area is outside of the known breeding range of the species. The species may winter within the project area in grasslands located adjacent to the access haul roads and within the staging areas. No burrowing owls or potential burrows were observed during site surveys.

White-tailed Kite

The white-tailed kite is designated as a Fully Protected species under the California Fish and Game Code. The species has extended its range and increased in numbers in recent decades (Zeiner et al. 1990a). They are rarely found away from agricultural areas and nest from February to October near the tops of trees in dense oak, willow or other tree stands, near open foraging areas (Zeiner et al. 1990a). They forage on small mammals and occasionally on birds, insects, reptiles and amphibians in undisturbed open grasslands, meadows, farmlands and emergent wetlands (Zeiner et al. 1990a). Potential nesting habitat is present within the project area. White-tailed kites were not observed during TES site surveys.

American Peregrine Falcon

The American peregrine falcon is designated as a Fully Protected species under the California Fish and Game Code. The species was previously listed as Endangered by the State of California and was delisted in 2009. The species was originally listed as Endangered by USFWS and was delisted in 1999. Declines in population associated with this species are attributed primarily to dichlorodiphenyltrichloroethane (DDT) contamination (Zeiner et al. 1990a). Riparian areas and coastal and inland wetlands are important habitats year-long, especially in non-breeding seasons. They require protected cliffs and ledges for cover. They breed near wetlands, lakes, rivers or other waters, and nest on cliff ledges, human structures and occasionally, in cavities in large snags and old nests from other raptors. The peregrine falcon feeds primarily on birds including ducks, and also takes mammals and fish. Peregrine falcons may nest within the project area due to suitable nesting habitat in the form of cliffs within the canyon. No nesting activity is known to exist in the general area however the potential still exists for new nesting territories to become established. Peregrine falcons were not observed during TES site surveys.

Bald Eagle

The bald eagle was listed as Endangered by the State of California in 1971, and is designated as a Fully Protected species under the California Fish and Game Code and is protected by the Bald and Golden Eagle Protection Act. The species was originally listed as Endangered by USFWS in 1967, was downlisted to Threatened in 1995 and was delisted in 2007. Past declines in bald eagle populations are attributed to the effects of DDT, lead shot and habitat disturbance, however in California, the number of territories has increased and the species range has expanded (California Department of Fish and Game 2005). Recovery efforts have focused on the protection of nesting areas and restrictions on the use of DDT. The bald eagle is a large bird of prey that winters throughout California. They nest in the upper canopy of large trees normally in mountain and foothill habitats near rivers, streams and reservoirs. They forage opportunistically on fish and waterfowl but also prey on other small animals and eat carrion (California Department of Fish and Game 2005). Potential nesting habitat is present in North Fork Battle Creek. Bald eagle nesting activity is not known to occur in the general area, however potential still exists for new nesting territories to be established. Bald eagles were not observed during TES site surveys, however, bald eagles were observed during prior site surveys (Jones and Stokes 2001) and construction monitoring (P. Herrera pers. comm.).

Yellow-breasted Chat

The yellow-breasted chat is designated as a CDFW Species of Special Concern. Threats to the species include destruction of riparian habitat and nest parasitism by brown-headed cowbirds (Remsen 1978). Yellow-breasted chats are neotropical migrant songbirds that nest in dense shrubs along streams and rivers and require dense, brushy thickets and tangles near water for cover. They nest from early May to early August with peak nesting activity in June, and forage on insects, spiders, berries and other fruit (Zeiner et al. 1990a). Potential nesting habitat is present within the project area in riparian / streamside habitats and dense understory vegetation within the canyon. Yellow-breasted chats were not observed during TES site surveys.

Loggerhead Shrike

The loggerhead shrike is a CDFW Species of Special Concern. Potential threats and reasons for population declines are not well-documented for this species although habitat loss, on breeding and wintering grounds as well as along migratory routes, is a major threat to the species. Loggerhead shrikes construct nests in dense foliage in trees or shrubs in areas with open habitat and scattered shrubs, trees, or other perches. They are found primarily in valley foothill hardwood, hardwood-conifer and riparian habitats as well as pinyon-juniper, juniper and desert riparian Joshua tree habitats (Zeiner et al. 1990a). Nesting occurs from March into May, with young becoming independent in July and August (Zeiner et al. 1990a). They feed primarily on large insects but also take small birds, mammals, amphibians, reptiles, fish, carrion and other invertebrates (Zeiner et al. 1990a). Potential nesting habitat is present in tree and shrub habitats within the project area. No loggerhead shrikes were observed within the project area during TES field surveys.

Yellow Warbler

The yellow warbler is designated as a CDFW Species of Special Concern. Threats to the species include destruction of riparian habitat and nest parasitism by brown-headed cowbirds (Remsen 1978). Numbers of breeding pairs have declined dramatically in recent decades in lowland areas. Yellow warblers are neotropical migrant songbirds that nest in riparian woodlands as well as in montane chaparral and in the shrubby understory of ponderosa pine and mixed conifer forests (Zeiner et al. 1990a, Shuford and Gardali 2008). They nest from mid-April into early August, with peak nesting activity in June, and eat insects, spiders and occasionally berries (Zeiner et al. 1990a). Potential nesting habitat is present in riparian / streamside areas within the project area. No yellow warblers were observed during TES site surveys.

Other Nesting Raptors

Nesting habitat exists within, and near the project area for several other raptor species (hawks, falcons and owls) that are not identified as special-status species, but are protected under several sections of the California Fish and Game Code. Several raptor species were observed during TES site surveys (Appendix D). Several nests were observed within, or in the vicinity of the study area that could potentially serve as raptor nests. A number of additional raptor species, while not observed, may potentially nest within, or near the project area.

Other Nesting Migratory Birds

Nesting habitat exists within the project area for a number of migratory bird species that are not identified as special-status species, but are protected under the federal Migratory Bird Treaty Act and / or under several sections of the California Fish and Game Code (California Department of Fish and Wildlife and California Attorney General 2018).

Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp was listed as Threatened by USFWS on September 19, 1994. CH was initially designated on August 6, 2003. Additional CH was designated on February 10, 2006. Population declines are attributed to destruction and degradation of vernal pool habitats. Vernal pool fairy shrimp occur exclusively in vernal pool and vernal pool-like habitats. Although the species has been collected from larger pools, it generally tends to occur in smaller pools less than 0.05 acres and is typically found in pools with low to moderate salinity or total dissolved solids (U.S. Fish and Wildlife Service 2005). Vernal pool fairy shrimp eggs, or cysts, remain dormant in the soil when the pools are dry and several separate hatches can occur in a single wet season. Adults can reach sexual maturity in as few as 18 days at optimal water temperatures and feed on algae, bacteria, protozoa, rotifers and detritus (U.S. Fish and Wildlife Service 2005). Potential vernal pool fairy shrimp habitat is present in seasonal wetlands and seasonally-wet depressions adjacent to the south access road and staging areas. Vernal pool fairy shrimp were not observed within the project area during TES surveys, however full protocol-level surveys were not conducted.

Vernal Pool Tadpole Shrimp

The vernal pool tadpole shrimp was listed as Endangered by USFWS on September 19, 1994. CH was initially designated on August 6, 2003. Additional CH was designated on February 10, 2006. Population declines are attributed to destruction and degradation of vernal pool habitats. Vernal pool tadpole shrimp occur in a wide variety of ephemeral habitats and have been collected in pools ranging in size from 6.5 square feet to 88 acres (U.S. Fish and Wildlife Service 2005). Vernal pool tadpole shrimp eggs, or cysts, remain dormant in the soil when the pools are dry and hatch in as few as four days after winter rains fill the vernal habitats (U.S. Fish and Wildlife Service 2005). Adults reach sexual maturity in three to four weeks and females can deposit as many as six clutches of eggs in a single wet season (U.S. Fish and Wildlife Service 2005). They feed on organic debris and living organisms such as fairy shrimp and other invertebrates (U.S. Fish and Wildlife Service 2007). Potential vernal pool tadpole shrimp habitat is present in seasonal wetlands and seasonally-wet depressions adjacent to

the south access road and staging areas. Vernal pool tadpole shrimp were not observed within the project area during surveys, however full protocol-level surveys were not conducted.

Pallid Bat

The pallid bat is designated as a CDFW Species of Special Concern. Threats to the species include destruction and disturbance of roosting sites which include caves, crevices, mines, and occasionally, hollow trees and buildings (Zeiner et al. 1990b). This species is most common in open, dry areas near rocky sites for roosting in a wide variety of habitats including grasslands, shrublands, woodlands and forests from sea level up through mixed conifer forests (Zeiner et al. 1990b). Females give birth in the early summer in nursery colony roosts and the young are not weaned until the fall. Pallid bats feed on large arthropods including scorpions, cicadas, katydids, beetles, crickets, grasshoppers, praying mantids and moths (Bolster et al. 1998). Pallid bats may roost in hollow trees or rock crevices within or near the project area. This species was not detected during TES acoustical site surveys.

Ringtail

The ringtail is designated as a Fully Protected species under the California Fish and Game Code. Threats to the species include urbanization and loss and degradation of riparian communities (Williams 1986). This medium-sized carnivore inhabits forests and shrublands in close association with riparian habitats or rocky areas. They are usually found within 0.6 miles of permanent water (Zeiner et al. 1990b) in low to middle elevations. Ringtails den and nest in hollow trees, snags, cavities in rocks, abandoned burrows and human structures. Ringtails primarily feed on rodents and rabbits and also birds and eggs, reptiles, invertebrates, fruits, nuts and some carrion. Ringtails may den in riparian and upland habitats within the project area. Ringtails have been observed in Eagle Canyon by PG&E staff (Jon Walsh, pers. comm.) No ringtails were observed during TES site surveys, however they are seldom observed without the use of specialized survey methods due to their strongly nocturnal nature.

Spotted Bat

The spotted bat is a CDFW Species of Special Concern. This species is considered one of the rarest mammals in North America but the reasons for population declines are not well documented (Zeiner et al. 1990b). The spotted bat is a solitary species and forages late at night, principally for moths. They roost in rock crevices, cliffs, caves and buildings with cliffs providing optimal habitat. The spotted bat forages over water and along washes (Zeiner et al. 1990b). Occupied habitats range from arid deserts and grasslands to mixed conifer forests (Zeiner et al. 1990b). Spotted bats may roost within the project area in suitable habitat (rock crevices). Spotted bats were not detected during TES acoustical site surveys.

Western Mastiff Bat

The western mastiff bat is a CDFW Species of Special Concern. Reasons for decline of this species are attributed to extensive loss of habitat, cultivation of foraging habitat and use of insecticides (Williams 1986). The species is non-migratory and day-roosts alone or in small colonies in crevices in rock outcrops, cliffs, trees and tall buildings. Nursery roosts described as tight rock crevices approximately three feet deep and two inches wide or crevices in buildings. They occupy semi-arid to arid habitats including conifer and deciduous woodlands, coastal scrub, grasslands and chaparral (Zeiner et al. 1990b). Night roosts are seldom used due to their prolonged foraging period. They feed primarily on hymenopteran insects (Zeiner et al. 1990b). When roosting in rock crevices, western mastiff bats need vertical faces to drop off from to take flight. Western mastiff bats may roost within the project area in suitable habitat (rock crevices). Western mastiff bats were not detected during TES acoustical site surveys.

Western Red Bat

The western red bat is designated as a CDFW Species of Special Concern. Potential threats to this species include loss of riparian habitat from habitat conversions and fatalities from wind turbines. Their roosting habitat includes forests and woodlands, ranging from sea level to mixed conifer forests. They roost in foliage near edge habitats

adjacent to streams, fields or urban areas in trees (Zeiner et. al. 1990b). The western red bat hibernates in the winter and is generally considered a solitary species. They feed over a wide variety of habitats including grasslands, shrublands, open woodlands and forests, and croplands. They are nocturnal and feed primarily on insects such as moths, crickets, beetles and cicadas. Breeding occurs in August and September and, after delayed fertilization, females give birth between late May and early July. Western red bats may roost within the project area in suitable habitat (riparian / streamside vegetation). This species was not detected during TES acoustical site surveys.

3.2.3.3 Wetlands and Other Jurisdictional Waters of the U.S.

Wetlands and other potentially jurisdictional waters of the U.S. are present within the project area, associated with Battle Creek, groundwater seeps, ephemeral drainages and human-made features associated with the Eagle Canyon diversion system. Based on the presence / absence of indicators of wetland hydrology, hydrophytic vegetation and hydric soils, 0.87 acres of potentially jurisdictional wetlands were identified and delineated. Based on the presence of an Ordinary High Water Mark (OHWM), 0.89 acres of potentially jurisdictional other waters of the U.S. were also identified and delineated (Figure 15 through Figure 19). Table 2 presents a summary of the total acreage of potentially jurisdictional waters of the U.S.

Table 2. Summary of Potentially Jurisdictional Waters of the U.S.	
North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project	
Wetlands	**Total Acreage**
Groundwater Seep Wetland	0.78
Seasonal Wetland	0.09
Total Wetlands	**0.87**
Other Waters	**Total Acreage**
Perennial Stream	0.81
Ephemeral Stream	0.03
Flume	0.02
Ditch	0.02
Total Other Waters	**0.89**
TOTAL WATERS OF THE U.S.	**1.75**

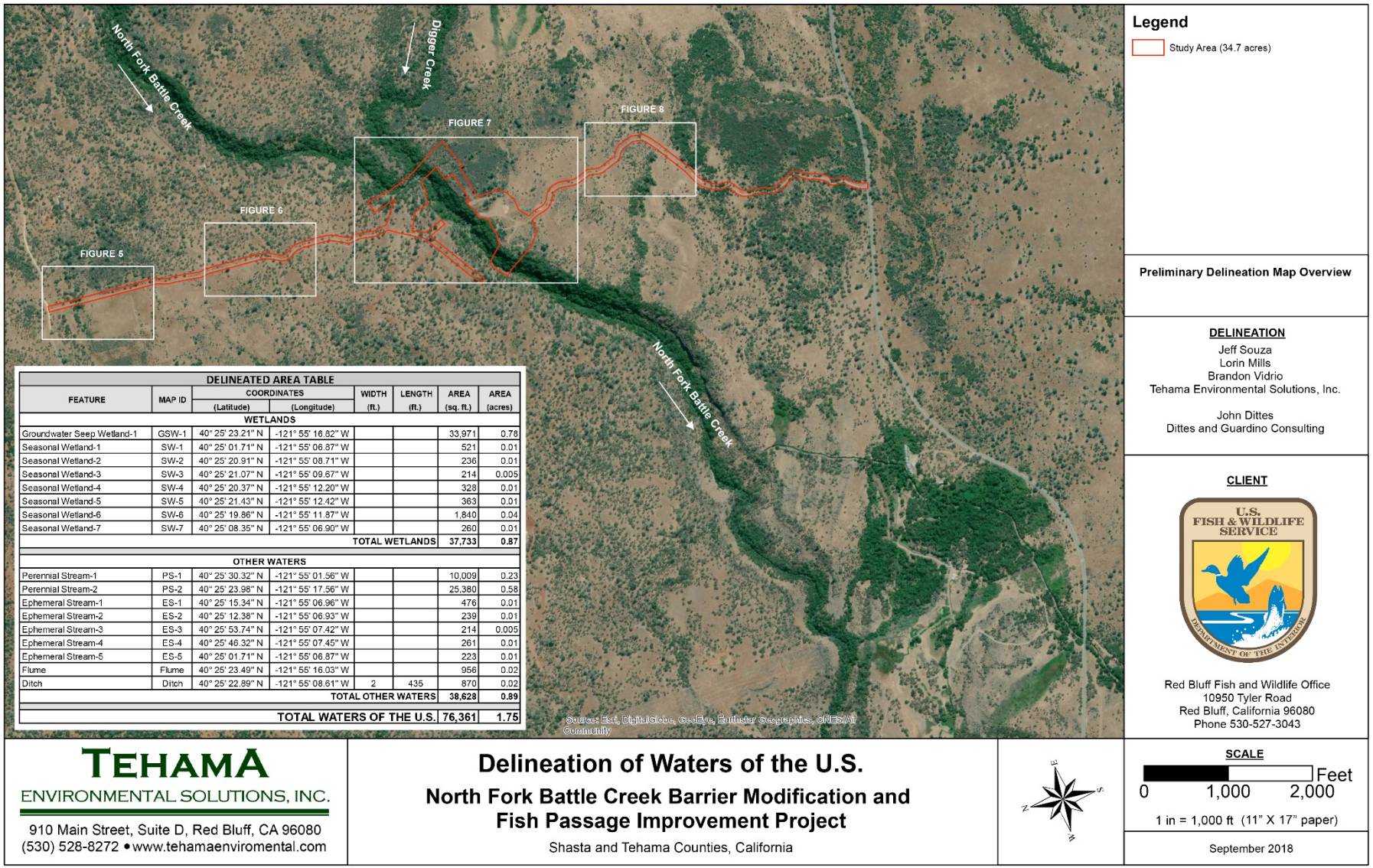
Wetlands

Groundwater Seep Wetland

The Groundwater Seep Wetland (GWS-1) feature (Figure 19) is associated with a perennial seep on the south canyon wall of Battle Creek. The feature is dominated by canyon live oak and bay laurel in the tree layer; edible fig, spicebush *(Calycanthus occidentalis)* and poison oak in the shrub layer; and Himalayan blackberry in the woody vine layer.

Seasonal Wetland

The Seasonal Wetland (SW) features (Figure 18 and Figure 19) all appear to be formed by human activities associated with the south access road and recent construction activities associated with a former construction staging area. They tend to be dominated by Mediterranean barley, hyssop loosestrife and annual hair grass. Common subdominants include Mediterranean beardgrass *(Polypogon maritimus)*, annual rye, purslane speedwell and Oregon woolly marbles. Several of these features have a layer of small pea gravel covering the bottom of the depression.



DELINEATED AREA TABLE

FEATURE	MAP ID	COORDINATES (Latitude)	COORDINATES (Longitude)	WIDTH (ft.)	LENGTH (ft.)	AREA (sq. ft.)	AREA (acres)
WETLANDS							
Groundwater Seep Wetland-1	GSW-1	40° 25' 23.21" N	-121° 55' 16.82" W			33,971	0.78
Seasonal Wetland-1	SW-1	40° 25' 01.71" N	-121° 55' 06.87" W			521	0.01
Seasonal Wetland-2	SW-2	40° 25' 20.91" N	-121° 55' 08.71" W			236	0.01
Seasonal Wetland-3	SW-3	40° 25' 21.07" N	-121° 55' 09.67" W			214	0.005
Seasonal Wetland-4	SW-4	40° 25' 20.37" N	-121° 55' 12.20" W			328	0.01
Seasonal Wetland-5	SW-5	40° 25' 21.43" N	-121° 55' 12.42" W			363	0.01
Seasonal Wetland-6	SW-6	40° 25' 19.86" N	-121° 55' 11.87" W			1,840	0.04
Seasonal Wetland-7	SW-7	40° 25' 08.35" N	-121° 55' 06.90" W			260	0.01
					TOTAL WETLANDS	**37,733**	**0.87**
OTHER WATERS							
Perennial Stream-1	PS-1	40° 25' 30.32" N	-121° 55' 01.56" W			10,009	0.23
Perennial Stream-2	PS-2	40° 25' 23.98" N	-121° 55' 17.56" W			25,380	0.58
Ephemeral Stream-1	ES-1	40° 25' 15.34" N	-121° 55' 06.96" W			476	0.01
Ephemeral Stream-2	ES-2	40° 25' 12.38" N	-121° 55' 06.93" W			239	0.01
Ephemeral Stream-3	ES-3	40° 25' 53.74" N	-121° 55' 07.42" W			214	0.005
Ephemeral Stream-4	ES-4	40° 25' 46.32" N	-121° 55' 07.45" W			261	0.01
Ephemeral Stream-5	ES-5	40° 25' 01.71" N	-121° 55' 06.87" W			223	0.01
Flume	Flume	40° 25' 23.49" N	-121° 55' 16.03" W			956	0.02
Ditch	Ditch	40° 25' 22.89" N	-121° 55' 08.61" W	2	435	870	0.02
					TOTAL OTHER WATERS	**38,628**	**0.89**
					TOTAL WATERS OF THE U.S.	**76,361**	**1.75**

Figure 15. Delineation of Waters of the U.S.

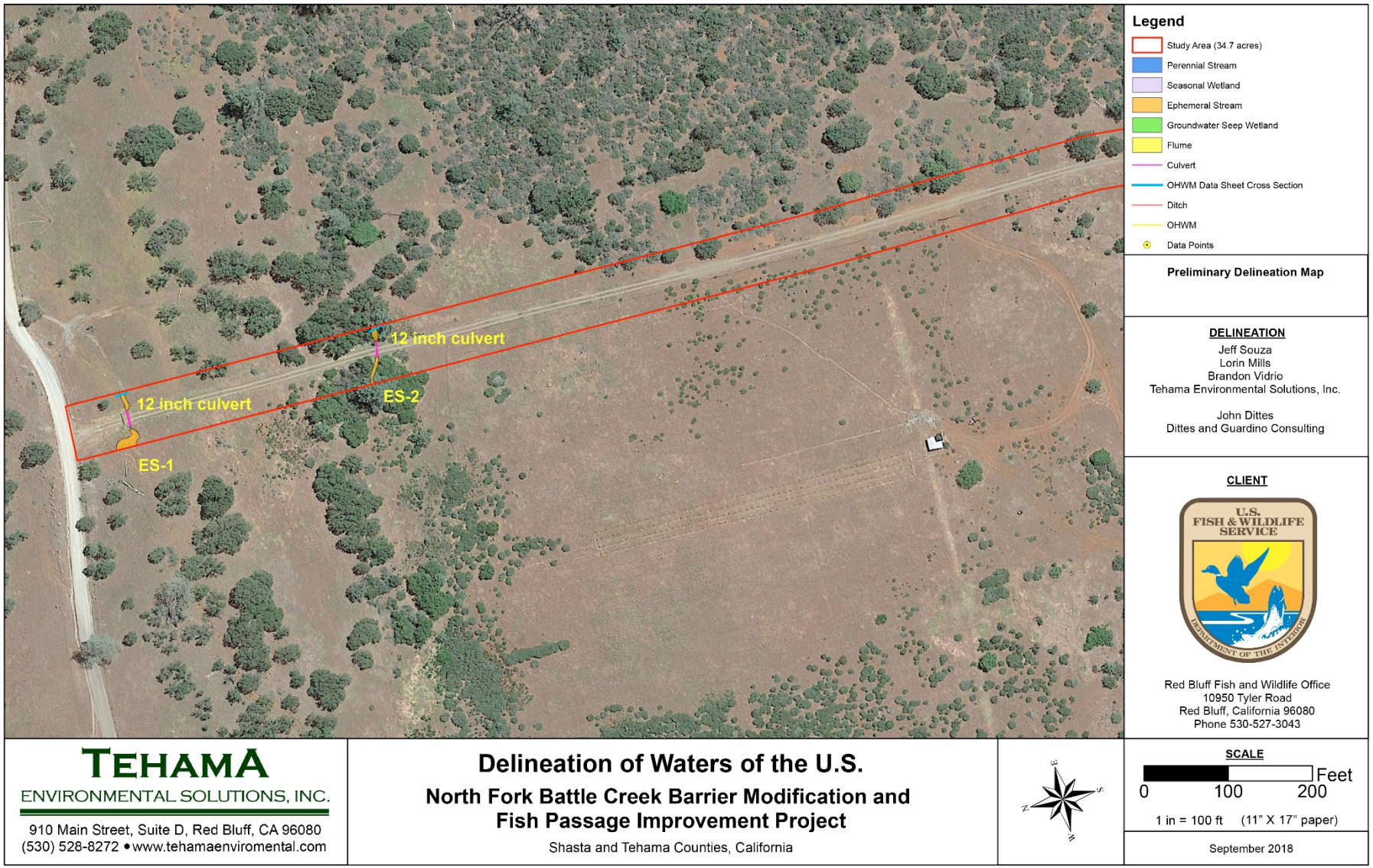


Figure 16. Delineation of Waters of the U.S.

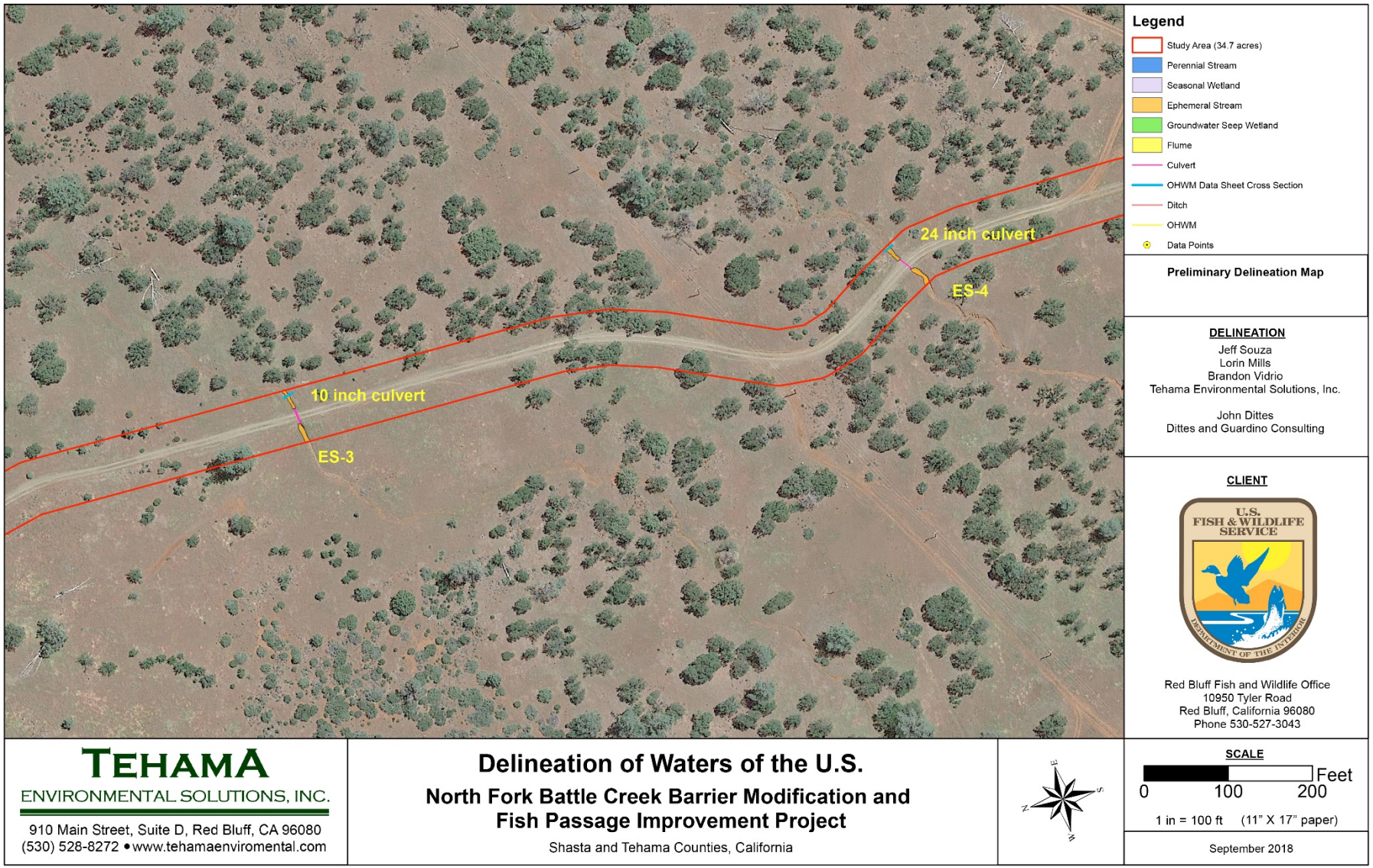


Figure 17. Delineation of Waters of the U.S.

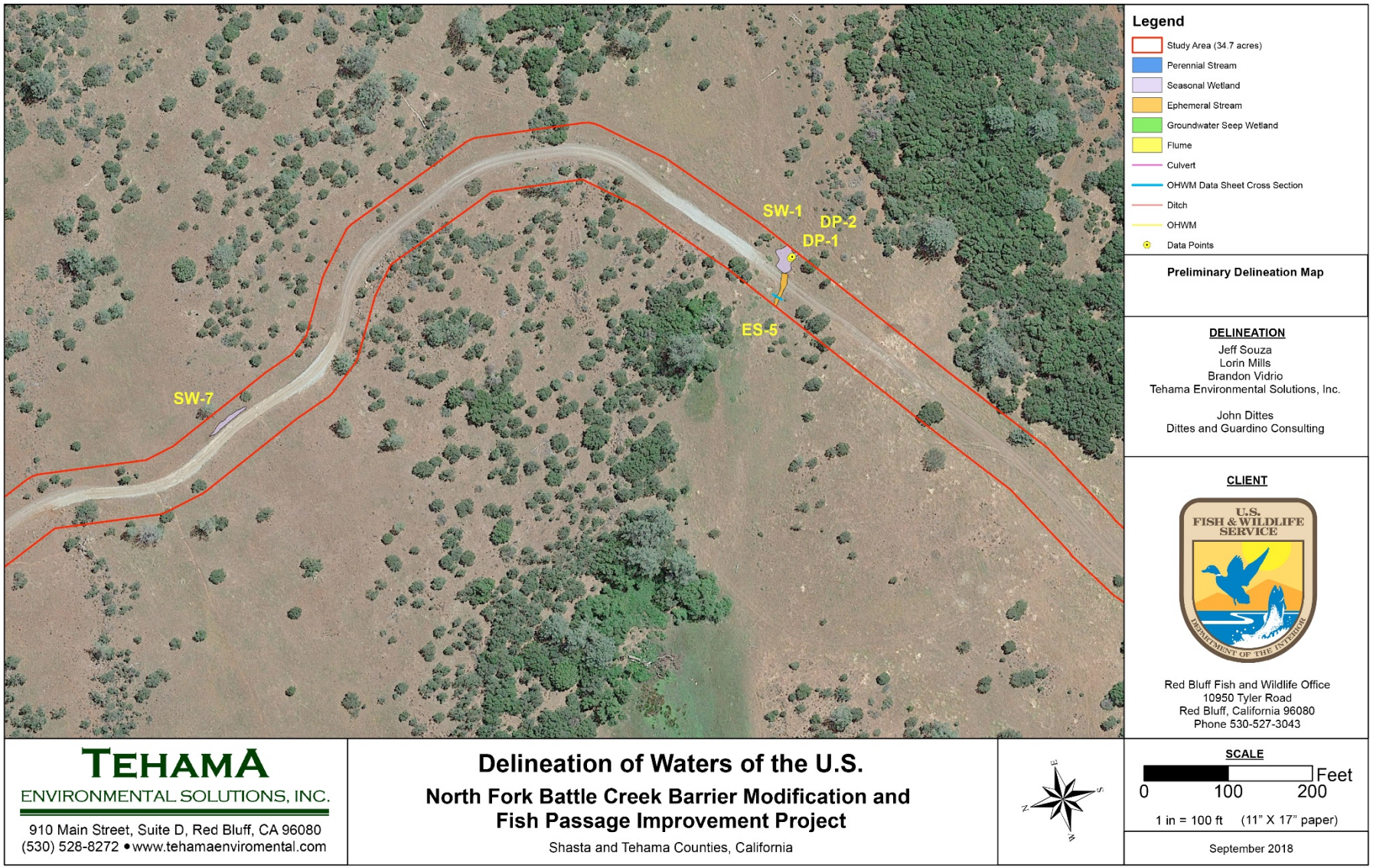


Figure 18. Delineation of Waters of the U.S

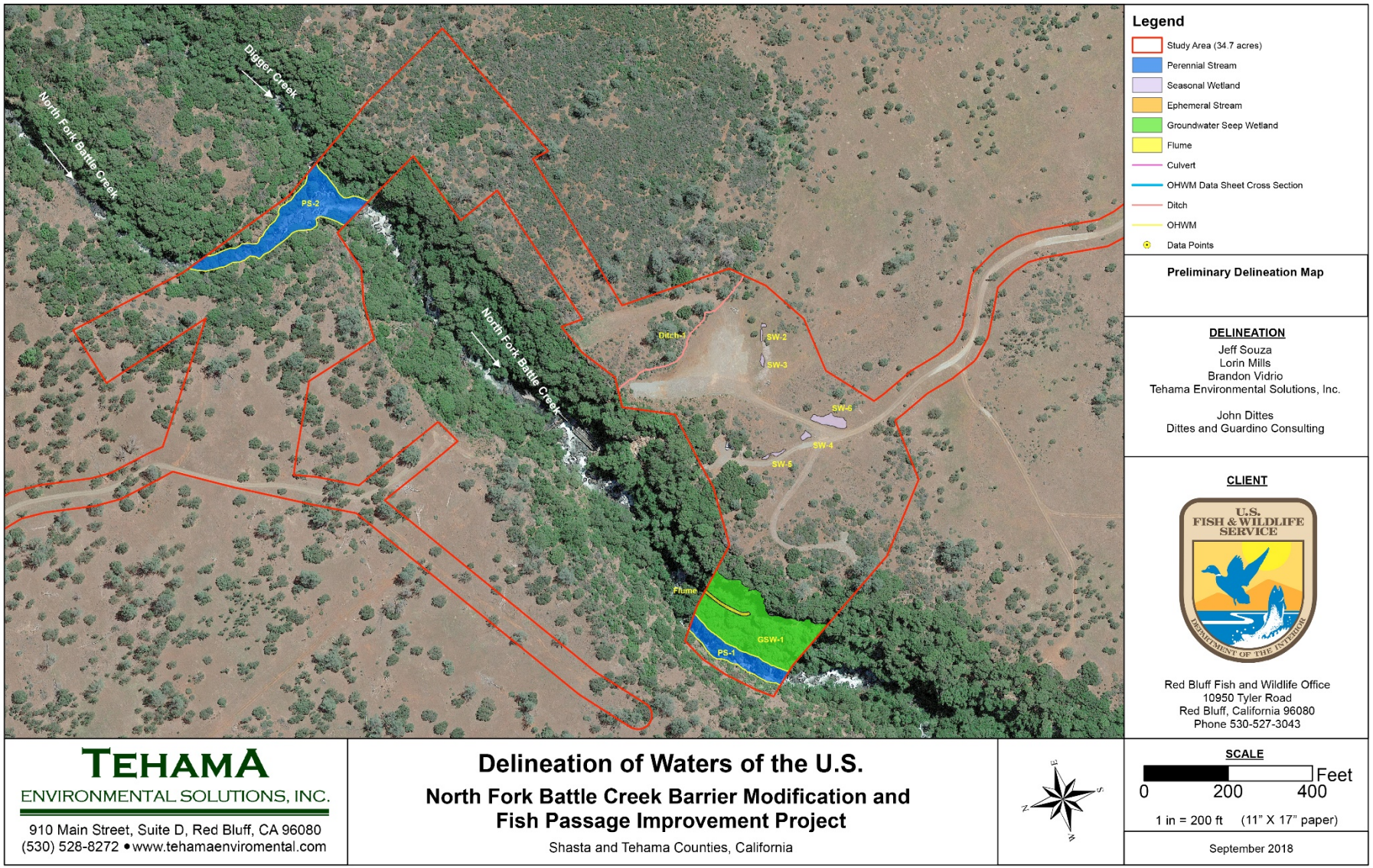


Figure 19. Delineation of Waters of the U.S.

Other Waters of the U.S.

Perennial Stream

A perennial stream is present within the channels of North Fork Battle Creek and Digger Creek. The creek channel is devoid of vegetation, and the vertical canyon rock walls throughout most of the stream banks only support occasional woody or herbaceous riparian plants such as red willow *(Salix lasiandra)*, white alder, California grape and California blackberry.

Ephemeral Stream

Five ephemeral streams cross under the north access road through small culverts. These streams do not support riparian vegetation but are lined by blue oak and interior live oak in some areas.

Flume

A flume system flows through the LBS. The flume carries water from the Eagle Canyon diversion through a series of underground tunnels and exposed flumes. Flows appear to be perennial, with the exception of planned outages for maintenance of PG&E facilities.

Ditch

A small ditch represents potentially jurisdictional waters of the U.S. but may not be jurisdictional due to the fact that it does not appear to carry water from a jurisdictional feature. The water that is does carry flows to North Fork Battle Creek by way of a waterfall over the vertical south canyon wall. The ditch appears to have been created to improve the drainage of a former construction staging area.

3.2.3.4 Fisheries

The volcanic geological conditions in the Battle Creek watershed make it a particularly unique and valuable fishery resource relative to other Sacramento River tributaries. Battle Creek drains the western slopes of Mount Lassen in the southern Cascade Range. Stream flows are fed by rainfall, snowmelt and abundant year-round cold springs. Battle Creek has the highest base flows of any Sacramento River tributary between Keswick Dam and the Feather River (Jones and Stokes 2005).

Battle Creek has two main tributaries, North Fork Battle Creek and South Fork Battle Creek. North Fork Battle Creek is approximately 29 stream miles from the headwaters to the confluence with the main stem of Battle Creek. A waterfall 13.5 stream miles upstream of the confluence acts as a natural fish barrier. South Fork Battle Creek is approximately 28 stream miles from the headwaters to the confluence with the main stem of Battle Creek. A waterfall 18.9 stream miles upstream of the confluence also acts as a natural fish barrier.

A number of fisheries studies have been conducted in the watershed (Thomas Payne and Associates 1998, Keir Associates 1999, Whitton et al. 2010). Nineteen species of fish have been documented in Battle Creek as presented in Table 3 (Jones and Stokes 2005, Whitton et al. 2010). Of these, 14 are native while the remaining five are non-native. Of these nineteen species, only rainbow trout *(Oncorhynchus mykiss)* and riffle sculpin *(Cottus gulosus)* were observed during snorkel and electrofishing surveys conducted in the project reach of North Fork Battle Creek, upstream and downstream of Eagle Canyon Dam (Whitton et al. 2010).

The Coleman National Fish Hatchery is located on the main stem of Battle Creek, approximately three stream miles upstream of the Sacramento River. The hatchery produces Chinook salmon and steelhead to partially compensate for the loss of anadromous fish due to the construction of Shasta and Keswick Dams (ICF International 2016). The hatchery operates a barrier weir on the main stem of Battle Creek and has a significant influence on Battle Creek fisheries and the restoration of anadromous fish populations in the watershed.

Table 3. Fish Species Known to Occur in Battle Creek		
Common Name	**Scientific Name**	**Native (N); Non-native (I)**
Sacramento Sucker	*Catostomus occidentalis*	N
Riffle Sculpin	*Cottus gulosus*	N
Pacific Lamprey	*Entosphenus tridentata*	N
Three-spine Stickleback	*Gasterosteus aculeatus*	N
Tule Perch	*Hysterocarpus traski*	N
River Lamprey	*Lampetra ayresi*	N
Unknown Brook Lamprey	*Lampetra sp.*	N
California Roach	*Hesperoleucus symmetricus*	N
Green Sunfish	*Lepomis cyanellus*	I
Smallmouth Bass	*Micropterus dolomieu*	I
Spotted Bass	*Micropterus punctulatus*	I
Hardhead	*Mylopharodon conocephalus*	N
Golden Shiner	*Notemigonus crysoleucas*	I
Steelhead	*Oncorhynchus mykiss*	N
Rainbow Trout	*Oncorhynchus mykiss*	N
Chinook Salmon	*Oncorhynchus tshawytscha*	N
Sacramento Pikeminnow	*Ptychocheilus grandis*	N
Speckled Dace	*Rhinichthys osculus*	N
Brown Trout	*Salmo trutta*	I

Battle Creek has been regarded as a uniquely important watershed because of the abundance and broad diversity of Chinook salmon and steelhead that historically used the creek. The year round influence of cold water springs allowed for such diversity to develop, including winter-run Chinook salmon, which is now in danger of extinction. Hydroelectric facilities and operations, and other human factors likely caused the extirpation of winter-run Chinook from the Battle Creek watershed in the early 1900s. Areas upstream of Eagle Canyon Dam have been identified as optimal habitat for winter-run Chinook.

Battle Creek is an important tributary to the Sacramento River, especially for the recovery of three state and / or federally listed species of salmonids including the state and federally listed as endangered Sacramento River winter-run Chinook salmon, state and federally listed as threatened Central Valley spring-run Chinook salmon, and federally listed as threatened Central Valley steelhead (National Marine Fisheries Service et al. 1999). In 1999, an MOU was signed between NMFS, Reclamation, USFWS, CDFW and PG&E, where parties agreed to pursue the BCRP. The BCRP is a cooperative, proactive undertaking by the public, interested parties, the Greater Battle Creek Watershed Working Group, state and federal agencies and PG&E to restore the anadromous fishery in the Battle Creek watershed. Upon completion, the BCRP will restore approximately 42 miles of habitat in Battle Creek and an additional six miles of habitat in its tributaries while minimizing the loss of clean and renewable energy produced by the hydroelectric project.

In 2005, a Final Environmental Impact Statement / Environmental Impact Report was issued for the BCRP describing impacts associated with specific restoration efforts (Jones and Stokes 2005). The BCRP involves modifications to Battle Creek hydroelectric facilities located on North Fork Battle Creek, South Fork Battle Creek and Baldwin Creek, including removing five diversions dams and two canal systems; constructing fish screens and ladders on three diversion dams; constructing a powerhouse bypass and two powerhouse tailrace connectors (to prevent the mixing of North Fork Battle Creek and South Fork Battle Creek waters); and constructing a fish barrier

weir (to protect a trout hatchery from diseases carried by anadromous fish). Other elements include increasing instream flows; dedicating water rights for instream purposes at dam removal sites; and implementing adaptive management to ensure fisheries objectives are met.. One of the components of the BCRP was the construction of the Eagle Canyon Diversion Dam fish screen and fish ladder which was completed in 2012. The Eagle Canyon Diversion Dam is located between the proposed project's LBS and UBS. The Eagle Canyon fish ladder will be fully operational upon completion of this proposed project.

In 2014, NMFS released the *Recovery Plan for the Evolutionary Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead*, which identifies a number of recovery actions for these species, specifically for Battle Creek (National Marine Fisheries Service 2014). In particular, Action Item Battle Creek (BAC) 1.12 is to:

> Improve fish passage at natural (rock or wood) fish barriers in the watershed including the ones immediately upstream and downstream of Eagle Canyon, and at the mouth of Digger Creek.

A recent program was initiated to reestablish a population of Sacramento River winter-run Chinook salmon in North Fork Battle Creek (ICF International 2016). The program involves the annual release of juvenile fish in North Fork Battle Creek, approximately four stream miles downstream of the proposed project. The goal of the program is to reintroduce a self-sustaining winter-run Chinook salmon population into the upper reaches of North Fork Battle Creek. These juvenile releases have been ongoing in an attempt to create an annual pipeline of adults that can potentially colonize Battle Creek when the proposed project is completed. The current strategy is to intercept all adult winter-run Chinook salmon at the Coleman National Fish Hatchery, located on the main stem of Battle Creek, approximately 16 stream miles downstream of the proposed project. The disposition of returning adult fish is determined by the Battle Creek Technical Team, which includes representatives from USFWS, CDFW and NMFS. Once the proposed project has been completed, making high-quality winter-run Chinook salmon habitat available, the adult fish will be allowed to access the upper reaches of North Fork Battle Creek.

A biological survey was conducted by TES staff on April 1, 2018, May 30, 2018, June 23, 2018, August 15, 2018 and August 22, 2018. The study area included all aquatic sites within the project boundary. The surveys were conducted by walking the entire project site and recording fisheries observations. No snorkel surveys, or other intensive fisheries surveys were conducted. A list of all fish species observed during site surveys is included as Appendix D.

An evaluation of the potential presence of special-status fish species is included in Appendix E. For the purposes of this evaluation, special-status species are defined as:

c) Those species listed by USFWS or NMFS as Endangered, Threatened, Proposed as Endangered or Threatened, Candidate to become Proposed or Species of Concern.
d) Those species listed by CDFW as Endangered, Threatened, Candidate for listing as Endangered or Threatened, Species of Special Concern or Fully Protected.

Special-status designations for fish species are depicted in Appendix D. Designations were based on the most recent version of the special animals list (California Department of Fish and Wildlife 2018a).

Based on the results of the evaluation in Appendix E, the Biological Resources Evaluation (Tehama Environmental Solutions Inc. 2019a) further evaluated the potential impacts of the proposed project on those species with the potential to occur within, or near the proposed project site. Based on that further evaluation, the following special-status fish species, designated CH and Essential Fish Habitat (EFH) are known to, likely to, or have the potential to occur within the project area, and could potentially be significantly impacted by the proposed project:

- Riffle Sculpin *(Cottus gulosus)*
- Central Valley Steelhead *(Oncorhynchus mykiss)*

- Central Valley Spring-run Chinook Salmon *(Oncorhynchus tshawytscha)*
- Central Valley Fall- / Late Fall-run Chinook Salmon *(Oncorhynchus tshawytscha)*
- Sacramento River Winter-run Chinook Salmon *(Oncorhynchus tshawytscha)*
- Central Valley Steelhead Critical Habitat
- Central Valley Spring-run Chinook Salmon Critical Habitat
- Pacific Salmon Essential Fish Habitat

Riffle Sculpin

The riffle sculpin is designated as a CDFW Species of Special Concern. It is reported that the riffle sculpin faces numerous threats from dams, agricultural runoff, urbanization mining and logging (Moyle et al. 2015). Both adult and young riffle sculpin have poor dispersal abilities (Moyle et al. 2015). Larvae do not move far after hatching and this greatly reduces their ability to quickly recolonize areas (Moyle et al. 2015). They are found in isolated watersheds in the Central Valley and the central coast. In the Sacramento River drainage, they are found in Putah Creek, a west-side tributary and in most of the east-side tributaries, from the American River north to the upper Sacramento and McCloud rivers. Riffle sculpin are found exclusively in permanent coldwater streams. This species spawns at the end of their second year, in February, March and April (Moyle et al. 2015). Adults spawn under rocks in swift riffles or inside cavities in submerged logs. Riffle sculpin feed mainly on benthic invertebrates, primarily active insect larvae. Riffle sculpin are known to be present in the project reach of Eagle Canyon (R. Battaro pers. comm.). An unknown sculpin, likely a riffle sculpin, was observed in North Fork Battle Creek during TES site surveys.

Central Valley Steelhead

The Central Valley steelhead Distinct Population Segment (DPS) was listed as Threatened by NMFS on May 18, 1998 and February 6, 2006. CH was designated by NMFS on September 2, 2005. EFH has not been designated by NMFS. Population declines are attributed to blockage from upstream habitats, entrainment from unscreened diversions, hatchery practices and degraded habitat conditions due to water development and land use practices. Steelhead are generally distributed from southern California to the Aleutian Islands. In the Central Valley, naturally producing populations only occur in the Sacramento River and its tributaries. Steelhead stocks in the Central Valley are considered winter-run steelhead (McEwan and Jackson 1996). Central Valley steelhead adult migration occurs from October through February. Spawning occurs from December through April in streams with cool, year-round, well-oxygenated water. Incubation generally occurs from December through April. Emigration occurs in the spring and early summer as one-year-old fish. The study area is located in the currently designated CH for Central Valley steelhead. Rainbow trout are known to occur within the study area (Whitton et al. 2010) and, from a regulatory perspective, are assumed to be Central Valley steelhead. A juvenile salmonid, likely a rainbow trout, was observed in North Fork Battle Creek, upstream of the UBS during TES site surveys.

Central Valley Spring-run Chinook Salmon

The Central Valley spring-run Chinook salmon was listed as Threatened by the State of California on February 5, 1999. NMFS listed the Central Valley spring-run Chinook salmon Evolutionary Significant Unit (ESU) as Threatened on September 16, 1999. CH was designated by NMFS on January 2, 2005. EFH was designated for Pacific salmon, which includes this ESU, by NMFS on June 28, 2005. Population declines are attributed primarily to altered stream flows and blocked access to upper elevation headwaters due to dams. Spring-run Chinook salmon are thought, by some, to once have been the most abundant run of salmon in the Central Valley. This race once migrated into the headwaters of tributaries to the Sacramento and San Joaquin Rivers. They now only exist in the mainstem and a few tributaries to the Sacramento River. Central Valley spring-run Chinook salmon adult migration occurs in the Sacramento River from late March to September. The fish oversummer in coldwater habitats and then spawn from August to October with peak spawning occurring in September. Incubation occurs from mid-August to mid-March with rearing and emigration occurring from mid-August through April. Potential habitat is present within the study area for one or more life stages of spring-run Chinook salmon. Central Valley

spring-run Chinook salmon are known to occur approximately 0.25 miles downstream from the study area (Whitton et al. 2010), however the downstream natural barrier is considered a total barrier to upstream migration. The study area is located in the currently designated CH and EFH for Central Valley spring-run Chinook salmon. Spring-run salmon were not observed during TES site surveys, however intensive fish surveys were not conducted.

Central Valley Fall- / Late Fall-run Chinook Salmon

The Central Valley fall-run and late fall-run Chinook salmon are designated as a NMFS Species of Concern and as a CDFW Species of Special Concern. EFH was designated for Pacific salmon, which includes this run, by NMFS on June 28, 2005. Population declines are attributed primarily to overfishing, unscreened diversions, and stream spawning and rearing habitat degradation. Fall-run salmon adult migration occurs in the Sacramento River from July through December. The peak of spawning occurs in October and November, incubation occurs from October through March, and rearing and emigration occurs from January through June. A majority of juvenile fish out-migrate within the first few months after emergence, but a small number remain in freshwater and out-migrate the following year. Late fall-run salmon overlap the fall-run spawning migration and enter the Sacramento River from mid-October through mid-April. Spawning occurs in the Sacramento River and tributaries from January through mid-April, incubation occurs from January through June, and rearing and emigration occurs from April through mid-December. Fall- / late fall-run salmon are known to occur in North Fork Battle Creek just downstream of the LBS (L. Earley pers. comm.). Fall- / late fall-run salmon were not observed during TES site surveys, however intensive fish surveys were not conducted.

Sacramento River Winter-run Chinook Salmon

The Sacramento River winter-run Chinook salmon was listed as Endangered by the State of California on September 22, 1989. NMFS listed the Sacramento River winter-run Chinook salmon ESU as Endangered on February 3, 1994. CH was designated by NMFS on March 23, 1999. EFH was designated for Pacific salmon, which includes this ESU, by NMFS on June 28, 2005. Population declines are attributed primarily to blocked access of historic spawning habitat from the construction of Shasta Dam. Winter-run salmon adult migration occurs in the Sacramento River from late November through early August. Spawning occurs from late April through mid-August peaking in May and June. Fry emergence occurs from mid-June through mid-October. Emigration past Red Bluff generally peaks in September but is highly dependent on stream flow conditions. Areas upstream of Eagle Canyon Dam have been identified as optimal habitat for winter-run Chinook. Adult winter-run salmon are not currently present in North Fork Battle Creek, however adults that have been produced as a result of the reintroduction program began migrating into the main stem of Battle Creek in 2019. The current plan is to intercept those fish at Coleman National Fish Hatchery until the proposed project is completed. However there is a chance that adults could move past the hatchery during high flow events and could be present downstream of the LBS. In addition, the reintroduction program juvenile winter-run salmon are released in North Fork Battle Creek approximately four stream miles downstream of the LBS (L. Earley pers. comm.). Winter-run salmon were not observed during TES site surveys, however intensive fish surveys were not conducted.

Central Valley Steelhead Critical Habitat

The stream reach in which the project is located is within the designated CH for Central Valley steelhead. CH for steelhead is defined as specific areas that contain Primary Constituent Elements (PCE) and physical habitat elements essential to the conservation of the species. The inland habitat types present within the project area that are used as PCEs for steelhead include spawning habitat, freshwater rearing habitat and freshwater migration corridors.

Central Valley Spring-run Chinook Salmon Critical Habitat

The stream reach in which the project is located is within the designated CH for Central Valley spring-run Chinook salmon. CH for spring-run salmon is defined as specific areas that contain PCEs and physical habitat elements

essential to the conservation of the species. The inland habitat types present within the project area that are used as PCEs for spring-run salmon include spawning habitat, freshwater rearing habitat and freshwater migration corridors.

Essential Fish Habitat

The proposed project is within the designated EFH of "Pacific Salmon". EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. EFH occurs within the project area for Central Valley spring-run salmon. EFH has not been designated for steelhead.

3.2.4 Cultural and Tribal Cultural Resources

Historical and Ethnographic Context

The project area is contained within traditional Northern Yana Indian territory. Much of what is known about Yana culture was provided by Ishi, a Yahi Yana, the last known member of the Yahi people. The Yana lived in small bands and seasonally-occupied villages and campsites along the region's perennial streams. Gathering, fishing and hunting provided their resources. They produced stone, bone, and wood tools, and the weaving of baskets, nets and bags. The first major hostility from Anglo-American contact took place on a gathering of Yana Indians at a village on Bloody Island (at the mouth of Battle Creek) in the Sacramento River. In approximately 20 years, continued conflict reduced Yana numbers from 1,900 individuals to fewer than 100. Today, there are no federally recognized Yana Indian tribes.

Although some early ranchers settled in the area, they had little effect on the Battle Creek watershed cultural history. The area was passed over by prospectors for lack of gold deposits. The history of the area is related primarily to the hydropower in the region. The Battle Creek hydroelectric system was a typical turn-of-the-century California system, characterized by high head / low volume plants, in which water comes from higher elevations and, as a result, the system uses a lower volume of water to generate energy. By 1910, power generated from the Battle Creek system supplied agricultural and urban users as far west as the Shasta mines, north to Redding, and south to Orland, Willows, Hamilton City and Chico.

Historic and Archeological Resources

Several historic and archeological cultural resources exist within the project Area of Potential Effect (APE). The APE is "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties if any such properties exist". An archeological survey found three cultural resources within the project area. These included two isolated prehistoric chipped stone artifacts and one historical archaeological site, a can dump dating to the early 1900s, probably representing the refuse related to a construction man camp occupied during the 1909–1910 construction of the Eagle Canyon Dam and canal features.

Isolated Find A

Isolated Find "A" was a unifacially-worked basalt flake tool chipped around the margins to make a serrated scraper. Based on the significant accumulation of oxidized "clay skin" on the surface of the tool, it appears to be quite old.

Isolated Find B

Isolated Find "B" was a small obsidian thinning flake, probably a soft hammer flake produced by biface reduction.

Historical Site

A dense "can dump," or more accurately a cooking refuse dump was found in the APE. The refuse is dominated by tin cans which occur in general scatters and high-density heaps. The dump contains an estimated 350 to 450 cans which show little variation in type. Most of the cans are single-serving sized although a few multi-serving

cans were observed. The cans all display time-sensitive characteristics attributable to the 1900–1910 time range. Three glass bottle fragments and two machine parts were also observed, the latter including a large bolt and a long-threaded steel rod. On the north edge of the dump is a large trussed boulder bound with a thick, woven canvass hawser probably used as a hoist or cabling anchor for canyon access.

3.2.5 Hazardous and Toxic Materials

Hazardous materials management involves the prevention of illegal hazardous materials actions on public lands; the proper authorization, permitting, and regulation of the uses of hazardous materials; and the timely, efficient and safe responses to hazardous materials incidences. Federal, state, and local agencies regulate hazardous materials and hazardous waste. Nonetheless, illegal storage and disposal and unintentional releases of hazardous materials or waste from leaks and accidents can occur when hazardous materials are used or hazardous waste is generated by a project.

Under the California Code of Regulations (CCR), Title 13, Section 1150-1194, and CFR Title 49, the California Highway Patrol (CHP) regulates the transport of hazardous materials. When a spill of hazardous material or waste occurs on a highway, such as State Route (SR) 36, the CHP is responsible for directing cleanup and enforcement (CCR Section 2450-2453b). A California Department of Toxic Substances Control (DTSC) record search (California Department of Toxic Substances Control 2019) indicated that there are no known hazardous waste and substances sites located within five miles of the project site.

3.2.6 Hydrology and Water Quality

Battle Creek, a perennial spring-fed, coldwater stream, drains the western flank of Mount Lassen and enters the Sacramento River from the east approximately five miles east of the town of Cottonwood, California. Battle Creek is composed of two main branches, North Fork Battle Creek (approximately 29.5 miles in length from its headwaters to the confluence) and South Fork Battle Creek (approximately 28 miles in length from its headwaters to the confluence). The two forks join approximately 17 miles east of Battle Creek's confluence with the Sacramento River.

The watershed drains an area of approximately 370 square miles on the eastside of the Sacramento River in Shasta and Tehama Counties. The watershed's volcanic geology and plentiful year-round cold and perennial streamflow make it unique. Battle Creek is one of a few streams that can successfully sustain breeding populations of steelhead trout and all four runs of Chinook salmon. State and federal agencies have made it a high priority to restore the declining runs of Sacramento River anadromous fish populations.

Battle Creek is the largest spring-fed tributary to the Sacramento River between Keswick Dam and the Feather River, with a median September flow of 250 cfs. The average flow is 500 cfs. Flows typically remain higher throughout the winter and spring and decrease to about one-half that amount in the summer and fall. Battle Creek flows through remote, deep, shaded canyons and riparian corridors with little development near its banks. Numerous spring flows enter Battle Creek (primarily North Fork Battle Creek) from the canyon walls along the watercourse, adding significant inflow at a fairly constant rate with a relatively cool temperature. Thick vegetation, rough terrain, and private ownership limit human access. Native vegetation and the land's limited suitability for agriculture, timber harvesting, and urban development protect Battle Creek's watershed from erosion. The watershed is comparatively undisturbed.

Pacific Gas & Electric (PG&E) operates the Eagle Canyon diversion near the study area, which is used to divert water for hydroelectric power generation. The Eagle Canyon diversion, located between the UBS and LBS, diverts water into a series of flumes and tunnels that travel through the project area, and are owned by PG&E. Water diversion is to be managed under a 1999 MOU between NMFS, Reclamation, USFWS, CDFW and PG&E, which outlines the minimum in-stream flow requirements below various diversion dams (Michael Love and Associates 2017b). The minimum in-stream flow requirements under the MOU vary by month and range from 35-46 cfs. The current

diversions are directed through an Interim Flow Agreement (30 + / - 5 cfs) that provides immediate improvements to habitat for salmonids while the BCRP is implemented.

Water Quality

Given the year-round, high-volume flow of water in Battle Creek, water quality is generally excellent and supports a variety of coldwater aquatic species, including runs of anadromous salmon and steelhead. Water quality issues in Battle Creek have centered on temperature and sediment conditions. Temperature has been an ongoing concern, particularly in stream reaches where flow is substantially reduced by hydropower operations. Another potential concern has been nutrient enrichment from the large number of fall-run salmon carcasses in Battle Creek downstream of the Coleman Hatchery.

Elevated water temperature is often considered the most important water quality factor limiting habitat productivity for fish. The sensitivity and specific effects of elevated water temperatures vary with the life stage of Chinook salmon and steelhead. Several factors influence water temperature in Battle Creek, including air temperature, streamflow, and riparian vegetation. North Fork Battle Creek flows through a steep canyon, which helps shade the water and numerous springs continually feed cold water into the system.

Excessive sediment can increase turbidity and reduce light penetration, resulting in the reduction in prey capture for sight-feeding predators, reduction in light available for photosynthesis, clogging of gills and filter mechanisms of fish and aquatic invertebrates, reduction in spawning and juvenile fish survival, smothering of bottom-dwelling organisms, changes in substrate composition, and reduction in aesthetic values. Concentrations of nutrients and other pollutants (such as metals and certain pesticides) associated with sediment particles could also increase. Although these effects are usually short-term and greatly diminish after revegetation, sediment and sediment-borne pollutants may be remobilized under suitable hydrologic and hydraulic conditions. In 2001, a watershed assessment was conducted to evaluate instream sediment conditions in the upper watershed. Fine sediment levels were found to be higher than favorable for salmonid production but similar to levels in other northern California streams (Sacramento River Watershed 2019). A 2006 repeat of this study found more favorable stream conditions indicating an improving trend (Sacramento River Watershed 2019).

Groundwater Quality

Water-bearing formations in the North Fork Battle Creek Basin include the Quaternary alluvium and underlying volcanic rocks. Alluvium is approximately 32 feet thick overlying a succession of volcanic rocks (California Department of Water Resources 2003). The volcanic rocks are composed of two 10- to 40-foot thick flows, which are separated by a 40- to 80-foot section of sand, gravel, ash, and cinders. Interbedded sand-gravel-ash-cinder strata is the primary groundwater source in the area. Groundwater in the project are is generally of excellent quality.

Site Hydrology

The following information was taken from the *Eagle Canyon Fish Passage Improvements in Battle Creek Lower and Upper Barrier Sites Basis of Design Memorandum* (Michael Love and Associates 2017).

<u>In-Stream Flow Agreements</u>

In February 1999, NMFS, Reclamation, USFWS, CDFW, and PG&E entered into an MOU. The MOU outlined the roles and responsibilities regarding actions to be undertaken as part of the Battle Creek Chinook Salmon and Steelhead Restoration Project. Among other details, the MOU outlined minimum instream flow releases below various diversion dams within the anadromous reaches of North and South Fork of Battle Creek. Table 4 presents minimum instream flow releases at North Battle Creek Feeder Dam and Eagle Canyon Dam by month. Figure 20 shows the location of these dams relative to the project sites. Currently, PG&E is operating under interim instream flow requirements.

Table 4. Minimum Instream Flow Releases.

Diversion Dam	Minimum Instream Bypass Flow (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Feeder Dam[1]	88	88	67	47	47	47	47	47	47	47	47	88
Eagle Canyon[2]	46	46	46	46	35	35	35	35	35	35	35	46

1. On occasion the release is not attainable due to the quantity of inflow reaching the dam. Additional inflows to the North Battle Creek Feeder reach are occasionally received from the junction box of the Volta 2 Powerhouse Tailrace and Cross-Country Canal a short distance downstream.

2. Eagle Canyon Dam releases reported on this table include releases from Eagle Canyon Springs (the springs located downstream of Eagle Canyon Dam).

(Source: National Marine Fisheries Service et al. 1999 *in* Michael Love and Associates 2017)

Hydrology Studies and Streamflow Gaging

Figure 20 presents an overview of the BCRP components with the location of the LBS and UBS indicated. The figure also indicates the location of key dams and flow gaging stations within the watershed. MLA's *Existing Site and Hydraulic Characterization Technical Memorandum*, presents a detailed discussion of project hydrology.

Lower Barrier Site Hydrology

Peak Flows

Peak flows were estimated from the work completed by U.S. Bureau of Reclamation (2001). The LBS peak flows are presented in Table 5. The flows were derived by scaling the Reclamation peak flows for Eagle Canyon Dam to the LBS drainage area, which is approximately 188 square miles. Daily average flow duration curves are often used to determine fish passage design flows and evaluate fish passage delays due to low or high flow conditions. The annual one percent exceedance flow is often used in northern California to set the high fish passage design flow for adult anadromous salmonids (California Department of Fish and Game 2002; National Marine Fisheries Service 2001).

Figure 21 presents flow duration curves (FDCs) constructed for the LBS. The FDC is based on daily average flow records for 16 water years collected at the North Fork Battle Creek Near Manton stream gage. Flows are scaled to the drainage area of the LBS. In summary, two different approaches were used to develop the FDC. The first is based on the traditional approach, which is a ranking of all of the daily average flow data to determine the exceedance flows. When applying this method, Water Year 2006 was identified as a high-flow outlier, such that eliminating this year decreased the one percent exceedance flow by 32 percent. Therefore, data from 2006 was excluded from the FDC, resulting in a one percent exceedance flow of 382 cfs.

The alternative approach used to create the FDC is based on methods outlined by Vogel and Fennessey (1994). This approach better describes annual variability and allows for calculation of annual statistics and confidence intervals. It involves constructing individual FDCs for each of the 16 water years, and then calculating the median FDC. As seen in Figure 21, the median one percent annual exceedance flow is 241 cfs. For 80 percent of the water years, the one percent annual exceedance flow was between 531 cfs and 138 cfs.

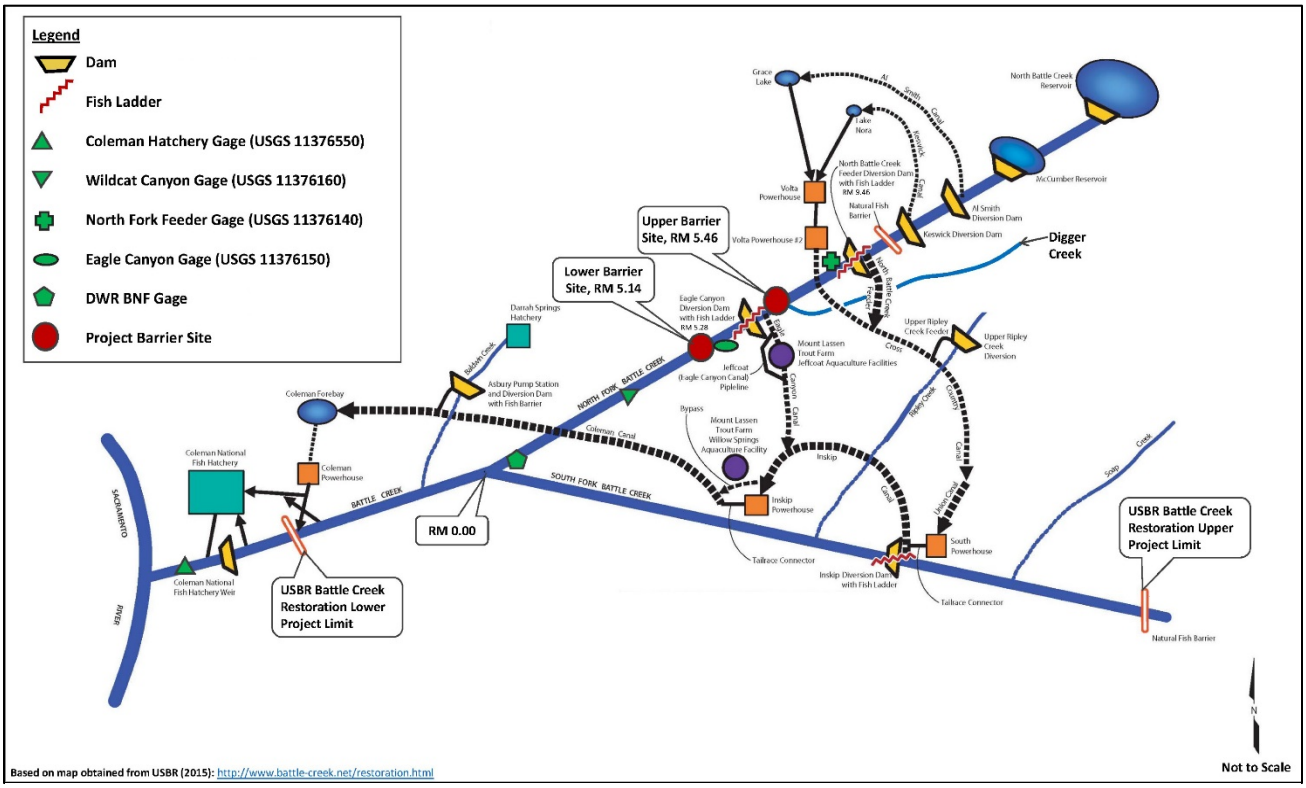


Figure 20. Battle Creek Salmon and Steelhead Restoration Project Schematic – Post Construction.

(Source: htttp://battlecreek.net/restoration.html with additional points of reference from Michael Love and Associates 2017)

Table 5. LBS Peak Flows for Selected Return Periods.

Return Period (years)	2	2.33	5	10	25	50	100
Flow (cfs)	2,504	2,905	4,407	5,709	7,512	8,914	10,216

(Source: Michael Love and Associates 2017)

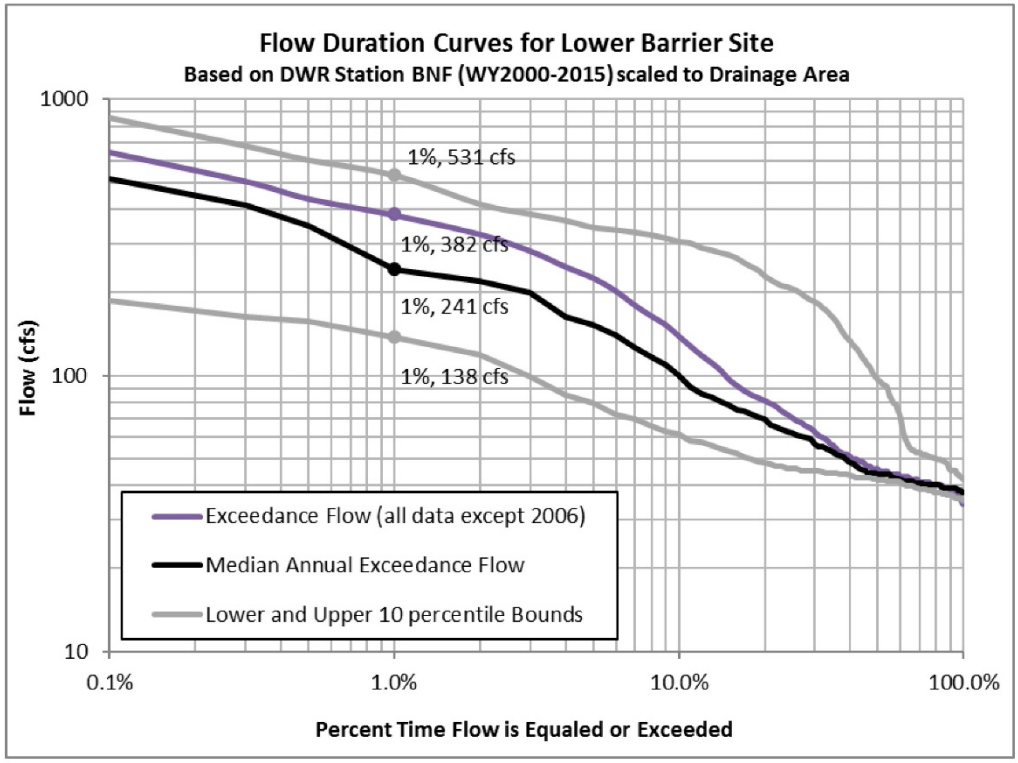


Figure 21. Flow Duration Curves for Lower Barrier Site.

(Source: Michael Love and Associates 2017)

Upper Barrier Site Hydrology

Peak Flows

Again peak flows were estimated from work completed by U.S. Bureau of Reclamation (2001). The UBS and Digger Creek peak flows associated with specified return periods are presented in Table 6. The UBS flows were derived by scaling the USBR peak flows for Feeder Dam to the UBS drainage area, which is approximately 148 square miles. Flows for Digger Creek, with a drainage area of 40 square miles, were derived by subtracting Eagle Canyon Dam peak flows from UBS flows. This approach likely underestimates the actual return period flows for Digger Creek, as Digger Creek likely peaks prior to North Fork Battle Creek due to its smaller drainage area.

Table 6. UBS and Digger Creek Peak Flows for Select Return Periods.

Return Period (year)	2	2.33	5	10	25	50	100
UBS Flow (cfs)	2,332	2,665	4,109	5,331	6,996	8,329	9,551
Digger Creek Flow (cfs)*	168	235	291	369	504	571	649

**Estimated using difference between Eagle Canyon Dam and UBS peak flows.*

(Source: Michael Love and Associates 2017)

Therefore, the data presented in Table 6 should be interpreted as the flow within Digger Creek at the time the UBS flow is peaking.

Daily Average Flow Duration Curves

To assist with establishing fish passage design flows and evaluating potential low-flow and high-flow passage delays, a FDC was constructed (Figure 22). The first approach constructed a FDC using all of the daily average flow data sorted and ranked for the entire period of record, excluding outlier water year 2006 (similar to LBS). This resulted in a one percent exceedance flow of 293 cfs. The second approach used to develop the FDC was constructed using the same methods described for the LBS and as presented in Michael Love and Associates (2016b). For 80 percent of the water years, the one percent annual exceedance flow was between 100 cfs and 410 cfs.

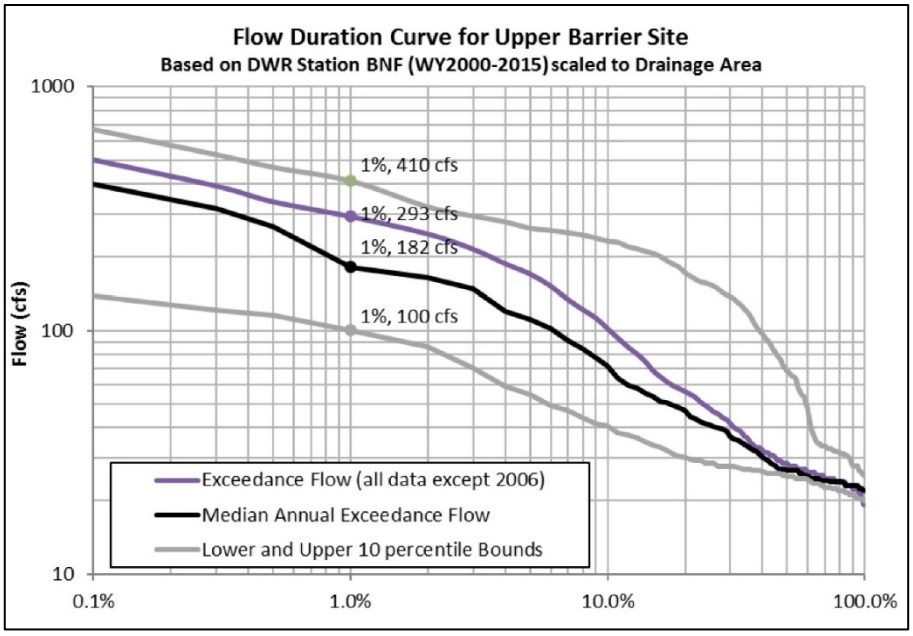


Figure 22. Flow Duration Curves for Upper Barrier Site.

(Source: Michael Love and Associates 2017)

3.2.7 Noise

Noise concerns are described in terms of sensitive receptors, or noise-sensitive land uses within hearing range of the activity. Using aerial photography, no sensitive receptors were identified within one mile of the LBS or UBS locations. The area surrounding the site is remote rangeland. There nearest paved public roads, Battle Creek Bottom Road to the north and Long Road to the south are located approximately 0.9 miles from the construction sites. Private gravel roads access the project site from both of these paved roads. There is limited, and regular traffic noise at the site from vehicle access to the PG&E diversion for routine maintenance along with occasional helicopter traffic noise. There is also limited, and occasional noise from construction activities at the PG&E diversion for larger maintenance projects. There is existing significant ambient and background noise associated with North Fork Battle Creek and Digger Creek, dam spillways and flumes and varied wildlife activities. Ambient noise levels within the canyon are dependent upon the amount of water flowing in the stream, over the structures and from waterfalls from seeps on the south canyon wall but are generally fairly high. Noise volumes away from the canyon are limited by the slope of the canyon walls and vertical distance from Battle Creek to the trailhead leading to the creek bed and diversion.

3.2.8 Recreation

The parcels upon which the project site is located are all privately owned. These parcels include portions of North Fork Battle Creek and Digger Creek. Recreational activities that occur around the project area include hunting, fishing, wildlife viewing, and hiking, however access to the project area itself is extremely limited due to the fact that the properties are held in private ownership with controlled access. There are no developed regional or neighborhood parks or other recreational facilities within, or directly adjacent to the project site.

3.2.9 Soils and Geology

Soils

Seven different soil map units occur within the project site (Figure 23) according to the local soil surveys (Soil Conservation Service et al. 1967, 1974). The seven identified map units are listed below:

Guenoc stony loam, 10 to 30 percent slopes (GsD) (Shasta County)

These soils occur on the foothills east of the Sacramento River. They are formed in material weathered from volcanic and metamorphic rock. The soil is well-drained, with moderately slow permeability and medium to rapid runoff. The taxonomy of the map unit is fine, kaolinitic, thermic, Typic Rhodoxeralfs (Natural Resources Conservation Service 2018).

Guenoc very stony loam, 0 to 30 percent slopes (GsD) (Tehama County)

These soils occur on the foothills east of the Sacramento River. They are formed in material weathered from volcanic and metamorphic rock. The soil is well-drained, with moderately slow permeability and medium to rapid runoff. Andesite bedrock occurs at a depth of 30 to 40 inches. The taxonomy of the map unit is fine, kaolinitic, thermic, Typic Rhodoxeralfs (Natural Resources Conservation Service 2018).

Guenoc very rocky loam, 0 to 30 percent slopes (GuD) (Shasta County)

These soils occur on the foothills east of the Sacramento River. They are formed in material weathered from volcanic and metamorphic rock. The soil is well-drained, with moderately slow permeability and slow to rapid runoff. Andesite bedrock occurs at a depth of 20 to 30 inches. The taxonomy of the map unit is fine, kaolinitic, thermic, Typic Rhodoxeralfs (Natural Resources Conservation Service 2018).

Inks cobbly loam, 3 to 30 percent slopes (IcD) (Tehama County)

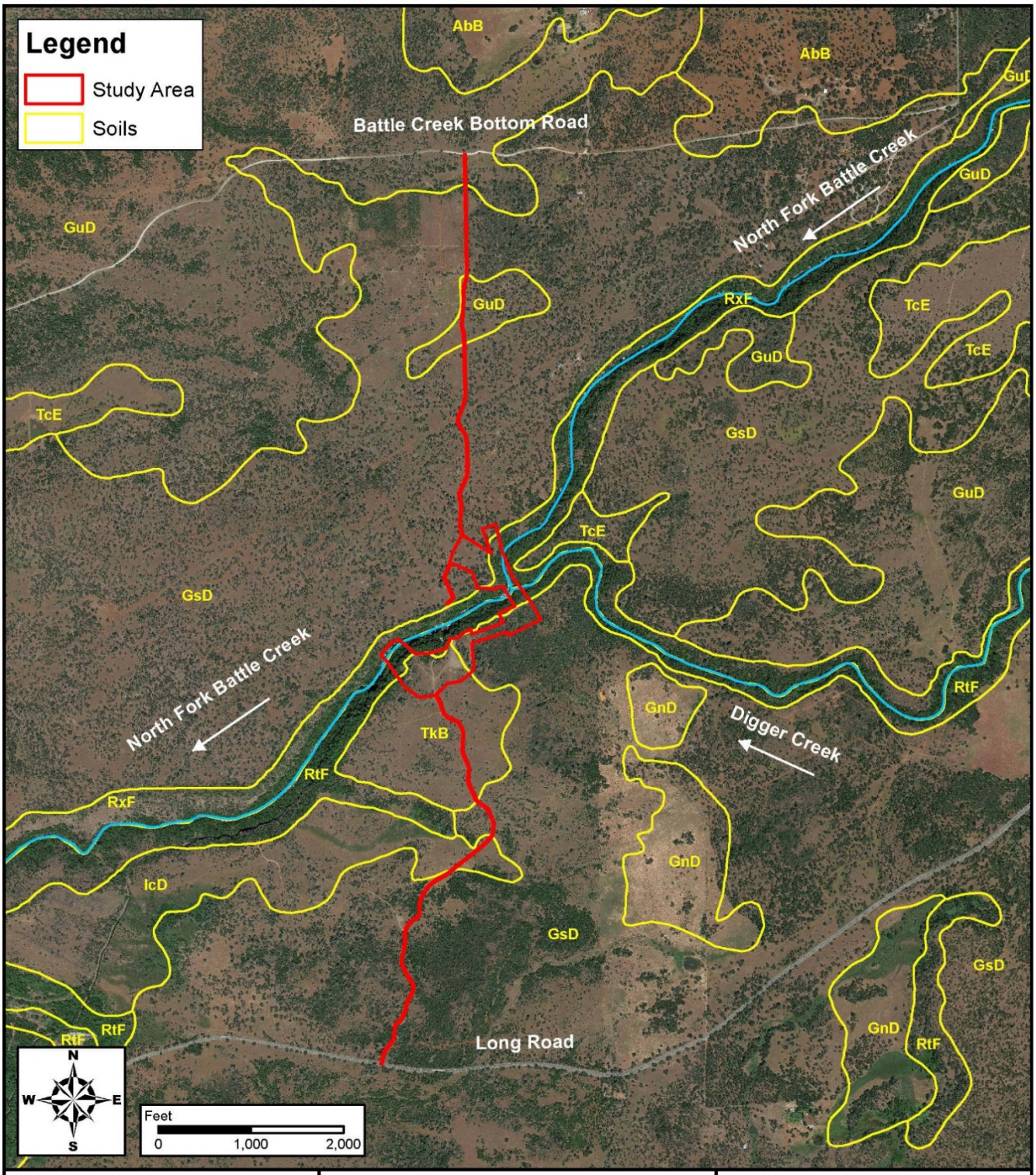
These soils are located on rounded hills east of the Sacramento River. They are formed in material from weakly consolidated volcanic rock, particularly andesite and basalt. The soil is well-drained, with medium runoff and moderate permeability. The taxonomy of the map unit is loamy-skeletal, mixed, superactive, thermic, shallow Ultic Argixerolls (Natural Resources Conservation Service 2018).

Rockland (RtF) (Tehama County)

This land type is located on very steep slopes or on sloping lava flows that consist of more than 50 percent exposed rock. The series is not classified taxonomically by higher categories in the soil survey.

Rockland (RxF) (Shasta County)

This land type is located on uplands of mountainous areas. Rockland consists of shale, sandstone, conglomerate, limestone, greenstone, quartz diorite, andesite, basalt, rhyolite, schist, gneiss, serpentine, or peridotite rock outcrops and covers 25 to 90 percent of the surface. The series is not classified taxonomically by higher categories in the soil survey.



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North Fork Battle Creek Barrier Modification and Fish Passage Improvement Project

Shasta and Tehama Counties, California
March 2019

Soil Survey Map

DATA SOURCE: USDA Natural Resources Conservation Service, September, 2017

PHOTO SOURCE: Google Earth, 5/25/2017

Figure 23. Soil Survey Map

Toomes very rocky silt loam, 1 to 10 percent slopes (TkB) (Tehama County)

These soils are located east of the Sacramento River and formed in material derived from volcanic rock. They are underlain by tuff breccia. The soil is well-drained, with moderate permeability and medium runoff. The taxonomy of the map unit is loamy, mixed, thermic, lithic Ruptic-xerorthentic Xerochrepts (Natural Resources Conservation Service 2018).

Regional Geology

The subject site is located on the southern edge of the Cascade Range geomorphic province of California. The Cascade Range includes a chain of prominent volcanic peaks that extend from northern California through Oregon, and into Washington. The southern extent of the province is Mount Lassen, located about 22 miles east of the site.

The northern Sacramento Valley has a diverse and complex geologic history. Convergence of the Pacific and North American plates has created tectonic stresses that caused the present-day northern Sacramento Valley to go through many changes. From the Mesozoic era through the mid-Cenozoic era, the present-day northern Sacramento Valley was inundated with Pacific Ocean waters, and the Pacific shoreline oscillated back and forth from the eastern side to the western side of the valley. From the mid-Cenozoic era to present, the Pacific shoreline migrated westward to its current position west of the California Coast Ranges, exposing the emergent valley as it looks today. The Sierran metamorphic and plutonic basement rocks extend to the west beneath the valley, and these are unconformably overlain by shales and sandstones of the Great Valley sequence. Beginning in the early-Miocene (about 23 million years ago), volcanism began and this process is still active today (e.g., Mount Lassen's latest eruptions occurred from 1914 to 1917). On the east side of the valley, the Tuscan Formation (Pliocene age), overlies the Great Valley rocks, and contains layered ash, volcanic mudflows and some alluvium. In the site vicinity, the Tuscan Formation unit is generally covered by young volcanic flows extending from east to west. In the Manton area, the young basalts that underlie the broad plain are exposed on the walls of Eagle Canyon and have been mapped by Helly and Harwood (1985) as the Basalt of Eagle Canyon. The rocks that underlie much of the broad plain in the Manton area are described in the referenced literature as dark grey, vesicular olivine basalt.

Site Geology

An *Engineering Geologic Investigation Technical Memorandum: Eagle Canyon Fish Passage Improvement in Battle Creek* was prepared by Cotton, Shires and Associates, Inc. (CSA) for the project site (Cotton, Shires and Associates 2016).

Lower Barrier Site

The LBS is much more geologically stable than the UBS but still includes some active toppling. Along the south canyon wall (river left) two very large blocks have a high failure potential and a thinner block or flake also has a high failure potential. These features are above the LBS and located within the Eagle Canyon Basalt layer adjacent to the PG&E foot paths. The Eagle Canyon Basalt layer has pervasive near-vertical cooling joints that result in relatively large bocks that can topple. There are other blocks and columns within this layer near the LBS, but they have a moderate failure potential (could fail within 50 – 100 years).

Below the Eagle Canyon Basalt layer is the relatively thin but very porous Red Bluff Formation, and below that is the layer referred to as the Basalt of Coleman Forebay. The Basalt of Coleman Forebay has thin layering, which results in much smaller (approximately five feet in diameter) boulders when failure occurs. Cotton Shires and Associates (2016) concluded that the joints appear to be short and fairly tight within this layer, which results in low rockfall hazards.

The north canyon can be separated into two distinct vertical walls (referred to as upper and lower) with a sloped area between. Some detached boulders were laying on the sloped area with approximately three-foot diameters and if mobilized, they would potentially tumble into the LBS.

No high potential rock hazards on the upper canyon wall were identified, which is comprised of massive Eagle Canyon basalt. The lower wall is comprised of the thinly layered Basalt of Coleman Forebay with six-inch to four-foot thick basalt layers. In general, the rockfall hazard from this area was considered low.

Field and laboratory tests quantified the characteristics of the boulders within the channel with respect to hardness. In general, the basalt boulder strength varied from very strong (unconfined compressive strength between 14,500 and 36,250 pound-force per square inch [psi]) to extremely strong (unconfined compressive strength greater than 36,000 psi).

Upper Barrier Site

The UBS is underlain by the Eagle Canyon Basalt formation, which is characterized by a thick-bedded to massive, lightly weathered to fresh, very hard and very strong basalt. The Red Bluff formation and the Basalt of Coleman Forebay were not identified in the UBS as they were at the LBS. The elevation of the channel at the UBS is consistent with the elevation of the Red Bluff formation at the LBS. Cotton Shires and Associates (2016) found multiple locations along the canyon walls where rock failure was either high (failure could occur at any time, but likely within 10 years), moderate to high (failure likely within 10 to 50 years), and moderate (failure likely within 50 to 100 years). The locations of the high potential failures were located at different locations along the entire UBS reach and on both sides of the channel. Many of these rockfall hazards consist of extremely large blocks of basalt.

Two “major toppling zones” were identified, referred to as the “Block Party” and the “Land of the Giants.” The Block Party is located on river right near the downstream end of the large boulders within the UBS, above Pool 3 and Pool 1 and across from the Digger Creek confluence. The Land of the Giants is located across North Fork Battle Creek from the Block Party and immediately upstream of Digger Creek. Both of these major toppling zones are actively failing and include very large columns of basalt that have separated from the bedrock canyon wall. CSA completed field and laboratory tests to quantify the characteristics of the boulders within the channel as well as the canyon walls with respect to hardness and joint characterization. In general, the basalt boulder strength varied from very strong (unconfined compressive strength between 14,500 and 36,250 psi) to extremely strong (unconfined compressive strength greater than 36,000 psi). The rock exposed in both canyon walls is generally non-vascular basalt with a structure that varies from thin (less than one foot thick) to massive. The canyon rock is generally fresh to slightly weathered, with fractures that vary from widely-spaced (three feet to ten feet) to extremely widely-spaced (greater than ten feet). Rock joints, although infrequent, are moderately continuous (ten feet to 30 feet in length) to highly continuous (30 feet to 100 feet). Joint openings varied from tight to up to two inches wide and were generally open one quarter- to one half-inch.

3.2.10 Transportation and Traffic

SR 36 and SR 44 are the main highways in the vicinity of the project site. The project site south bank would be accessed from Long Road by an approximate 0.9 mile section of unpaved private road. The north bank would be accessed from Battle Creek Bottom Road by an approximate 0.9 mile section of unpaved private road. The project area is rural and surrounded by private property. The mostly unpaved roads are commonly used for agricultural (livestock) and PG&E maintenance operations.

4.0 Environmental Consequences

4.1 Concept of Impact Analysis

The purpose of this section is to present an analysis of the impacts that can be expected under the Proposed Action and No Action alternatives discussed in this document, for both the LBS and UBS. Through the presentation of this impact analysis, the advantages and disadvantages of the alternatives can be weighed. The alternatives are evaluated in terms of how the actions proposed would impact the affected environment described above. A description of the methods for determining impacts to an affected environment is listed below, followed by an assessment of the environmental impacts for each alternative. Impacts are measured in terms of type, duration and intensity.

4.1.1 Type of Impact

- Adverse: Likely to result in unnatural or detrimental changes to the resource
- Beneficial: Likely to protect, improve and / or restore the resource

4.1.2 Duration of Impact

- Short-term: Immediate changes to the resource where the effects last one year (season)
- Intermediate-term: Immediate changes to the resource where the effects last two to five years
- Long-term: Immediate changes to the resource where the effects last more than five years

4.1.3 Intensity of the Impact

- Negligible: Undetectable or imperceptible impacts
- Minor: Slightly perceptible and limited in extent, without further impacts, adverse impacts would reverse and resources would recover
- Moderate: Readily apparent, but limited in extent and without further impacts, adverse impacts would reverse and resources would eventually recover, with impacts localized in scale
- Major: Substantial, highly noticeable

4.1.4 Mitigation of Impacts

Potential impacts to resources may be mitigated by one or more of the following:

- Avoid conducting management activities in an area of the affected environment
- Reduce the type of impact to an affected environment
- Minimize the duration or intensity of the impact to an affected environment
- Repair localized damage to the affected environment immediately after an adverse impact
- Rehabilitate an affected environment with a combination of additional management activities
- Compensation of a major long-term adverse direct impact through the additional strategies designed to improve an affected environment as much as is practical.

4.2 Aesthetics

4.2.1 Methodology

An aesthetic resource impact analysis in the project area was based on document review and site analysis. An evaluation was made of the proposed project and its potential impact on the scenic resources and visual character of the project area.

4.2.2 Alternative 1 - Proposed Action

Under this alternative, the steep terrain and vegetation in the vicinity would limit construction visibility from adjacent areas. Construction-related equipment may be visible from public viewing areas such as public roads, scenic vista points, recreational facilities or communities, however the project sites are located on private property, restricting public access and viewing opportunities. If the crane option is used, the crane boom would likely be visible from surrounding areas, however construction impacts would be temporary, and any construction impacts would be restored following project completion. Some noticeable changes to the sites would occur, in the form of boulder removal, cut / trimmed vegetation and vegetation clearing for staging areas, however the general aesthetic nature of the site would not be significantly altered and the sites would be revegetated following construction. The project would not have a substantial adverse effect on a scenic vista or substantially damage scenic resources. The project would not create a new source of light or glare which would affect day or nighttime views. The impacts of project implementation on aesthetic resources of the general area are not considered to be adverse. Impacts would be short-term in duration and minor in intensity.

4.2.3 Alternative 2 - No Action

Under this alternative, no impacts to the visual character of the project area would occur. No changes would occur to the character of the aesthetic features and existing land uses. The existing visual characteristics related to Eagle Canyon would remain.

4.3 Air Quality

4.3.1 Methodology

Data for the impacts analysis were taken from 2017 and 2018 data maps from the CARB as well as calls to the TCAPCD and SCAQMD. The air quality analysis is qualitative, and was conducted by assessing anticipated construction-related impacts of the project and comparing them to existing and anticipated future air quality conditions. GHG Inventory worksheets were used to estimate CO_2 equivalencies based on construction equipment and estimated operation days required for the proposed project.

4.3.2 Alternative 1 - Proposed Action

Under this alternative, activities associated with the proposed project would require the removal of constricting boulders and channel regrading. The proposed construction would occur over a two-season construction schedule. Types of construction equipment to be used would include generators, rock drills, front-end loaders, cranes, dump trucks, yarders, concrete trucks and skid steers.

Construction-related activities would generate criteria air pollutants, including carbon monoxide, sulfur dioxide, PM_{10}, precursors such as reactive organic gases and oxides of nitrogen, GHG from exhaust and fugitive dust emissions. Sources of exhaust emissions include delivery trucks, commuting worker's motor vehicles and off-road heavy-duty equipment. Sources of fugitive dust emissions such as particulate matter dust include construction-related activities such as soil disturbance, grading and material hauling.

The project would involve the use of equipment and travel on unpaved roads to access the sites, which would temporarily contribute fugitive dust in the project area. This source of fugitive dust is associated with PM_{10}, a criteria pollutant, for which the Tehama air basin is in non-attainment. Construction activities at LBS are expected to take approximately 36 total operation days and approximately 91 operation days for the UBS. Once activities cease at the project area, the resulting impact on air quality and increase in GHG emissions would also cease.

GHG emissions would not be cumulatively significant considering the amount of GHG emissions generated by the project. The proposed project is consistent with the USFWS goals and objectives, including the promotion of

habitat connectivity and integrity (U.S. Fish and Wildlife Service 2010). The proposed action would facilitate the movement of native fish species. The estimated 857 metric tons of CO_2 increase due to construction activities would be short-term and would not exceed the 25,000 metric tons of CO_2-equivalent GHG emissions' threshold based on NEPA guidance.

Construction associated with the proposed project would require the use of equipment that would temporarily contribute to air pollution in the local area but not affect an existing or projected air quality violation. Exhaust emissions from heavy equipment during construction could contribute to air emissions. Construction activities would generate emissions from diesel- and gasoline-powered equipment and vehicles. Diesel particulate is an identified Hazardous Air Pollutant and Toxic Air Contaminant, emissions of which should be minimized. In addition, vehicles traveling to the site and construction activities would generate GHG emissions from diesel- and gasoline-powered vehicles and equipment.

The project is not anticipated to produce toxic air contaminants which could affect surrounding land uses. Also the project will not produce odors that will create a nuisance for any substantial number of people in the immediate area. There are no sensitive receptors located in the areas of the project site. Any adverse impacts would be short-term in duration and minor in intensity.

The following RPMs would be implemented as design features to reduce and minimize impacts to air quality:

AIR-1: Fugitive Dust Permits will be obtained from the Tehama County Air Pollution Control District (TCAPCD) and Shasta County Air Quality Management District (SCAQMD).

AIR-2: All construction equipment will be maintained in proper tune according to manufacturer's specifications.

To the extent feasible, the use of diesel construction equipment meeting the California Air Resources Board's (CARB) 1996 or newer certification standard for off-road heavy-duty diesel engines will be maximized.

If required by the TCAPCD or SCAQMD, verify that owners or operators of vehicles are registered with the California Air Resources Board Diesel Off-Road On-Line Reporting System (DOORS) program: (www.arb.ca.gov/msprog/ordiesel/ordiesel.htm). The DOORS program assists fleet owners in reporting their off-road diesel vehicle inventories to reduce vehicle emissions, as required by the In-Use Off-Road Diesel Regulation.

If required by the TCAPCD or SCAQMD, verify that owners or operators of portable engines and certain other types of equipment are registered under the California Air Resources Board's Statewide Portable Equipment Registration Program (PERP) in order to operate their equipment throughout California without having to obtain individual permits from local air districts: (www.arb.ca.gov/portable/portable.htm).

4.3.3 Alternative 2 - No Action

Under this alternative, no UBS or LBS improvement-related construction activities would occur. No short-term emissions would occur and air quality conditions would remain consistent with current conditions.

4.4 Biological Resources

4.4.1 Vegetation and Plant Communities

4.4.1.1 Methodology

The assessment of potential impacts of the proposed project on vegetation and plant communities is based on a review of databases and pertinent literature, consultation with resource agency staff, and field studies that are documented in a *Survey for Special-status Vascular Plant Species* (Dittes and Guardino Consulting 2018) that was

prepared for the proposed project. This document is available on the Red Bluff Fish and Wildlife Office website on the AFRP webpage (http://www.fws.gov/redbluff/afrp.html).

A preliminary investigation was performed that included a query of the CNPS's *Inventory of Rare and Endangered Plants* (California Native Plant Society 2018) for Tehama County. The California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife 2018b) was also queried for special-status plant species from the Shingletown, and surrounding eight USGS 7.5-minute topographic quadrangles (Clough Gulch, Inwood, Hagaman Gulch, Tuscan Buttes NE, Manton, Inskip Hill and Finley Butte). In addition, the Consortium of California Herbaria (http://ucjeps.berkeley.edu/consortium/) was queried for special-status species recorded from the vicinity, but not included in the CNDDB. The results of these database queries were used, along with consideration of site location and habitat (including parent material and soils), to compile a list of vascular plant species with potential to occur in the study area (Appendix C).

4.4.1.2 Alternative 1 - Proposed Action

Wooly Meadowfoam

Under this alternative, the proposed project has potential to directly and indirectly impact populations of wooly meadowfoam. Mitigation is generally not required for CNPS List 4 species unless the population has particular conservation significance (e.g., outside of known range, the type locality, morphologically / genetically unique, etc.). Loss of plants as a result of implementing this alternative would not likely affect the overall viability of this species.

Butte County Fritillary

The proposed project has potential to directly and indirectly impact populations of Butte County fritillary. These populations are near the northern range of the taxon's distribution. Shasta and Tehama County populations are suggested by some to possibly represent a currently-undescribed taxon and some have suggested that Butte County fritillary may deserve designation as a CNPS Rank 1.B species, which may be considered potential candidates for formal listing under state and / or federal Endangered Species Acts.

Invasive Species

Invasive exotic plant species that do not currently occur at the project site could potentially be introduced by the importation of seeds or plant tissues during the mobilization of construction equipment, which could allow them to colonize the site.

There would also be direct and indirect impacts to small areas of mixed riparian woodland / scrub, seasonal and perennial aquatic habitats. This is considered a potentially significant impact. Some of these impacts and measures to address them are discussed in Section 3.4.3 Wetlands and Other Jurisdictional Waters of the U.S.

Potential adverse impacts to rare plants and vegetation are considered short-term in duration and minor in intensity. Potential adverse impacts related to the spread of invasive species are considered long-term in duration and moderate to major in intensity.

The following measures would be implemented to avoid, reduce and minimize impacts to vegetation and plant communities:

> **VEGETATION-1:** Disturbance to existing vegetation will be avoided or minimized to the extent possible. Prior to the onset of construction, a vegetation removal plan will be submitted to the USFWS for review and approval.
>
> **VEGETATION-2:** A revegetation plan will be prepared to replace impacted vegetation by a measure of quantity and quality equal to, or exceeding impacts of the project using appropriate native plant species.

VEGETATION-3: Disturbing streamside woody vegetation that is present within the project area associated with Battle Creek and Digger Creek shall be avoided to the extent possible. For streamside woody vegetation that cannot be avoided, appropriate avoidance and minimization measures will need to be developed during the environmental permit processes with CDFW, NMFS and other regulatory agencies.

All disturbed streamside woody vegetation shall be revegetated following the completion of construction activities.

VEGETATION-4: Impacts to trees will be avoided to the extent possible. Native trees greater than 16-inch diameter at breast height (dbh) with defects (snags, cavities, leaning toward stream channel, nests, late seral characteristics) and native trees greater than 36-inch dbh will be retained, to the extent possible. Impacts to trees that cannot be avoided will be minimized by limbing rather than cutting vegetation to the ground in order to promote regrowth.

VEGETATION-5: All heavy equipment shall be thoroughly cleaned prior to mobilization onsite to remove any soil, weed seeds and plant parts in order to reduce the importation and spread of invasive exotic plant species.

VEGETATION-6: Only certified weed-free straw shall be used for erosion control or other purposes to reduce the importation and spread of invasive exotic plant species.

VEGETATION-7: An appropriately-timed preconstruction survey will be conducted to identify and map Butte County fritillary plants / colonies within the project area.

VEGETATION-8: To the extent possible, a minimum 30-foot protective buffer will be established around Butte County fritillary plants / colonies that occur on the canyon edges / plateau, which might be subject to impacts relating to vegetation disturbance, equipment and materials staging, equipment operation, and placement of rocks removed from the canyon. Orange plastic barrier fencing will be used to mark the outer boundaries of the minimum 30-foot protective buffer established around each Butte County fritillary subpopulation.

VEGETATION-9: For any proposed access trails extending downslope to the creek, a route will be delineated that will avoid Butte County fritillary plants to the maximum extent possible, and will require the least amount of disturbance to soil and woody vegetation. Plastic flagging and / or plastic orange barrier fencing will be used to define the route and boundaries of allowable pedestrian traffic.

VEGETATION-10: Educate those involved with project implementation regarding Butte County fritillary and other sensitive botanical resources present. All participants will be made aware of the purpose and locations of the orange plastic barrier fences. Photographs of Butte County fritillary plants, flowers and mature fruits will be provided to all workers who walk or operate machinery / equipment in the project area.

VEGETATION-11: No smoking will be allowed on the construction site or within the project area, for fire prevention purposes.

VEGETATION-12: Road improvement activities shall be conducted in such a manner that disturbances are confined to the already disturbed road prism.

VEGETATION-13: Vehicle traffic will be limited to the existing disturbed road prism. The condition of the road post-project will be coordinated with the landowners and all measures will be taken to return the road to pre-project conditions. Truck passing and parking areas will be established in areas away from populations of wooly meadowfoam and seasonal wetlands. Truck passing areas will be clearly mapped in the field with high visibility fencing or flagging and all construction personnel will be made aware of the sensitive resources and avoidance measures. Orange barrier fencing will be placed around the seasonal wetlands and wooly meadowfoam populations.

4.4.1.3 Alternative 2 - No Action

Under this alternative, no project activities would occur, therefore no impacts would occur to special-status plant species or existing vegetation, and no additional exotic plant species would potentially become established at the site, over and above existing baseline conditions.

4.4.2 Wildlife

4.4.2.1 Methodology

The assessment of potential impacts of the proposed project on wildlife is based on a review of databases and pertinent literature, consultation with resource agency staff, and field studies that are documented in a *Biological Resources Evaluation* (Tehama Environmental Solutions 2019a) and a *Biological Assessment* (Tehama Environmental Solutions 2019b) that was prepared for the proposed project. These documents are available on the Red Bluff Fish and Wildlife Office website on the AFRP webpage (http://www.fws.gov/redbluff/afrp.html).

Prior to the initiation of field studies, a records search of the CNDDB (California Department of Fish and Wildlife 2018b) was conducted to determine if any special-status animals, or rare natural communities had previously been documented within the project study area, or in the vicinity of the study area. The query was conducted using the USGS Shingletown 7.5-minute quadrangle, in which the project is located, along with the eight adjoining quadrangles (Manton, Dales, Inskip Hill, Finley Butte, Clough Gulch, Inwood, Hagaman Gulch and Tuscan Buttes NE). In addition, species lists for the study area were requested from USFWS (U.S. Fish and Wildlife Service 2018) and NMFS (National Marine Fisheries Service 2018).

Based on the results of the CNDDB search, the USFWS and NMFS species lists and TES's additional knowledge of the site and local area, a list of potentially occurring special-status species was developed for the project and is included as Appendix E.

4.4.2.2 Alternative 1 - Proposed Action

Under this alternative, activities from the proposed project would potentially cause impacts to the following species. Project activities that could cause impacts include people and equipment working at the project site, vegetation removal and noise from construction activities.

<u>Western Pond Turtle</u>

Under this alternative, western pond turtles could be harmed or killed if they were present within the project area during construction activities.

<u>Grasshopper Sparrow</u>

Under this alternative, project activities could cause nests to be destroyed or abandoned if active grasshopper sparrow nests were present within or near the project area during construction activities.

<u>Golden Eagle</u>

Under this alternative, project activities could cause nests to be destroyed or abandoned if active golden eagle nests were present within or near the project area and were disturbed by project construction activities.

<u>Long-eared Owl</u>

Under this alternative, project activities could cause nests to be destroyed or abandoned if active long-eared owl nests were present within or near the project area during construction activities.

<u>Burrowing Owl</u>

Under this alternative, project activities could cause burrows to be destroyed or abandoned if active burrowing owl burrows were present within or near the project area during construction activities.

White-tailed Kite

Under this alternative, project activities could cause nests to be destroyed or abandoned if active white-tailed kite nests were present within or near the project area during construction activities.

American Peregrine Falcon

Under this alternative, project activities could cause nests to be destroyed or abandoned if active American peregrine falcon nests were present within or near the project area during construction activities.

Bald Eagle

Under this alternative, project activities could cause harassment, habitat modification or nest abandonment if active bald eagle nests were present within or near the project area during construction activities. Beneficial effects to this species could occur as a result of the proposed alternative from the potential increase in prey abundance, as a result of improved salmonid and other native fish species populations.

Yellow-breasted Chat

Under this alternative, project activities could cause nests to be destroyed or abandoned if active yellow-breasted chat nests were present within or near the project area during construction activities.

Loggerhead Shrike

Under this alternative, project activities could cause nests to be destroyed or abandoned if active loggerhead shrike nests were present within or near the project area during construction activities.

Yellow Warbler

Under this alternative, project activities could cause nests to be destroyed or abandoned if active yellow warbler nests were present within or near the project area during construction activities.

Other Nesting Raptors

Under this alternative, project activities could cause nests to be destroyed or abandoned if other active raptor nests were present within or near the project area during construction activities.

Other Nesting Migratory Birds

Under this alternative, project activities could cause nests to be destroyed or abandoned if other active migratory bird nests were present in the project vicinity during construction activities.

Vernal Pool Fairy Shrimp

Under this alternative, vernal pool fairy shrimp could be impacted through mortality to a or cysts through destruction or modification of potential habitat that is present in seasonal wetlands and seasonally-wet depressions near the south access road and contractor use areas. Potential impacts include filling of the wetlands or seasonally-wet depressions or changes in hydrology due to road grading. Additional potential impacts include contamination of the depression sediments from petroleum products or other contaminant spills.

Vernal Pool Tadpole Shrimp

Under this alternative, potential impacts to vernal pool tadpole shrimp and their cysts are expected to be similar to those described above for vernal pool fairy shrimp.

Pallid Bat

Under this alternative, project activities could cause pallid bats to be harmed or killed if active roosts were present in vegetation impacted by construction activities.

Ringtail

Under this alternative, ringtail could be harmed or killed if active ringtail dens or nests were present within the project sites and were disturbed by project construction activities.

Spotted Bat

Under this alternative, project activities could cause spotted bats to abandon their roost if bats were roosting within, or in close proximity to the project site.

Western Mastiff Bat

Under this alternative, project activities could cause western mastiff bats to abandon their roost if bats were roosting within, or in close proximity to the project site.

Western Red Bat

Under this alternative, project activities could cause juvenile western red bats to be harmed or killed if active maternal roosts were present in vegetation impacted by construction activities.

Potential adverse impacts to wildlife resources are considered short-term in duration and minor to moderate in intensity. An Intra-Service Endangered Species Act consultation with USFWS has been completed for potential impacts to vernal pool fairy shrimp and vernal pool tadpole shrimp and a Letter of Concurrence has been issued (Appendix F).

The following RPMs would be implemented as design features of the project to avoid, reduce and minimize impacts to wildlife:

WILDLIFE-1: Any tree removal, vegetation clearing, or the onset of potentially disturbing construction activities shall occur between September 1 and January 1 (outside of the nesting season for raptors with potential to occur within, or in the vicinity of the project site). NOTE: Also see measure WILDLIFE-5.

If tree removal, vegetation clearing, or the onset of potentially disturbing construction activities must occur during the nesting season, a raptor nesting survey of the construction area and adjacent suitable habitat shall be conducted by a qualified biologist no more than ten (10) days prior to the initiation of the onset of these activities or as appropriate survey protocols require. If active raptor nests are found to be present, tree removal, vegetation clearing and the onset of potentially disturbing construction activities shall be suspended until a qualified biologist, in consultation with CDFW and / or USFWS can establish an appropriate protective buffer area to minimize impacts to the nesting raptors. No construction activities shall commence within the buffer area until the qualified biologist determines that the young birds have fledged or the nest is no longer active.

Construction activities shall occur continuously (not including weekends) until the end of the nesting season to discourage raptors from initiating nesting. If construction activities cease for more than ten (10) consecutive days (including weekends), all construction activities shall cease until CDFW can be consulted to determine if a subsequent raptor nesting survey must be performed.

Active or inactive nests are not to be disturbed or removed as a result of construction activities without CDFW consultation per Fish and Game Code Section 3503.5.

WILDLIFE-2: The USFWS shall be consulted to 1) develop appropriate avoidance and minimization measures, and 2) determine whether an Endangered Species Act Section 7 take permit will be required for the project.

Project activities shall avoid direct impacts to seasonal wetlands or other large branchiopod (fairy shrimp, tadpole shrimp) habitats.

High-visibility fencing shall be installed in areas where equipment will be working near any large branchiopod habitat.

No road grading or road improvements shall be allowed in or, where feasible, near large branchiopod habitats.

All transporters of potentially hazardous materials (fuel, oil, cement, etc.) will be notified as to the presence of potential large branchiopod habitats, and be required to inspect their vehicles prior to entry and exit of the project site to prevent accidental discharge.

All vehicular traffic will be restricted to stay within the designated work boundaries. The work boundaries will be flagged or fenced and identified on construction drawings to limit equipment and personnel to the minimum area necessary to perform the project work and minimize impacts to wetland habitat.

WILDLIFE-3: Prior to work in aquatic habitats, water bodies shall be surveyed by a qualified biologist to determine if any western pond turtles are present. If any individuals of these species are found, a qualified and permitted biologist shall determine and implement appropriate relocation procedures, in coordination with CDFW. The site shall be checked daily by trained construction workers prior to work commencing, including underneath vehicles and equipment that will be used. If special-status species are found, they will be moved by a qualified and permitted biologist to an area of safety out of harm's way.

WILDLIFE-4: Within ten (10) calendar days prior to the onset of potentially disturbing construction activities, a burrowing owl burrow survey of the construction area and adjacent suitable habitat shall be conducted by a qualified biologist. If active burrowing owl burrows are found to be present, the onset of potentially disturbing construction activities shall be suspended until a qualified biologist, in consultation with CDFW, can establish an appropriate protective buffer area to minimize impacts to the roosting birds. No construction activities shall commence within the buffer area until the qualified biologist determines that the burrow is no longer active.

WILDLIFE-5: Any tree removal, vegetation clearing, or the onset of potentially disturbing construction activities shall occur between August 1 and March 1 (outside of the nesting season for grasshopper sparrow, yellow-breasted chat, loggerhead shrike, yellow warbler and other nesting migratory birds). NOTE: Also see measure WILDLIFE-1.

If tree removal, vegetation clearing, or the onset of potentially disturbing construction activities must occur during the nesting season, a nesting survey of the construction area and adjacent suitable habitat shall be conducted by a qualified biologist no more than ten (10) days prior to the initiation of the onset of these activities. If active bird nests are found to be present, tree removal, vegetation clearing and the onset of potentially disturbing construction activities shall be suspended until a qualified biologist, in consultation with CDFW, can establish an appropriate protective buffer area to minimize impacts to the nesting birds. No construction activities shall commence within the buffer area until the qualified biologist determines that the young birds have fledged or the nest is no longer active.

Construction activities shall occur continuously (not including weekends) until the end of the nesting season to discourage avian species from initiating nesting. If construction activities cease for more than ten (10) consecutive days (including weekends), all construction activities shall cease until CDFW can be consulted to determine if a subsequent nesting bird survey must be performed.

Active nests are not to be disturbed or removed as a result of construction activities per Fish and Game Code Section 3503.

WILDLIFE-6: Prior to any vegetation removal or disturbance to rock cliffs with cracks, an attempt will be made by a qualified biologist to determine if pallid bats, spotted bats, western red bats or western mastiff bats are roosting in the area to be removed / disturbed.

If pallid bats, spotted bats, western red bats or western mastiff bats are found to be roosting within the area to be removed / disturbed, these activities shall be suspended until a qualified biologist, in consultation with CDFW, can establish appropriate measures to minimize impacts to these species.

WILDLIFE-7: To the extent possible, all direct disturbance to identified bat roosts shall occur between August 31 and May 1, in order to minimize the likelihood of injuring or killing juvenile bats during the period when they are still unable to fly.

WILDLIFE-8: To the extent possible, the removal of trees or branches with defects (cavities, cracks, exfoliating bark, etc.) that provide potential bat roosting or bird roosting / nesting habitat will be avoided.

WILDLIFE-9: As appropriate, revegetation efforts will incorporate tree and vine species that are known to be used by western red bats for roosting including, but not limited to white alder *(Alnus rhombifolia)*, California sycamore *(Platanus racemosa)*, pipevine *(Aristolochia californica*) and California grape *(Vitis californica)*.

WILDLIFE-10: Potential ringtail denning habitat exists within the project area in the form of hollow trees and rock talus. Prior to construction, a biologist will inspect the project site for signs of denning.

If ringtails are found to be denning, construction activities will be suspended until a qualified biologist, in consultation with CDFW, can establish appropriate measures to protect ringtail.

WILDLIFE-11: A qualified biologist (biological monitor) shall regularly inspect construction-related activities to ensure that no unnecessary disturbance to special-status species and / or their associated habitats occurs. The biological monitor shall have the authority to stop all activities that may result in such disturbance until appropriate corrective measures have been completed. The biologist will also be required to report any unauthorized take to CDFW, USFWS and / or NMFS immediately.

WILDLIFE-12: A construction worker education program shall be implemented that includes an explanation of all special-status animal species, identification, avoidance measures, and federal and state laws that protect the species. This shall include, at a minimum, those species listed in the environmental documents.

WILDLIFE-13: Appropriate measures will be used to avoid the spread of aquatic invasive species such as zebra / quagga mussels, New Zealand mudsnails and chytrid fungus to and from the project area according to the current CDFW Aquatic Invasive Species Disinfection / Decontamination Protocols (Northern Region) and the current USFWS Red Bluff Fish and Wildlife Office Anadromous Fish Restoration Program Hazard Analysis Critical Control Point Plan.

WILDLIFE-14: All food-related trash will be disposed of in closed containers and removed from the project area daily during the construction period. Construction personnel will not feed or otherwise attract wildlife to the project area.

WILDLIFE-15: No pets will be allowed within the project area.

WILDLIFE-16: While foothill yellow-legged frogs are not expected to occur within the project site, prior to work in aquatic habitats, water bodies shall be surveyed by a qualified biologist to determine if any foothill yellow-legged frogs are present. If any foothill yellow-legged frogs are found, a qualified and permitted biologist shall determine and implement appropriate relocation procedures, in coordination with CDFW. The site shall be checked daily by trained construction workers prior to work commencing, including underneath vehicles and equipment that will be used. If foothill yellow-legged frogs are found, they will be moved by a qualified and permitted biologist to an area of safety out of harm's way.

4.4.2.3 Alternative 2 - No Action

Under this alternative, there would be no impacts to wildlife, including special-status wildlife species because the project would not be implemented. Baseline levels of disturbance to wildlife populations as a result of ranching and hydropower system maintenance activities would continue to occur at current levels.

4.4.3 Wetlands and Other Jurisdictional Waters of the U.S.

4.4.3.1 Methodology

The assessment of potential impacts of the proposed project on wetlands and other jurisdictional waters of the U.S. is based on consultations with resource agency staff and field studies that are documented in a *Delineation of Waters of the U.S.* (Tehama Environmental Solutions 2018) that was prepared for the proposed project. This document is available on the Red Bluff Fish and Wildlife Office website on the AFRP webpage (http://www.fws.gov/redbluff/afrp.html).

A delineation of waters of the U.S. was conducted by TES and Dittes and Guardino Consulting staff within the project study area on May 30, 2018, June 20, 2018, August 15, 2018 and August 22, 2018. The delineation was conducted in accordance with the *1987 Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (U.S. Army Corps of Engineers 2008) using a Routine Determination Method. Based on the results of the delineation, maps of all identified wetlands and other waters were prepared. The maps are considered preliminary until they are verified by USACE. These features and measurements are shown in Figure 15.

4.4.3.2 Alternative 1 - Proposed Action

Under this alternative, as a result of the modifications to the Battle Creek stream channel, some of the wetland and other waters of the U.S. features would be temporarily and permanently impacted as represented in Table 7.

Table 7. Impacts to Preliminary Waters of the U.S.

FEATURES	Permanent Impacts		Temporary Impacts	
	Sq. Ft.	Acres	Sq. Ft.	Acres
WETLANDS				
Lower Barrier Site				
Groundwater Seep Wetland	0	0.00	200	0.005
TOTAL WETLANDS	**0**	**0.00**	**200**	**0.005**
OTHER WATERS				
Upper Barrier Site				
Perennial Stream	680	0.02	12,154	0.28
Ditch	0	0.00	83	0.002
Ephemeral Stream	118	0.003	0	0.00
Lower Barrier Site				
Perennial Stream	0	0.00	5,777	0.13
TOTAL OTHER WATERS	**798**	**0.02**	**18,014**	**0.41**
TOTAL WATERS OF THE U.S.	**798**	**0.02**	**18,214**	**0.42**

While a small portion of the impacts associated with the stream channel modification would be permanent, no loss of wetlands or other waters of the U.S. would occur. All impacted wetlands would be revegetated. Beneficial impacts to the Battle Creek aquatic system would occur as a result of the improvement in upstream and downstream passage conditions for anadromous salmonids (including several federally listed species) and other native species, and the restoration of access to upstream habitats that are not currently accessible for fish downstream of the barriers. Adverse impacts to wetlands and other jurisdictional waters of the U.S. are considered short-term in duration and minor in intensity. Beneficial impacts to the aquatic system are considered long-term in duration and major in intensity.

The following RPMs would be implemented as design features of the project to avoid, reduce and minimize impacts to wetlands and other jurisdictional waters of the U.S.:

WETLAND-1: Project activities will avoid impacts to wetlands and other aquatic habitats to the extent possible.

WETLAND-2: High-visibility fencing will be installed in areas where equipment will be working near any wetlands or other aquatic habitats that are not to be disturbed.

WETLAND-3: Construction crews will be informed about the importance of avoiding sensitive areas, including wetlands.

WETLAND-4: A Clean Water Act Section 404 Permit will be obtained from the U.S. Army Corps of Engineers and a Clean Water Act Section 401 Certification will be obtained from the Central Valley Regional Water Quality Control Board (RWQCB).

4.4.3.3 Alternative 2 - No Action

Under this alternative, there would be no impacts to wetlands or other waters. The boulder barriers at the LBS and UBS would remain in place and fish passage would not be improved. No beneficial impacts to the aquatic system would occur.

4.4.4 Fisheries

4.4.4.1 Methodology

The assessment of potential impacts of the proposed project on fisheries is based on a review of databases and pertinent literature, consultation with resource agency staff, and field studies that are documented in a *Biological Resources Evaluation* (Tehama Environmental Solutions 2019a) that was prepared for the proposed project. This document is available on the Red Bluff Fish and Wildlife Office website on the AFRP webpage (http://www.fws.gov/redbluff/afrp.html).

Prior to the initiation of field studies, a records search of the CNDDB (California Department of Fish and Wildlife 2018b) was conducted to determine if any special-status animals, or rare natural communities had previously been documented within the study area, or in the vicinity of the study area. The query was conducted using the USGS Shingletown 7.5-minute quadrangle, in which the project is located, along with the eight adjoining quadrangles (Manton, Dales, Inskip Hill, Finley Butte, Clough Gulch, Inwood, Hagaman Gulch and Tuscan Buttes NE). In addition, species lists for the study area were requested from USFWS (U.S. Fish and Wildlife Service 2018) and NMFS (National Marine Fisheries Service 2018).

Based on the results of the CNDDB search, the USFWS and NMFS species lists and TES's additional knowledge of the site and local area, a list of potentially occurring special-status species and natural communities was developed for the project and is included as Appendix E.

4.4.4.2 Alternative 1 - Proposed Action

Under this alternative, activities from the proposed project would potentially cause impacts to the following species and designated CH and EFH. Project activities that could cause significant impacts include site dewatering and rewatering activities, fish rescue operations, instream boulder removal, water quality issues and vegetation removal.

<u>Riffle Sculpin</u>

Under this alternative, riffle sculpin could be harmed or killed by construction activities if they were present within the project area. Beneficial effects to this species would likely occur as a result of improved passage conditions for native adult and juvenile fish, including riffle sculpin.

Central Valley Steelhead

Under this alternative, steelhead could be harmed or killed by construction activities if they were present within the project area. The persistent cold water in the project reach of North Fork Battle Creek presents favorable year-round habitat for rainbow trout / steelhead. The start of instream construction is scheduled to occur during the low-flow period, however adult and juvenile trout / steelhead would still be expected to be present. Impacts to migrating fish would be expected to be minimal due to the fact that the two project sites are currently complete fish passage barriers.

A fish exclusion zone upstream and downstream of the construction areas, as needed, would be implemented prior to the onset of any instream construction activities. The actions necessary to remove fish out of the construction area are expected to result in some form of fish capture and handling. A permitted crew would be responsible for the seining, dip-netting, and / or electroshocking. Actions would be taken first to encourage fish to volitionally move out of the area prior to implementing other methods. If electrofishing is required, NMFS electrofishing guidelines (National Marine Fisheries Service 2000) would be used. Any capture and handling associated with electrofishing is likely to result in direct effects to juvenile and adult fish present in the fish exclusion zones. It is expected that capture, handling and release of the juvenile steelhead would disrupt normal behavior and cause temporary stress, injury, and potentially mortality. It is anticipated that fish capture / relocation would not last more than two to three days for dewatering and another two to three days for rewatering, however additional capture / relocation would occur if additional fish are observed within the exclusion zone as a result of daily monitoring. The fish exclusion zones would be maintained until the construction is completed and instream turbidity has dissipated.

Areas upstream of the fish exclusion zones would likely have juvenile and adult fish present through the summer construction period. These fish would not be able to move upstream or downstream during the instream construction period but would be supported by cold water flowing through the reach.

During rewatering, a plume of turbidity would be anticipated immediately following construction activities as the channel immediately begins to adjust to the new conditions. This turbidity and small amount of suspended sediment would likely persist in the water column for several hours until channel conditions stabilize, however rewatering activities would occur slowly, in order to prevent and minimize turbid conditions in North Fork Battle Creek. Turbidity and settleable matter are not expected to exceed the likely conditions in the Clean Water Act Section 401 Certification issued by the RWQCB.

During the initial time period following construction and the initial winter, a small amount of sediment that would be disturbed by project construction activities would likely be redistributed by high flows. Because the anticipated amount of sediment is very small, and mobilization would occur slowly post-construction and during high flows of the initial winter (when background turbidity and sediment transport is relatively high), only minimal affects to adult or juvenile fish are anticipated.

In order to provide for the crane / yarder system to transport boulders out of the canyon, some of the streamside vegetation would be trimmed or cut down. It is estimated that selective cutting and trimming would occur along approximately 80 feet of channel, primarily on the south bank, at the LBS using the crane system. It is estimated that selective cutting and trimming would occur along approximately 240 feet of channel, primarily on the south bank, at the UBS if the crane system is used. Alternatively, selective cutting and trimming would occur along approximately 380 feet of channel at the UBS if the yarder system is used. Cutting and trimming would be minimal in approximately half of this area due to the lack of streamside vegetation where vertical rock canyon walls are present. This is expected to cause only minimal reductions of shaded aquatic habitat due to the shaded nature of the stream at the bottom of the steep vertical canyon.

Beneficial effects to this species would occur as a result of improved passage conditions for native adult and juvenile fish, including Central Valley steelhead, and restored access to upstream habitats that are not currently accessible for fish downstream of the barriers.

Central Valley Spring-run Chinook Salmon

Under this alternative, the impacts to spring-run salmon are expected to be similar to the impacts listed for steelhead with the exception that there would be less of an impact to spring-run salmon due to the fact that they would not be expected to be present within the construction sites due to the impassable LBS. Spring-run salmon are present just downstream of the LBS at certain times of the year and could be potentially be impacted by water quality effects. Beneficial effects to this species would occur as a result of improved upstream and downstream passage conditions for native adult and juvenile fish, including Central Valley spring-run Chinook salmon, and restored access to upstream habitats that are not currently accessible for fish downstream of the barriers.

Central Valley Fall- / Late Fall-run Chinook Salmon

Under this alternative, the impacts to fall / late fall-run salmon are expected to be similar to the impacts listed for steelhead with the exception that there would be less of an impact to fall / late fall-run salmon due to the fact that they would not be expected to be present within the construction sites due to the impassable LBS. Fall / late fall-run are present just downstream of the LBS at certain times of the year and could be potentially be impacted by water quality effects.

Sacramento River Winter-run Chinook Salmon

Under this alternative, impacts to winter-run salmon are expected to be similar to the impacts listed for steelhead with the exception that there would be less of an impact to winter-run salmon due to the fact that they would not be expected to be present within the construction sites due to the impassable LBS. Adult and / or juvenile winter-run salmon released as part of the Battle Creek reintroduction program could be present just downstream of the LBS at certain times of the year and could potentially be impacted by water quality effects. Beneficial effects to this species would occur as a result of improved upstream and downstream passage conditions for native adult and juvenile fish, including Sacramento River winter-run Chinook salmon, and restored access to upstream habitats that are not currently accessible for fish downstream of the barriers.

Central Valley Steelhead Critical Habitat

Under this alternative, while there would be changes to the habitat that currently exists within the project sites as a result of the boulder removal and channel reconfiguration, no net loss of CH would be expected as a result of project implementation. Turbidity generated by construction activities could have an effect on the CH elements that address water quality, however the impact to this element is considered very minimal because 1) the impact is considered very small in quantity; and 2) the project would make additional habitat accessible to fish. As a result of streamside vegetation trimming and removal, there would be a minimal reductions of shaded aquatic habitat due to the shaded nature of the stream at the bottom of the steep vertical canyon. To further minimize this effect, trimming would be uses, when possible to allow woody vegetation to reestablish itself quicker and vegetation would be replanted as detailed in the revegetation plan to be prepared for this project. Given the temporary nature of project construction, the risk of short-term impacts is relatively low, compared to the long-term benefits of improved fish passage that the proposed project would provide. Beneficial impacts would occur by enhancing all three PCEs including spawning habitat, freshwater rearing habitat and freshwater migration corridors.

Central Valley Spring-run Chinook Salmon Critical Habitat

Under this alternative, the impacts to Central Valley spring-run Chinook salmon CH are expected to be similar to the impacts described above for Central Valley steelhead CH, including beneficial impacts.

Essential Fish Habitat

Under this alternative, no net loss of EFH is expected as a result of project implementation. The effects would be expected to be similar to the effects described under the Central Valley Steelhead CH section above, including beneficial impacts.

Potential adverse impacts to fisheries resources are considered short-term in duration and minor to moderate in intensity. Beneficial impacts to fisheries resources are considered long-term in duration and major in intensity. An Endangered Species Act consultation with NMFS has been completed for potential impacts to Central Valley steelhead, Central Valley steelhead CH, Central Valley spring-run Chinook salmon, Central Valley spring-run Chinook salmon CH, Sacramento River winter-run Chinook salmon and Pacific Salmon EFH. The proposed project has been authorized under a Programmatic Biological Opinion for restoration projects in the Central Valley of California (Appendix G).

The following RPMs would be implemented as design features of the project to avoid, reduce and minimize impacts to fisheries resources:

FISH-1: NMFS shall be consulted to 1) develop appropriate Central Valley Steelhead and Central Valley Spring-run Chinook Salmon avoidance and minimization measures, and 2) determine whether an Endangered Species Act Section 7 take permit will be required for the project.

FISH-2: Construction outside of the stream channel could start as early as July 1, based upon permits receipt, permit conditions, and / or consultation terms and conditions. For fisheries protection, instream work will occur between July 1 and September 30. Instream work could start sooner if CDFW, in coordination with NMFS determines that adult spring-run Chinook salmon are no longer present based on environmental conditions, proper installation of an exclusionary weir and real-time passage data. Instream work could be extended to October 14, if environmental conditions, which will preclude juvenile steelhead and spring-run Chinook salmon emigration or adult steelhead / fall-run Chinook salmon immigration, are expected to persist. Instream work outside of the July 1 to September 30 work window must be approved by CDFW and NMFS on a case-by-case basis with details on how take will be avoided and / or minimized. For work within the channel and banks, fish rescue efforts (herding fish, netting / seining, electrofishing, etc.) will be required prior to the onset of any dewatering of the area. Dewatering will be coordinated with CDFW to ensure that adequate staff are available, and onsite during dewatering efforts.

FISH-3: All construction debris (concrete, metal, etc.) from the fish passage improvement-related construction activities shall be removed from the active stream channel post-construction.

FISH-4: Prior to construction, exclusionary fish netting or other CDFW approved exclusionary structure and / or other mechanism(s) shall be installed upstream and / or downstream of the construction area as determined by CDFW. USFWS, in coordination and consultation with NMFS and CDFW, will ensure that qualified fish biologists are onsite to implement fish rescue operations through the use of herding, seining and / or electrofishing, etc., if necessary. Best professional determination will be used to decide which method(s) of rescue and location of exclusionary structure and / or other mechanism(s) is most appropriate. Biologists will first try to haze and herd fish out of the fish exclusion area. If fish biologists determine that the use of electrofishing is necessary for the efficient and successful removal of fish, USFWS biologists with electrofishing certification will strictly follow the NMFS electrofishing guidelines (National Marine Fisheries Service 2000). The fish rescue team will be comprised of fishery biologists with professional experience using seines and electrofishing equipment.

FISH-5: Adequate erosion and pollution control measures shall be taken to ensure that sediment, turbidity, petroleum products or other harmful chemicals do not enter Battle Creek, wetlands or other aquatic sites as a result of construction activities. Standard Best Management Practices (BMPs) shall be incorporated into the project designs.

FISH-6: Best Management Practices (BMPs) will be developed and implemented to ensure that wet concrete does not enter Battle Creek, wetlands or other aquatic sites during construction.

FISH-7: All water pumps used during construction shall be screened to meet CDFW and NMFS criteria, unless deemed unnecessary by CDFW and NMFS (i.e. if water was being diverted from an off-channel pool). The refueling of pumps will occur away from the wetted area / channel. If pumps are using fuel, they will be outfitted with a spill kit.

FISH-8: All dewatering and rewatering activities will be conducted slowly, in order to minimize disturbance to fish and will be carefully coordinated with CDFW.

FISH-9: While Pacific lamprey are not expected to occur within the project site, all reasonable measures will be taken to minimize impacts to lamprey, including spending more time at the area as it becomes dewatered (and they are moving out of the mud, chasing the water as it recedes), and possibly electroshocking.

4.4.4.3 Alternative 2 - No Action

Under this alternative, all existing project components would remain unchanged, which would continue to impede the ability for anadromous fish and other native species to migrate upstream of the barriers. Under this alternative, potential injury or mortality would not occur to anadromous fish or other native fish species as a result of the construction activities. Beneficial impacts to Battle Creek fish populations from removing passage barriers to upstream areas that have favorable habitat would not occur. No modifications would occur to Central Valley steelhead CH or Central Valley spring-run Chinook salmon CH. Beneficial effects to Central Valley steelhead CH and Central Valley spring-run Chinook salmon CH as a result of removing passage barriers would not occur. No modifications would occur to Pacific Salmon EFH. Beneficial effects to Pacific Salmon EFH as result of removing passage barriers would not occur.

4.5 Cultural and Tribal Cultural Resources

4.5.1 Methodology

The assessment of potential impacts of the proposed project on cultural resources is based on a review of databases and pertinent literature and field studies that are documented in a Historical Resource Investigation that was prepared for the proposed project (White and Reifschneider-Smith 2018). A document review was conducted at the Northeast Information Center (NEIC) of the California Historical Resources Information System, California State University, Chico (NEIC File #W18-101) on June 4, 2018. The document review covered records of previous investigations within a 1.0 mile (1.6 kilometer) radius and previously recorded sites on-file within a 2.5 mile (4.0 kilometer) radius around the project area. A field survey took place on May 31, 2018 by Dr. Gregory White of Sub Terra Consulting, Archaeology and Paleontology (Sub Terra). The entire APE was studied, including:

- Cursory inspection of the previously constructed, 4,766-foot (1,453-meter) improved gravel south access corridor;
- Cursory inspection of the northern two-thirds of the previously-constructed 6,165-foot (1,879-meter) north access corridor, also improved gravel; and intensive pedestrian reconnaissance of the south one-third, which is unimproved dirt; and
- Intensive pedestrian survey of the UBS and LBS proposed staging areas located along the bluff top. This reconnaissance covered the entire proposed APE in the Davis and Gamon properties, and no investigation of the Rusch property, per the status of trespass agreements in place at the time of investigation.

The survey was conducted following an intensive survey strategy consisting of close-spaced pedestrian transects augmented by surface scrapes using a trowel and hoe. In open areas free of brush, transects were spaced

between five and 12 meters apart (16–40 feet). However, in some areas dense scrub vegetation prevented passes at regular intervals, especially in the eastern portion of the proposed staging area on the south bluff of Eagle Canyon. In this area, game trails and aerial photos provided clues regarding the complex arrangement of open space, and these clues were used to trace a circuitous path through the brush enabling maximum coverage given the vegetation constraints. Significant access constraints were also encountered in portions of the APE overlapping Eagle Canyon. Much of the canyon wall is vertical or near-vertical and characterized by wet, slick duff, a tangle of vegetation thick with poison oak, and few, if any reasonable options for vertical travel. In this portion of the APE, the canyon wall was traversed along a midslope debris fan bench providing reasonable access on both the north and south sides of Eagle Canyon. The canyon bottom was accessed via stairways and catwalks built to service the dam and canal and used various positions for observation of the subject boulders.

Native American Coordination

Work reported here was carried out in conformance with 54 U.S.C. Section 302706, which requires federal agencies and entities operating under federal permits or funding, in carrying out their Section 106 responsibilities, to consult with any Indian tribe that attaches religious and cultural significance to historic properties that may be affected by an undertaking. In order to establish a context for field investigation of the project area, primary and secondary Northern Yana ethnographic resources were consulted. In order to address this mandate, on May 29, 2018, Sub Terra contacted the State of California, Native American Heritage Commission (NAHC) to request a Sacred Lands Inventory for the proposed project area. NAHC responded to the Sacred Lands Inventory request on July 12, 2018, indicating that NAHC files contain no listing for sacred lands in the vicinity of the proposed project. The NAHC response also included a list of eight additional recommended tribal contacts. Letters containing a project description and map location were sent to the eight on July 19, 2018. No response has been received as of this writing. Any responses received by Sub Terra after filing of the report will be forwarded to the appropriate entity with recommendations.

4.5.2 Alternative 1 - Proposed Action

Isolated Finds A and B

Under the National Historic Preservation Act (NHPA), isolated prehistoric artifacts do not constitute historical resources and therefore, no additional treatment measures can be proposed for the two isolated finds identified. However, it should be noted that both isolated finds were identified in a location characterized by soil development and dense vegetation growth making it possible that new disturbance and exposure of soils in the area could reveal additional finds.

Historical Site

The Eagle Canyon Can Dump represents an historic property but the resource does not qualify for the National Register of Historic Places because it is acontextual and lacks association with a broad spectrum of work camp features. It reflects the relatively narrow venue of company-controlled meal consumption. It is not associated with significant events or events integral to broad historical patterns and it is not associated with significant persons. It does not embody distinctive characteristics, it is not unique to the period, does not represent the work of a master, nor is it a work of high artistic value. Therefore, a Finding of Effects of “No Historic Properties Affected” was reached pursuant to 36 Code of Federal Regulations (CFR) Part 800.4(b)(1). Nevertheless, the data sets present in the dump have a limited analytical value because they are specific to a limited time period and undertaking, the construction of the Eagle Canyon Dam and Canal in 1909–1910.

Implementation of the proposed project would have no adverse effect to any identified cultural resource.

The following RPMs would be implemented as design features of the project to avoid, reduce and minimize impacts to cultural resources:

CULTURAL-1: Prior to construction, a cultural resource specialist will flag any potentially sensitive cultural resource areas to be avoided.

CULTURAL-2: While the Eagle Canyon Can Dump does not qualify for the National Register of Historic Places, it will be avoided. If it cannot be avoided, an Extended Phase 1 inventory will take place. An Extended Phase 1 investigation will consist of a more detailed site record documentation, and include compilation of a detailed site map and an inventory of individual refuse items by type, size, function, make and manufacture, modifications, and associations.

CULTURAL-3: In the event subsurface archaeological resources are encountered during ground-disturbing activities, all work will cease at the general area of discovery and the USFWS regional archaeologist, or other lead agency archaeologist, will be notified immediately. A field exam by a professional archaeologist may be required and further steps for resource protection will be implemented, including mitigation and consultation with the Native American Indian community if human remains are encountered (following Native American Graves Protection and Repatriation Act procedures). Work may proceed on other parts of the project site while mitigation for historical, unique archaeological or tribal resources is being carried out.

4.5.3 Alternative 2 - No Action

Under this alternative, no impacts or changes would occur to existing cultural or tribal resources that were identified and evaluated in the project area. The identified cultural resources would remain subject to existing levels of disturbance.

4.6 Hazardous and Toxic Materials

4.6.1 Methodology

The hazardous and toxic materials analysis is based upon a review of a governmental record search of the DTSC EnviroStor database (California Department of Toxic Substances Control 2019).

4.6.2 Alternative 1 - Proposed Action

Under this alternative, activities associated with the proposed project would utilize potentially hazardous materials associated with project construction and the operation of vehicles and construction equipment during project implementation including oil, fuels and concrete. These materials are similar to those routinely used for other types of construction projects throughout Tehama and Shasta Counties. The widespread use and associated transport of these materials along the highways and county roads that traverse Tehama and Shasta Counties, combined with the low level of incidents (spills), suggest that impacts related to transportation activities would be similar to those found elsewhere in the counties. Given the temporary nature of project construction, the risk of hazardous materials spills from accidental conditions is relatively low, however the potential release of these hazardous materials still exists for elements of construction working near water. Adverse impacts to Battle Creek could occur if concrete, fuel, oil other petroleum products were accidentally spilled as a result of construction activities and entered surface waters.

Under this alternative, impacts related to hazardous and toxic materials could occur. Impacts could potentially be adverse, intermediate-term in duration and minor to major in intensity. The following RPMs would be implemented as design features of the project to avoid, reduce and minimize potential impacts from hazardous and toxic materials:

HAZ-1: A designated concrete washout area will be located at least 100 feet from any high water mark within adjacent waterways and from any wetlands and will be developed and used following the U.S. EPA Stormwater BMP for a Concrete Washout.

HAZ-2: Measures WATER-3 through WATER-6 associated with potential petroleum product spills will be fully implemented.

HAZ-3: Construction equipment and materials shall not be stored or stockpiled in the creek channel, and shall be stored at least 50 feet from the top of the stream bank or any wetlands or other aquatic sites.

4.6.3 Alternative 2 - No Action

Under this alternative, no construction activities would occur and thus there would be no risk of spill or release of hazardous or toxic materials over and above existing conditions.

4.7 Hydrology and Water Quality

4.7.1 Methodology

Impacts on hydrology and water quality were evaluated by analyzing regional and site-specific reports. The analysis was conducted through document review and field studies that are documented in an *Existing Site and Hydraulic Characterization Technical Memorandum* (Michael Love and Associates 2016) that was prepared for the proposed project.

4.7.2 Alternative 1 - Proposed Action

Under this alternative, water quality impacts such as short-term minor increases in turbidity and suspended sediment concentrations would likely occur due to project activities during the construction process and, potentially during the initial winter following construction due to erosion from the project construction areas. Water quality impacts to Battle Creek could occur if concrete, fuel, oil other petroleum products were accidentally spilled as a result of construction activities and entered surface waters. The project would result in minor changes to stream flows due to boulder removal and reconfiguration of the stream channel.

Impacts related to water quality would be short-term in duration and minor in intensity. Impacts related to hydrology would be long-term in duration and moderate in intensity but would not be adverse. The following RPMs would be implemented as design features of the project to avoid, reduce and minimize potential impacts to hydrology and water quality:

WATER-1: All construction shall be conducted in the summer / early fall during the low flow period. Any work within the channel and banks, outside of this instream work window must be isolated from flowing water and dewatering will be required.

WATER-2: Monitoring of water turbidity and settleable materials shall be conducted in accordance with the Clean Water Act Section 401 Certification through consultation with the RWQCB.

WATER-3: All equipment and machinery that contains fuel, oil or other petroleum products used during construction related activities shall be checked for petroleum leaks immediately prior to being mobilized to the project site and again each day prior to use.

WATER-4: All equipment refueling and / or maintenance shall take place within a secondary containment structure and, when feasible, a minimum of 100 feet away from Battle Creek, wetlands or other aquatic sites.

WATER-5: An emergency spill kit and absorbent oil booms will be onsite during construction activities.

WATER-6: All equipment operations within the channel and banks of Battle Creek will be required to use readily biodegradable hydraulic oil.

WATER-7: A dewatering permit will be obtained from the RWQCB, if deemed necessary based on the dewatering methods used.

WATER-8: Helicopter delivery of all materials including wet and dry concrete materials, will use a helicopter route that minimizes the length of time spent over open water areas of Battle Creek and will be delivered to the site in sealed protective containers such as intermediate bulk containers (IBCs) designed for containment of dry flowable chemical materials or fluids. Helicopter staging and delivery areas will be isolated from the adjacent upland, wetland and stream areas through use of silt barriers.

WATER-9: Transfer of cement and mixing of concrete will be performed in a containment berm or cell and will occur only during dry weather. Cement stored on site will be in containers or covered at all times. Any equipment to be cleaned of concrete will be washed in / over a sealed protective container. Concrete wash water and any excess concrete will be collected in containers such as flexible or rigid IBCs and removed from the site.

WATER-10: In the event that any concrete materials are spilled onsite, it shall be immediately cleaned up and transferred to an IBC. Any operations resulting in spills will be immediately stopped. Modifications will be made to prevent spills, prior to resuming operations.

WATER-11: Concrete will be placed in dry conditions to the maximum extent feasible. Areas where concrete is to be placed within ten feet of water, will be isolated from the creek with silt and turbidity barriers. If concrete is to be placed underwater, it will be fully contained in formwork extending above the water level and will be installed by tremie methods. Water displaced by the tremie placement will be pumped to a dewatering storage system. Pumping will be used to maintain a positive flow gradient toward the area of work (away from the creek), and pumped water will be discharged to the dewatering storage system.

WATER-12: A water quality protection plan will be prepared by the contractor that includes concrete / cement measures and shall be approved by the project engineer prior to the start of any construction-related activities, including mobilization of materials to the project site.

4.7.3 Alternative 2 - No Action

Under this alternative, no changes would occur to the existing LBS or UBS. Stream flows would continue as currently exist. No changes in water quality would occur.

4.8 Noise

4.8.1 Methodology

Construction noise related to the project site improvements are the focus of this analysis. Assumptions related to construction equipment and industry noise averages based on the Federal Highway Administration Roadway Construction Noise Model were used to evaluate construction-related noise impacts.

4.8.2 Alternative 1 - Proposed Action

Under this alternative, construction vehicles entering and leaving the Battle Creek project site would temporarily increase traffic levels and, thus, ambient noise levels along a total of 0.9 miles of unpaved private road from either Battle Creek Bottom Road to the north or Long Road to the south.

During the construction phase of the project, noise from construction activities would temporarily impact the environment in the immediate area. The noise levels of typical construction equipment that could be used to implement the project are shown in Table 8.

Table 8. Typical Construction Equipment Noise	
Equipment Description	**At 50 feet (Decibels-Acoustic, slow)**
Auger Drill Rig	85
Backhoe	80
Boring Jack Power Unit	80
Compressor (air)	80
Concrete Mixer Truck	85
Concrete Pump Truck	82
Crane	85
Dozer	85
Dump Truck	84
Excavator	85
Flatbed Truck	84
Front-End Loader	80
Generator	82
Grader	85
Jackhammer	85
Pneumatic Tools	85
Pumps	77
Rock Drill	85

Source: Federal Highway Administration Roadway Construction Noise Model

There would be no permanent noise impacts resulting from implementation of the proposed project. While noise levels during construction activities would be in excess of Shasta and Tehama County General Plan standards of 50+ Energy-Equivalent Level (LEQ), depending on site-specific topography and vegetative screening, there are no sensitive receptors within a mile of the project area that would be impacted. LEQ measures individual noises for a period of time (typically for one hour) and determines the average noise level. Mobile equipment such as excavators, loaders, etc., may operate in a cyclic fashion in which a period of full power is followed by a period of reduced power and noise.

Under this alternative, any adverse impacts related to noise would be short-term in duration and minor in intensity.

4.8.3 Alternative 2 - No Action

Under this alternative, the proposed project would not be implemented, therefore no change in permanent, temporary or periodic ambient noise levels would occur.

4.9 Recreation

4.9.1 Methodology

Analysis of potential recreation resource impacts consists of identifying recreational resources near the project area to determine whether project implementation would impact them. In addition to evaluating the impacts on recreational resources, an evaluation was made of the project's consistency with Tehama County recreation objectives.

4.9.2 Alternative 1 - Proposed Action

Under this alternative, project construction activities would be coordinated with all project site landowners. During project construction activities, a limited duration of increased noise in the general area of the project site would occur that could potentially impact recreational uses for a short time, in particular hunting or fishing activities in the general area. However, because recreational use of the area is privately controlled, any adverse impacts would be short-term in duration and minor in intensity.

Under this alternative, beneficial impacts to recreation may result from increased fish populations, both locally and regionally. These beneficial impacts would be long-term in duration and moderate to major in intensity.

RPMs that have been developed for potential water quality impacts would also avoid, reduce and minimize potential impacts to downstream recreational uses. Refer to Section 4.7 for water quality RPMs.

4.9.3 Alternative 2 - No Action

Under this alternative, no change in recreational uses would occur. The types of recreational activities within the project area, as well as upstream and downstream of the project area would remain unaffected. Potential recreational benefits, in the form of increased fish populations as a result of the proposed project, would not occur.

4.10 Soils and Geology

4.10.1 Methodology

The soils and geology analysis is based on information in *Engineering Geologic Investigation Technical Memorandum Eagle Canyon Fish Passage Improvements in Battle Creek* (Cotton, Shires and Associates, Inc.) that was prepared for the project, the *Soil Survey of Tehama County, California* (Soil Conservation Service et al. 1967), the *Soil Survey of Shasta County Area, California* (Soil Conservation Service et al. 1974), and a review of reports regarding regional soil and geologic resources.

4.10.2 Alternative 1 - Proposed Action

Under this alternative, construction-related ground disturbances would occur as a result of the LBS and UBS channel modifications. Substantial soil erosion could occur as a result of the ground disturbance in the channel and banks of North Fork Battle Creek and in the uplands associated with construction staging areas and road construction. Geologic hazards exist at both project sites. The primary geologic hazard would be worker safety issues during construction from rockfall.

Adverse impacts related to soil erosion would be short-term to moderate in duration and minor to moderate in intensity. Potential adverse impacts related to geologic hazards would be long-term in duration and major in intensity. The following RPMs would be implemented as design features of the project to avoid, reduce and minimize impacts to soils and geology:

SOIL/GEO-1: After ground-disturbing activities are complete, all disturbed areas (outside of the active stream channel) shall be seeded with native plant species and mulched as described in the revegetation plan.

SOIL/GEO-2: Construction of all project actions shall comply with RWQCB Basin Plan Objectives. Standard BMPs will be incorporated into the project designs and / or the Stormwater Pollution Prevention Plan (SWPPP), if required.

SOIL/GEO-3: If the total disturbance area is greater than one acre, a Notice of Intent will be submitted to the State Water Resources Control Board to obtain coverage under the National Pollution Discharge Elimination System General Permit for Discharges of Stormwater Associated with Construction Activity.

SOIL/GEO-4: Geologic hazards from rockfall will be mitigated by removing (scaling), shotcrete or securing (rock bolts) to potential rockfall or selecting locations for infrastructure away from known or anticipated rockfall hazards.

4.10.3 Alternative 2 - No Action

Under this alternative, there would be no impact to soils or geology due to the fact that fish passage improvements to the LBS and UBS would not occur. The existing barriers would all remain in place. No ground-disturbing activities would occur and no risks to construction personnel from rockfall would occur.

4.11 Transportation and Traffic

4.11.1 Methodology

A qualitative assessment of traffic effects was performed, based on the construction procedures and equipment that would be used, and site review of existing conditions.

4.11.2 Alternative 1 - Proposed Action

Under this alternative, vehicle and heavy machinery access to the project area would occur on existing roads and to the extent possible. Existing parking areas and construction staging areas on the private unpaved project access roads would be employed for parking and equipment staging. The private access roads may need new or additional rock material for repairs during and after construction, and the north access road may need new or replacement culverts due to the increased traffic.

During the construction period when the greatest number of workers and trucks would be required, approximate trips to the site are listed below. There are currently two UBS design options. Trip and equipment estimates include the largest potential impacts between these two UBS options.

Lower Barrier Site

- 450 trips for transportation of construction workforce
- 118 trips for transportation of construction materials

Upper Barrier Site

- 950 trips for transportation of construction workforce
- 150 trips for transportation of construction materials

The following is the expected equipment list needed at both the LBS and UBS sites:

- 1 Excavator
- 1 Large Front-end Loader
- 1 Dump Truck
- 1 Yarder
- 1 Crane
- 1 Concrete Truck
- 1 Skid Steer
- 2 Helicopters

Project construction activities would require truck and worker trips on Long Road, Battle Creek Bottom Road, and the privately-owned unsurfaced roads to access the project site. The primary access to the project area would likely be from Red Bluff along SR 36 to Manton Road with most workers, materials, equipment delivery and disposal trips originating and ending in (or passing through) Red Bluff. Alternatively workers, materials, equipment delivery and / or disposal trips could travel north on Wildcat Road to access SR 44, depending on the location of the contractor, material sources and disposal site. The proposed project would increase vehicle trips and type of equipment transported on these routes. Construction vehicles would temporarily increase traffic levels on 0.9 miles of unpaved private roads from both Manton Road and Battle Creek Bottom Road but access roads leading from Long and Battle Creek Roads have locked gates and do not provide public access. Construction equipment would be mobilized to the site prior to project activities and would be demobilized upon completion of these activities.

Throughout construction, the amount of daily construction equipment traffic would be limited by staging the construction vehicles and equipment within the project boundary for the duration of work. Post-construction

activities (i.e. revegetation, maintenance and monitoring) would require intermittent access for approximately three years.

The potential increase in traffic generated from construction along SR 36 and / or SR 44 would be localized and minimal. Project-related traffic would not increase traffic on the local roads to a level that is substantial in relation to the existing traffic load, or capacity of the road system. Because of the relatively minor number of construction-related trips added to federal, state and local roads, and the temporary nature of construction traffic, the project is not expected to result in significant increases in traffic volumes. SR 36 and SR 44 are designated truck routes that were built to withstand transport of heavy equipment and was designed to accommodate a mix of vehicle types, including heavy trucks. Construction traffic would increase on the other local paved and unsurfaced roads in conjunction with the various construction activities. The local roadways have previously provided, and currently provide access for construction-related and maintenance activities. Use of these roads by project-related trucks and heavy equipment would likely not increase the wear-and-tear on the local roadways to a level which would result in adverse impacts on the road conditions due to roadway design and existing condition. Standard construction and transportation practices would also be implemented to reduce the potential adverse impacts on roadway conditions.

Project construction activities would be managed to ensure that the rural roads serving as access to the project site would remain open to through traffic. Temporary traffic control may be necessary during mobilization and demobilization of heavy equipment, however no road closures are planned.

Under this alternative, impacts related to transportation and traffic would be short-term in duration and minor in intensity.

4.11.3 Alternative 2 - No Action

Under this alternative, no transportation and traffic effects would occur. Existing traffic and transportation associated with livestock and hydropower operations, and other private uses would continue to occur at current levels.

4.12 Cumulative Effects and Other NEPA Considerations

This EA includes a discussion of statutory considerations required under NEPA, such as the significant irreversible and irretrievable commitments of resources and the relationship between local short-term uses of the environment and the maintenance of long-term productivity and the energy requirements and conservation potential of alternatives. These considerations are addressed below.

4.12.1 Cumulative Effects

This section provides a description of other actions in the area and a discussion of the cumulative impacts of those projects, in combination with the previously identified effects of the proposed project. A cumulative impact is defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7).

Changes to the local environment will be made through project construction activities in the LBS and UBS in North Fork Battle Creek. The proposed project is intended to provide long-term improvements to the environment through improved fish passage. The proposed project would improve fish passage for native species and alleviate the current fish passage restrictions during certain flows. Improving habitat connectivity is an important factor that helps reduce the risk of extinction of species and populations during environmental changes. Effects of the proposed project would be beneficial towards maintaining the quality of the human environment. Overall, the

proposed project would cause short-term impacts to some environmental resources. Project design features would result in these impacts being less than significant. Analysis for the individual resources considered in this EA are described within the individual sections of this document.

There are a number of watershed restoration projects and RPMs that have been implemented by USFWS, Reclamation, CDFW, NMFS, PG&E, the Battle Creek Watershed Conservancy and / or other groups over the past approximately 20 years. These projects include but are not limited to, development of minimum instream flows, fish passage restoration, development of conservation easements, riparian habitat restoration, erosion and sediment control, non-native vegetation control and fuels management.

The cumulative impacts of these projects and the proposed project are not anticipated to be negative, and in fact should improve natural resource conditions for anadromous fish and other native species in the Battle Creek watershed. In addition, AFRP has recently implemented, and is planning several other anadromous fish passage improvement projects on several Sacramento River tributary streams. The cumulative impacts of these projects and the proposed project are not anticipated to be negative, and in fact should improve natural resource conditions for anadromous fish and other native species in the larger Sacramento River watershed.

4.12.2 Irreversible and Irretrievable Commitments of Resources

Section 102 of the CEQ NEPA Regulations and 40 CFR 1502.16 require a discussion of "any irreversible and irretrievable commitments of resources which would be involved in a proposed project should it be implemented."

Implementation of the proposed project would not involve the substantial use of nonrenewable resources in such a way that would result in conditions which would be irreversible though removal or nonuse thereafter. Implementation of the proposed project would result in the use of fossil fuels, a nonrenewable form of energy for construction activities. A relatively minor amount of nonrenewable resources would be used in the project construction, transport of equipment and personnel, and related activities at the project area. The material requirements for this project would be relatively minor compared to the overall demand for such materials, and the use of these materials would not have a significant adverse effect on their continued availability. Future generations would not be committed to irreversible consequences or uses; the effect on future generations would be beneficial as a result of the restored stream ecosystem and related fishery resources. No irreversible damage from environmental accidents would be foreseeable in association with the proposed project.

4.12.3 Local Short-Term Uses and Long-Term Productivity Relationship

Section 102 of the CEQ NEPA Regulations and 40 CFR 1502.16 require that an environmental document include a discussion of "the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity." The proposed project does not involve a trade-off between a "local short-term use" of the environment and the maintenance and enhancement of the environment in the sense contemplated by NEPA. Implementation of the proposed project is intentionally aimed at restoring and enhancing the long-term biological and environmental productivity of the fishery resource in Battle Creek and downstream in the Sacramento River system. Construction impacts associated with the proposed project would be short-term and temporary. Short-term effects to the environment from construction include soil erosion, air quality emissions, noise, disturbance to fish, wildlife, vegetation and wetlands, and temporary surface water quality impacts. In the long-term, however, the proposed project would improve passage conditions for native fish species, including several state and / or federally listed species. Implementation of the proposed project would not sacrifice the long-term productivity of the project area for short-term uses during construction.

5.0 Consultation and Coordination

5.1 Tribes, Agencies, and Organizations Contacted or Consulted

Letters were sent to Native American Tribes in accordance with Section 106 of the NHPA. The California State Historic Preservation Officer has been consulted, in accordance with Section 106 of the NHPA, regarding the project. NMFS and USFWS have been consulted, in accordance with Section 7 of the ESA and CDFW is being consulted, in accordance with the California Endangered Species Act, regarding the project.

5.2 Public Review and Comments

An initial public scoping notice was published in the legal sections of the Red Bluff Daily News and the Redding Record Searchlight on January 8, 2019. No public comments were received. A draft EA was mailed to the three involved landowners on September 18, 2019. A second public scoping notice was sent to the Greater Battle Creek Watershed Working Group on September 25, 2019 and published in the legal sections of the Red Bluff Daily News and the Redding Record Searchlight on September 27, 2019. Three comment letters were received and are included in Appendix H. Received comments are addressed in Appendix I.

6.0 Compliance with Environmental Laws and Regulations

The following environmental laws and regulations will be complied with, as applicable, for the proposed project:

Table 9. Compliance with Environmental Laws and Regulations

Environmental Law / Regulation	Agency
Bald and Golden Eagle Protection Act	U.S. Fish and Wildlife Service
California Endangered Species Act	California Department of Fish and Wildlife
California Environmental Quality Act	California Department of Fish and Wildlife Central Valley Regional Water Quality Control Board
California Fish and Game Code Section 1600	California Department of Fish and Wildlife
Clean Air Act	Tehama County Air Pollution Control District Shasta County Air Quality Management District
Clean Water Act Section 401	Central Valley Regional Water Quality Control Board
Clean Water Act Section 402, National Pollution Discharge Elimination System – Construction Activities Storm Water General Permit	California State Water Resources Control Board
Clean Water Act Section 404	U.S. Army Corps of Engineers
Endangered Species Act Section 7	National Marine Fisheries Service U.S. Fish and Wildlife Service
Magnuson-Stevens Fishery Conservation and Management Act	National Marine Fisheries Service
Fish and Wildlife Coordination Act	U.S. Fish and Wildlife Service California Department of Fish and Wildlife National Marine Fisheries Service
Migratory Bird Treaty Act	U.S. Fish and Wildlife Service
National Environmental Policy Act	U.S. Fish and Wildlife Service
National Historic Preservation Act Section 106	California Office of Historic Preservation
Executive Order 11990 Protection of Wetlands	U.S. Fish and Wildlife Service
Executive Order 11988 Floodplain Management	U.S. Fish and Wildlife Service
Executive Order 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations	U.S. Environmental Protection Agency

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Appendices

Appendix A: 100% Design Plan Drawings
Appendix B: Vascular Plant Species Observed Within or Near the Project Site
Appendix C: Potentially-occurring Special-status Vascular Plant Species
Appendix D: Faunal Species Observed Within or Near the Project Site
Appendix E: Potentially-occurring Special-status Faunal Species
Appendix F: USFWS ESA Concurrence Letter
Appendix G: NMFS ESA Programmatic Biological Opinion
Appendix H: Public Comments
Appendix I: Response to Public Comments