Final Initial Study/Proposed Mitigated Negative Declaration

Merced River Agricultural Diversion and Fish Habitat Enhancement Project

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Prepared For: Merced Irrigation District

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List of Acronyms

AFRP	Anadromous Fish Restoration Program
BACI	before-and-after-control-impact
BMPs	Best Management Practices
CalEEMod	California Emissions Estimator Model
CDC	California Department of Conservation
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CV	Central Valley
CCV	California Central Valley
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFS	Cramer Fish Sciences
cfs	cubic feet per second
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps	United States Army Corps of Engineers
CVPIA	Central Valley Project Improvement Act
CVRWQCB	Central Valley Regional Water Quality Control
CWA	Clean Water Act
dbh	diameter at breast height
DO	dissolved oxygen
DOI	Department of the Interior
DPS	distinct population segment
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EA	Environmental Assessment
ECs	Environmental Commitments
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ERPP	Ecosystem Restoration Program Plan
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
GHG	Greenhouse Gas
HAPC	Habitat Areas of Particular Concern
IS	Initial Study
ISRAP	Invasive Species Risk Assessment and Planning
LMR	Lower Merced River
MBTA	Migratory Bird Treaty Act
Merced ID	Merced Irrigation District
MNP	Mitigated Negative Declaration

MMRP	Mitigation Monitoring and Reporting Program
MRSHEP	Merced River Salmon Habitat Enhancement Project
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen Oxides
NPDES	National Pollution Discharge Elimination System
NTU	Nephelometric turbidity unit(s)
OHWM	Ordinary High-Water Mark
PBF	Physical and Biological Features
Quad	Topographic Quadrangle
RM	River Miles
ROG	reactive organic gases
SHIRA	Spawning Habitat Integrated Rehabilitation Approach
SMAQMD	Sacramento Metropolitan Air Quality Management District
SO_x	sulfur oxides
SWPPP	Stormwater Pollution Prevention Plan
TGBA	Turlock Groundwater Basin Association
tpy	tons per year
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Valley Air	San Joaquin Valley Unified Air Quality Standards
VELB	Valley Elderberry Longhorn Beetle
WSE	Water Surface Elevation

1 Project Information

1.1 Project Title

Merced River Agricultural Diversion and Fish Habitat Enhancement Project

1.2 Lead Agency Name and Address

Merced Irrigation District
744 W. 20th Street
Merced, CA 95340

1.3 Contact Person and Phone Number

Michael Morris
Survey Project Manager
(209) 354-2882

1.4 Project Location

The Proposed Project seeks to improve and enhance three of seven agricultural diversions that are part of the Cowell Agreement on the LMR below Merced ID's Crocker-Huffman Diversion Dam. The Cuneo diversion is on the LMR generally across from Henderson Park, approximately 1.1 miles east of Snelling. The Cowell 1 diversion is approximately 1 mile downstream of Snelling Road Bridge and 2.2 miles southwest of Snelling, California. The Cowell 2 diversion is located about 2.9 miles west of State Route 59 bridge. The Merced River lies within United States Geologic Survey (USGS) hydrologic unit 18040002. The diversions occur approximately 51 river miles (RM) upstream from the confluence with the San Joaquin River, between 37.463112 N, -120.552661 W (downstream limit) and 37.496382 N , -120.466602 W (upstream limit). Cuneo and Cowell 1 are both located within the "Snelling, CA" U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (quad), in Sections 17, 18, 3 and 10 in Township 5 South, Range 14 East. Cowell 2 is located in Sections 28 and 29 in Township 5 South, Range 13 East in the "Winton, CA" quad. See **Figure 1**, Project Locations.

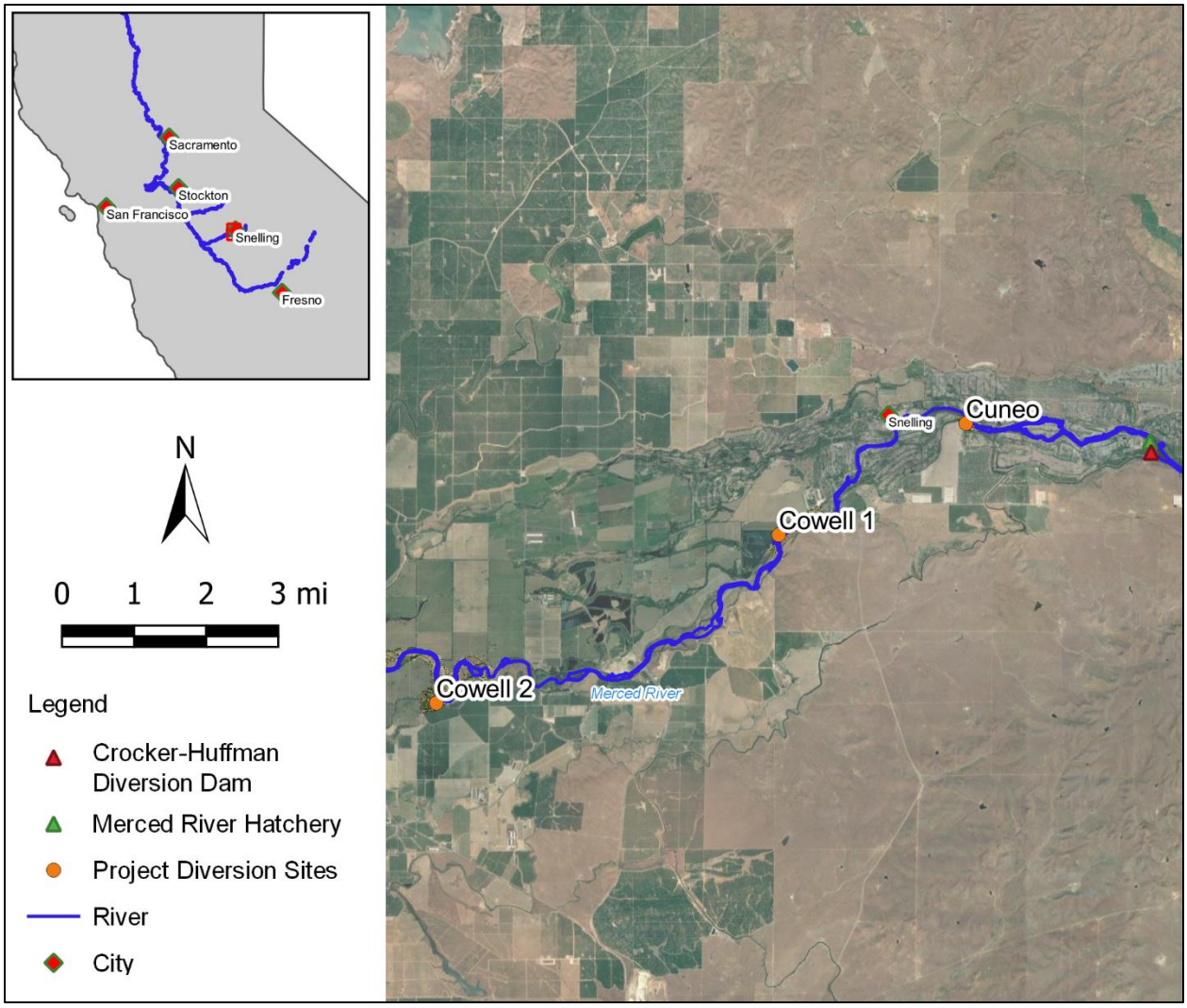


Figure 1. Project locations on the lower Merced River (right) and in relation to the state of California (top left).

1.5 General Plan Designation

Agricultural

1.6 Zoning

General Agricultural

1.7 Description of Project

The Project proposes to modify, replace and improve antiquated fish screens to reduce fish loss from the Merced River and optimize function for diverters. Diversions will also be designed to provide in channel spawning and off channel rearing habitat for salmonids. Finally, diversions will be re-sited and/or in channel features will be designed to increase longevity and diversion function, reducing operations and maintenance efforts as well as in channel disturbance of fish habitat.

1.8 Surrounding Land Use and Setting

The Merced River is a tributary to the San Joaquin River in California. Most of the land adjacent to the Merced River, downstream of the Crocker-Huffman Diversion Dam and in the area of the proposed Project, is privately owned and predominantly used for agriculture. The section of the LMR between Crocker-Huffman Diversion Dam and Shaffer Bridge has been extensively affected by land use activities, most notably gold mining in the 1800s, dredger gold mining in the early to mid-1900s, aggregate mining, and by local water withdrawals and agricultural water returns. Major water withdrawals are associated with the Cowell Adjudication Agreement (Cowell Agreement) water users and other landowners with riparian water rights, who divert water from this section of river at varying flow rates. The Cowell Agreement is the result of an adjudicated settlement issued by the Merced County Superior Court in 1926. The adjudication determined that Merced ID must provide water downstream of the Crocker-Huffman Diversion Dam. The water could then be diverted from the river for consumptive purposes by the diverters, known as the Cowell Agreement Diverters, at 11 locations. In general, these diverters withdraw water from the Merced River via either gravity through ditches or through lift pumps; there is no requirement that each diverter notify Merced ID in advance if it does not plan to take its water and none of the withdrawals or return flows are currently gaged. Landowners with riparian rights also have no obligation to report their withdrawals to Merced ID.

Currently, all of the Cowell Agreement diversions exhibit some combination of improperly functioning fish screens, poor diversion siting, and/or diversion configurations which are not engineered or designed to meet fish and diverter needs. The diversions to be enhanced by the Project are located on private lands along the LMR (**Figure 1)**. The diversions are accessible via Robinson Road (Cuneo), State Route 59 (Cowell 1), and Turlock Road (Cowell 2).

1.9 Other Public Agencies Whose Approval is Required

Merced Irrigation District (Merced ID) has consulted or will consult with the following regarding the Project:

- National Marine Fisheries Service
- U.S. Fish and Wildlife Service
- U.S. Army Corps of Engineers (Corps)
- Regional Water Quality Control Board

- State Historic Preservation Office
- State Lands Commission
- California Department of Fish and Wildlife
- Central Valley Flood Protection Board.

1.9.1 Federal Permits

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

Clean Water Act (33 U.S.C. § 1251 et seq.)
Section 401 of the Clean Water Act (CWA) (33 U.S.C. § 1341) requires any applicant for an individual Corps dredge and fill discharge permit (see Section 404, below) to first obtain certification from the state that the activity associated with dredging or filling will comply with applicable state effluent and water quality standards. This certification must be approved or waived prior to the issuance of a permit for dredging and filling.

The State Water Resources Control Board, through the Central Valley Regional Water Quality Control Board (CVRWQCB), is responsible for issuing water quality certifications, or waivers thereof, pursuant to Section 401 of the CWA. A pre-consultation meeting was held with the CVRWQCB on September 2, 2021, and a Section 401 Water Quality Certification will be obtained for the Project prior to implementation. Because there is a change to a Point of Diversion, the certification will be processed through the Division of Water Rights.

Section 402 of the CWA (33 U.S.C. § 1341) establishes the National Pollution Discharge Elimination System (NPDES) to regulate point source discharges of pollutants into waters of the United States. A NPDES permit sets specific discharge limits for point sources discharging pollutants into waters of the United States and establishes monitoring and reporting requirements, as well as special conditions.

A Stormwater Pollution Prevention Plan (SWPPP) will be drafted and a NPDES permit will be obtained for the Project prior to implementation.

Section 404 of the CWA (33 U.S.C. § 1344) authorizes the Corps to issue permits to regulate the discharge of "dredged or fill materials into waters of the United States". An application for a Regional General Permit 16 (RGP 16) for Anadromous Salmonid Fisheries Restoration projects will be submitted to the Corps for the Project.

Endangered Species Act (16 U.S.C. § 1531 et seq.)
Section 7 of the Endangered Species Act (ESA) requires Federal agencies, in consultation with the Secretary of the Interior and/or Commerce, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of these species.

In addition to Section 7 requirements, Section 9 of the ESA prohibits the taking of endangered species of fish and wildlife. Take is broadly defined as those activities that "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect [a protected species], or attempt to engage in any such conduct." An activity can be in violation of take prohibitions even if the activity is unintentional or accidental. Significant modification or degradation of occupied habitat for listed species, or activities that prevent or significantly impair essential behavioral patterns, including breeding, feeding, or sheltering, are also considered "take" under the ESA. Section 10 provides exceptions to Section 9 take prohibitions. USFWS and NMFS can issue permits to take listed species for scientific purposes, or to enhance the propagation or survival of a listed species. The USFWS and NMFS can also issue permits to take listed species incidental to otherwise legal activity. The Secretary of Commerce, acting through NMFS, is involved with projects that may affect marine or anadromous fish species listed under the ESA. All other species listed under the ESA are under USFWS jurisdiction.

Biological assessments are being developed for the Project for USFWS and NMFS to determine potential impacts to ESA listed species. It is anticipated that a concurrence letter will be obtained from USFWS and a Biological Opinion will be obtained from NMFS prior to implementation of the Project.
USFWS and MID have consulted with NMFS and intend to apply for Section 7 take coverage under the NMFS Programmatic Biological Opinion for Central Valley Restoration Projects.

Migratory Bird Treaty Act (16 U.S.C. § 703 et seq.)
The MBTA implements various treaties and conventions between the United States and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Unless permitted by regulations, the Act provides that it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not. Subject to limitations in the Act, the Secretary of the Interior may adopt regulations determining the extent to which, if at all, hunting, taking, capturing, killing, possessing, selling, purchasing, shipping, transporting or exporting of any migratory bird, part, nest or egg will be allowed, having regard for temperature zones, distribution, abundance, economic value, breeding habits and migratory flight patterns.

The Project will comply with the MBTA. Migratory birds will be protected by implementation of specific EC's, including pre-construction surveys and impact avoidance measures that are part of the Project.

Executive Order 11312 – Invasive Species
Executive Order 11312 directs all Federal agencies to prevent and control introduction of invasive nonnative species in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts. Executive Order 11312 established a

National Invasive Species Council made up of Federal agencies and departments and a supporting Invasive Species Advisory Committee composed of State, local, and private entities. The National Invasive Species Council and the Invasive Species Advisory Committee oversee and facilitate implementation of the executive order, including preparation of a National Invasive Species Management Plan.

A National Invasive Species Management Plan will be developed prior to the Proposed Project implementation.

Executive Order 11990 – Protection of Wetlands

Executive Order 11990 requires Federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands.

The IS has identified that the activities associated with the proposed Project would not result in the net loss of any wetlands. Implementation of the Project could enhance wetlands or increase total wetland area, enhance existing wetlands, and is in compliance with Executive Order 11990. The IS for the Proposed Project, including the wetland delineation report, will be available for public review during the CEQA review process.

Executive Order 11988 – Floodplain Management

Executive Order 11988 requires that all Federal agencies take action to reduce the risk of flood loss, to rehabilitate and preserve the natural and beneficial values served by floodplains, and to minimize the impact of floods on human safety, health, and welfare.

The Action Area is within the 100-year floodplain. The Proposed Project supports the preservation and enhancement of the natural and beneficial values of floodplains and is in compliance with Executive Order 11988.

Fish and Wildlife Coordination Act (16 U.S.C. § 661 et seq.)

The Fish and Wildlife Coordination Act requires that the federal Lead Agency consult with fish and wildlife agencies (federal and state) on all water development projects that could affect biological resources. The amendments enacted in 1946 require consultation with the Service and State fish and wildlife agencies "whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license". Consultation is to be undertaken for the purpose of "preventing the loss of and damage to wildlife resources".

Formal consultation with USFWS and NMFS has been initiated for this Project to ensure that the Project complies with the Fish and Wildlife Coordination Act.

Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 et seq.)

The MSA is the primary law governing marine fisheries management in United States federal waters. The Act was first enacted in 1976 and amended in 1996. Pacific coast salmon species are subject to the MSA. Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or Projects that may adversely affect essential fish habitat (EFH). The MSA

defines EFH as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity”. Adverse effects refers to any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of or injury to benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 Code of Federal Regulations [CFR] 600.810).

Formal consultation with NMFS will include an Essential Fish Habitat Assessment. Compliance with the MSA will be accomplished through the Section 7 NMFS Programmatic Biological Opinion for Restoration Projects.

National Historic Preservation Act (Title 54 USC § 306108)

The NHPA of 1966, as amended (Title 54 United States Code [USC] § 306108), requires that federal agencies give the Advisory Council on Historic Preservation an opportunity to comment on the effects of an undertaking on historic properties, properties that are eligible for inclusion in the National Register. The 36 CFR Part 800 regulations implement Section 106 of the NHPA.

Section 106 of the NHPA requires federal agencies to consider the effects of federal undertakings on historic properties, properties determined eligible for inclusion in the National Register. Compliance with Section 106 follows a series of steps that are designed to identify interested parties, determine the area of potential effects, conduct cultural resource inventories, determine if historic properties are present within the area of potential effects, and assess effects on any identified historic properties.

A cultural resource assessment has been developed for the Project (HWE 2021), and the assessment found that the Project would result in no significant impacts to objects or sites included or potentially eligible for inclusion in the California Register of Historic Resources or the National Register of Historic Places. It is anticipated that the State Historic Preservation Office will issue a letter of concurrence.

Rivers and Harbors Act of 1899 (33 U.S.C. § 403), as Amended

Under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403), the Corps regulates work in, over, or under, excavation of material from, or deposition of material into, navigable waters. Navigable waters of the United States are defined as those waters subject to the ebb and flow of the tide shoreward to the mean high-water mark, and those that are currently used, have been used in the past, or may be susceptible to use, to transport interstate or foreign commerce.

A wetland delineation report has been developed for the Project and an RGP 16 application has been submitted to the Corps for the Project.

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

These laws are designed to protect Indian Trust Assets, accommodate access and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites, and protect and preserve the observance of traditional Native

American religions, respectively. The Project and its associated EC's would not violate these protections.

1.9.2 State Permits

California Endangered Species Act, California Fish and Game Code 2081 and 2090
The CESA allows CDFW the ability to authorize, by means of an incidental take permit, incidental take of state-listed threatened, endangered or candidate species if certain conditions are met. However, no CESA listed species have the potential to be affected by the Project therefore, a CESA permit is not required for the Proposed Project.

Fish and Game Code Section 1600 et. seq., Streambed Alteration Agreement
(CDFW has regulatory authority with regard to activities occurring in streams and/or lakes that could adversely affect any fish or wildlife resource, pursuant to Fish and Game Code Section 1600 et seq. Authorization is required for Projects prior to any activities that could substantially divert, obstruct, result in deposition of any debris or waste, or change the natural flow of the river, stream, or lake, or use material from a stream or lake.

Central Valley Flood Protection Board Encroachment Permit
The Flood Protection Board issues permits to maintain the integrity and safety of flood control project levees and floodways that were constructed according to flood control plans adopted by the Board of the State Legislature.

State Lands Commission Land Use Lease
The State Lands Commission has jurisdiction and management control over those public lands received by the state upon its admission to the United States in 1850 that generally include all ungranted tidelands and submerged lands and beds of navigable rivers, streams, lakes, bays estuaries, inlets, and straits. A State Lands Lease will be obtained for this Proposed Project for work in the river channel.

San Joaquin Valley Air Pollution Control District
The San Joaquin Valley Air Pollution Control District requires that all portable equipment registrations are obtained for all equipment. Portable equipment used for the Proposed Project must be registered by the contractor.

2 Project Description

2.1 Project Background

The goal of the proposed Project is to reduce negative effects of agricultural diversions on salmonids by increasing quantity and quality of spawning, incubation, and rearing habitat, increasing salmonid survival, and reducing or eliminating entrainment/impingement/predation while increasing water diversion efficiency and reliability within the LMR. The Proposed Project

is funded by Merced ID and a grant to Merced ID from the DWR. The purpose of this IS is to address specific impacts that may result from implementing the Proposed Project. This document relies on various regional studies and published reports that address in detail the effects or impacts associated with the Proposed Project. The Proposed Project is consistent with the larger programmatic view on environmental management and rehabilitation shared by several state and federal resource agencies. Projects in the Merced River corridor have also been evaluated in the Ecosystem Restoration Program Plan (ERPP) in the CALFED Bay-Delta Program (CALFED 2000). The ERPP vision for the Merced River includes reducing juvenile fish loss by screening diversions, coarse sediment recruitment with gravel augmentation, reducing non-native fish habitat, and enhancing stream channel and riparian habitat to improve ecological functions and processes for salmonids.

Historically, the LMR below Merced Falls was an anastomosing river channel system with a diversity of wetland and off channel features (Downs et al. 2011, Stillwater Sciences 2006). Several factors including riparian agricultural diversions, historical gold mining and other local land use activities, altered sediment supply and transport, and current land use and property ownership do not currently allow the maintenance of a dynamic multi-thread channel that once occurred under historical conditions (Stillwater Sciences 2006). Many areas within the LMR's historic corridor, including floodplains, side channels, and other off channel areas, are now hydrologically disconnected from the main channel during more frequent flood flows (1.5- to 5-year recurrence interval) due to channel incision, levees, dredger tailing piles, and reduction in flood flows due to flow regulation and reduced stream capacity (Kondolf et al. 1996). Most of the land adjacent to the Merced River downstream of the Crocker-Huffman Diversion Dam in the general area of the proposed Project is privately owned, and diverted water is predominantly used for agriculture. The section of the LMR between Crocker-Huffman Diversion Dam and Shaffer Bridge has been extensively affected by land use activities, most notably gold mining in the 1800s, dredger gold mining in the early to mid-1900s, aggregate mining, and by local water withdrawals and agricultural water returns. Major water withdrawals are associated with the Cowell Adjudication Agreement (Cowell Agreement) water users and other landowners with riparian water rights, who divert water from this section of river at varying flow rates. The Cowell Agreement is the result of an adjudicated settlement issued by the Merced County Superior Court in 1926. The adjudication determined that Merced ID must provide water downstream of the Crocker-Huffman Diversion Dam. The water could then be diverted from the river for consumptive purposes by the diverters, known as the Cowell Agreement Diverters, at 11 locations. In general, these diverters withdraw water from the Merced River via either gravity through ditches or through lift pumps; there is no requirement that each diverter notify Merced ID in advance if it does not plan to take its water and none of the withdrawals or return flows are currently gaged. Landowners with riparian rights also have no obligation to report their withdrawals to Merced ID. There are numerous agricultural return flows in this section of river as well. For instance, Ingalsbe Slough, which is used as a return flow for some of the diversions of the Cowell Agreement water users, enters the Merced River approximately 2 miles upstream of Shaffer Bridge. The Merced River is currently the southernmost river in the world with an extant population of fall-run Chinook Salmon.

The CDFW has determined that the river reach between Crocker-Huffman Diversion Dam and the confluence with the San Joaquin River is of considerable importance for maintenance and restoration of Chinook Salmon. In addition, recommendations of the San Joaquin River

Management Plan (1995) included actions to increase survival of salmonid eggs and enhance the channel and riparian corridor of the tributaries to the San Joaquin River, including the Merced River. In the Merced River Corridor Restoration Plan, actions were recommended for defined reaches of the Merced River from Crocker-Huffman Diversion Dam downstream to the confluence with the San Joaquin River (Stillwater Sciences 2002). Recommendations for the Dredger Tailings and Gravel Mine 1 reaches, where the diversions are located, included increasing the coarse sediment supply (Stillwater Sciences 2002). The USFWS (1995) Working Paper on salmonid restoration in the CV identified the need to restore and protect instream and riparian habitat in the Merced River to ensure the long-term sustainability of physical, chemical, and biological conditions needed to meet production goals for Chinook Salmon (*Oncorhyncus tshawytscha*). The Merced River is listed as a priority watershed in the Anadromous Fish Restoration Program (AFRP) Final Restoration Plan (USFWS 2001), and one of the priority actions listed calls for collaboration among diverters, CDFW[1], DWR, USFWS, the NMFS, and Reclamation to screen all diversions to protect all life history stages of anadromous fish. One of the high priority actions listed in the AFRP is that landowners, Merced County, NRCS, CDFW, USFWS, and Reclamation improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel. Finally, the AFRP calls for CDFW, USFWS, and Reclamation to evaluate and implement actions to reduce predation on juvenile Chinook Salmon. Objectives of the Project are aligned with the following AFRP goals: 1) improve habitat for all anadromous life stages through improved physical habitat; and 2) collect fish population, health, and habitat data to facilitate evaluation of restoration actions (USFWS 2001).

This IS has been prepared to identify the environmental resources in the Action Area, analyze the effects to the environment of the Project and a No Action Alternative, and propose ECs to reduce any effects to less than significant levels.

There are a series of documents related to the LMR that rely on analyses conducted and recommended in the broader programmatic review (CALFED 2000), which are used to guide specific projects. The AFRP is a component of a broader program, the CVPIA, which supports provisions for fish and wildlife habitat restoration. The CVPIA program prepared a programmatic environmental impact statement (Reclamation 1999) and Record of Decision (ROD) (Reclamation 2001) in accordance with the National Environmental Policy Act (NEPA). A programmatic environmental document is frequently used to: 1) evaluate new programs, 2) analyze a series of actions that are part of a larger action, or 3) consider broad policy alternatives and programmatic mitigation measures. This document was prepared to address details and site-specific factors of the habitat rehabilitation actions in the LMR. The IS for this Project is consistent with the CALFED and CVPIA programs, and adopts appropriate provisions of the CVPIA's ROD. This IS has been prepared to assess the impacts of the Project components as required by the State CEQA Guidelines.

2.1.1 Anadromous Fish Restoration Program (AFRP)

The CVPIA authorizes and directs the Secretary of DOI, in consultation with other state and federal agencies, Native American tribes, and affected stakeholders to develop and implement a

[1] Formerly known as the California Department of Fish and Game (CDFG)

program which makes reasonable efforts to at least double natural production of anadromous fish in CCV rivers and streams. Anadromous fish include Chinook Salmon, steelhead (*Oncorhynchus mykiss*), White Sturgeon (*Acipenser transmontanus*), and Green Sturgeon (*A. medirostris)*. Fall-run Chinook Salmon is the primary management focus in the Merced River because of its value as a sport and commercial fishery. Further, the CVPIA requires that this program give first priority to measures that protect and restore natural channel and riparian habitat values through habitat restoration actions, modifications to CV Project operations, and implementation of the supporting measures mandated by the CVPIA. The DOI approached implementation of this directive by creating the AFRP, with the USFWS assuming lead responsibility. The AFRP encourages local citizens and groups to share or take the lead in implementing restoration actions. This approach is consistent with California's Coordinated Regional Strategy to Conserve Biological Diversity (Available: http://biodiversity.ca.gov/), in which 26 state and federal agencies emphasize regional solutions to regional problems. The successful implementation of the Project would contribute to salmonid recovery goals of the Merced River.

2.1.2 Previous Environmental documentation

Salmonid rearing habitat and spawning gravel improvements for the LMR have been identified as priority actions in USFWS's Working Paper (USFWS 1995) and the AFRP Final Restoration Plan (USFWS 2001), in the California DWR comprehensive assessment for Chinook Salmon (DWR 1994), in several CDFG publications (CDFG 1990, 1993, 1996), and in NMFS' Central Valley Salmonid Recovery Plan (NMFS 2014), as part of the effort to improve rearing and spawning habitat for fall-run Chinook Salmon in the Merced River. In addition, the following environmental documents have addressed the issues being considered for the Project:

- **CVPIA and AFRP.** In Section 3406(b), the Secretary of the Interior is required to develop and implement a program that makes reasonable efforts to double natural production of anadromous fish in CV rivers and streams. In response to this directive, USFWS prepared a draft plan for the AFRP and identified anadromous fish habitat deficiencies in each tributary within the CV (USFWS 2001). The Merced River system was identified as High Priority with the need to "improve watershed management to restore and protect instream and riparian habitat, including consideration of restoring and replenishing spawning gravel" and to "screen diversions to protect all life history stages of anadromous fish." (USFWS 2001).
- **NMFS.** In the Central Valley Salmonid Recovery Plan, NMFS (2014) recommends as high priority recovery actions in the Merced River; 1) develop and implement a long-term gravel management plan to improve spawning habitat downstream of Crocker-Huffman Diversion Dam, and 2) prioritize Merced River diversions based on their level of entrainment and screen those with the highest benefit to cost ratio.
- **CALFED Bay-Delta Program.** This cooperative state and federal effort was established to reduce conflicts in the Delta by solving problems in ecosystem and water quality, water supply reliability, and levee and channel integrity. The goal of CALFED's ERPP is to improve and increase aquatic and terrestrial habitats and improve ecosystem functions in the Delta to support sustainable populations of diverse and valuable plant and animal species (CALFED 2000). The ERPP vision for the Merced River includes, among other things: (1) reducing the loss of young salmon at water diversions, (2) restoring coarse sediment recruitment, (3) reducing non-native fish habitat, and (4) restoring stream

channel and riparian habitat and ecological functions and processes to improve habitat for fall-run Chinook Salmon, late-fall run Chinook Salmon, riparian vegetation, and wildlife resources.

- **CDFW.** Habitat rehabilitation is recommended in the Merced River as a fisheries management strategy in several reports, including Salmon and Steelhead Restoration and Enhancement Plan (1990), Restoring Central Valley Streams - A Plan for Action (1993), and Steelhead Restoration and Management Plan (1996), and Strategic Plan for Trout Management (2003).
- **Federal Energy Regulatory Commission (FERC).** At present, there are two FERC licenses for hydroelectric projects on the Merced River, both owned and operated by Merced ID. The Merced River Hydroelectric Project, FERC Project No. 2179-043, is comprised of the New Exchequer and McSwain developments. The Merced Falls Project, FERC Project No. 2467-020, is a run of the river project located directly below and contiguous to the Merced River Hydroelectric Project. These hydroelectric projects are currently undergoing FERC relicensing.

2.1.3 Previous Salmonid Habitat Improvement Efforts

On the LMR, a series of salmonid habitat improvement efforts have been completed. In 1990, the DWR and CDFG placed spawning gravel and boulders in a highly degraded section of the Merced River adjacent to the fish hatchery. Since this project was initiated, this reach has received varying amounts of gravel in 1996, 1997, 2000, 2003, 2006, 2011, and 2012. More recent gravel placements have been organized by the Merced Flyfishing Club, who worked with CDFW, Merced County Supervisors, and Merced ID to purchase and place gravels in the LMR adjacent to the Merced River Fish Hatchery.

The Merced River Salmon Habitat Enhancement Project (MRSHEP) included two enhancement projects. For the MRSHEP Ratzlaff project, CALFED provided about $1.6 million in 1999 to partially fill and isolate the Ratzlaff gravel pit. Approximately $2 million more was provided to this project from a fund designed to mitigate post-1986 increased fish kills at the Sacramento Delta water diversion pumps, and an additional $250,000 was contributed from AFRP, making the total cost around $4 million to isolate this pit. The MRSHEP Robinson Reach project received $4.13 million from CALFED to isolate a gravel pit and reconstruct the channel and floodplain of a 2.7 km section of shallow, braided channel into a meandering, single-thread channel with alternating riffles and pools.

The Merced River Ranch Salmonid Habitat Restoration Project was completed in 2013 by Cramer Fish Sciences (CFS), with funding from the USFWS AFRP and CDFW. This enhancement project created approximately 6 acres of seasonally inundated floodplains and side channels and 5.5 acres of instream salmonid spawning and rearing habitat. The Henderson Park Salmonid Habitat Restoration Project was completed in 2015 by CFS with funding by the USFWS AFRP. The Henderson Park project rehabilitated approximately 15 acres of seasonally inundated floodplain habitat and 7.8 acres of instream salmonid spawning and rearing habitat.

The Merced River Instream and Off-Channel Habitat Rehabilitation Project was completed in 2020 by CFS, with funding from CDFW for design and from Merced ID, Reclamation, and

USFWS for permitting, monitoring, and implementation. This project rehabilitated or created approximately 6.1 acres of salmonid spawning and rearing habitat and 3 acres of upland habitat.

2.2 Project Summary

The overall objective of the Proposed Project is to improve and enhance the screening of agricultural water diversions in order to better protect native fish populations in the Merced River while increasing water diversion efficiency and reliability within the LMR. The Proposed Project targets three of seven agricultural diversions in the two uppermost reaches of the LMR. Enhancement actions aim to increase the quantity and quality of salmonid spawning, incubation, and rearing habitats, enhance salmonid survival, reduce or eliminate salmonid entrainment/impingement/predation associated with diversions, and improve water diversion efficiency and reliability within the LMR. Enhancement actions implemented pursuant to Section 3406(b) of the CVPIA include a plan to assess the effectiveness of each action. The specific goals and objectives of the Proposed Project are to:

- Support state and federal fisheries goals for the San Joaquin River System, including enhancing native fish populations in the lower San Joaquin River watershed and reducing vulnerability of native fishes to water diversions, predation, and other impacts to their populations at all life stages within or upstream of the of the Sacramento-San Joaquin Delta, while maintaining diversion efficiency and reliability for water users.
    - Remove/reduce loss of salmonids and other native species by avoiding impingement and entrainment and/or minimizing predation.
    - Increase quantity and quality of habitat for target species and life stages and address habitat deficiencies due to poor diversion design/siting and overall habitat degradation associated with diversions.
    - Improve fish migration within the Merced River as it relates to facility configuration and operation.
- Improve infrastructure.
    - Improve screen function and meet or exceed state (CDFG 2002) and federal (NMFS 2011) screening criteria and regulations.
    - Improve longevity of diversions to reduce operations, maintenance, and construction requirements.
    - Increase existing diversion reliability and efficiency by designing diversions to function over a range of flows and over time, by improving diverter control of the timing and amount of water diverted, and by reducing unnecessary water removal and water loss from diversion ditches.

Diversion-specific designs have been developed in collaboration between Merced ID and diverters to modernize target diversions and bring them into accordance with best operating practices, which avoid salmonid entrainment/impingement/predation. The Proposed Project also aims to increase salmonid production through the creation and enhancement of spawning and rearing habitat. Managing for salmon recovery is expected to aid other native fishes, as salmonids are indicator species of native fish habitat quality (Moyle 2002). Spawning riffles would be designed to provide sufficient water head to drive water into diversion canals, and to persist in the system for 5-10 years under current flow and sediment regimes. Spawning riffles

would thus replace the function of temporary in-channel berms and remove the need for these berm features. The success of these spawning riffles as drivers of both salmon production and water head is of particular interest, as this approach is potentially applicable to other riparian diversions in the LMR and the CV that depend on temporary in-channel berms to direct river flow into diversion canals. Temporary in-channel berms similar to those constructed in past years, would be constructed and maintained as needed until the new Project diversion facilities have been completed. Temporary in-channel berms are required by the CDFW 1600 permit to be built of spawning-sized gravels, resulting in annual gravel augmentation associated with berm construction and erosion; however, these gravels are not initially well placed for use by salmonids. In contrast, gravel augmentation associated with the Proposed Project would be readily usable by salmonids, improving on current conditions. Additional information regarding the design process for this Proposed Project can be found in the 30% Design documents (Appendix A).

The Sacramento-San Joaquin Delta watershed contains more than 3,000 diversions, many of which are unscreened or have screens which do not meet regulatory standards (Herren and Kawasaki 1998, Moyle and White 2002, Vogel 2011). When properly designed and functional, screens mitigate fish loss via entrainment in diversion canals or impingement against screens (Nobriga et al. 2004; Gale et al. 2008; Simpson and Ostrand 2012). However, poor screen, diversion, or bypass design presents opportunities for direct fish mortality from the diversion structure itself or by causing increased predation risk by concentrating juvenile salmonids that may be exhausted, injured, or disoriented after navigating through the diversion (Nordlund 2008; Sabal et al. 2016).

In recognition of these potential effects, regulations favor the placement of on-channel screens (NMFS 2011; CDFG 2002). Currently, none of the target Project screens are located on channel and current configurations of the target diversions require frequent maintenance and in-channel construction of temporary sediment berms that help direct flow into the diversions. These features are incorrectly sited at channel constrictions and are not engineered to withstand regular flow regimes. Thus, they do not function under regular high flows and erode rapidly, requiring frequent maintenance. Finally, diversions do not maximize diverter control of water removal or the efficiency of water delivery within diversion ditches. The Proposed Project provides an opportunity to address these issues of diversion efficiency and reliability, while also improving conditions for native fish populations and increasing the quality and quantity of native fish habitat (Schneider 2015).

2.2.1 Project Operation and Maintenance

Construction for the Proposed Project will take place over two to three years, depending on permit acquisition timing and availability of construction crews and equipment.

Following construction, post-project monitoring activities will take place to ensure the Proposed Project was built to design standards. After construction and revegetation are complete (see Section 2.2.2 below), the diversions and Proposed Project sites are expected to require minimal maintenance; however, as the LMR is a dynamic system it is expected that sediment will likely mobilize over time and potentially require occasional sediment augmentation and maintenance, particularly following flood events. It is anticipated that minor sediment removal in the

immediate vicinity of the fish screen will be required, at times. The new fish screen structures should minimize the need for vegetation removal, but periodic removal may be necessary if vegetation accumulates near the screen.

2.2.2 Project Construction

The Proposed Project enhancement actions may include relocating diversion entrances, replacing outdated fish screening infrastructure, and improving in- and off-channel habitat. Habitat improvements will include salmonid spawning gravel augmentation and eliminating or reducing size of predator holding habitats. For impacts analysis, the Action Area includes all staging and construction areas, as well as the river reach 1000 meters downstream from the construction area, which may experience temporary but minor impacts during in-stream construction (**Figures 2-4**).

The Proposed Project will require the operation of construction equipment (e.g., rubber-tired front-end loaders, excavators, articulated haulers, dozers etc.) within Project Action Area. Gravel and cobble will be placed in the stream by rubber-tired front-end loaders. Construction equipment shall be clean and use biodegradable, vegetable-based lubricants and hydraulic fluids. To minimize any potential negative effects on salmonids, in-stream work will occur from 15 July to 15 October when flows are typically and comparatively low (approximately 200 cubic feet per second (cfs) or less) and active salmonid spawning is not occurring. Off-channel construction and on-site gravel sorting to obtain spawning sized gravel may occur throughout the year; mitigation measures to avoid impacts to special status species will be implemented (Appendix B). Construction will occur over two or three seasons and will require approximately 16 weeks per season. Work will occur Monday – Friday from 7:00 am to 5:00 pm to ensure minimal disturbance to adjacent landowners.

Prior to completion of diversion enhancements, a gravel berm will be constructed and maintained at each diversion location to provide head for directing water into the existing diversion structures. Each gravel berm will be constructed of imported gravel-sized rock (or gravel already stockpiled onsite for Cowell 1). Berm construction will follow methods employed in previous years, as described in the 2021 CDFW Streambed Alteration Agreement (EPIMS-MER-14619-R4) for the project. Berms will be constructed by placing gravel at the edge of the active, wetted channel, and pushing it into the river using heavy equipment such as tractors or dozers. Gravel will be added and built up allowing the equipment to be driven and operated from on top of the berm without being in contact with the river flow. Equipment will advance along the length of the dam as it is constructed to deposit additional gravel. Each berm will be constructed to a height that is above the level of the river as construction occurs, between one and five feet high.

Construction and maintenance of gravel berms may occur annually between 1 March and 15 July and will comply with the Avoidance and Minimization Measures detailed in the CDFW LSAA for each diversion location.

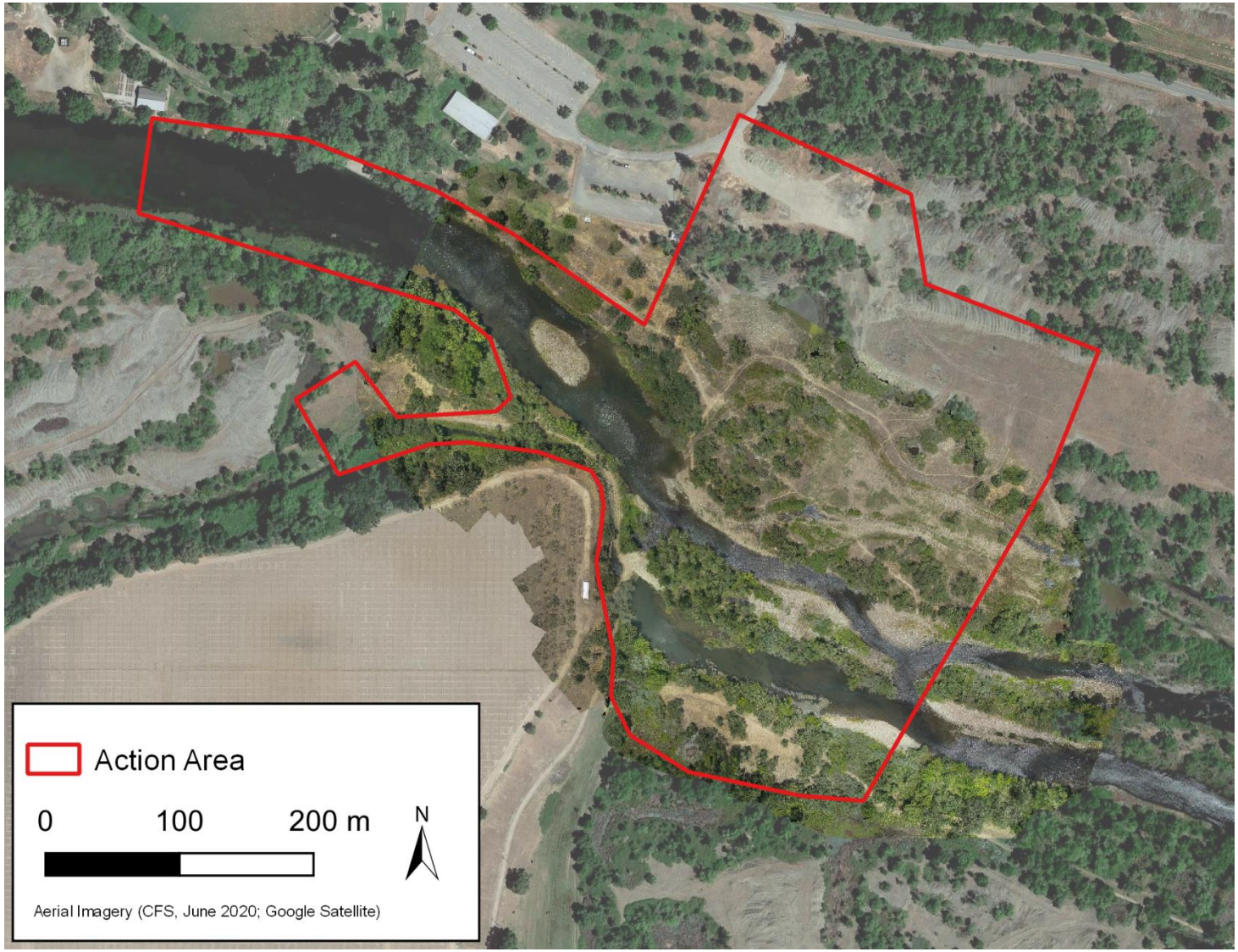


Figure 2. Cuneo Action Area.

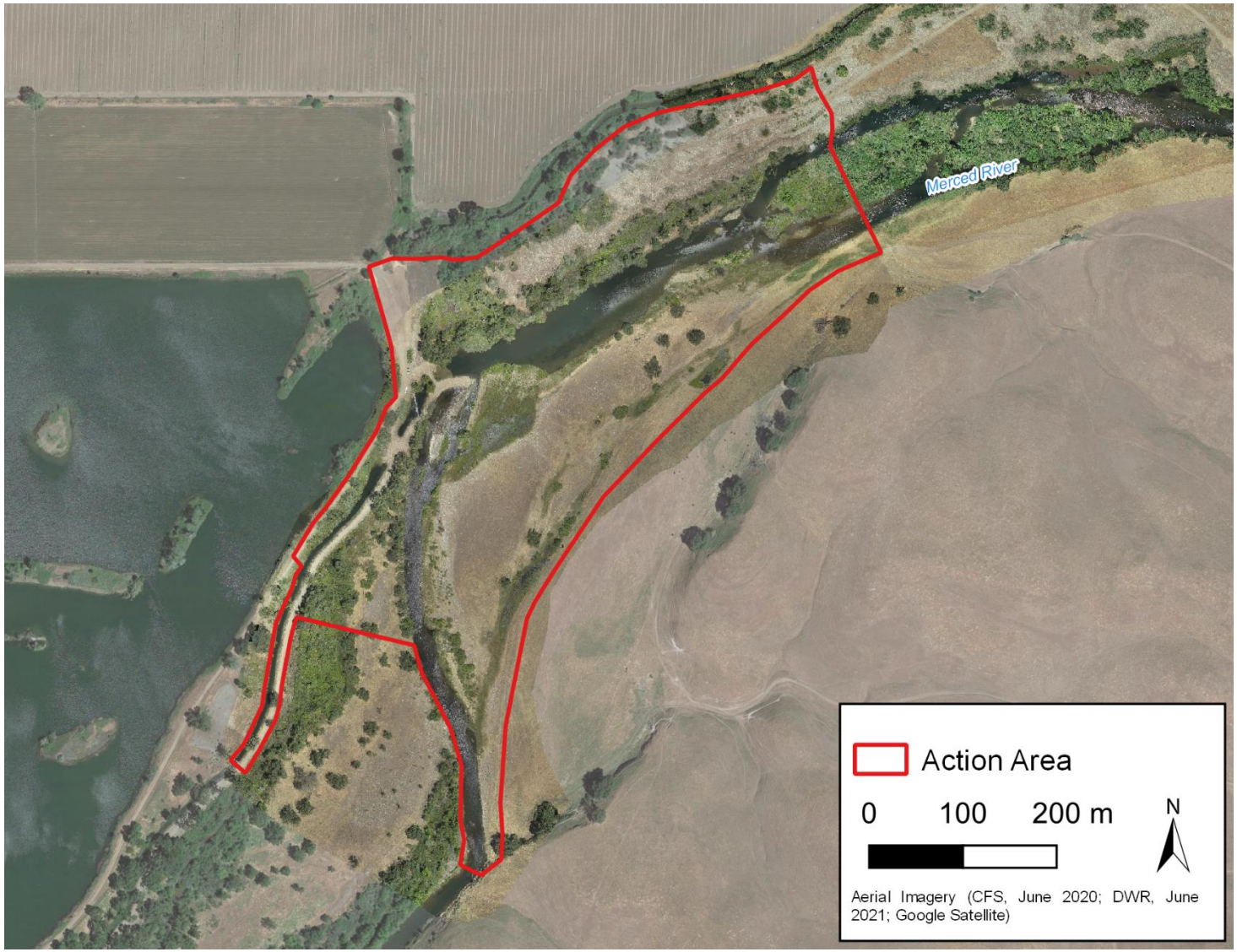


Figure 3. Cowell 1 Action Area.

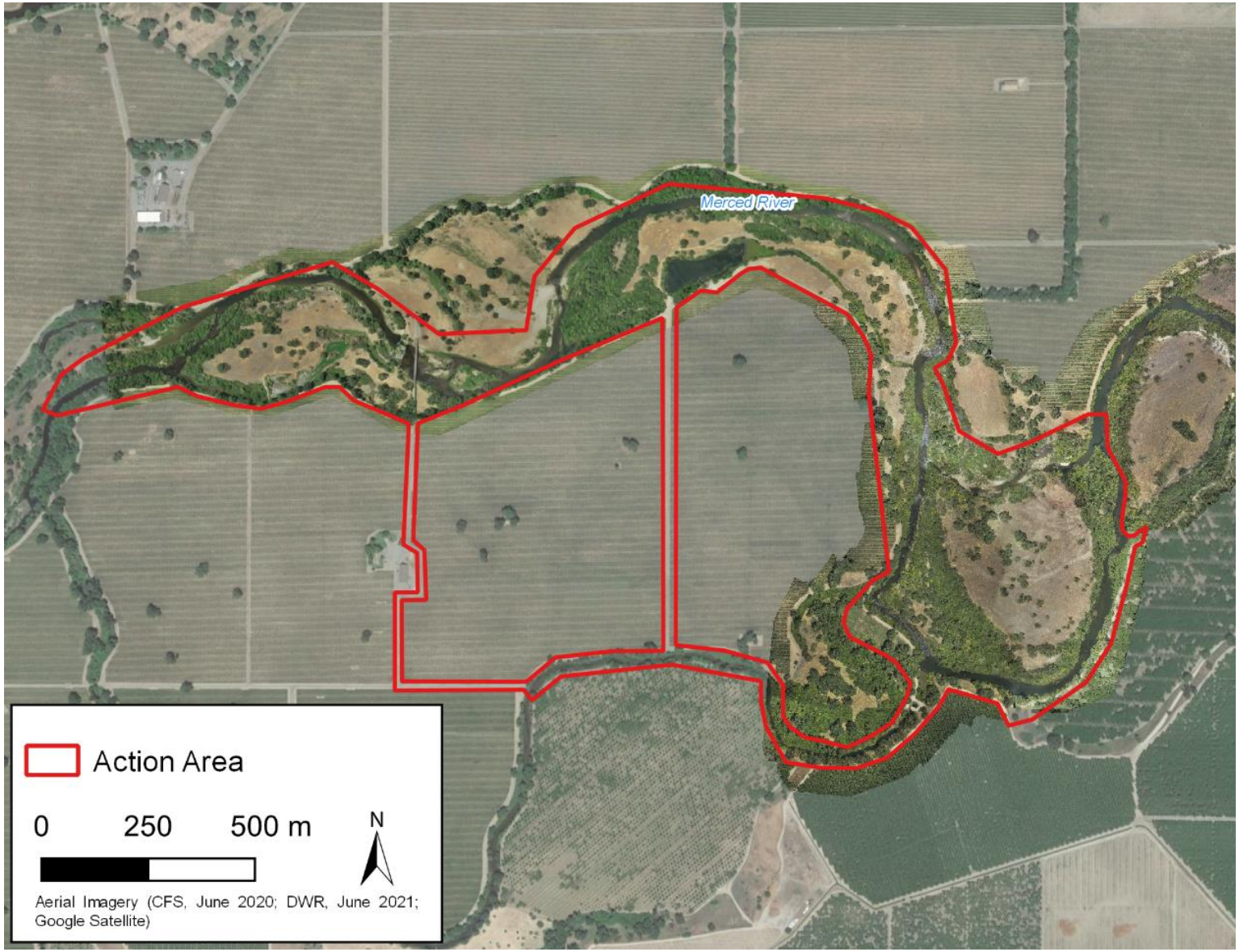


Figure 4. Cowell 2 Action Area.

The three diversions will be redesigned to address issues of improperly functioning fish screens, poor diversion siting, and diversion configurations which are not engineered or designed to meet fish and diverter needs. The new diversions will no longer require the annual construction of temporary gravel berms (discussed below) at the each of the sites to direct flow and provide head to the diversion intakes. Habitat improvements will be undertaken to reduce predation and increase quantity and quality of salmonid spawning, incubation, and rearing habitat associated with diversions. The strategy for instream gravel replenishment is based on an understanding of the existing channel bed topography (CFS unpublished data) and is intended to re-create channel bedforms to enhance salmonid spawning.

The restoration design will utilize hydrogeomorphic scaling relationships between flow and river form and ecohydraulics to optimize habitat for spawning and rearing Chinook Salmon. Designs will be iterated following the the Spawning Habitat Integrated Rehabilitation Approach (SHIRA) (Wheaton et al. 2004 a,b; Pasternack 2008; Sawyer et al. 2009). Diversion enhancements will require limited in-channel work, as much of the construction will occur outside the main channel. Habitat features proposed for creation or enhancement are described in detail for each diversion below.

2.2.2.1 Staging

Staging areas will be located in upland areas, on existing gravel pullouts adjacent to diversion access roads or in barren, flat cobble areas. Implementation of the Proposed Project design will require frequent coordination with adjacent landowners and water diverters. It is anticipated that the in-channel construction period will be 15 July through 15 October to minimize potential for impacts to special-status species. Out of channel work may occur outside this period, and mitigation measures will be followed to avoid impacts to special-status species (Appendix B). Construction access and staging will be configured to minimally impact landowner operations during the growing season while providing efficient work area during construction activities. Water diversions will be maintained throughout the construction period as needed by the diverters. Temporary diversion works may be necessary depending on the location of the new diversion structure, and irrigation canal improvements will need to be staged to provide a bypass around the work area if needed. This could include temporary pumping of water at the existing diversion location depending on construction phasing and decommissioning of the existing structures. Construction considerations will be refined throughout the design process with direct coordination with landowners and project stakeholders.

It is not anticipated that the full flow of the river will need to be diverted to install the fish screen and diversion structure and associated components. It is anticipated the sites will be able to be isolated using piles or gravel berms to create a coffer dam to temporarily dewater a limited work area adjacent to the channel. It is possible that construction or placement of some features may occur without flow diversions. This will be site-specific and refined as the specific screen type is selected and headworks needed to connect to existing irrigation canals. Any heavy equipment entering the channel would use vegetable-based lubricants.

2.2.2.2 Project Implementation Time Frame

In-channel construction is expected to start 15 July and be completed by 15 October. Out of channel construction may occur year round. No in-stream work would occur after 15 October to avoid impacting spawning Chinook Salmon. The Cowell 1 and 2 diversions will be targeted in

2022. Cuneo diversion will be targeted in 2023. Replanting would commence at the beginning of the rainy season, which would presumably begin in late November and continue through February. Construction activities would take place during normal working hours, 7:00 am to 5:00 pm, Monday through Friday.

2.2.2.3 Revegetation

As possible, native trees, such as Fremont Cottonwood (*Populus fremontii*), oak (*Quercus* spp.), and willow (*Salix* spp.) with a diameter at breast height (dbh) of at least 12 in (15.2 cm) will be protected with 30 ft (9.1 m), 10 ft (3 m) and 10 ft (3 m) buffers, respectively. However, it is expected that a limited number of native trees will need to be removed to create the planned habitat features. Mitigation planting will be conducted to compensate for any riparian shrub and tree removal during Proposed Project implementation, described in greater detail in Section 3. The plans and specifications will identify tree and shrub species that will be planted, how, where, and when they will be planted, and measures taken, with a goal of 70% survival of planted trees. If annual tree survival survey data indicates survival is less than 70%, the reason(s) for poor survival would be evaluated and addressed, and more native vegetation would be planted.

After re-siting diversions and completing in-channel restoration features, disturbed areas will be revegetated by seeding native annual plants and planting native trees. Planting will occur between late November and January, during the rainy season, to maximize survival rates.

2.2.2.4 Cowell 1 (Diversion 5)

The highest priority diversion for enhancement is the Cowell 1 diversion (37°29'48.01"N 120°27'58.95"W), also referred to as Diversion 5 (Figure 5). It consists of a gravel berm maintained annually across approximately 75% of the Merced River channel which directs water into the diversion canal on the north bank. To enter the canal, water passes through three (two at 36-inch and one at 48-inch) culverts set in a gravel and earth embankment that functions as a partial debris barrier and then through a vertical flat plate fish screen equipped with a flow-powered brush cleaning system. Fish and debris are funneled through a bypass return (36-inch pipe) at the south bank of the canal and back into the river approximately 100 feet below the berm.

Designed in the late 1980's, Cowell 1 diversion function is negatively impacted by even small flow changes. The berm, constructed of spawning-size gravels begins to mobilize at ~900 cfs (25.5 cms), resulting in considerable loss of function over the irrigation season. A large, slow pool with conditions favorable for juvenile salmonid predators such as black bass is present upstream of the diversion entrance, counter to screen regulations which require that diversions are designed to minimize predator habitat (NMFS 1997; CDFG 2002). The river continues to form a straight, homogenous chute for ~0.2 mi (0.3 km) upstream. The berm (~135 x 40 ft [~41.1 x 12.2 m]) is usually constructed of 1,000-2,000 yd^3 (765-1,529 m^3) of gravel; a berm of this size is required to create flow velocities sufficient to power the screen's brush cleaning system and meet screening regulations (NMFS 1997; CDFG 2002), rather than to meet diverters' water needs. As a result, the diversion operator estimates that, while more than half of river flow passes into the canal mouth, up to 50% of this water may be returned to the river through the bypass. The berm must be maintained annually and ongoing screen maintenance, including debris removal, is conducted approximately three times per week throughout the season. Although gravel mobilization from the berm undoubtedly helps feed downstream spawning

riffles, it is not constructed to function as stable salmonid spawning habitat. Off-channel habitat on the south bank provides potential rearing habitat during flood flows, but aerial extent and inundation frequency could be expanded through rehabilitation actions.

The design for the new Cowell 1 diversion includes moving the diversion structure [Point of Diversion (POD) ID 62455] approximately 1,000 ft upstream to gain ~2 ft in head elevation and placing one or two cone screens directly on the main channel (Appendix A). Approximately 1,400 LF of pipe or open ditch would be constructed to connect the new diversion to the existing canal, downstream of the existing fish screen. The riverbed would be rebuilt between the new and current diversion structure and two riffles would be constructed to provide elevation head (Appendix A). This alternative may also include improvements to the canal such as lining with cement or concrete in specific locations to reduce infiltration losses from the canal. Benefits of this design for water diversion include updating and relocating the screen, eliminating the need for a fish bypass, and reducing maintenance at the diversion site. Benefits for salmonid habitat include creating approximately 0.45 acres of spawning habitat and 7.6 acres of off-channel rearing habitat and reducing suitable predator habitat by 2.9 acres.

The staging area for Cowell 1 will be an existing gravel stockpile/staging area and on a large flat disturbed gravel area adjacent to the access road (Figure 6). As possible, spawning gravel would be sourced on-site during floodplain and side channel construction. Spoils from spawning gravel sorting would be incorporated as fill or used during floodplain grading. Some additional gravel may need to be locally sourced from tailings.

Prior to completion of diversion enhancement at Cowell 1, a gravel berm will be constructed and maintained, as detailed above, to provide head for directing water into the existing diversion structure. Similar to previous years, the Cowell 1 gravel berm will use a maximum of 1,670 cubic yards (1277 m^3) of gravel, will be approximately 150 feet long by 60 feet wide, and will not exceed 75% of width of LMR channel.

Figure 5. Conceptual design of Cowell 1 diversion enhancement.

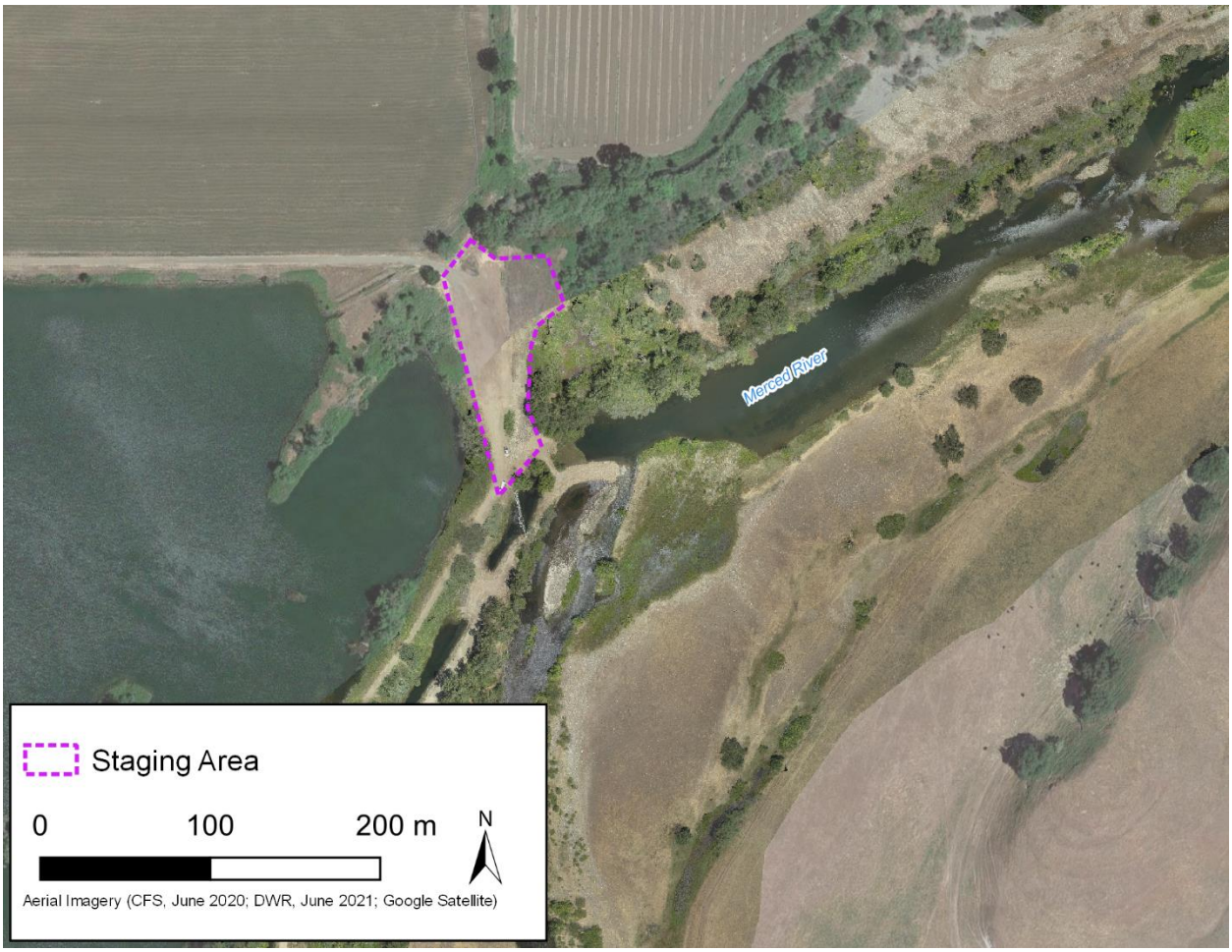


Figure 6. Cowell 1 staging area.

2.2.2.5 Cowell 2 (Diversion 6)

The Cowell 2 diversion (POD ID 62456) is the furthest downstream of the three diversions (Figure 7) and has been ranked second priority for enhancement. A riffle feature immediately downstream of the diversion has remained stable since 1997 and provides some control of hydraulic head, but an additional berm is constructed annually across a side channel, approximately 2,800 feet upstream of the diversion, which cuts across the neck of the riverbend (Figure 7). Approximately 240 feet of slow, deep water exists at the diversion entrance, within which a rock gabion was placed to act as a fish barrier between the main channel and the upstream diversion embankment. Downstream of the rock gabion, water passes through two inlet gates to enter a small pool and then through metered gates into the irrigation canal. In addition to this diversion location, two smaller pumped diversions ~0.5 miles (Pump 11; POD ID 62453) and ~1.5 miles (Pump 12; POD ID 62454) downstream of the main Cowell 2 diversion will be incorporated into Project activities. Water for Pump 11 is diverted via a canal into a pond on which the pump is located and which reconnects to the main channel at its downstream extent. Pump 12 only connects at flows above 2,000 cfs (56.6 cms) which limits its utility and has not been used in several years due to flow conditions in the river.

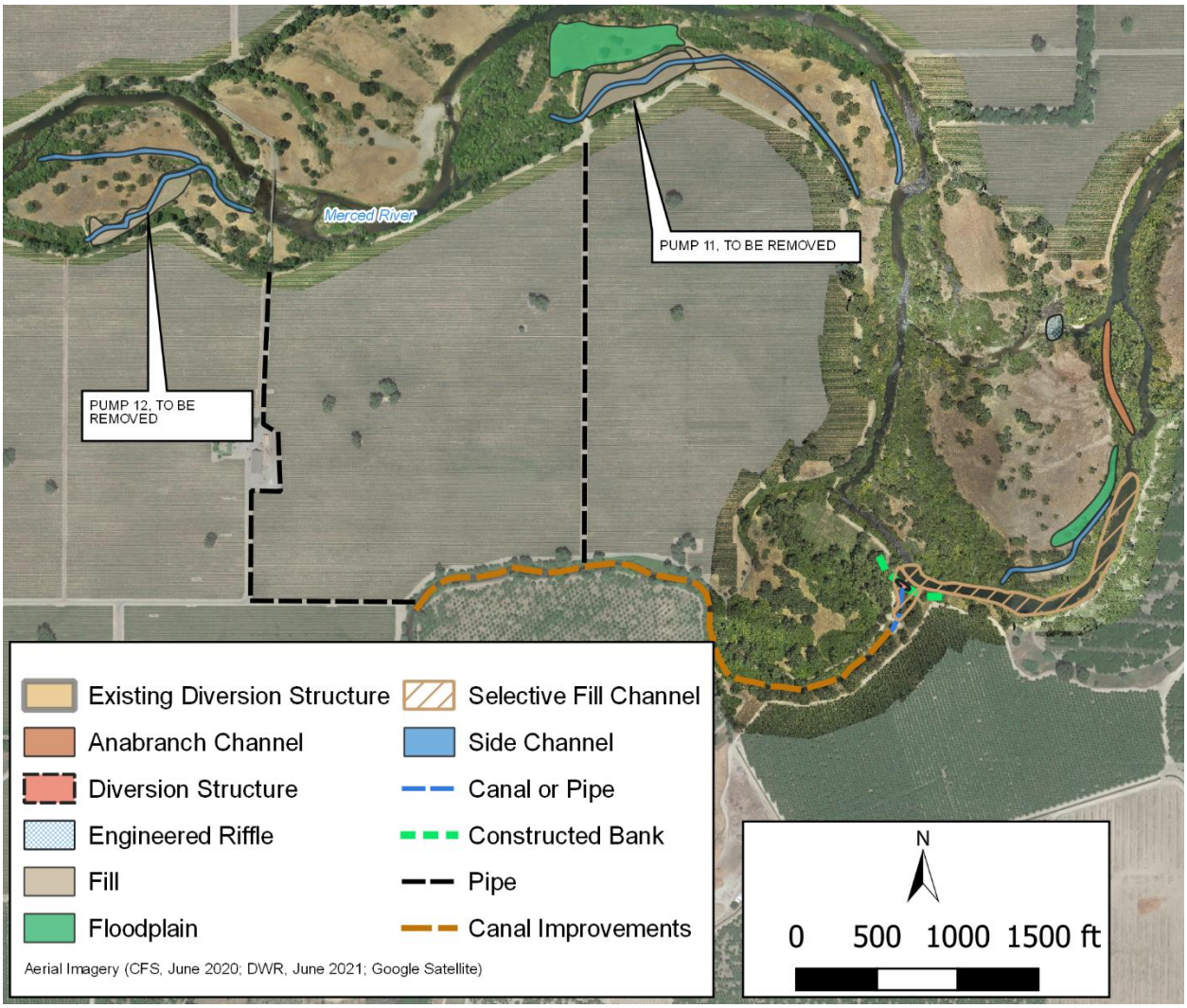


Figure 7. Conceptual design of Cowell 2 enhancement.

Enhancements at Cowell 2 will include the removal of pumps 11 and 12, and their existing infrastructure. A pipe or open ditch will be constructed to connect the existing canal to meet the needs currently served by the pumps (Figure 7). Based on detailed irrigation design, this may require pumping water from the irrigation ditch to pressurize the water delivery to the irrigation system. Both ponds associated with these pumps would be partially filled with nested side channels so that they seasonally inundate, creating approximately 14.5 acres of salmonid rearing habitat. Above the new diversion structure, habitat restoration elements are focused on eliminating predator habitat, enhancing rearing habitat and stabilizing the upstream flow split. A cone screen will be installed and the deep area where the current diversion intake is located would be filled to eliminate ~0.4 acres of suitable predator habitat (Appendix A). The new diversion structure would be connected to the existing irrigation canal by a pipe (~250 ft) extending through this area. In addition, ~1,900 ft of upstream channel would be selectively filled with cobble or large gravel, reducing ~ 4.7 additional acres of suitable predator habitat. Further upstream there would be grading and an engineered riffle in the overflow channel meant to stabilize the channel from capturing the main river channel. Concurrent with this action would be the grading of an existing seasonal channel to become a perennial, secondary channel

immediately below the overflow channel that is meant to help convey high flows past the diversion structure. This alternative may also include improvements to the canal such as lining with cement or concrete in specific locations to reduce infiltration losses from the canal.

The staging area for Cowell 2 would be on existing flat, disturbed area adjacent to the access roads (Figure 8). As possible, spawning gravel would be sourced on-site during floodplain and side channel construction. Spoils from spawning gravel sorting would be incorporated as fill or used during floodplain grading. Some additional gravel may need to be locally sourced from tailings.

Invasive aquatic vegetation accumulates rapidly in the area upstream of the inlet gates, at the gabion, requiring a few days of in-water maintenance with heavy machinery several times throughout the year to remove the vegetation.

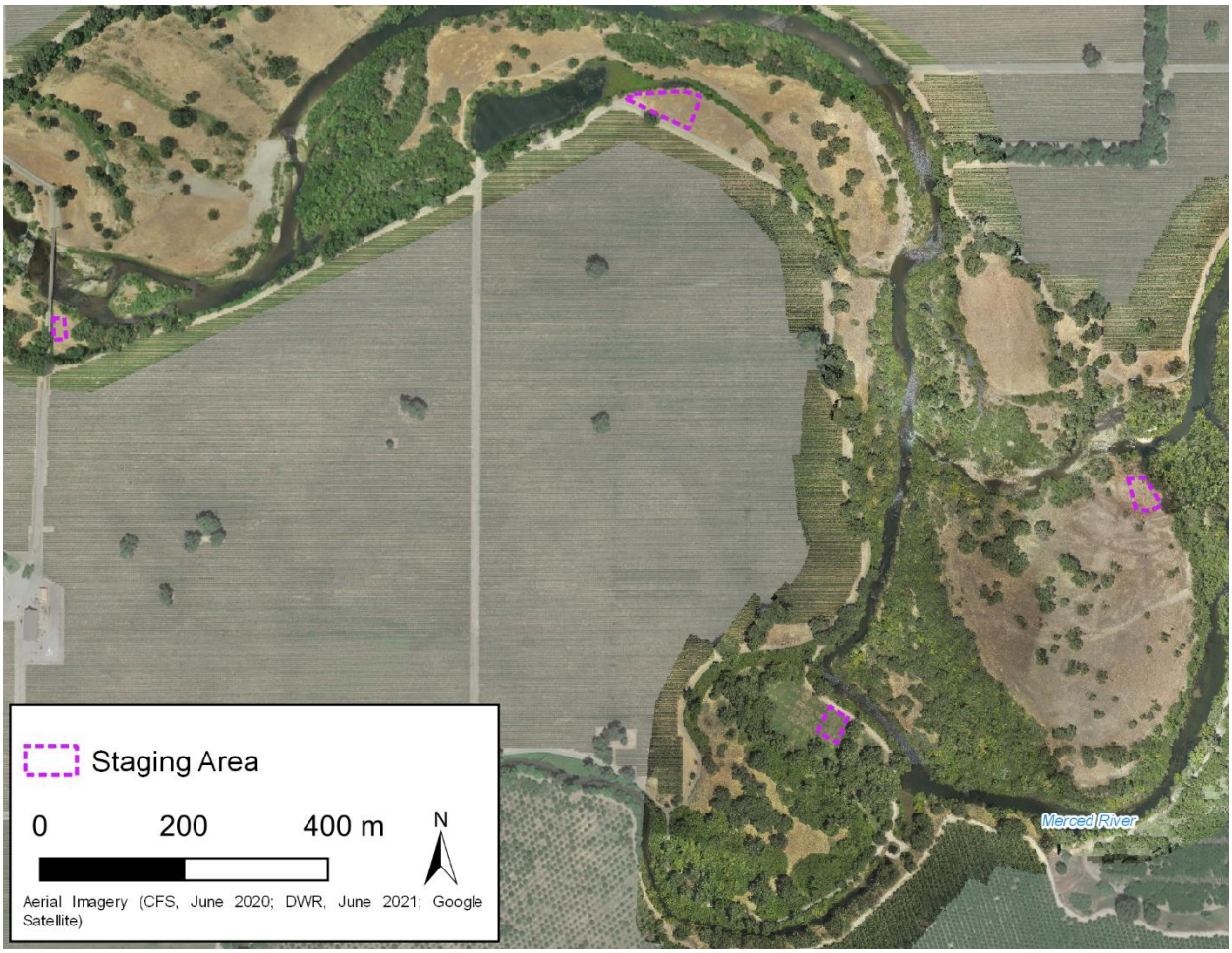


Figure 8. Cowell 2 staging areas.

2.2.2.6 Cuneo (Diversion 2)

The Cuneo diversion (Diversion 2; 37°31'8.33"N 120°25'9.08"W) is the third Project location (Figure 9). The river forks ~0.5 miles (~0.8 km) upstream of this diversion, which is located at the bottom of the river left (south) fork. Originally designed in 1986, several connections between the north and south channels present in this area were bermed regularly to direct water into the diversion. This occurred until the Henderson Park Salmonid Habitat Restoration Project was completed in 2015. As part of this restoration project, stable river features were engineered at all berm locations except the berm at the diversion entrance. This berm spans the south channel to provide elevation head to the diversion structure but still washes out in most years and requires regular maintenance. The berm is constructed of approximately 500-600 yd^3 of gravel and is approximately 80 feet long by 50 feet wide. Water passes through two inlet pipes at the diversion entrance, then through a vertical fixed plate screen, and on to a canal carved through bedrock. Although originally equipped with a powered brush cleaning system, the brushes pulled away from the screen and were removed in 2020. A bypass return at the north side of the screen returns fish and debris to the main channel. Approximately 40 cfs (1.1 cms) are diverted at this ditch during the irrigation season to supply diverters with 10-15 cfs (0.28-0.42 cms) of water, with a small amount diverted year-round for livestock needs.

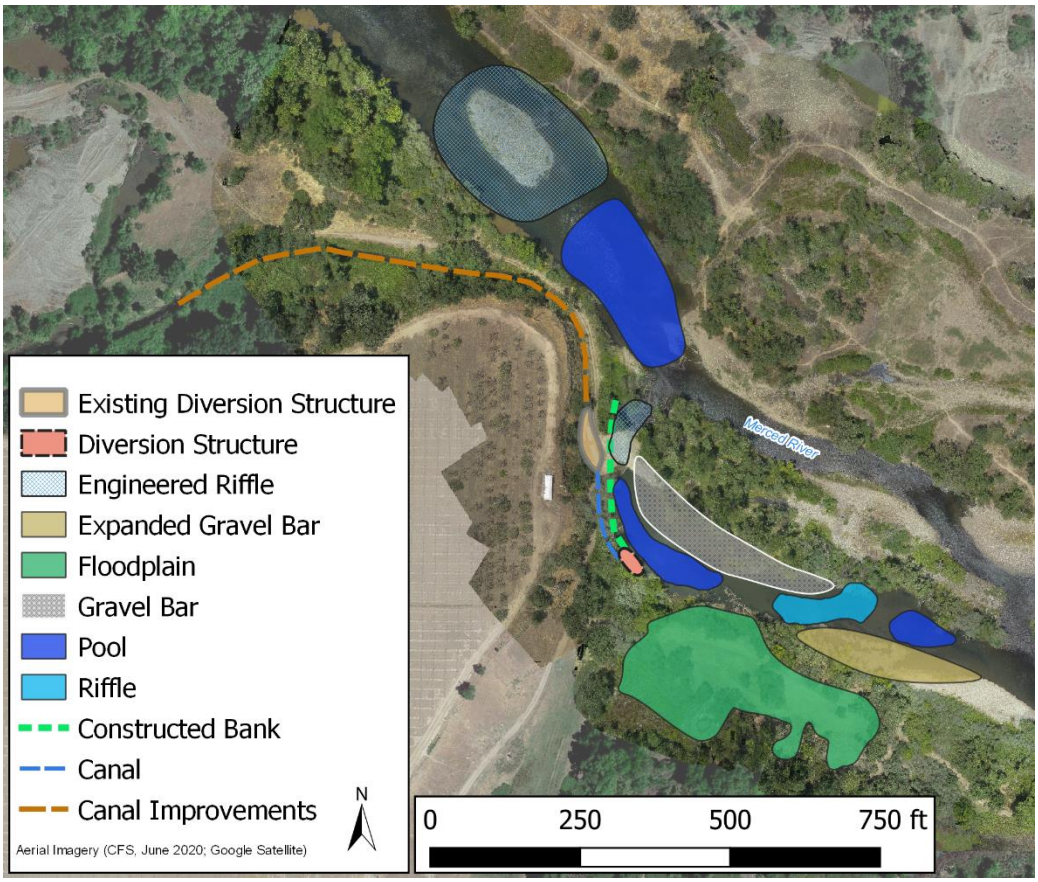


Figure 9. Conceptual design of Cuneo enhancement.

The berm at this site must be constructed almost annually, requiring the addition of up to 890 yd^3 (680 m^3) of gravel. Although more stable than berms at other diversions located on the main channel, the Cuneo berm is overtopped and begins to wash out at flows of ~4000 cfs (~113.3cms). The stretch of channel above the berm is stagnant and deep, likely supporting populations of predator species. Since the cleaning system is no longer functioning, the screen requires daily manual cleaning to meet regulations (NMFS 1997; CDFG 2002). Despite this maintenance, the screen is not functioning appropriately or efficiently, and fish have been observed in the diversion canal (CFS, unpublished data).

The new Cuneo diversion design includes moving the diversion structure upstream to gain ~2 ft in head elevation and placing a cone screen directly on the south channel (Figure 9). Approximately 250 feet of pipe would be laid to connect the new diversion to the existing canal without impacts to the location of the current pump infrastructure. This alternative may also include improvements to the canal such as lining with cement or concrete in specific locations to reduce infiltration losses from the canal. This design provides the benefits of updating and relocating the screen, eliminating the need for a fish bypass, and reducing maintenance at the site while working with the morphology of this restored river section to meet diverters needs. The habitat enhancement concepts for the design include resizing overly wide and deep sections of river channel with a rescaled alluvial river morphology consisting of bars, riffles, and pools. These actions would address limitations in spawning and rearing habitat as well as stressors to juvenile salmonids such as predation. Rebuilding the river channel in this area would spread out the elevation need over ~ 600 ft and two riffles; this requires that the riffle immediately below the diversion be engineered with a slope of ~0.8%. In addition, the river island and adjacent channels, created by the Henderson Park Restoration Project, would be engineered to also gain elevation. All off-channel areas represent approximate areas needed to generate fill for the channel and will likely be adjusted during design development. If the areas shown are not feasible due to sediment size distribution or logistical challenges, mine tailings associated with the Henderson Park Project could potentially be utilized to build riffles. This design would create an estimated 0.5 acres of spawning habitat and approximately 2.2 acres of off-channel habitat, while eliminating 1.5 acres of suitable predator habitat (Figure 9).

The staging area for Cuneo will be an existing gravel stockpile/staging area and on a large flat disturbed gravel area adjacent to the access road on the south side of the river and in the disturbed gravel area near Henderson Park on the north side of the river (Figure 10). Additionally the proposed floodplain area on the southern bank would be used as temporary staging during installation of the fish screen and gravel placement (Figure 10). As possible, spawning gravel would be sourced on-site during floodplain and side channel construction. Spoils from spawning gravel sorting would be incorporated as fill or used during floodplain grading. Some additional gravel may need to be locally sourced from tailings.

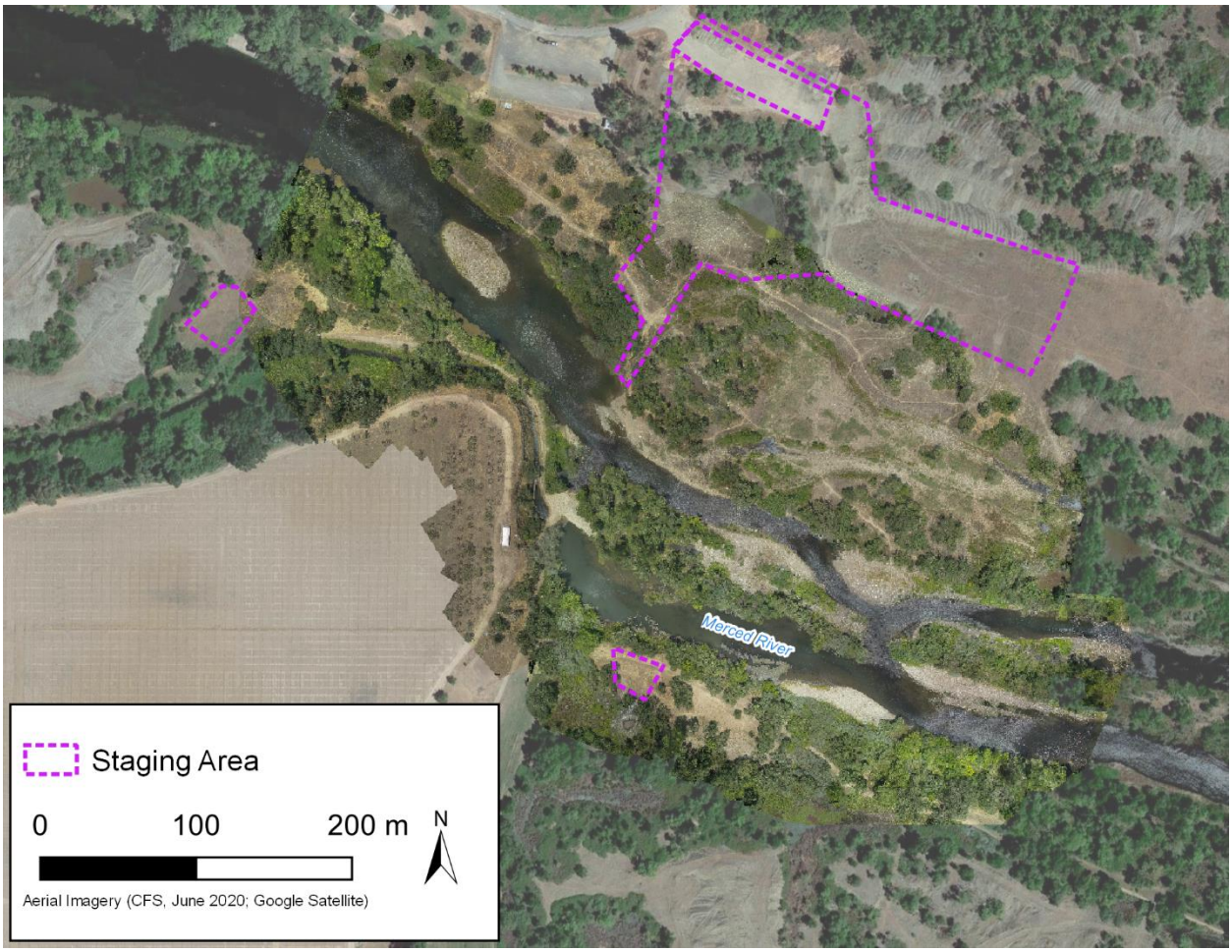


Figure 10. Cuneo staging area.

Prior to completion of diversion enhancement at Cuneo, a gravel berm will be constructed and maintained annually, as detailed previously, to provide head for directing water into the existing diversion structure. The Cuneo gravel berm will span the south channel, use a maximum of 890 cubic yards (680 m^3) of gravel, and will be approximately 80 feet long by 60 feet wide.

2.2.3 Best Management Practices (BMPs)

The Proposed Project includes the following Best Management Practices (BMPs) to minimize adverse environmental effects. In this section, a general approach to minimizing these impacts is discussed; specific Mitigation Measures are described in specific sections of the CEQA checklist (Section 3.3) and are also listed in the Mitigation Monitoring and Report Program (MMRP; Appendix B).

2.2.3.1 Water Quality

Some construction activities would occur in the main channel of the Merced River. All equipment working within the river corridor would be inspected daily for fuel, lubrication, and coolant leaks; and for leak potentials (e.g., cracked hoses, loose filling caps, stripped drain plugs); and all equipment used for the Proposed Project would be free of leaks. Vehicles or equipment would be washed and/or cleaned only at approved offsite areas. All equipment would

be steam cleaned prior to working within the stream channel to remove contaminants that may enter the river and adjacent lands, including biological contaminants such as invasive species. All equipment would be fueled and lubricated in a designated staging area located outside the stream channel or banks, wetlands, and riparian corridors.

A SWPPP, including a Spill Prevention and Response Plan, would be developed as part of the BMP plan for the Project. All pertinent staff would be trained and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them would be made available onsite and staff would be trained in its use. Spill prevention kits would be in close proximity to construction areas, and workers would be trained in their proper use. The Proposed Project would comply with Section 401 of the CWA and certification would be obtained for all activities to control and monitor sediment and other contaminants entering the main river channel during construction. To minimize risk from additional fine sediments, all trucks and equipment would be cleaned. Stream bank impacts would be isolated and minimized to reduce bank sloughing. Banks would be stabilized, as needed, with the appropriate erosion control method identified in the SWPPP and on design plans following Project activities.

2.2.3.2 Air Quality and Traffic

Basic Air Quality Control Measures would be implemented at the Action Area, including, but not limited to, daily watering of dirt roads and construction areas. Construction equipment would be limited to operating from 7 a.m. to 5 p.m.

2.2.3.3 Vegetation, Fish and Wildlife

All reasonable and prudent measures in the biological opinions issued for the Proposed Project by the USFWS and NMFS would be followed. Pre-project wildlife surveys would be conducted by a qualified biologist no more than 30 days prior to start of construction activities. Nesting birds and raptors are protected under the MBTA and California Fish and Game Code and may be present within the Action Area. Several bat species of special concern may also be present. Trees and shrubs within the Action Area may provide nesting and roosting habitat for songbirds, raptors and/or bats. If tree removal is unavoidable, it would occur during the non-breeding season (mid-September through January), as possible. Any trees that must be removed during breeding season would be examined thoroughly for nests and roosts by a qualified biologist prior to removal. If other construction activities must occur during the potential breeding season (February through mid-September) surveys for active nests and/or roosts would be conducted by a qualified biologist no more than 10 days prior to the start of construction. A minimum no disturbance buffer would be delineated around active nests until the breeding season has ended or until a qualified biologist has determined that the birds/bats have fledged and are no longer reliant upon the nest or parental care for survival. The radius of the buffer will depend on the species; see mitigation measures below for additional details.

Pre-project vegetation monitoring surveys were conducted within the Action Area in August 2021 (Vaghti 2021). No special status plants were identified within the Action Area during these vegetation surveys. If any special status plants are observed in subsequent surveys they would be avoided through use of appropriately sized buffers.

Pre-project elderberry plant surveys were conducted to assess impacts to the Valley Elderberry Longhorn Beetle (VELB, *Desmocerus californicus* ssp. *dimorphus*), and surveyors identified a

total of 21 elderberry (*Sambucus* spp.) shrubs with stem diameter greater than 1 inch at ground level within the Action Area (Figures 11-13). Complete avoidance may be assumed when there is at least a 20-ft (6 m) buffer around the drip line of an elderberry plant (USFWS 2017). During construction, we will attempt to avoid impacts by field fitting around elderberries; however, it is anticipated that a total of up to four elderberry shrubs in the Cowell 1 Project footprint and up to five elderberry shrubs within the Cowell 2 Project footprint may not be able to be avoided with a 20-ft buffer. If a buffer cannot be implemented during construction, in coordination with USFWS these elderberry shrubs will be transplanted to suitable locations, which will be identified during Section 7 consultation. Elderberry shrubs that can be avoided using a 20-ft buffer would be marked prior to construction using construction stanchions and flagging.

All equipment entering the water would be steam cleaned before it is used elsewhere to minimize the chance of introducing New Zealand mud snails to other water bodies. Additional measures may be taken at the recommendation of CDFW.

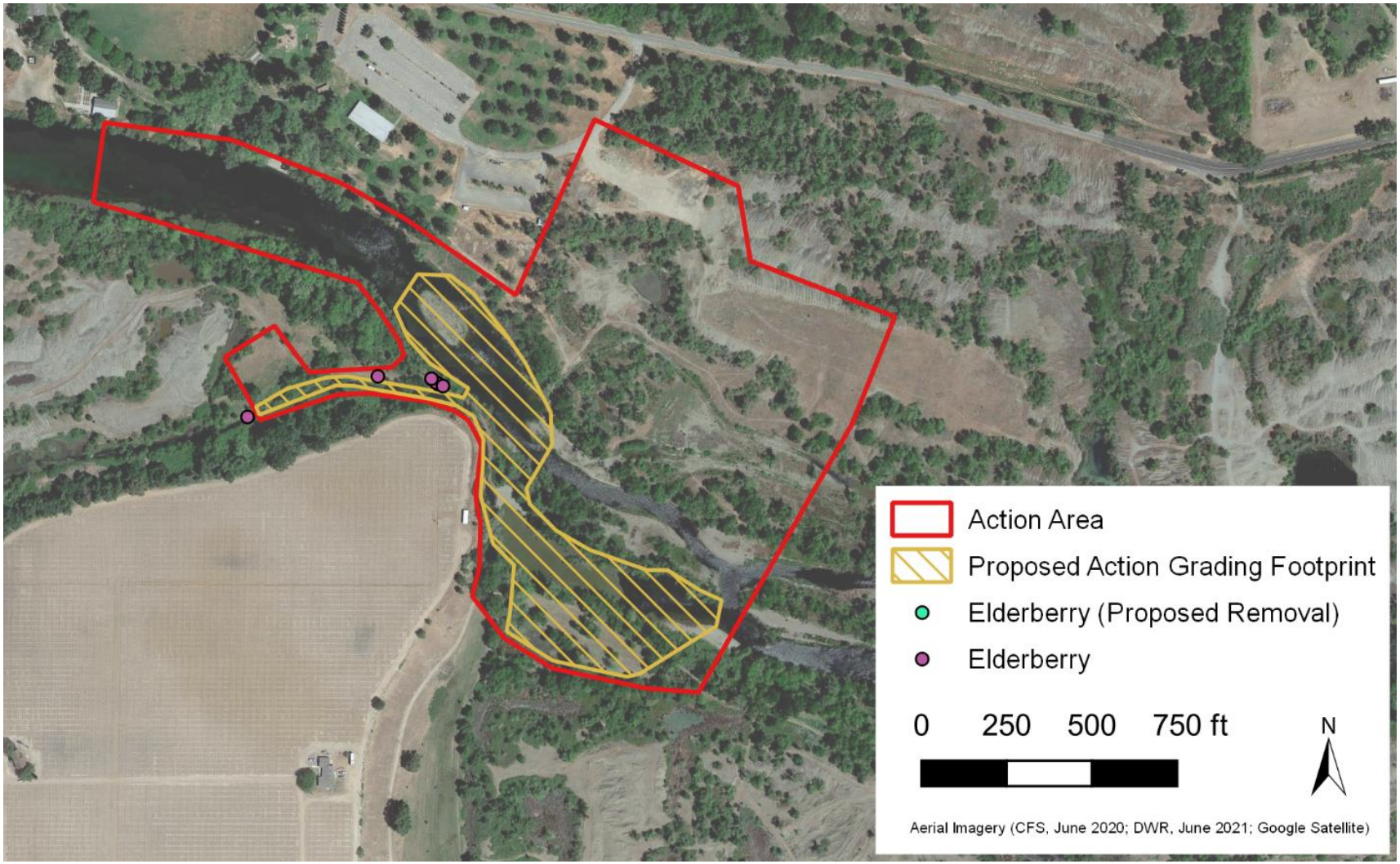


Figure 11. Elderberry plant locations at Cuneo relative to the Project Action Area and grading footprint. Note that individual points may represent more than one plant.

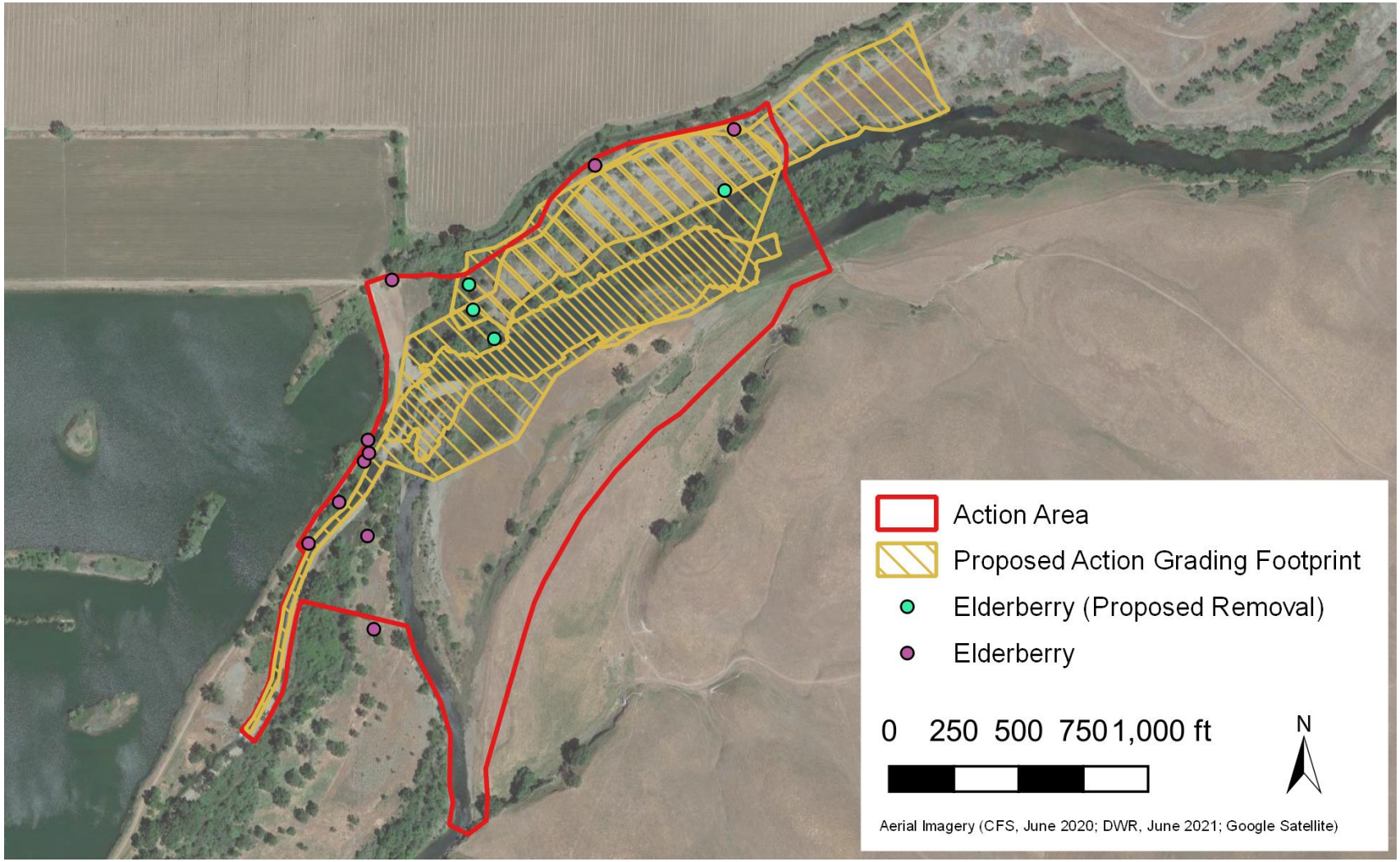


Figure 12. Elderberry plant locations at Cowell 1 relative to the Project Action Area and grading footprint. Note that individual points may represent more than one plant.

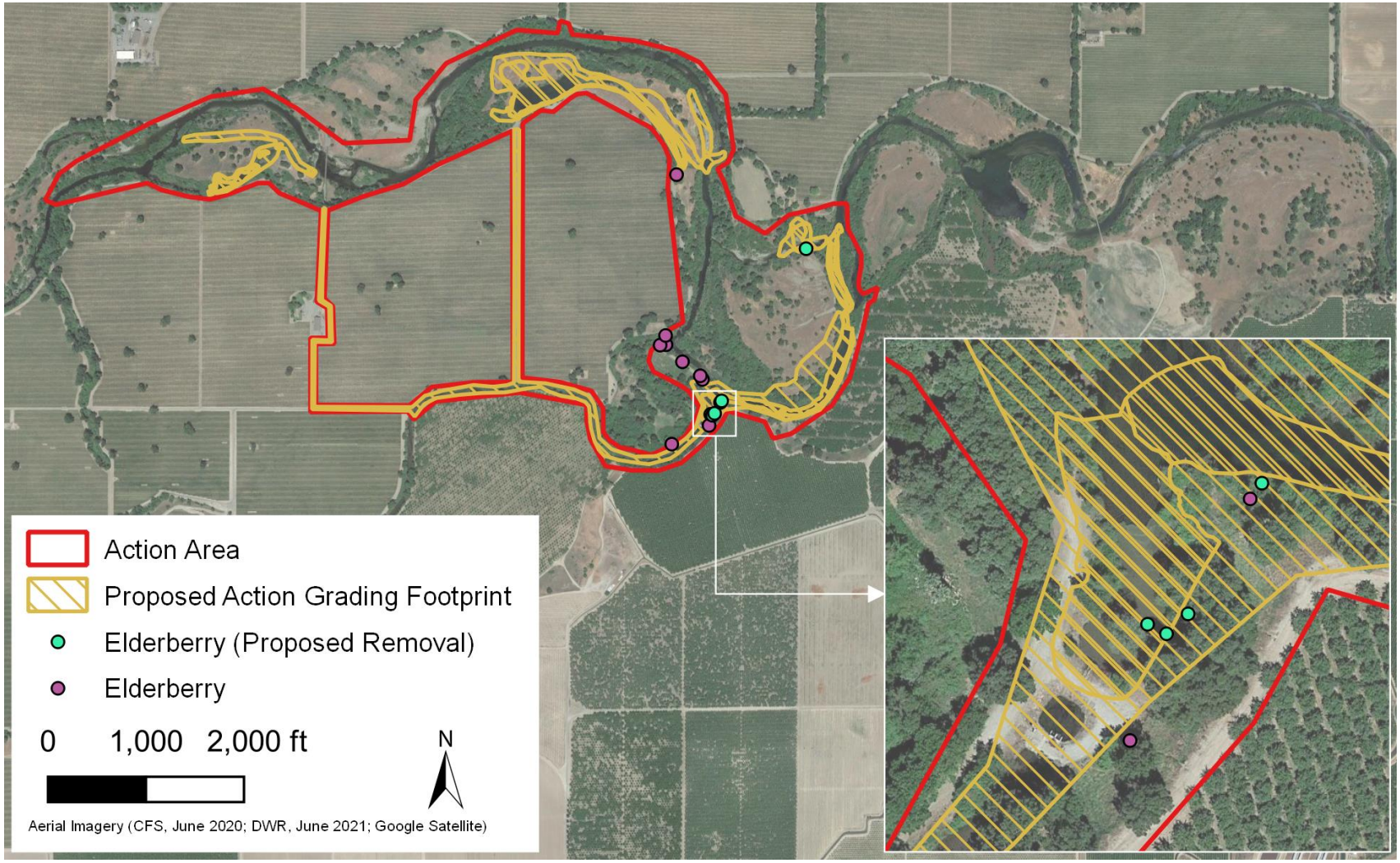


Figure 13. Elderberry plant locations at Cowell 2 relative to the Project Action Area and grading footprint. Note that individual points may represent more than one plant.

Following the Proposed Project completion, diverters will no longer rely on erosion-prone berms to generate sufficient hydraulic head into the diversions. A native grass seed mix would be spread over disturbed areas containing fine sediment. Native riparian trees and shrubs would be planted in select locations, particularly in locations which have been disturbed by construction activities. Additional erosion control measures as detailed in the SWPPP and on design plans, such as fiber rolls, would be installed as needed to areas if slopes exceed a ratio of 1:4.

2.2.3.4 Revegetation of Disturbed Area

A revegetation management plan will be prepared for the Proposed Project to: 1) reduce impacts to existing native trees and other riparian vegetation due to rehabilitation activities, 2) provide mitigation for any mature native trees are negatively impacted, and 3) detail the Proposed Project implementation BMPs to ensure site stability and erosion control, including the use of a native seed mixture. After grading activities have been completed, disturbed areas that contain fine sediment would be seeded with a certified organic and weed-free native grass seed mixture including the species blue wildrye (*Elymus glaucus*), California brome (*Bromus carinatus*), small fescue (*Vulpia microstachys*), and creeping wildrye (*Leymus triticoides*). Native trees would be marked with flagging and fenced if close to Action Area to prevent disturbance. Existing native trees with a diameter of at least 6 in (15.2 cm) would be protected with appropriately sized buffers, to the extent possible. There would be no impacts on heritage size trees (i.e., greater than 16 in [40.6 cm] dbh). Native riparian tree and shrub species, such as Fremont Cottonwood, willow, and elderberry would be planted in selected areas to compensate for the removal of riparian shrubs and trees during Proposed Project implementation and the replacement of non-native vegetation.

To mitigate for any loss of native trees impacted by Proposed Project implementation, the contractor would follow the guidelines below:

- Oaks having a dbh of three to five inches would be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a dbh greater than five inches would be replaced in kind at a ratio of 5:1.
- Riparian trees (i.e., willow, cottonwood, sycamore, alder, ash, etc.) would be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed.

Measures would be taken to ensure a minimum performance criteria of 70% survival of planted trees. Irrigation would not be used, but the combination of lowering the existing ground level and the return of frequent inundation to the floodplain is expected to promote growth of native riparian species (Sellheim et al. 2016). Frequent inundation of the floodplain and side channel habitats created by the Proposed Project would support recruitment and survival of vegetation within the Action Area. Numerous native plant taxa, including both upland and wetland species, are expected to colonize newly created floodplain and secondary channels (Sellheim et al. 2016).

2.2.4 Project Monitoring

A detailed Monitoring Plan has been developed for the Proposed Project, with the primary goal of defining the current state of the system before rehabilitation and determining whether the implemented Proposed Project had the desired effect on target species and overall system health

(**Table 1**; CFS 2020). The Monitoring Plan is intended to be a working document, and would be further refined with input from DWR, USFWS AFRP, NMFS, CDFW, the Corps, and other Merced River stakeholders, as appropriate.

The monitoring program consists of four conceptual approaches to monitoring: 1) pre-project site description, 2) implementation, 3) effectiveness, and 4) validation. Pre-project monitoring helps identify the baseline for the Proposed Project including the identification of deficiencies in ecosystem health and for detecting change over time (Roni and Quimby 2005). Implementation monitoring would determine if the Proposed Project was installed according to the design standards. Hydrology, topography/bathymetry, sediment dynamics, and vegetation would be assessed. The effectiveness monitoring would determine if the Proposed Project was effective in meeting target infrastructure and habitat objectives. A range of physical and biological traits would be tracked before and after rehabilitation to assess ecosystem function. Pre-project monitoring is essential for effectiveness monitoring because it establishes an objective baseline to against which to compare post-project conditions and determine whether the Proposed Project effectively enhanced diversion function and native fish habitat. Finally, validation monitoring would be conducted to confirm the underlying assumptions of the Proposed Project and determine whether diversion improvements, like the Proposed Project, effectively enhance diversion function and salmonid production. The monitoring efforts described in this plan would improve understanding of rehabilitated ecosystem function and the potential of modernizing diversions and rehabilitating associated main channel habitats to enhance salmonid populations within the Merced River and other CV rivers impacted by riparian diversions and historic dredge mining.

A before-and-after-control-impact (BACI) study design structure would be used to test the differences between the non-rehabilitated and rehabilitated diversions (Green 1979). This approach is ideal for rehabilitation effectiveness monitoring because it utilizes a paired series of Control-Impact diversions (in this case, “impact” is the rehabilitation treatment), subjected to a series of Before-After replicated measurements, allowing for discrimination between response to rehabilitation and stochastic environmental variability (Bernstein and Zalinski 1983; Stewart-Oaten et al. 1986; Smith 2002). Pre-project monitoring would provide baseline data on current channel extent, vegetation composition, physical and biological conditions (i.e., depth, flow, DO, invertebrates, sediment composition), presence of non-target species (i.e., birds, amphibians, etc.), and photo documentation of site conditions. The post-project monitoring would provide detailed information on physical and biological characteristics, including recruitment of native vegetation, fish use and diet composition, prey production, and various physical parameters (i.e., temperature, flow, DO) critical to habitat development.

This approach would follow previous rehabilitation actions taken on the Yuba, Mokelumne, Merced, and Stanislaus rivers to rehabilitate productive adult spawning habitat and juvenile rearing habitat and monitor Proposed Project performance. The monitoring approach would include measures to ensure the implementation was successful and to document the Proposed Project’s effectiveness at recovering juvenile salmonid rearing habitat by determining that essential ecosystem linkages (i.e., appropriate physical conditions, fish access and survival) are intact, and validation studies to test habitat function. The monitoring team would collaborate with diverters to address any concerns, conduct public outreach to foster support for river

rehabilitation, and broadly communicate results to stakeholders, scientists, and the public. The study design would maximize information richness available to decision makers by building on previous and existing work to improve and refine rehabilitation actions, by conducting efficient monitoring, and fostering public support for river rehabilitation. Effort would be made to integrate the monitoring work with other ongoing rehabilitation projects. In the past decade, Kondolf (1995) noted an increased frequency of river rehabilitation projects, but the rarity of systematic post-project evaluation.

Two recent papers (Moyle and White 2002, Moyle and Israel 2005) have highlighted the mismatch between the strong interest in screening diversions to mitigate against adverse effects on fish and the paucity of studies evaluating either the effectiveness of screens at preventing fish loss or the cumulative fish loss at smaller agricultural diversions in the CV. Evaluation is essential to advance river rehabilitation science (Kondolf 1995; Roni and Quimby 2005) and document the Proposed Project effectiveness. The Proposed Project team is dedicated to conducting scientifically robust monitoring and would define quantifiable objectives, gather and analyze baseline data and post-project data, use a hypothesis-testing approach, and use the best available science to implement, evaluate, and monitor ecosystem function in the Action Area. All monitoring data collected would be submitted for inclusion in the California Natural Diversity Database, as appropriate.

A detailed description of the biological monitoring actions related to this project is available in Appendix C.

2.2.5 Mitigation Measures

The Proposed Project shall implement appropriate mitigation measures to reduce the impacts to the surrounding environment to less than significant levels. Environmental consequences for resource areas assume the measures specified will be fully implemented. The Proposed Project shall also use accepted BMPs associated with using large construction equipment in sensitive environments and flagging and/or fencing of sensitive plant species to prevent harm. The mitigation measures are described in the appropriate sections of the Environmental Impacts checklist and are also summarized in the MMRP (Appendix B).

Table 1. The performance evaluation approach for the Project on the lower Merced River.

Biological and Ecological Objective	Question or Hypothesis to Evaluate	Monitoring Variables and Data Collection Approach	Evaluation Approach
Reduce agricultural water demands for the LMR without adversely impacting water right holders	Water removal beyond what is required by diverters will be reduced following diversion enhancement.	TBD water diversion monitoring to be facilitated by Merced ID and diverters, Water surface elevation	Analyze data to determine if design criteria are met to 95% confidence
Reduce/eliminate direct mortality of fish at diversions due to entrainment and impingement	Diversion design and screen improvements will reduce fish entrainment in canals.	Monitor fish use via snorkel surveys and collect screen performance metrics	Analyze data to determine if design criteria are met; document juvenile fish use
Increase salmonid production via gravel augmentation and the creation/improvement of spawning habitat for adult salmonids	Spawning habitat quantity and redd construction within diversion footprints will increase following enhancement.	2D spawning habitat modeling, Monitor fish use (via redd surveys), gravel movement/scour, depth, velocity, egg survival, substrate, topography, flow, physical parameters	Document adult fish use
Increase juvenile salmonid survival by improving incubating and rearing habitat for juvenile salmonids	Juvenile salmonid rearing capacity and abundance within diversion footprints will increase following enhancement.	2D spawning habitat modeling, Monitor fish use, diet composition, consumption rate, invertebrate density and composition, and physical parameters	Document fish foraging success; Conduct *in situ* experiments to assess modeled growth potential
Reduce local abundance of non-native fish predators on salmonids and opportunities for predation through habitat rehabilitation	Habitat conditions that favor nonnative predators and predation on juvenile salmonids will be reduced or eliminated following diversion enhancement.	2D predator habitat modeling, monitor fish use via snorkel surveys, determine predation rates via predation assays	Analyze data to determine if design criteria are met, conduct *in situ* experiments to assess modeled predation potential
Increase salmonid production by reducing migration costs to adult and juvenile salmonids	Diversion enhancement will facilitate fish passage for migrating and out-migrating salmonids.	2D habitat modeling of conditions during migration windows	Analyze data to determine if design criteria are met
Rehabilitated habitats persist in the system as designed, so long as current flow and sediment regimes are maintained	Spawning riffles that control diversion flow rates will persist under the current flow and sediment regime for 5-10 years (depending on hydrologic conditions)	Topographic surveys DEM differencing	Analyze data to determine if design criteria are met

3 Environmental Impacts Analysis

3.1 Environmental Factors Potentially Affected

The following checked environmental factors would be potentially affected by this project, involving at least one "Potentially Significant Impact," as indicated by the checklist on the following pages.

☐	Aesthetics	☐	Agriculture and Forestry	☐	Air Quality
☐	Biological Resources	☐	Cultural Resources	☐	Energy
☐	Geology/Soils	☐	Greenhouse Gas Emissions	☐	Hazards and Hazardous Materials
☐	Hydrology/Water Quality	☐	Land Use/Planning	☐	Mineral Resources
☐	Noise	☐	Population/Housing	☐	Public Services
☐	Recreation	☐	Transportation	☐	Tribal Cultural Resources
☐	Utilities/Service Systems	☐	Wildfire	☐	Mandatory Findings of Significance

DETERMINATION:

On the basis of this initial evaluation:

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

Signature: Kirsten Sellheim	**Date: 1/27/2022**
Printed Name: Kirsten Sellheim	**For: Cramer Fish Sciences**

3.2 Evaluation of Environmental Impacts

1. A brief explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, according to a project-specific screening analysis).

2. All answers must take account of the whole action involved, including offsite as well as onsite, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3. After the lead agency has determined that a particular physical impact might occur, then the checklist answers must indicate whether the impact is potentially significant, less than significant with mitigation, or less than significant. "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect might be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an environmental impact report (EIR) is required.

4. "Negative Declaration: Less Than Significant with Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level.

5. Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration (Section 15063(c)(3)(D)). In this case, a brief discussion should identify the following:

   a) Earlier Analysis Used. Identify and state where they are available for review.

   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.

   c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures that were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

6. Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans and zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

7. Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.
8. This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.
9. The explanation of each issue should identify the following:
    a) The significance criteria or threshold, if any, used to evaluate each question
    b) The mitigation measure identified, if any, to reduce the impact to less than significance

3.3 California Environmental Quality Act

The CEQA Guidelines (California Code of Regulations Section 15000-15387) apply only to discretionary governmental activities that are defined as "projects". A project is defined as the whole of an action that has the potential for resulting in either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment. Merced ID determined that the project would not result in potentially significant impacts and has elected to prepare an IS/MND. Under CEQA, the purpose of an IS/MND is to provide objective information to public decision makers and the public regarding potential environmental effects of the project. Merced ID intends to use this IS/MND to identify the impacts likely to result from implementation of the project.

This document was developed under current CEQA guidelines (updated 28 December 2018). All affected resource sections in the current Appendix G are evaluated in this IS/MND.

4 Initial Study/Environmental Impacts Checklist

I. Aesthetics	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Except as provided in Public Resources Code Section 21099, would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from a publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?	☐	☐	☐	☒
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

Discussion:

a) All locations to be targeted by the Proposed Project are visible to persons using the main channel of the Merced River for recreation, primarily individuals rafting or floating down past the diversions during the summer months, with the heaviest use occurring on weekends and holidays. Generally, diversion canals and other off-channel areas targeted for enhancement would not be visible to persons rafting down the river. However, construction related to diversion enhancements at Cuneo will occur across the LMR from Henderson Park, a popular public access location for kayaks, inflatable rafts, and inner tubes. The Cowell 1 and 2 diversions are in a section of the river that is less frequently used for public recreation resulting from a lack of public river access points. Temporary changes in visual resources would result during re-siting diversions as necessary, and during excavation, grading, and transport of material within the Action Area in this rural area of Merced County. Construction activities would not occur on the weekends when public use is the highest; therefore, potential impacts to visual resources during Proposed Project construction would be minimized. Construction activities would also only occur during typical work hours (7 am to 5 pm) on weekdays. The main channel of the Merced River adjacent to diversions during construction activities would always be passable for rafters so will not create hazards or interfere with public use. When the Proposed Project is complete, the visual resources would be improved as river users would be able to see a more natural channel configuration that is more easily navigable due to the elimination of temporary berms and associated upstream pools that are currently ideal habitat for non-native aquatic vegetation. The Proposed Project is also expected to enhance the rafting experience as the number of riffles within the Action Area would be increased concurrent with the loss of deep, slow pool habitat. Because impacts would be relatively short term and

temporary with construction activities not occurring on weekends, the peak use time, impacts on visual resources are considered **less than significant**.

b) Only one of the targeted diversions, Cuneo, would be visible from a public access point to the LMR, Henderson Park. However, the diversion is on the opposite side of the river from Henderson Park and most construction would not be visible from the park due to visual obstruction by riparian vegetation. The Project would have a limited construction season, work during normal weekday working hours, and only take two construction seasons to complete (Cowell 1 and 2 are expected to be completed in year 1 and Cuneo in year 2, each site would take one construction season to complete). No trees visible from Henderson Park would be removed by the Proposed Project. With the limited amount of one of the diversions visible from Henderson Park and the temporary nature of the Proposed Project construction, there will be **no impacts** on scenic resources**.** After completion of the Proposed Project, the scenic resources are expected to be improved as a more natural looking river channel would be created.

c) Temporary changes in visual resources would result during any required re-siting of diversions and during excavation, grading, and transport of material within the site in this rural area of Merced County. Under the Proposed Project, the movement of material away from and within the Action Area would only be visible in limited areas of the river adjacent to the site. Furthermore, because impacts would be relatively short term and temporary, impacts on visual resources are considered less than significant. The Action Area has limited visibility to the general public, a small section of one of the targeted diversions can be observed from Henderson Park. Therefore, there will be a **less than significant impact** on the existing visual character or quality of public views of the site and its surroundings.

d) The Proposed Project is designed for salmonid habitat rehabilitation that involves the modernization of diversions to bring them into accordance with current best operational practices, associated excavation and grading adjacent to the Merced River, and substrate addition into the channel to create features beneficial for salmonid spawning and rearing. These rehabilitation activities would not create a new source of light or glare; therefore, the Project would have **no impact** on day or nighttime views.

Documentation:

None.

Mitigation:

None required.

II. Agriculture and Forest Resources	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and the forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

Discussion:

a) The Action Area is in the eastern CV in northeastern Merced County. The Action Area is designated as agricultural in the Merced County General Plan (Merced County 2013). The CDC Farmland Mapping and Monitoring Program designated the land where Cuneo is located as "Vacant or Disturbed Land" but the land adjacent to Cuneo, on top of the bluff, as Prime Farmland. Cowell 1 is located on "Vacant or Disturbed Land" but there is Prime Farmland approximately 600 feet north. Cowell 2 is located on land designated as "Grazing Land" but there is adjacent land just to the south on top of a bluff designated as "Farmland of Statewide Importance" (CDC 2014). However, the Proposed Project would not convert any farmland to a non-agricultural use. The Proposed Project would improve agricultural diversion facilities. Therefore, the Proposed Project would have **no impact**.

b) The land surrounding the Action Area is zoned as agricultural in the Merced County General Plan. Cowell 1 and 2 diversions and adjacent lands are under Williamson Act contract. Cuneo is not located on land nor is there adjacent land under Williamson Act contract. The Proposed Project would enhance agricultural diversions and in-channel habitat which does not conflict with the current zoning or Williamson Act contracts (CDC 2016). Therefore, the Proposed Project would have **no impact**.

c) There is no forest land, timberland, or timberland zoned Timberland Production in the Action Area. Therefore, the Proposed Project would have **no impact.**

d) There is no forest land in the Action Area. Therefore, the Proposed Project would have **no impact.**

e) e) The Proposed Project does not involve the conversion of agricultural or forest land. Therefore, the Proposed Project would have **no impact.**

Documentation:

California Department of Conservation (CDC). 2021. California Important Farmland Finder. Accessed 14 July 2021. https://maps.conservation.ca.gov/dlrp/ciff/

CDC. 2016. Merced County Williamson Act FY 2013/2014, Sheet 1 of 2.

Merced County. 2013. Merced County General Plan Land Use Policy Diagram. Accessed 14 July 2021. https://www.co.merced.ca.us/DocumentCenter/View/3619/General-Plan-and-Zoning

Mitigation:

None required.

III. Air Quality	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable Air Quality Attainment Plan or Congestion Management Plan?	☐	☐	☐	☒
b) Violate any stationary source air quality standard or contribute to an existing or projected air quality violation?	☐	☐	☒	☐
c) Result in a net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☒	☐
d) Create or contribute to a non-stationary source "hot spot" (primarily carbon monoxide)?	☐	☐	☐	☒
e) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
f) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

Discussion:

a) The Proposed Project does not conflict with or obstruct implementation of the San Joaquin Valley Air Quality Attainment Plan or Congestion Management Plan. There would be **no impact.**

b) The Proposed Project is within the San Joaquin Valley Air Basin. The San Joaquin Valley Unified Air Pollution Control District (Valley Air) is responsible for monitoring air quality in Merced County (SJVAPCD 2015). The Clean Air Act requires the EPA to set National Ambient Air Quality Standards to protect public health. National standards have been set for the following; ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, respirable particulate matter (particulate matter less than 10 microns in diameter; PM-10), fine particulate matter (particulate matter less than 2.5 microns in diameter; PM-2.5), and lead (**Table 2**). The air quality in the San Joaquin Valley Air Basin has been designated nonattainment by the Air Resources Board for ozone, PM-10, and PM-2.5 and by the EPA for Ozone and $PM_{2.5}$ (**Table 2**) (SJVAPCD 2015).

The federal Clean Air Act and the California Clean Air Act require areas that are designated nonattainment to reduce emissions until standards are met. Air quality is affected by a combination of air contaminants, meteorological conditions, and the topographical configuration of the valley. A primary factor responsible for the increase of air pollution is the increased amount of pollutants and particulate matter produced by vehicles, industrial processes, mining operations, and agricultural activities, such as burning and ground disturbance.

Table 2. Designation/classification for criteria pollutants in the San Joaquin Valley Air Basin based on federal and state standards.

Pollutant	Federal Standards	State Standards
Ozone – One Hour	No Federal Standard	Nonattainment/Severe
Ozone – Eight Hour	Nonattainment/Extreme	Nonattainment
PM 10	Attainment	Nonattainment
PM 2.5	Nonattainment/Moderate	Nonattainment
Carbon Monoxide	Attainment/Unclassified	Attainment/Unclassified
Nitrogen Dioxide	Attainment/Unclassified	Attainment
Sulfur Dioxide	Attainment/Unclassified	Attainment
Lead (Particulate)	No Designation/Classification	Attainment
Hydrogen Sulfide	No Federal Standard	Unclassified
Sulfates	No Federal Standard	Attainment
Visibility Reducing Particles	No Federal Standard	Unclassified
Vinyl Chloride	No Federal Standard	Attainment

The Proposed Project may cause temporary changes in air quality in the area, including potentially the generation of dust and small particulates from the operation of equipment and the excavation and transportation of material related to any required re-siting of diversions and creation of in-channel restoration features. Restoration activities may potentially result in localized, short-term emissions. Activities are temporary, so any changes in air quality due to the Proposed Project would be limited in duration.

Small quantities of dust may occasionally be produced and result in temporary increases in PM_{10} concentrations. Heavy equipment used during construction may include loaders, excavators, bulldozers, backhoes, haul trucks, and a mobile sorting station; emissions estimates by phase compared with Valley Air emissions thresholds are summarized in **Table 3**. A water truck would be used periodically throughout the workday to reduce the dust (**AIR-1 – Reduce Dust and Air Quality Impacts**). This would result in a **less than significant impact**.

c) Valley Air has established criteria for determining local air basin impact significance (SJVAPCD 2015). For the purpose of determining significance, the District's criteria for emissions of carbon monoxide is 100 tons per year (tpy), nitrogen oxides (NO_x) and reactive organic gases (ROG) are 10 tpy for each, sulfur oxides (SO_x) are 27 tpy, and PM_{10} and $PM_{2.5}$ are 15 tpy for each (**Table 3**). Proposed Project emissions that exceed the threshold limits set forth by the District are considered significant and require mitigation. Valley Air has not established a significance threshold for construction greenhouse gas (GHG) emissions. Therefore, to evaluate GHG emissions for the Proposed Project under CEQA, the SMAQMD threshold of 1,100 metric tons (1213 tons) of CO_{2e} was adopted (ARB 2014).

Table 3. The emissions estimates of criteria pollutants for the Project in tons per year compared to the Valley Air significance thresholds and *de minimis* thresholds (SJVAPCD 2015).

	NO_x (tpy)	ROG (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	CO (tpy)	SO_2 (tpy)
Project Year 1 (Cowell 2)	0.53	0.14	1.43	0.31	2.71	0.01
Project Year 2 (Cowell 1 and Cuneo)	0.73	0.14	1.44	0.31	2.73	0.01
Valley Air Threshold	10	10	15	15	100	27
Valley Air *de minimis* Threshold	25	25	100	100	100	100

Section 176 (C) of the Clean Air Act (42 U.S.C. 7506 (C)) requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses or permits, or approves any activity to demonstrate that the action conforms to the applicable State Implementation Plan required under Section 110 (a) of the Federal Clean Air Act (42 U.S.C. 7401 [a]) before the action is otherwise approved. In this context, conformity means that such federal actions must be consistent with State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards and achieving expeditious attainment of those standards. Each federal agency must determine that any action proposed by the agency and subject to the regulations implementing the conformity requirements would conform to the applicable State Implementation Plan before the action is taken.

On 30 November 1993, the EPA promulgated final general conformity regulations at 40 CFR 93 Subpart B for all federal activities except those covered under transportation conformity. The general conformity regulations apply to a proposed federal action in a non-attainment or maintenance area if the total of direct and indirect emissions of the relevant criteria pollutants and precursor pollutant caused by the Project equal or exceed certain *de minimis* amounts thus requiring the federal agency to make a determination of general conformity.

The emissions estimates for criteria pollutants from the Proposed Project were estimated using the SMAQMD Road Construction Emissions Model Version 9.0.0 (Appendix E). Rehabilitation activities may potentially result in localized, short-term emissions. Emissions may include hydrocarbons, NO_x, sulfur oxides, carbon monoxide, and particulate matter. Activities are temporary, so any changes in air quality due to the Proposed Project would be limited in duration. Fugitive dust may be emitted during use of earth working equipment. Fugitive dust emissions during rehabilitation activities would vary daily based on activity type and level, fines content of the sediment, and the weather. Fine sediment composition is low throughout the Action Area; the majority of areas that would be disturbed are dredge tailings piles which consist largely of gravel and cobble.

The emissions estimates for criteria pollutants are all substantially below the Valley Air significance thresholds and implementation of **AIR-1 – Reduce Dust and Air Quality Impacts** would minimize the production of fugitive dust. Therefore, this impact is **less than significant**.

d) The Proposed Project would not create or contribute to a non-stationary source "hot spot" (primarily carbon monoxide). The Proposed Project construction is limited in scope and duration,

and over the long term the Proposed Project would contribute to improving air quality, through restoration of river function, which includes native tree establishment and growth. Therefore, there is **no impact**.

e) Sensitive receptors include hospitals, schools, daycare facilities, elderly housing, and convalescent facilities. The occupants of these facilities, children, elderly, and the infirm, are more sensitive to poor air quality and associated health effects than the general population. In addition, residential areas are considered sensitive receptors because the general public spends substantial amounts of time at home. The closest sensitive receptor to the Action Area, the Snelling-Merced Falls Elementary School, is approximately 3 miles west of Cowell 1, and rehabilitation activities would occur within a single season. Therefore, **no impact** is expected.

The Proposed Project would result in short term emissions of diesel particulate matter. Heavy equipment, including excavators and front-end loaders, all run on diesel and would produce diesel emissions during excavation, grading, transport, and placement of material. Valley Air has not adopted a methodology for analyzing the impact of diesel particulate matter emission. However, the estimated emissions of PM_{10} are substantially below the significance threshold (**Table 3**). Considering the Proposed Project's two to three year construction period and that thee rehabilitation activities are occurring in an area with few nearby residences or businesses, it is not likely that the Proposed Project would expose sensitive receptors to substantial pollutant concentrations. Therefore, **no impact** is expected**.**

f) The only objectionable odor that may be produced by the Proposed Project would be from diesel exhaust from operation of heavy equipment and a mobile screening plant. The closest residences to the Action Area where construction would occur are nearly 0.2 miles southwest of the Cuneo diversion, 0.5 miles west of the Cowell 1 diversion, and 0.8 miles southwest of Cowell 2 diversion. Overall, there are a low number of residences in the immediate vicinity of the Proposed Project and the area is primarily agricultural. The nearest residents are widely spaced, typical of rural areas. Diesel exhaust from rehabilitation activities would be restricted to the limited two-year construction season and would dissipate over time and distance. Therefore, diesel exhaust resulting from construction activities would not be expected to create objectionable odors which would affect a substantial number of people, resulting in **no impact**.

Documentation:

California Air Resources Board (ARB). 2014. *Final Regulation Order, Area Designations for State Ambient Air Quality Standards*. Chapter 1. Air Resources Board. Subchapter 1.5. Air Basins and Air Quality Standards. Article 1.5. Area Pollutant Designations. Accessed August 19, 2017. http://www.arb.ca.gov/regact/2013/area13/area13fro.pdf.

San Joaquin Valley Air Pollution Control District (SJVAPCD). 2015. *Guidance for Assessing and Mitigating Air Quality Impacts*. Accessed July 14, 2021. http://www.valleyair.org/transportation/GAMAQI_3-19- 15.pdf.

U.S. Environmental Protection Agency (EPA). 2021. *Green Book – California Nonattainment/Maintenance Status for Each County By Year for All Criteria Pollutants, As of June 30, 2021*. Accessed July 14, 2021. https://www3.epa.gov/airquality/greenbook/anayo_ca.html

Mitigation:

AIR-1. Reduce Dust and Air Quality Impacts.
The following dust reduction measures shall be implemented during movement of materials from the construction staging areas to sites where gravel augmentation occurs to reduce construction-related emissions:

- wet materials to limit visible dust emissions using water;
- provide at least 6 in (15.2 cm) of freeboard space from the top of the container; or,
- cover the container.

The following dust reduction measure shall be implemented during cobble and gravel placement to reduce construction-related emissions:

- limit or promptly remove any of mud or dirt on construction equipment and vehicles at the end of each workday, or once every 24 hours.

The following measure shall be implemented to ensure that emissions meet current air quality standards:

- the off-road work fleet average at a minimum must meet the current California Air Resources Control Board standards, including the use of Tier 4 emission standards of at least 0.3 g/hp-hr Nitrogen Oxides (NOx).

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

Discussion:

a) Special status species are species that are classified as such based on the following categories:

1. Species listed or proposed for listing on the federal ESA as threatened or endangered (animals: 50 CFR §17.11, plants: 50 CFR §17.12, and proposed species: federal register notices)
2. Candidate species for possible future federal ESA listing as threatened or endangered (61 FR 40)
3. Species listed or proposed for listing under the CESA as threatened or endangered (14 California Code of Regulations §670.5)
4. Plants listed as rare or endangered under the California Native Plant Protection Act (California Fish and Game Code, Section 1900 et seq.)
5. CDFW designated species of special concern (CDFW 2021)
6. Animals designated as fully protected under California Fish and Game Code (birds: Section 3511, mammals: 4700, and reptiles and amphibians: 5050)

7. Species that meet the definition of rare or endangered even if not on one of the official lists (CEQA Guidelines, Section 15380)
8. Plants considered by the CNPS and CDFW to be rare, threatened or endangered in California (California Rare Plant Rank 1A, 1B, and 2) as well as California Rare Plant Rank 3 and 4 species (CNPS 2021)

An official species list was requested for the entire Action area from the USFWS on 1 February 2021, by accessing their database: https://ecos.fws.gov/ipac/ (Consultation Code: 08ESMF00-2018-SLI-1003). The California Department of Fish and Wildlife, CNDDB was queried for records of protected species within 10 miles of the four diversions targeted by the Proposed Project (CDFW 2021). The two lists were combined to create **Table 4** and **Table 5**.

Pre-project vegetation surveys of the Action Area were performed in 2020 and 2021 by CFS. Several species listed by state and federal agencies as threatened, endangered, or a species of special concern are present in the LMR vicinity (CDFW 2021; USFWS 2021). **Table 4** lists the special status species that have the potential to occur in the Action Area (Nine quadrangles surrounding the Snelling quadrangle and the nine quadrangles surrounding the Winton quadrangle, for a total of 14 quadrangles as the Snelling and Winton quadrangles meet at their respective southwest and northeast corners) and may be affected by rehabilitation activities. This list includes spring and winter-run Chinook Salmon listed in the USFWS Sacramento Endangered Species Program database (http://www.fws.gov/sacramento/es/default.htm). While spring and winter-run Chinook Salmon are on this list, they do not include the San Joaquin River or tributaries as habitat in their respective National Oceanic and Atmospheric Administration (NOAA) Evolutionary Significant Unit (ESU) determinations (http://www.nwr.noaa.gov/ESA-Salmon-Listings/), as defined in Federal Register 50 CFR Parts 222 and 226. These species are not listed for the Snelling or Merced Falls quadrangles in the CDFW CNDDB (http://www.dfg.ca.gov/biogeodata/cnddb/). Spring-run Chinook Salmon have been extirpated from the San Joaquin Basin (NMFS 2014). An experimental hatchery population is being propagated on the San Joaquin River; however, no strays from the experimental population have been documented in the Merced River, so we assume there would be no adverse impacts to this ESU. Winter-run Chinook Salmon are not present in the San Joaquin Basin nor were they likely historically present; therefore, we assume there would be no adverse impacts to this ESU.

Table 6 lists the critical periods when disturbance could result in significant impacts to individuals or populations of special status species. To avoid these impacts, all in-water work would be conducted during the period 15 July through 15 October, which is outside the listed critical periods for aquatic species listed in the table as having the potential to occur within the Action Area (**Table 6)**. No in-stream work would occur after 15 October to avoid impacts to spawning Chinook Salmon. Mitigation measures will be employed when ground-disturbing work occurs within the critical periods, as discussed below.

Table 4. Federal and state special status species that may occur in the Prt Area. Data compiled from the USFWS database for Merced County (USFWS 2021) and from the CNDDB database by searching the Snelling and Winton quadrangles and eight adjoining quadrangles of each (CDFW 2021).

Species	Status[1]	Effects[2]	Potential to occur and summary basis for ESA determination[3]
Amphibians and Reptiles			
California Tiger Salamander *Ambystoma californiense*	FT, ST, SWL	NLAA	Possible
Foothill Yellow-legged Frog *Rana boylii*	SE, SSC	NLAA	Possible
Western Spadefoot *Spea hammondii*	SSC	NLAA	Possible
Western Pond Turtle *Emys marmorata*	SSC	NLAA	Possible
Birds			
Osprey *Pandion haliaetus*	SWL	NLAA	Likely
Cooper's Hawk *Accipiter cooperii*	SWL	NLAA	Likely
Ferruginous Hawk *Buteo regalis*	SWL	NLAA	Likely
Swainson's Hawk *Buteo swainsoni*	ST	NLAA	Likely
Northern Harrier *Circus hudsonius*	SSC	NLAA	Likely
White-tailed Kite *Elanus leucurus*	SFP	NLAA	Likely
Yellow-breasted Chat *Icteria virens*	SSC	NLAA	Likely
Tricolored Blackbird *Agelaius tricolor*	ST, SSC	NLAA	Likely
California Horned Lark *Eremophila alpestris actia*	SWL	NLAA	Likely
Bald Eagle *Haliaeetus leucocephalus*	SE, SFP	NLAA	Possible
Golden Eagle *Aquila chrysaetos*	SFP, SWL	NLAA	Possible
Burrowing Owl *Athene cunicularia*	SSC	NLAA	Possible
Fish			
Hardhead *Mylopharodon conocephalus*	SSC	NLAA	Present
Fall-run Chinook Salmon *Oncorhynchus tshawytscha*	FSC, NMFS, EFH	NLAA	Present
Riffle Sculpin *Cottus gulosus*	SSC	NLAA	Possible
San Joaquin Roach *Lavinia symmetricus*	SSC	NE	Possible
Pacific Lamprey *Entosphenus tridentatus*	SSC	NLAA	Possible
Western River Lamprey *Lampetra ayresii*	SSC	NLAA	Possible
Kern Brook Lamprey *Lampetra hubbsi*	SSC	NLAA	Possible
Western Brook Lamprey *Lampetra richardsoni*	SSC	NLAA	Possible
California Central Valley steelhead *Oncorhynchus mykiss*	FT	NLAA	Unlikely
Invertebrates			
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus*	FT	NLAA	Possible
Crotch's Bumble Bee *Bombus crotchii*	SSC	NLAA	Possible
Mammals			
Western Red Bat *Lasiurus blossevillii*	SSC	NE	Possible
Townsend's Big-eared Bat *Corynorhinus townsendii*	SSC	NE	Possible
Western Mastiff Bat *Eumops perotis californicus*	SSC	NE	Possible
Plants			
Hoover's Calycadenia *Calycadenia hooveri*	RP 1B.3	NE	Likely

Beaked Clarkia *Clarkia rostrata*	RP 1B.3	NE	Possible
Dwarf Downingia *Downingia pusilla*	RP 2B.2	NE	Possible
Heckard's Pepper-grass *Lepidium latipes heckardii*	RP 1B.2	NE	Possible
Little Mousetail *Myosurus minimus apus*	RP 3.1	NE	Possible
Merced Phacelia *Phacelia ciliata opaca*	RP 3.2	NE	Possible
Hartweg's Golden Sunburst *Pseudobahia bahiifolia*	FE, SE, RP 1B.1	NE	Possible

Table 5. Federal and state special status species that is unlikely or will not occur in the Action Area. Data compiled from the USFWS database for Merced County (USFWS 2021) and from the CNDDB database by searching the Snelling and Winton quadrangles and eight adjoining quadrangles of each (CDFW 2021).

Species	**Status[1]**	**Effects [2]**	**Potential to occur and summary basis for ESA determination[3]**
Amphibians and Reptiles			
California Red-legged Frog *Rana draytonii*	FT, SSC	NLAA	Unlikely
Giant Gartersnake *Thamnophis gigas*	FT, ST	NLAA	Unlikely
Northern California Legless Lizard *Anniella pulchra*	SSC	NLAA	Unlikely
Blunt-nosed Leopard Lizard *Gambelia sila*	FE, SE, SFP	NE	Absent
Coast Horned Lizard *Phrynosoma blainvillii*	SSC	NE	Absent
Birds			
Double-crested Cormorant *Phalacrocorax auritus*	SWL	NLAA	Unlikely
Merlin *Falco columbarius*	SWL	NLAA	Unlikely
Black Tern *Chlidonias niger*	SSC	NLAA	Unlikely
Mountain Plover *Charadrius montanus*	SSC	NE	Absent
Least Bell's Vireo *Vireo bellii pusillus*	FE, SE	NE	Absent
California Condor *Gymnogyps californianus*	FE	NE	Absent
Fish			
Sacramento Hitch *Lavinia exilicauda exilicauda*	SSC	NlAA	Unlikely
Sping-run Chinook Salmon *Oncorhynchus tshawytscha*	FT, ST	NLAA	Unlikely
Sacramento Splittail *Pogonichthys macrolepidotus*	SSC	NLAA	Unlikely
Delta Smelt *Hypomesus transpacificus*	FT, SE	NE	Absent
Winter-run Chinook Salmon *Oncorhynchus tshawytscha*	FE, SE, SSC	NE	Absent
Invertebrates			
Vernal Pool Tadpole Shrimp *Lepidurus packardi*	FE	NE	Absent
Conservancy Fairy Shrimp *Branchinecta conservatio*	FE	NE	Absent
Vernal Pool Fairy Shrimp *Branchinecta lynchi*	FT	NE	Absent
Mammals			
Pallid Bat *Antrozous pallidus*	SSC	NE	Unlikely

American Badger *Taxidea taxus*	SSC	NE	Unlikely
Giant Kangaroo Rat *Dipodomys ingens*	FE	NLAA	Absent
Fresno Kangaroo Rat *Dipodomys nitratoides exilis*	FE	NLAA	Absent
San Joaquin Kit Fox *Vulpes macrotis mutica*	FE, ST	NLAA	Absent
Fisher *Pekania pennanti*	FE	NE	Absent
Plants			
Henderson's Bent Grass *Agrostis hendersonii*	RP 3.2	NLAA	Unlikely
Alkali Milk-vetch *Astragalus tener var. tener*	RP 1B.2	NE	Unlikely
Lesser Saltscale *Atriplex minuscula*	RP 1B.1	NE	Unlikely
Heartscale *Atriplex cordulata cordulata*	RP 1B.2	NE	Unlikely
Small-flowered Morning-glory *Convolvulus simulans*	RP 4.2	NE	Unlikely
Ewan's Larkspur *Delphinium hansenii ewanianum*	RP 4.2	NE	Unlikely
Spiny-sepaled Button-celery *Eryngium spinosepalum*	RP 1B.2	NE	Unlikely
San Joaquin Spearscale *Extriplex joaquinana*	RP 1B.2	NE	Unlikely
Hogwallow Starfish *Hesperevax caulescens*	RP 4.2	NE	Unlikely
Forked Hare-leaf *Lagophylla dichotoma*	RP 1B.1	NE	Unlikely
Shining Navarretia *Navarretia nigelliformis radians*	RP 1B.2	NE	Unlikely
California Alkali Grass *Puccinellia simplex*	RP 1B.2	NE	Unlikely
Keck's Checkerbloom *Sidalcea keckii*	FE, RP 1B.1	NE	Unlikely
Vernal Pool Smallscale *Atriplex persistens*	RP 1B.2	NE	Absent
Watershield *Brasenia schreberi*	RP 2B.3	NE	Absent
Fleshy Owl's-clover *Castilleja campestris succulenta*	FT, SE, RP 1B.2	NE	Absent
Mariposa Clarkia *Clarkia biloba australis*	RP 1B.2	NE	Absent
Hoover's Cryptantha *Cryptantha hooveri*	RP 1A	NE	Absent
Mariposa Cryptantha *Cryptantha mariposae*	RP 1B.3	NE	Absent
Peruvian Dodder *Cuscuta obtusiflora glandulosa*	RP 2B.2	NE	Absent
Delta Button-celery *Eryngium racemosum*	SE, RP 1B.1	NE	Absent
Hoover's Spurge *Euphorbia hooveri*	FT, RP 1B.2	NE	Absent
Stinkbells *Fritillaria agrestis*	RP 4.2	NE	Absent
Foothill Jepsonia *Jepsonia heterandra*	RP 4.3	NE	Absent
Coulter's Goldfields *Lasthenia glabrata coulteri*	RP 1B.1	NE	Absent
Merced Monardella *Monardella leucocephala*	RP 1A	NE	Absent
Pincushion Navarretia *Navarretia myersii myersii*	RP 1B.1	NE	Absent
Prostrate Vernal Pool Navarretia *Navarretia prostrata*	RP 1B.2	NE	Absent
Colusa Grass *Neostapfia colusana*	FT, SE, RP 1B.1	NE	Absent

San Joaquin Valley Orcutt Grass *Orcuttia inaequalis*	FT, SE, RP 1B.1	NE	Absent
Hairy Orcutt Grass *Orcuttia pilosa*	FE, SE, RP 1B.1	NE	Absent
Eel-grass Pondweed *Potamogeton zosteriformis*	RP 2B.2	NE	Absent
Sanford's Arrowhead *Sagittaria sanfordii*	RP 1B.2	NE	Absent
Greene's Tuctoria *Tuctoria greenei*	FE, SR, RP 1B.1	NE	Absent

1 Status = Status of state and federally protected species protected under the ESA.
SE: Listed as State Endangered
FE: Listed as Federally Endangered
NMFS: Species under the Jurisdiction of the National Oceanic & Atmospheric Administration Fisheries Service
ST: Listed as State Threatened
FT: Listed as Federally Threatened
SSC: Listed as State Species of Concern
SWL: State Watch List
SFP: Listed as State Fully Protected
RP: Designated by CNPS as a Rare Plant
EFH: Essential Fish Habitat
X: Critical Habitat designated for this species
2 Effects = ESA Effect determination
MA: Project may Adversely Affect federally listed species and/or designated critical habitat
NE: No Effect anticipated from the Project to federally listed species or designated critical habitat
NLAA: Project Not Likely to Adversely Affect federally listed species
3 Definition of Occurrence Indicators
Present: Species recorded in area and suitable habitat present.
Possible: Species recorded in area and habitat suboptimal.
Unlikely: Species recorded in area but habitat marginal or lacking entirely.
Absent: Species not recorded in study area and suitable habitat absent.

Table 6. Critical periods for special status species that may be affected by the construction activities.

Common Name	Critical Period
Fall-run Chinook Salmon	October through June
California Central Valley steelhead/Rainbow Trout	December through May
Riffle Sculpin	February through April
Pacific Lamprey	March through June
River Lamprey	March through June
Kern Brook Lamprey	March through June
Western Brook Lamprey	March through June
San Joaquin Roach	March through July
Hardhead	April through May
Sacramento Splittail	March through April
Swainson's Hawk	March through August
White-tailed Kite	February through October
Bald Eagle	November through July
Yellow-breasted Chat	April through August
Tri-colored Blackbird	March through June
Osprey	March through July
Western Pond Turtle	March through July
Foothill Yellow-legged Frog	April through July
Valley Elderberry Longhorn Beetle	November through June
Crotch's Bumblebee	March through June
Western Red Bat	May through August
Townsend's Big-eared Bat	April through August
Western Mastiff Bat	April through August

Special Status Plants

Pre-project monitoring was conducted within the Action Area in 2020 and 2021. No special status plant species were observed within the Action Area during these surveys. However, the special status plant species listed below have the potential to occur in the Action Area.

Henderson's Bent Grass *Agrostis hendersonii*

Henderson's Bent Grass is a monocot annual grass in the Poaceae family. It is 6 to 70 cm tall with a 1 to 5 cm long inflorescence (Peterson and Harvey 2014). It is found in association with vernal pools and other mesic areas in valley and foothill grassland. Its current range includes Calaveras, Merced, Napa, Shasta, Tehama, and Tuolumne counties. There are no documented occurrences of Henderson's Bent Grass in the Snelling or Winton quadrangles but it is documented in two of the adjacent quadrangles (CDFW 2021). Henderson's Bent Grass is not likely to be present in the Action Area as vernal pool habitat is absent.

Alkali Milk-vetch *Astragalus tener* var. *tener*
Alkali Milk-vetch is an annual herb in the pea family (Fabaceae) and is endemic to California. It prefers alkaline soils and grows in playa, valley and foothill grassland, and vernal pool habitat (CNPS 2021). It grows between 4 to 30 cm tall with 2-9 cm long leaves containing 7-17 leaflets (Jasper Flora Project 2021). It has not been documented in the Snelling or Winton quadrangles, but has been documented in the adjacent Arena quadrangle (CDFW 2021). Therefore, Alkali Milk-vetch is unlikely to be present within the Action Area.

Vernal Pool Smallscale *Atriplex persistens*
Vernal Pool Smallscale is a grey-green annual herb endemic to California that prefers alkaline soils. Vernal Pool Smallscale and other species in the *Atriplex* genus were recently moved from the polyphyletic goosefoot family (Chenopodiaceae) to the Amaranth family (Amaranthaceae). The plant grows 10-20 cm tall with many spreading to ascending branches and small oval leaves that have heart-shaped to triangular leaf bases. The male flowers and the fruiting bracts have a purplish tinge. As the common name implies, Vernal Pool Smallscale grows in vernal pool habitat (CDFW 2021) and is likely to be absent as the Action Area does not contain suitable habitat.

Heartscale *Atriplex cordulata* var. *cordulata*
Heartscale is an annual herb endemic to California in the Amaranth family (Amaranthaceae). It prefers saline to alkaline soils and grows in chenopod scrub, meadows and seeps, and valley and foothill grasslands with sandy soils (CNPS 2021). The plant grows as one to several erect stems, 10-50 cm tall. Heartscale has heart-shaped leaf bases and scaly stems. The stems and leaves are grey, and the stems have wooly fibers near the ends. The nearest documented occurrences recorded in the CNDDB are in the Arena quadrangle, which neighbors the Winton quadrangle (CDFW 2021). Therefore, Heartscale is unlikely to be present within the Action Area.

Lesser Saltscale *Atriplex minuscula*
Lesser Saltscale is an annual herb endemic to California in the Amaranth family (Amaranthaceae). It prefers alkaline to sandy soils and grows in chenopod scrub, playas, and valley and foothill grasslands (CNPS 2021). The plant grows as several upright, reddish stems with brittle spreading branches. The egg-shaped leaves are white and scaly below, green and smooth above. Flowers are inconspicuous. The tiny, reddish fruits grow at the leaf bases near the base of the plant, as male flowers are found near the top of the stems. The nearest documented occurrences recorded in the CNDDB are in the Arena quadrangle, which neighbors the Winton quadrangle (CDFW 2021). Therefore, Lesser Saltscale is unlikely to be present within the Action Area.

Watershield *Brasenia schreberi*
Watershield is a perennial rhizomatous aquatic herb that grows in freshwater marshes and swamps across North America (CNPS 2021). It is readily identifiable by its floating, oval shaped leaves whose undersides are covered with a jelly-like slime. The leaves grow centered on their stalks, like mushrooms. The tops of the leaves are green, underneath the water both leaves and stems are reddish-purple. There are no documented occurrences within the Snelling or Winton quadrangles, but it has been recorded in the adjacent Merced quadrangle (CDFW 2021). Watershield is unlikely to be present in the Action Area as there is no suitable marsh or swamp habitat.

Hoover's Calycadenia *Calycadenia hooveri*
Hoover's Calycadenia is a California native plant and is an annual herb in the Asteraceae family. Plants are 10-60 cm tall with relatively many branching stems. Leaves are alternate and hairy. It has small white flowers during its blooming period, July through September (CNPS 2021). It is found in rocky exposed areas 100-400 meters in elevation, in Valley Grassland and Foothill Woodland communities throughout California. Its current range includes Calaveras, Madera, Merced, Mariposa, and Stanislaus counties. There are documented occurrences of the species in CNDDB in the Snelling quadrangle (CDFW 2021). However, Hoover's Calycadenia is likely absent from the Action Area because rocky habitat is not present.

Succulent Owl's Clover *Castilleja campestris* ssp. *succulenta*
Succulent Owl's-Clover, is a partly parasitic (hemiparasitic) native annual herb in the snapdragon family (Scrophulariaceae). Its stems are erect, generally 2 – 10 inches (5 – 25.4 cm) tall, and may be branched or unbranched. The leaves are succulent and brittle. Bright yellow to white flowers appear in May, clustered near the ends of branches and surrounded by leafy bracts. Like other members of Castilleja and related genera, it is partly parasitic (hemiparasitic) on the roots of other plants. It occurs on the margins of vernal pools, swales and some seasonal wetlands, often on acidic soils. It is never dominant and it is found in only a few of the pools in a given area. Succulent Owl's-Clover is found only in vernal pools along the rolling lower foothills and valleys along the eastern San Joaquin Valley in the Southern Sierra Foothills Vernal Pool Region. The CNDDB has catalogued occurrences in 24 quads, including the Snelling quadrangle (CDFW 2021). About one third of these occurrences are in Merced County, catalogued in association with rare plant and wildlife surveys of eastern Merced County grass and ranch lands conducted during 2001 by a team of consultants to Merced County and CDFW (Robins and Vollmar 2002). The Action Area does not possess the soil properties needed to sustain vernal pools or their plant communities; therefore, succulent owl's clover is likely absent.

Mariposa Clarkia *Clarkia biloba* ssp. *australis*
Mariposa Clarkia is an annual herb that is endemic to California. It has linear to narrowly lanceolate leaves and bright pink to magenta petals (Lewis and Lewis 1955). Mariposa Clarkia is found in chaparral and foothill woodland on serpentinite soils generally from 300 to 500 m elevation. There are no documented occurrences in the Snelling quadrangle but it is documented in two adjacent quadrangles (CDFW 2021). The Action Area does not contain serpentine soils; therefore, Mariposa Clarkia is likely absent.

Beaked Clarkia *Clarkia rostrata*
Beaked Clarkia is a native annual herb in the evening primrose family (Onagraceae) that is endemic to California. It stands up to approximately 24 inches in height and produces pink to purple-red flowers from April to May. It is found in oak/pine woodlands and valley grasslands in Merced, Mariposa, Stanislaus, and Tuolumne counties (CNPS 2021). Beaked Clarkia is usually found on steep/rocky slopes. Beaked clarkia has been recorded in the Snelling quadrangle (CDFW 2021). The Action Area does not contain steep/rocky grass covered slopes; therefore, Beaked Clarkia is likely absent.

Small-flowered Morning-glory *Convolvulus simulans*
Small-flowered Morning-glory is an annual herb endemic to California and Baja California. It grows in clay to serpentine soils and can be found in seeps, openings in chaparral habitat, coastal scrub, and valley and foothill grassland (CNPS 2021). The diffusely branched stems grow 10-40 cm tall with small lavender flowers that produce conspicuous, sharply nodding fruits. There are no documented occurrences within the Snelling or Winton quadrangles, but it has been recorded in the adjacent Merced quadrangle (CDFW 2021). Small-flowered Morning-glory is unlikely to be present in the Action Area due to a lack of suitable soils.

Hoover's Cryptantha *Cryptantha hooveri*
Hoover's Cryptantha is an annual herb that inhabits inland dunes and sandy areas within valley and foothill grassland. It is presumed to be extinct in California (CNPS 2021); therefore, it is not likely to be present within the Action Area.

Mariposa Cryptantha *Cryptantha mariposae*
Mariposa Cryptantha is an annual herb found growing on rocky, serpentinite soil in chaparral. It is generally less than 10 inches tall, with yellow flowers, and bristles on its leaves, flowers, and influorescence (Kelley et al. 2012). The Action Area does not contain serpentine soils; therefore, Mariposa Cryptantha is likely absent.

Peruvian Dodder *Cuscuta obtusiflora* var. *glandulosa*
Peruvian Dodder is an annual, parasitic vine found in freshwater marshes and swamps. It has not been observed in California in recent years, with the last observation in a marsh near Snelling in 1948 (CNPS 2021). Therefore, it is not likely present within the Action Area.

Ewan's Larkspur *Delphinium hansenii* ssp. *ewanianum*
Ewan's Larkspur is a native perennial herb belonging to the buttercup family (Ranunculaceae). It occurs in rocky habitats in valley grasslands and foothill woodlands, and is found in Calaveras, Fresno, Kern, Madera, Merced, and Tulare counties (CNPS 2021). It is generally 25-130 cm in height with few leaves and produces violet to maroon flowers during the blooming period, March through May (Jepson Flora Project 2018). There are no recorded occurrences of the species in the Snelling quadrangle but it is documented in an adjacent quadrangle, Yosemite Lake (CDFW 2021). The Action Area lacks rocky, grassland habitat so Ewan's Larkspur is likely absent.

Dwarf Downingia *Downingia pusilla*
Dwarf Downingia is an erect annual plant belonging to the bellflower family (Campanulaceae) and is native to California. It occurs in vernal pool habitats and wetlands within the valley and foothill grassland communities and is found in Amador, Fresno, Merced, Napa, Placer, Sacramento, San Joaquin, Solano, Sonoma, Stanislaus, Tehama, and Yuba counties (CNPS 2021). Dwarf Downingia grows from spiral-lined seeds to a height of 15-27 millimeters (0.6 to 1 in), and its flowers have white or blue, narrowly triangular petals, with two yellow spots near the throat (Jepson Flora Project 2018). There are documented occurrences of the species in the Snelling quadrangle as well as adjacent quadrangles (CDFW 2021). The Action Area does not contain vernal pool habitat; therefore, Dwarf Downingia is unlikely to be present.

Delta Button-celery *Eryngium racemosum*
Delta Button-celery is an annual or perennial herb that is endemic to California. It grows in riparian scrub habitat in seasonally wet clay depressions in floodplains and is found in Amador, Calaveras, Sacramento, Sonoma, and Tuolumne counties (CNPS 2021). It is a glabrous erect plant, approximately 15 to 50 cm in height, with inflorescent heads producing tiny white florets during the blooming period; May through August (Preston et al. 2012a). There are no documented occurrences in CNDDB of the species in the Snelling quadrangle but it is documented in one of the eight adjacent quadrangles, Turlock Lake (CDFW 2021). The Action Area lacks floodplains with clay soils; therefore, Delta Button-celery is not likely to be present.

Spiny-sepaled Button-celery *Eryngium spinosepalum*
Spiny-sepaled Button-celery is an annual or perennial herb that is endemic to California. It is a glabrous erect plant, approximately 30 to 75 cm in height, with spines on the margins of the inflorescence bracts, and small white flowers that bloom from April to June (Preston et al. 2012b). There are documented occurrences of Spiny-sepaled Button-celery in the Snelling quadrangle as well as in the adjacent La Grange and Merced Falls quadrangles (CDFW 2021). Spiny-sepaled Button-celery occurs in wetland areas particularly vernal pools, swales, and ditches. The Action Area does not contain vernal pools so Spiny-sepaled Button-celery is unlikely to be present.

Hoover's Spurge *Euphorbia hooveri*
Hoover's Spurge, also known as Hoover's Sanmat, is a prostrate, tap-rooted, annual herb in the spurge family (Euphorbiaceae). It is a California native plant growing exclusively in vernal pools and wetlands, and is found in Butte, Colusa, Glenn, Merced, Stanislaus, Tehama, and Tulare counties (CNPS 2021). It forms growths of mats several inches to several feet across and produces small cup-like flowering structures (cyathium) as in other spurges (Chamaesyce and Euphorbia). Flowers possess petal-like glands that are red to olive in color produced during the blooming period July through late September (Jepson Flora Project 2018). The species is readily distinguished from other species of Chamaesyce by characteristics of growth habit, plant color and leaf shape. It is distinguished from plants in the genus Euphorbia by differences in growth habit, vascular anatomy, and photosynthetic pathway. Hoover's Spurge grows in relatively large, deep vernal pools among the rolling hills, remnant alluvial fans and depositional stream terraces at the base of the Sierra Nevada foothills. It tends to occur where competition from other species has been reduced by prolonged seasonal inundation or other factors. Hoover's Spurge is most concentrated in the northeastern Sacramento Valley, primarily in the Vina Plains of Tehama and Butte counties. It is also present in the Southern Sierra Foothills, including the Visalia-Yettem area of Tulare County and the Hickman-La Grange area of Stanislaus County. Three other occurrences are on the Sacramento National Wildlife Refuge in Glenn County. There are no documented occurrences in CNDDB of the species in the Snelling quadrangle, but it has been documented in Merced County (CDFW 2021). The Action Area does not possess the vernal pool habitat required by Hoover’s spurge; therefore, it is unlikely to be present.

San Joaquin Spearscale *Extriplex joaquinana*
San Joaquin Spearscale is an annual herb in the goosefoot family (Chenopodiaceae) that is endemic to California. It occurs in alkaline soils in chenopod scrub, meadows and seeps, playas, and grasslands. It is found in Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Monterey, Napa, San Benito, Santa Clara, San Joaquin, San Luis Obispo, Solano, Tulare, and Yolo counties

(CNPS 2021). It can grow up to a meter tall and has irregularly wavy, tapered leaves (Jasper Flora Project 2021). It has not been documented in the Verona quadrangle; however, it has been documented in the adjacent Grays Bend quadrangle (CDFW 2021). The Action Area does not contain suitable habitat, so it is likely absent from the project site.

Stinkbells *Fritillaria agrestis*
Stinkbells are a perennial bulbiferous herb in the lily family (Liliaceae) and are native to California. The species grows in clay and serpentine soils, in Chaparral, Valley Grassland, Foothill Woodland and wetlands habitats. It is found in Alameda, Contra Costa, Fresno, Kern, Mendocino, Merced, Monterey, Mariposa, Placer, Sacramento, Santa Barbara, San Benito, Santa Clara, Santa Crus, San Luis Obispo, San Mateo, Stanislaus, Tuolumne, Ventura, and Yuba counties (CNPS 2021). The species is an erect plant growing to 5 to 15 cm in height. It has 5 to 12 alternate leaves crowded below the middle of the stem and produces green-white or yellow and purple-brown nodding, ill-scented flowers during the blooming season, March through June (Jepson Flora Project 2018). There are documented occurrences of the species in the Snelling quadrangle (CDFW 2021). The Action Area does not contain the soil types used by Stinkbells; therefore, it is unlikely to be present.

Hogwallow Starfish *Hesperevax caulescens*
Hogwallow Starfish is an erect to decumbent annual herb in the Asteraceae family and is native to California. It grows in mesic, clay, alkaline, and serpentine soils; often on the periphery of vernal pools and wetlands in Valley and Foothill grasslands. It is found in Alameda, Amador, Butte, Contra Costa, Colusa, Fresno, Glenn, Kern, Merced, Monterey, Napa, Sacramento, San Diego, San Joaquin, San Luis Obispo, Solano, Stanislaus, Sutter, Tehama, and Yolo counties (CNPS 2021). The species is small, growing to less than 20 cm in height, and produces inflorescent heads with 1-2 mm disc flowers during the blooming period, March through June (Jepson Flora Project 2018). The species is not documented in CNDDB in the Snelling quadrangle and there are three unprocessed records for the species in adjacent quadrangles (CDFW 2021). The Action Area does not contain vernal pools or soil types used by Hogwallow Starfish so it is unlikely to be present.

Foothill Jepsonia *Jepsonia heterandra*
Foothill Jepsonia is a perennial herb in the Saxifragaceae family and is native to California. It grows in rocky, metamorphic soils in Foothill Woodland and Yellow Pine Forest communities, commonly occupying crevices in slate-like rock on rocky slopes. The species is found in Amador, Calaveras, El Dorado, Mariposa, Stanislaus, and Tuolumne counties (CNPS 2021). It produces inflorescent heads with 3.5 to 6 mm pink flowers with deep pink veins during the blooming period August through January (Jepson Flora Project 2018). There are no documented occurrences of the species in the Snelling quadrangle but there are three unprocessed records of the species occurring in the following adjacent quadrangles: Merced Falls, Penon Blanco Peak, and La Grange (CDFW 2021). The Action Area does not possess rocky, metamorphic soils; therefore, Foothill Jepsonia is unlikely to be present.

Forked Hare-leaf *Lagophylla dichotoma*
Forked Hare-leaf is a California endemic annual plant belonging to the Asteraceae family. It grows in Valley grassland and Foothill Woodland communities and is found in Butte, Calaveras, Fresno, Merced, Monterey, San Benito and Stanislaus counties (CNPS 2021). The species reaches

10 to 60 cm in height and is self-sterile (cannot self-pollinate). It has distal, often glandless leaves, and inflorescences are panicle-like clusters that are minutely hairy. The species produces yellow ray flowers during its April to May blooming period. There are no documented occurrences of the species in CNDDB in the Snelling quadrangle, but the species has been documented in the adjacent Cooperstown quadrangle (CDFW 2021). Forked Hare-lead is unlikely to be present as the Action Area lacks grassland habitat.

Coulter's Goldfields *Lasthenia glabrata* ssp. *coulteri*
Coulter's Goldfields is an annual herb in the daisy family (Asteraceae) endemic to California and Baja California (CNPS 2021). It grows in coastal saltmarsh and coastal swamps, playas, and vernal pools. The plant is differentiated from similar species by the yellow to rust-colored wart-like papillae that cover the tiny (2-3 mm) fruit. The plant has relatively long, narrow leaves and bears several bright yellow disk florets. Like all goldfields, Coulter's Goldfields blanket their habitat in yellow when in bloom. There are no documented occurrences within the Snelling or Winton quadrangles, but it has been recorded in the adjacent Arena quadrangle (CDFW 2021). Coulter's Goldfields is unlikely to be present in the Action Area due to a lack of suitable habitat.

Heckard's Pepper-grass *Lepidium latipes var. heckardii*
Heckard's Pepper-grass is an annual herb in the mustard family (Brassicaceae) that is endemic to California. It grows in alkaline flats in valley and foothill grasslands below 700 m elevation and is found in Glenn, Merced, Sacramento, Solano, and Yolo counties (CNPS 2021). It grows from 2 to 15 cm tall and has basal leaves (Jasper Flora Project 2021). There are no documented occurrences of the species in the Verona quadrangle, however it has been documented in the adjacent Grays Bend quadrangle (CDFW 2021). It likely absent from the Action Area since the site contains no grassland habitat.

Merced Monardella *Monardella leucocephala*
The Merced Monardella is a California endemic annual herb that grows in sandy, mesic areas of valley and foothill grasslands (CNPS 2021). It blooms from May to August. The Merced Mondardella is presumed to be extirpated in California and has not been observed since 1941 (CNPS 2021). Therefore, Merced Monardella is unlikely to be present within the Action Area.

Little Mousetail *Myosurus minimus* ssp. *apus*
Little Mousetail is an annual herb in the buttercup family (Ranunculaceae) native to the Pacific Coast and adjacent inland areas from Oregon to Baja California. It prefers alkaline soils and can be found growing in valley and foothill grasslands as well as vernal pools (CNPS 2021). Also known as Tiny Mousetail, or just Mousetail, it grows to about 12 cm tall, with narrow, sometimes threadlike leaves up to 6 cm long. The stems end in a single inflorescence with an elongated receptacle up to 4 cm long. There are no recorded occurrences in the Snelling or Winton quadrangles, but it has been recorded in the neighboring Arena quadrangle (CDFW 2021). Within the Action Area, occurrence of Little Mousetail at the Cowell 2 project site is possible.

Pincushion Navarretia *Navarretia myersii* ssp. *myersii*
Pincushion Navarretia is a California endemic annual herb that is found associated with valley and foothill vernal pools, often in acidic soils (CNPS 2021). It blooms in April and May with white tube flowers. It is found in Amador, Calaveras, Merced, Placer, and Sacramento counties (CNPS

2021). Pincushion Navarretia has not been documented in the Snelling quadrangle but has been mapped in the adjacent Haystack Mountain quadrangle (CDFW 2021). There are no vernal pools present in the Action Area; therefore, pincushion Navarretia is unlikely to be present.

Shining Navarretia *Navarretia nigelliformis* ssp. *radians*
Shining Navarretia is a California endemic annual herb that is found in vernal pools or clay depressions in foothill woodland and valley and foothill grasslands (CNPS 2021). It is wider than it is high, with gray-green stems and leaves and a white hairy inflorescence (Johnson 2013). Shining Navarretia blooms from May to July. It has not been documented to occur in the Snelling quadrangle but has been mapped in the adjacent quadrangles Haystack Mountain and Yosemite Lake (CDFW 2021). There are no vernal pools or clay depressions present in the Action Area; therefore, Shining Navarretia is unlikely to be present.

Prostrate Vernal Pool Navarretia *Navarretia prostrata*
Prostrate Vernal Pool Navarretia is a California endemic annual herb that is found associated with valley and foothill vernal pools, often in acidic soils (CNPS 2021). It blooms in April and May with white tube flowers. It is found in Amador, Calaveras, Merced, Placer, and Sacramento counties (CNPS 2021). Pincushion Navarretia has not been documented in the Snelling quadrangle but has been mapped in the adjacent Haystack Mountain quadrangle (CDFW 2021). There are no vernal pools present in the Action Area; therefore, Prostrate Vernal Pool Navarretia is unlikely to be present.

Colusa Grass *Neostapfia colusana*
Colusa Grass is a California endemic annual herb belonging to the grass family (Poaceae). It grows exclusively in vernal pool habitat, and is found in Colusa, Glenn, Merced, Solano, Stanislaus, and Yolo counties (CNPS 2021). The species reaches 10 to 30 cm in height with continuous sheath leaves. It produces inflorescences that are cylindrical and dense, with spikelets arranged along an axis breaking between florets during the blooming season May through August. The species is not documented in CNDDB in the Snelling quadrangle but it has been documented in four of the eight adjacent quadrangles: Haystack Mountain, Yosemite Lake, Turlock Lake, and Cooperstown (CDFW 2021). The Action Area does not possess vernal pool habitat that Colusa Grass requires; therefore, it is unlikely to be present.

San Joaquin Valley Orcutt Grass *Orcuttia inaequalis*
San Joaquin Valley Orcutt Grass is a California endemic annual herb belonging to the grass family (Poaceae). The species is a federally threatened, state endangered species. CNPS ranks it as very rare. The species grows almost exclusively in vernal pool habitat, and is found in Fresno, Madera, Merced, Solano, Stanislaus, and Tulare counties. The species grows erect from 5 to 25 cm, occasionally spreading to form mats. It produces inflorescences with irregularly toothed florets during the blooming period April through September. There are no documented occurrences of the species in CNDDB in the Snelling quadrangle but it is documented in two of the eight adjacent quadrangles: Haystack Mountain and Yosemite Lake (CDFW 2021). The Action Area does not possess the vernal pool habitat required by San Joaquin Valley Orcutt grass so it is unlikely to be present.

Hairy Orcutt Grass *Orcuttia pilosa*
Hairy Orcutt Grass, also called pilose Orcutt grass, is a California endemic annual herb belonging to the grass family (Poaceae). The species is a federally threatened and state endangered species ranked by the CNPS as very rare (CNPS 2021). The species grows almost exclusively in vernal pool habitats, and is found in Glenn, Madera, Merced, Stanislaus, and Tehama counties. The species grows decumbent to erect 5-35cm in length, and is densely hairy. It produces inflorescences crowded at the tip with florets that have awn tipped teeth during the May through September blooming season. There are no documented occurrences of the species in CNDDB in the Snelling quadrangle but it has been documented in three adjacent quadrangles: Yosemite Lake, Turlock Lake, and Cooperstown (CDFW 2021). The Action Area does not possess the vernal pool habitat required by Hairy Orcutt Grass; therefore, it is unlikely to be present.

Merced Phacelia *Phacelia ciliata* var. *opaca*
Merced Phacelia is an annual herb in the Hydrophyllaceae family endemic to California. It grows in clay to alkaline soils and can be found in valley and foothill grasslands (CNPS 2021). Also known as Great Valley Phacelia, the plant can grow up to two feet tall with erect stems that may be branched at the base. The stems are covered with short, downy hairs, the oblong compound leaves are subdivided into toothed leaflets, and the pale blue flowers have five petals. It is one of the earliest blooming members its genus (Jan-Mar). It has not been documented in the Snelling or Winton quadrangles, but has been recorded in the adjacent Merced quadrangle (CDFW 2021). Within the Action Area, occurrence of Merced Phacelia is possible at the Cowell 2 project site.

Eel-grass Pondweed *Potamogeton zosteriformis*
Eel-grass Pondweed is an annual aquatic herb that is native to California and flowers in June and July. It has a stem that is generally less than 60 cm long and light green leaves that are submersed and 5 to 20 cm long and 2 to 5 mm wide. Eel-grass Pondweed is found along the margins of ponds, lakes, and streams. The species has not been observed in the Snelling or Winton quadrangles but is documented in the adjacent Merced Falls quadrangle (CDFW 2021). The Action Area lacks areas of slow water with silty substrate; therefore, the species is likely to be absent.

Hartweg's Golden Sunburst *Pseudobahia bahiifolia*
Hartweg's Golden Sunburst, also called Hartweg's pseudobahia, is a California endemic annual herb in the Asteraceae family. The species is listed as federally and state endangered, and the CNPS ranks the species as seriously endangered in California. The species is slender and woolly with one or a few stems and grows to 5-20 cm in height, with mostly linear-oblanceolate leaves. It produces inflorescences with yellow disc flowers during the blooming period March through April. It grows in clay and often acidic soils in valley grasslands and foothill woodlands in Fresno, Madera, Merced, Stanislaus, Tuolumne, and Yuba counties. It occurs primarily in shallow, well-drained, fine-textured soils, nearly always on the north face of "mima mounds." These are mounds of earth with unknown origins, roughly 3 to 30 m in diameter at the base interspersed with basins that pond during the rainy season. The species is found only in the CV of California. Historically, the range of the species may have extended from Yuba County south to Fresno County. Within this range, the species was only locally abundant. Today, there are 16 populations remaining on the eastern edge of the San Joaquin Valley. Remaining populations are concentrated in the Friant region of Fresno and Madera counties and the La Grange region in Stanislaus County. According

to the USFWS, Hartweg's Golden Sunburst has declined because of habitat loss caused by agricultural and urban development, levee construction, pumice mining, cattle grazing, and competition with nonnative weeds, road widening and off-road vehicle use. One population is protected under a conservation agreement between The Nature Conservancy and the U.S. Bureau of Reclamation. The remaining populations continue to be threatened by some or all of the above activities. The species is documented in the Snelling quadrangle and four adjacent quadrangles: Cooperstown, Merced Falls, La Grange, and Haystack Mountain (CDFW 2021). The Action Area does not possess the mima mound habitat required by the Hartweg's Golden Sunburst; therefore, it is unlikely to be present.

California Alkali Grass *Puccinellia simplex*
California Alkali Grass is an annual herb in the grass family (Poaceae) that is native to California. It prefers alkaline and vernally mesic soils in sinks, flats, and lake margins. It grows in chenopod scrub, meadows, seeps, grasslands, and vernal pools, as well as saline flats and mineral springs. It is found in Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kern, Lake, Los Angeles, Madera, Merced, Napa, San Bernardino, Santa Clara, Santa Cruz, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo counties (CNPS 2021). There are no documented occurrences of the species in the Verona quadrangle, however it has been documented in the adjacent Grays Bend quadrangle (CDFW 2021). The Action Area does not contain alkaline soils, so is likely absent.

Sanford's Arrowhead *Sagittaria sanfordii*
Sanford's Arrowhead is a California endemic perennial, emergent rhizomatous herb. It is found in freshwater marshes including along ponds and ditches. Sanford's arrowhead blooms from May to October. It is found in low elevation areas (< 300 m) from northern to southern California. However, it is currently believed to be extirpated from southern California and most of the CV (CNPS 2021). Sanford's arrowhead has not been documented in the Snelling quadrangle but is documented in the Yosemite Lake adjacent quadrangle (CDFW 2021). The Action Area only contains small marshes in which Sanford's arrowhead was not observed. It is not likely to be present because it is very rare in the CV and has never been observed in the Snelling quadrangle.

Keck's Checkerbloom *Sidalcea keckii*
Keck's Checkerbloom is California endemic annual herb which blooms from April to May. It is from 6 to 13 inches tall and has pink five petalled flowers (USFWS 2012). Keck's Checkerbloom seeds can remain dormant for long periods of time. It is found in relatively open grassy areas in foothill woodland and valley and foothill grassland on serpentine or clay soils (USFWS 2012). Keck's Checkerbloom is listed as federally endangered (65 FR 7757). It has not been documented in the Snelling quadrangle but has been documented in the Yosemite Lake adjacent quadrangle (CDFW 2021). The Action Area lacks grassy areas with serpentine or clay soils; therefore, the species is likely absent.

Greene's Tuctoria *Tuctoria greenei*
Greene's Tuctoria, also known as Greene's Orcutt Grass or Awnless Spiralgrass, is a California endemic annual herb belonging to the grass family (Poaceae). The species is listed as federally endangered, is a state rare species, and the CNPS ranks the species as seriously endangered. The species grows almost exclusively in vernal pools and is found in Butte, Fresno, Glenn, Madera, Merced, Modoc, Shasta, San Joaquin, Stanislaus, Tulare, and Tehama counties. Eastern Merced

County has about 30% of the known occurrences, and the species is presumed extirpated from Fresno, Madera, San Joaquin, Stanislaus and Tulare counties. The species has several to many stems 5 to 15 cm in length, each ending in a spike-like inflorescence that may be partly enfolded in the upper leaf. The bracts are strongly curved and more or less truncate at the apex. The species produces florets during the blooming period May to July. There are no documented occurrences of the species in the Snelling quadrangle but two of the eight adjacent quadrangles have documented occurrences: Cooperstown and Haystack Mountain (CDFW 2021). The Action Area does not contain vernal pool habitat; therefore, Greene's Tuctoria is not likely to be present.

No special-status plant species were observed at the Action Area during pre-project field vegetation surveys in 2020 and 2021. If special status plants are discovered, they would be flagged and fenced with 100-foot buffers to prevent impact. Implementing these measures would avoid adverse effects on special status plant species and associated habitats. Therefore, the impact to special status plant species would be **less than significant**.

Special Status Wildlife Species

The Action Area includes perched floodplain habitat and heavily impacted riparian areas. There is residual riparian habitat in the Action Area that is used by various wildlife species. Special-status wildlife species are defined as taxa that are: 1) designated as threatened or endangered by the state or federal governments; 2) proposed or petitioned for federal threatened or endangered status; 3) state or federal candidate species; 4) listed as Species of Concern by the USFWS; or, 5) identified by the CDFW as Species of Special Concern. The special-status wildlife species that may potentially occur in the Action Area are described below. Pre-construction surveys shall be conducted for these species and if any are found, the required avoidance and conservation measures will be implemented.

Special-Status Invertebrates

Crotch's Bumble Bee *Bombus crotchii*

Crotch's Bumble Bee is named after the entomologist George Robert Crotch. The bee is characterized as a short-tongued species with a square-shaped face. Most populations occur in coastal areas of southern California, although its native range is much larger (Koch etal. 2012). Historically, the bee was common in the California Central Valley (CCV), but it is now rare in the region. Crotch's Bumblebee can be found in grassland and scrub habitats where worker bees feed on milkweeds, phacelias, lupines, and sages (Koch etal. 2012). The species is non-migratory and often nests in abandoned rodent dens in hotter climes than those preferred by most bumblebee species. Males are present May-September and female worker bees are active April-August. Queen bees are only active March-May. The species was last evaluated in 2014 and is listed as endangered due to a restricted climatic range that is expected to contract with anthropogenic climate change. Due to the scarcity of documented occurrences in Merced County and lack of extensive grassland and scrub habitats in the Action Area, presence of the species is not likely to be present.

Conservancy Fairy Shrimp *Branchinecta conservatio*

The Conservancy Fairy Shrimp, an anostracan, is found in cool water ponds with low to moderate amounts of dissolved solids. Pools containing conservancy fairy shrimp are seasonally astatic, filled by winter and spring rains, and are generally inundated into June at the latest (Eriksen and

Belk 1999). Individuals have been collected November-April, when temperatures are 5°C – 24°C. Hatching occurs about a week after pool filling at 10°C, and at least 19 days are required to reach maturity if water temperatures slowly increase to 20°C. Individuals may live up to 154 days. Only one cohort is produced each year, so both sexes usually disappear long before their native pools are dry. Cysts are produced in large numbers and are relatively small (mean diameter of 0.23 mm) compared to other California fairy shrimp (Eriksen and Belk 1999). The conservancy fairy shrimp is found in grasslands in the northern two-thirds of the CV, at elevations of 16 – 476 ft (4.9 – 145 m). Within this area, populations are even more restricted and occur in just a few fragmented localities. The limited range of the species is within a prime region for agriculture and urban development, which constitute the largest threat to this species (Eriksen and Belk 1999). The Conservancy Fairy Shrimp is a federally listed endangered species. The conservancy fairy shrimp is not documented in the Snelling quadrangle but is documented in the adjacent Haystack Mountain quadrangle (CDFW 2021). This species is not likely to occur within or adjacent to the Action Area as it dependent upon short grass vernal pool landscapes which is absent from within or directly adjacent to the Action Area.

Vernal Pool Fairy Shrimp *Branchinecta lynchi*
The Vernal Pool Fairy Shrimp is federally listed as threatened. It occurs in a wide variety of vernal pool habitats in the coast ranges and CV of California as well as at two locations in southern Oregon's Jackson County (USFWS 2005). The vernal pool fairy shrimp typically occurs in vernal pools but have also been found in alkali pools, ephemeral drainages, stock ponds, roadside ditches, vernal swales, and rock outcrop pools (Helm 1998). The seasonal habitat in which this species is found is usually small and shallow (Helm 1998). It has a rapid life cycle, usually completing reproduction within 40 days, thus allowing it to complete reproduction in its ephemeral habitat (Helm 1998). The Vernal Pool Fairy Shrimp has been observed to live as long as 147 days (Helm 1998). Like other vernal pool crustaceans, cysts of the Vernal Pool Fairy Shrimp remain dormant in the soil when its vernal pool habitats are dry (USFWS 2006b). This species is typically found at elevations from 33 to 4,000 ft (Eng et al. 1990). Mortality has been observed to occur once water temperature exceed 75ºF (Helm 1998) or when water temperatures drop below 40ºF (Eriksen and Belk 1999). The Vernal pool Fairy Shrimp feeds on algae, bacteria, protozoa, rotifers, and bits of detritus (USFWS 2006b). It is documented in the Snelling quadrangle and five adjacent quadrangles: Haystack Mountain, Yosemite Lake, Merced Falls, Winton and Turlock Lake (CDFW 2021). This species is not likely to occur within or adjacent to the Action Area as it does not contain vernal pool habitat.

Vernal Pool Tadpole Shrimp *Lepidurus packardi*
The Vernal Pool Tadpole Shrimp is a notostracan characterized by few, similarly-sized median spines on its supra-anal plate, which are not placed on a keel, and 35 pairs of legs (Pennack 1989). They are typically found in temporary ponds and swales containing clear to highly turbid water. Pools containing Vernal Pool Tadpole Shrimp are commonly found in unplowed grasslands, and currently exist in vernal pools ranging from the north end of the CV around Redding to the south CV around Visalia, between the Coast Range and the Sierra Nevada. Within this range, distribution is patchy and generally in clustered vernal pool complexes. The vernal pool tadpole shrimp appears in pools filled by fall and winter rains, re-establishing each year from diapaused (resting) cysts (King et al. 1996). Virtually all pools inhabited by this species become inundated, even during drought years (King et al. 1996). The majority of the sites where Vernal Pool Tadpole

shrimp occur are on flat, developable land that has easy accessibility (Cheatham, 1976). As a result, habitat loss constitutes the largest threat to this species. The Vernal Pool Tadpole Shrimp is not documented to occur in the Snelling quadrangle but is documented in three adjacent quadrangles: Yosemite Lake, Turlock Lake, and Haystack Mountain (CDFW 2021). Because this species only occurs in short grass vernal pool landscapes, it is unlikely that this species occurs within the Action Area.

Longhorn Fairy Shrimp *Branchinecta longiantenna*
The Longhorn Fairy Shrimp is a short-lived anostracan found in clear to turbid grass-bottomed vernal pools in unplowed grasslands and clear-water pools in sandstone depressions (Eng et al. 1990). The Longhorn Fairy Shrimp occurs only in ephemeral freshwater habitats that are filled by winter and spring rains (Eriksen and Belk 1999). Only one cohort is produced each year, so both sexes usually disappear long before their native pools are dry. The Longhorn Fairy Shrimp is found in northern, central, and portions of southern California (Eng et al. 1990). Within this area, populations are often discontinuous and occur in just a few fragmented localities. The Longhorn Fairy shrimp is a federally listed endangered species. The CNDDB shows no known occurrences of the Longhorn Fairy Shrimp in or near the Action Area. This species is dependent upon vernal pool landscapes, so is not likely to occur within or directly adjacent to the Action Area.

Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus*
The Valley Elderberry Longhorn Beetle (VELB) is a medium-sized (about 0.8 in [2 cm] long) beetle, with dimorphous sexes; the male forewings are primarily red with dark green spots, while the female have dark metallic green with red margins. Its entire life cycle is associated with elderberry trees in California's Central Valley. In the CV, elderberry trees are associated with riparian forests (Vaghti et al. 2009, USFWS 2014), and the VELB appears to be more abundant in dense native plant communities with a mature overstory and a mixed understory (USFWS 1999). The beetle historically ranged throughout the valley, but recent surveys find it persists only in limited localities along the Sacramento, American, San Joaquin, and Kings rivers and their tributaries. Occurrences have been documented from southern Shasta County to Fresno County (USFWS 2014). Kellner (1992) reported the most observations of VELB along the Merced River and further north. The adult stage is short-lived, and adults are active from early March to early June; mating occurs in May (Barr 1991). Eggs are laid singly, or in groups, along the elderberry bark's crevices, and hatch in about 10 days. Larvae burrow a cavity inside the bark, roots and branches of the elderberry and pupate. Larvae gestate for one to two years before emerging as adults (Barr 1991). They appear to prefer elderberry trees of certain size classes, typically larger mature plants (Kellner 1992). The USFWS Conservation Guidelines for the beetle consider elderberry plants with one or more stems (>0.98 in [2.5 cm]) at ground level to be potential host plants (USFWS 1999). There are 21 elderberry shrubs present within the Action Area that could potentially be occupied by the VELB (**Figures 11-13**). During construction, an attempt will be made to avoid impacts to these shrubs by field-fitting, but up to nine of these shrubs (four at Cowell 1 and five at Cowell 2) may need to be transplanted to construct functional habitat features. Formal Section 7 consultation will be initiated with the USFWS to assess impacts to the VELB and a USFWS Biological Opinion will be obtained before Proposed Project construction begins.

To minimize adverse Action Area effects on the VELB, elderberry plants with ground level stem diameter one inch or greater would be avoided or buffered with a 20-ft buffer around the drip line of the plant **(BIO-1 – Adaptive Construction Approach to Protect Elderberry Plants and Mitigate for Loss**). The majority of the elderberry plants present in the Action Area would be completely avoided, but heavy equipment and dust may disturb some elderberry plants during Proposed Project construction activities at the Cowell 1 and Cowell 2 sites, which is a **potentially significant impact**. Implementation of **BIO-1 - Adaptive Construction Approach to Protect Elderberry Plants and Mitigate for Loss** and **BIO-2 - Transplant Unavoidable Elderberry Plants to Suitable Locations and Monitor Survival** would reduce any potentially significant impacts to VELB to **less than significant**.

Special Status Amphibians

California Tiger Salamander *Ambystoma californiense*

The California Tiger Salamander is an amphibian in the family Ambystomatidae. Adult stages are primarily terrestrial and larval stages are aquatic. It is large and stocky with a broad, rounded snout with small eyes with black irises protruding from their heads. Adult males are about 8 in (20 cm) long, females a little less than 7 in (18 cm). Coloration consists of white or pale yellow spots or bars on a black background on the back and sides. The belly varies from almost uniform white or pale yellow to a variegated pattern of white or pale yellow and black. The California Tiger Salamander is restricted to breeding in vernal pools and seasonal ponds, including many constructed stock ponds, in grassland and oak savannah plant communities, predominantly from sea level to 2,000 ft (609.6 m), in central California. Larvae require significantly more time to transform into juvenile adults than other native amphibians. They are relatively poor burrowers, requiring refuges provided by ground squirrels and other burrowing mammals in which they live underground during dry months. The primary causes of California Tiger Salamander decline are the loss and fragmentation of habitat from urban and agricultural development, land conversion, and other human-caused factors. The California Tiger Salamander requires large contiguous areas of vernal pools (vernal pool complexes or comparable aquatic breeding habitat) containing multiple breeding ponds to ensure recolonization of individual ponds, in association with extensive upland areas. A strong negative association between Bullfrogs (*Rana catesbiana*) and California Tiger Salamanders has been documented (USFWS 2009). Louisiana Crayfish (*Procambarus clarkia*), Mosquitofish, Green sunfish and other introduced fishes also prey on adult or larval salamanders (USFWS 2009). Other impacts to this species include disease, reduction of ground squirrel populations and direct and indirect impacts from pesticides. The introduction of various nonnative tiger salamander subspecies may out-compete the California Tiger Salamander or interbreed with them to create hybrids that may be less adapted to the California climate or are not reproductively viable past the first or second generations. Automobiles and off-road vehicles kill a significant number of migrating California Tiger Salamanders, and contaminated runoff from roads, highways and agriculture may adversely affect them. Suitable breeding and upland habitat is not present in the portion of the Action Area to be disturbed. The range of the California Tiger Salamander does not overlap with the Action Area.

California Red-legged Frog *Rana aurora draytonii*

The California Red-legged Frog *Rana aurora draytonii* is the largest native frog in the western United States, ranging from 1.6 – 5.1 in (4 – 13 cm) long. The abdomen and hind legs of adults are largely red, and the back has small black flecks and larger irregular dark blotches. The spots

on the frogs' backs usually have light centers. Lateral folds are prominent on the back. The frog has indistinct outlines on a brown, gray, olive, or reddish background color. It is most commonly found in quiet pools of streams, marshes, and occasionally ponds. The California Red-legged Frog prefers habitat in aquatic sites with substantial riparian and aquatic vegetation cover, especially those areas that lack invasive predators such as Bullfrogs, bass (*Micropterus* spp.), and sunfish (*Lepomis* spp.) (USFWS 1997). Coastal lagoons, marshes, springs, permanent and semi-permanent natural ponds, ponded or backwater portions of streams, and artificial impoundments such as stock ponds, irrigation ponds, and siltation ponds can all be inhabited by the California red-legged Frog. This species occurs along the Coast Range Mountains from Mendocino County south, and in portions of the Sierra Nevada and Cascade mountain ranges. Sierra populations are highly restricted and consist of small numbers of individuals.

Breeding occurs from late November to April. Females lay loose masses of eggs attached to the undersides of emergent vegetation near the top of the water, and eggs hatch within 6 – 14 days. Within 14 – 21 weeks, tadpoles transform into frogs, and metamorphosis usually occurs in the summer months (USFWS 1997). Human activities that result in habitat destruction and/or the introduction of exotic competitors such as bullfrogs and green sunfish may have a negative effect on this species. There is an unprocessed observation of California Red-legged Frog in the Snelling quadrangle (CDFW 2021). However, pre-construction wildlife surveys for the nearby Merced River Ranch and Henderson Park salmonid habitat restoration projects did not observe California Red-legged Frog. Pre-construction wildlife surveys would be performed for the Proposed Project. However, based on previous surveys the California Red-legged Frog is likely absent within the Action Area.

Western Spadefoot Toad *Spea hammondii*
Ranging from 1.5 to 2.95 inches (3.8 - 7.50 cm), the Western Spadefoot Toad is a relatively smooth-skinned species; eye is pale gold with vertical pupil; green or grey dorsum often with skin tubercles tipped in orange; whitish color on venter; wedge-shaped black spade on each hind foot (USGS 2004). The toad is nocturnal and can occur in oak woodlands, but is more common in grasslands, scrub, and chaparral; open areas with sandy or gravelly soil (USGS 2004). Breeding occurs in vernal pools and other temporary rain pools, water or feed tanks, and pools of intermittent streams. Breeding occurs after heavy rainfall creates the temporary shallow rain pools preferred for breeding, generally January through May. Western Spadefoot Toad habitat is characterized by open, grassy areas in vernal pool habitats. The preferred habitat of the species is not present within or near the Action Area, therefore this species is unlikely to occur.

Special Status Reptiles

Northern California Legless Lizard *Anniella pulchra*
The Northern California Legless Lizard is endemic to California with a range that extends from the Central California Coast inland to southwestern portions of the CCV. Due to its limited range, CDFW has listed it as a species of special concern (CDFW 2021). The species may occur at stream edges where large oaks or cottonwoods are present, but prefers sandy dunes and scrub habitat. Legless lizards are often confused for small snakes, but can be differentiated from snakes by the presence of eyelids, which snakes lack. The slender, counter-shaded lizard is 4.3 – 6.9 in (11-17 cm) long from snout to vent. The head and back are beige to black, the belly is white to bright yellow. There is usually a dark dorsal line and several thin stripes along the sides, but this

can vary (Stebbins and McGinnis 2012). The lizard is crepuscular and can be found above ground near dawn and dusk. Mostly, the species lives underground, burrowing into loose, sandy soil, where it feeds on larval insects, beetles, termites, and spiders. Suitable habitat for the Northern California Legless Lizard is scarce in the Action Area, so the species is unlikely to occur.

Western Pond Turtle *Emys marmorata*
The Western Pond Turtle is a CDFW species of special concern. Its status is currently under review by the USFWS to determine if it warrants listing under the federal ESA (80 FR 19259). The Western Pond Turtle is typically 3.5 to 8.5 in (8.9 – 21.6 cm) in shell length with a marbled carapacial pattern and drab coloration; dark brown, olive brown, or blackish. The Western Pond Turtle is found in California in the coast ranges north of Santa Cruz and in the CV west of the Sierra crest, and there are also isolated populations near Susanville and in the Truckee, Carson, and East Walker rivers (Spinks et al. 2014). The Western Pond Turtle is typically found at elevations from sea level to 5,000 ft in a wide variety of aquatic habitats including rivers, streams, lakes, ponds, and marshes as well as human created habitat such as irrigation ditches and sewage treatment ponds. Structures such as logs, rocks, bedrock outcrops, and exposed banks are required for basking. The western pond turtle preferred aquatic habitats with access to deep, slow water containing underwater refugia (Ashton et al. 1997). In some environments the western pond turtle may spend half the year or more on land (Ashton et al. 1997). In both aquatic and terrestrial environments, this species demonstrates a high degree of site fidelity, with males using a larger aquatic home range than females (Ashton et al. 1997). Mating takes place underwater in the spring and mature females typically oviposit every other year (Ashton et al. 1997). Oviposition occurs on land, from just above the floodplain to a few thousand ft from water, and the nest typically occurs in sparsely vegetated areas of annual grasses and herbs with dry soil, with the clutch size typically from 4 to 7 eggs (Ashton et al. 1997). In northern California, hatching occurs in the fall, and the hatchlings usually remain in the nest chamber over the winter and emerge in spring (Holland 1994). In lakes and ponds, the Western Pond Turtle generally overwinters underwater by burying itself in the mud, while turtles in streams and rivers overwinter on land by burrowing in the duff or soil (Ashton et al. 1997). The Western Pond Turtle is a dietary generalist, feeding on both live prey and browsing on plants as well as scavenging carrion (Ashton et al. 1997). Commonly consumed food items include aquatic macroinvertebrates, crustaceans, annelids, and carcasses of mammals, birds, reptiles, amphibians, and fish (Ashton et al. 1997). The altered flow regime and cold water temperatures in rivers below dams have been found to have negative effects on basking behavior, growth, development, and body condition in the Western Pond Turtle, which has implications for reproductive output and population fitness (Ashton et al. 2011). There is potential for competitive exclusion by introduced species such as the Bullfrog or Largemouth Bass. Habitat destruction is also noted as a reason for decline (Jennings et al. 1992). The greatest threats to the species are the predation of hatchlings by the introduced, non-native Bullfrog and habitat loss due to urbanization.

The Action Area overlaps the range of the Western pond turtle and contains potentially suitable aquatic habitat for the Western pond turtle. The Proposed Project construction activities have the potential to cause harassment, injury, or mortality to the Western pond turtle, if it is present. This would be a **potentially significant** impact. However, implementation of **BIO-3 - Monitor for Fish and Wildlife to Prevent Impacts** would reduce impacts to Western pond turtle to **less than significant**.

Blunt-nosed Leopard Lizard *Gambelia sila*
The Blunt-nosed Leopard Lizard is endemic to southern California and is currently only found in isolated, undeveloped areas of the San Joaquin Valley at elevations of 800 m and below (CDFW 2021). It is listed as endangered in California and at the federal level (USFWS 2021). This insectivorous lizard is relatively large, 3.1 – 4.7 in (8 to 12 cm) in length, with a long regenerative tail, powerful hindlegs, and a short, blunt snout. The coloring of the Blunt-nosed Leopard Lizard varies according to its environment. Background colors range from yellow to greyish brown to brown, the underbelly is always white, and the dark dorsal spots range from brown to black. The lizard can be distinguished from similar species by the undersides of the hindlegs and tail, which are yellow (Smith and Brodie 1982). Blunt-nosed Leopard Lizard is unlikely to be present in the Action Area due to a lack of suitable, undeveloped habitat.

Coast Horned Lizard *Phrynosoma blainvillii*
The Coast Horned Lizard, also known as Blainville's Horned Lizard, is a CDFW species of special concern native to the central and southern California Coast and the CCV (CDFW 2021). Small and stout, adults are 2.4 – 4.3 in (6-11 cm) long from snout to vent and dorsoventally flattened, with a wide, oval-shaped body. Their heads are crowned with horns, their sides are fringed with enlarged, spiky scales, and additional enlarged scales cover their back and tail, completing the armored look (Stebbins and McGinnis 2012). The species is diurnal, going underground at night or when temperatures are too hot or cold. The lizard can be found in playas, valley and foothill grasslands, coniferous forests, woodlands, and chaparral, provided there are open areas with patches of loose, sandy soils for easy burrowing. The species is non-migratory and feeds mainly on ants, but will consume other insects and small, terrestrial invertebrates. The Coast Horned Lizard is unlikely be present within the Action Area due to a lack of suitable habitat within the grading footprint.

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

Special Status Birds

Cooper's Hawk *Accipiter cooperii*

The Cooper's Hawk is a medium-sized hawk with an elongated body. Individuals have a blue-gray back with a light nape and dark crown. The Cooper's Hawk can be distinguished from similar species by its long-barred tail with a rounded tip (Dewey and Perepelyuk 2000). Adults range from 13.8 – 19.7 in (35 – 50 cm) in length and average ~1.2 lb (~525 g) in weight (Johnsgard 1990; Peterson and Peterson 2002). The Cooper's Hawk is native to nearctic and neotropical regions and can be found wintering as far north as the northern U.S. and southern Canada and as far south as Costa Rica. The species prefers deciduous and mixed forests but can also be found in other open woodland habitats (Johnsgard 1990; Dewey and Perepelyuk 2000). The Cooper's Hawk is monogamous, and breeding begins in March and occurs once each year. Females deposit 3 – 6 eggs in a stick-built nest and hatching occurs in 32 – 36 days (Dewey and Perepelyuk 2000; Peterson and Peterson 2002). Common diet items include birds and small mammals (Dewey and Perepelyuk 2000). The Cooper's Hawk has been observed in the vicinity of Proposed Project diversions during raptor surveys (CFS unpublished data). The Cooper's Hawk is likely to occur in the Action Area.

Tri-colored Blackbird *Agelaius tricolor*

The Tri-colored Blackbird ranges from Northern California in the U.S. (with occasional strays into Oregon and Washington) to upper Baja California in Mexico. The USFWS determined that listing the species under the ESA is not warranted in 2019 (84 FR 41694) following a listing petition in 2015. The Tri-colored Blackbird forms the largest colonies of North American landbirds, as it is highly social and gregarious. Nesting colonies may consist of tens of thousands of individuals. This social nature makes the bird vulnerable to impacts from urban and agricultural land uses. Native freshwater marshes consisting of cattails and bulrushes once used for nesting and feeding have been lost to urban and agricultural development (Shuford and Gardali 2008). Birds adapting to nesting in agricultural fields have been disturbed by harvesting during the breeding season. The tri-colored blackbird is not likely to nest in the Action Area due to an absence of preferred nesting habitat.

Burrowing Owl *Athene cunicularia*

The Burrowing Owl is a small, long-legged owl with bright yellow eyes. The beak can be yellowish or greenish depending on the subspecies. The owls have prominent white eyebrows and a white chin patch. The breast and belly are white with variable brown spotting or barring. Burrowing Owl populations in California have been greatly reduced over the past fifty years due to urban development in prime habitat areas. This species has not been observed in the Action Area, and the Action Area lacks the sandy substrate it requires for burrowing, therefore the Burrowing Owl is not likely to be present.

Golden Eagle *Aquila chrysaetos*

The Golden Eagle is a large, dark brown raptor with a wide distribution throughout the Northern Hemisphere. It is uncommon in California except for an isolated area in the middle of the CV(CDFG 2005). The Golden Eagle is typically found in rolling foothills, mountainous areas, sage-juniper flats, and deserts, and require open terrain for hunting small mammals that make up most of its diet (CDFG 2005). Nesting takes place on cliffs and in large trees, and nest sites are

reused in successive years (CDFG 2005). Breeding occurs from late January through August (CDFG 2005). The Golden Eagle has not been observed in the Action Area and is unlikely to be nesting within the Action Area.

Ferruginous Hawk *Buteo regalis*
The Ferruginous Hawk is the largest hawk in North America. It hunts small mammals in open areas such as prairies and grasslands. The Ferruginous Hawk is present in the CVduring the winter. The Proposed Project would be constructed outside of the period when the ferruginous hawk is present in the CV therefore the species is likely to be absent.

Swainson's Hawk *Buteo swainsoni*
The Swainson's Hawk is a medium-sized hawk that breeds in California and may migrate to Mexico and South America in the winter. It often nests adjacent to riparian systems of the valley and in lone trees or groves of trees in agricultural fields. Valley oak, Fremont Cottonwood, black walnut and large willows are the most commonly used nest trees in the CV. This species also requires large open grasslands with suitable nest trees and abundant prey. Migrating individuals move south through the southern and central interior of California in September and October, and north March through May. Breeding occurs late March to late August. Nesting occurs primarily in the southern Sacramento Valley and northern San Joaquin Valley regions (Stillwater Sciences 2005). Swainson's Hawk has been documented in the Action Area during previous raptor surveys but no nests or breeding activity were observed (CFS unpublished data).

Black Tern *Chlidonias niger*
The Black Tern is a CDFW species of special concern with breeding habitat in the CCV (CDFW 2021). Unlike other terns, which are white, the Black Tern is a lovely grey above, whitish below, and has a dark crown. Adults in breeding plumage have a black head and underparts. Black Terns nest in large, freshwater marshes or at the edges of shallow lakes. They have also been known to nest in rice fields or on river islands. As migrants, they can appear in a variety of wetland habitats, from sewage ponds to coastal lagoons to the open ocean. Outside the breeding season, Black Terns stick mostly to the coast or tropical waters, but they are also known to venture inland to forage at flooded fields near the ocean (Heath etal. 2009). The Black Tern is unlikely to occur in the Action Area due to an absence of suitable wetland habitat.

Northern Harrier *Circus cyaneus*
The Northern Harrier is an Accipiter hawk. Individuals have specialized feathers in the shape of a disk to focus sound into their ears, a white rump patch visible in flight, and wings that form a dihedral when gliding (Wheeler and Clark 1987). Adults range from 16.1 – 19.7 in (41 – 50 cm) in length and average ~1 lb (~450 g) in weight (Limas 2001). The northern harrier is found throughout the northern hemisphere and is known to breed from Alaska and Canada in northern North America to Baja California in southern North America. North American populations winter from southern Canada to Central America (Macwhirter and Bildstein 1996). The species prefers open habitats, such as fields, meadows, and marshes, but is also found in agricultural areas and riparian zones (Wheeler and Clark 1987; Macwhirter and Bildstein 1996). The northern harrier nests in loose colonies and breeding occurs from April through September. Nests are built on the ground on raised mounds (Limas 2001). Home range sizes vary and average 642 acres (~2.6 km^2) (Macwhirter and Bildstein 1996). Common diet items include small mammals, birds, reptiles, and

amphibians (Wheeler and Clark 1987; Macwhirter and Bildstein 1996). The northern harrier has not been observed in the Action Area during previous raptor surveys but it is possible that it may be present.

White-tailed Kite *Elanus leucurus*
The White-tailed Kite is a resident of coastal and valley lowlands west of the Sierra Nevada Mountains. The monogamous raptor breeds from February to October. Nests are built in loosely piled sticks near the tops of tree stands (Dixon et al. 1957) and a single clutch may contain 4 – 8 eggs. The species preys on small mammals, and other birds, insects and reptiles. They are solitary hunters but may roost communally (Dunk 1995). Essential habitats include herbaceous lowlands with limited tree growth and dense tree groves for perching and nesting. Urbanization of agricultural lands may have contributed to the decline of the white-tailed kite (Kalinowski and Johnson 2010). The White-tailed Kite likely nests along the Merced River; therefore, this species may be present within the Action Area.

Bald Eagle *Haliaeetus leucocephalus*
The Bald Eagle is a large Accipiter with a brown body and white head and tail. Adults can have wingspans up to 7.5 ft (2.3 m) and average ~6.8 lb (~3.1 kg) in weight. Historically, the bald eagle was found throughout North America, from Alaska and northern Canada to Baja California and the Gulf of Mexico. Currently, most populations are limited to the northern portion of their historic range; however, the Bald Eagle can live anywhere in North America with adequate nesting sites and open water (Snyder and Snyder 1991). The Bald Eagle requires large bodies of water or free-flowing rivers. The Bald Eagle may be present within the Action Area.

California Condor *Gymnogyps californianus*
The California Condor is a New World Vulture and the largest bird in North America. The species is federally endangered (USFWS 2021) due to the use of DDT and populations are still rebounding. The species has been reintroduced to portions of the Southwest and southern and central California. Currently, there are year-round residents California, Arizona, and Baja California. The California Condor continues to be threatened by lead-poisoning. Individuals in flight can be readily identified by their impressive size, bulky bodies, and striking white patches under the wings. The wings are also exceptionally broad, with long primary feathers that give the spread wings a ‘fingered’ appearance. The California Condor nests in chaparral scrub or forest habitat, up to 6,000 ft in elevation. They require open grasslands for foraging, and will fly great distances for food but have difficulty getting off the ground. Therefore, they often launch from open, windy areas by running downhill or launching from a cliff or tree branch (Finkelstein et al. 2015). Individuals can then soar and glide great distances by riding rising air currents. California Condors feed on marine and terrestrial carrion and tend to avoid humans and roadkill. California Condors are unlikely to occur at the Action Area, due to their restricted range and preference for upland habitats.

Yellow-breasted Chat *Icteria virens*
The Yellow-breasted Chat is a very large, aberrant warbler with distinctive plumage. It has olive green to grayish upper parts with lemon-yellow chin, throat, and breast; the large bill is strongly curved. The face of this species is grayish with black lores, white supercilium, and white eye-crescent on lower eye-lid (Eckerle and Thompson 2001). It is an uncommon summer resident and

migrant in coastal California and in foothills of the Sierra Nevada. The Yellow-breasted Chat is present in portions of the northern Sacramento Valley (Shuford and Gardali 2008). The breeding and nesting period extends from late April through September. Nesting yellow-breasted chat select early successional riparian habitat with a mature shrub layer and open canopy with nesting habitat typically only found along streams and rivers (Shuford and Gardali 2008). The Yellow-breasted Chat may occur in the Action Area; however, they are an uncommon summer resident, migrating through areas near the Action Area on the Merced River during the summer months (McCaskie et al. 1979).

Osprey *Pandion haliaetus*
The Osprey is a large bird of prey in the Accipiter family. Adults range from 21.7 – 22.8 in (55 – 58 cm) in length and 2.6 – 4.4 lb (1.2 – 2.0 kg) in weight, with wingspans ranging from 57.1 – 66.9 in (145 – 170 cm) (Kirschbaum and Watkins 2000). On average, the female osprey weighs 20% more than the male and has a 5% – 10% greater wingspan (Poole 1994). Individuals have a dark stripe through each eye, a dark brown back, and a white underside with dark brown patches at the carpal joints (Poole 1989). The Osprey has a worldwide distribution, with four sub-species that winter or breed on every continent except Antarctica. Of the four sub-species, *Pandion haliaetus carolinensis* is the only sub-species common in North America. This sub-species winters in South America and can be found breeding throughout North American and the Caribbean (Kirschbaum and Watkins 2000). Osprey are able to survive anywhere with adequate nesting sites and abundant fish. Nest sites are typically within 1.9 – 3.1 mi (3 – 5 km) of water and are commonly found near marshes, swamps, lakes, or rivers (Poole 1989). In North America, Osprey are migratory and typically begin breeding in April or May (Poole 1989). Females lay an average of three eggs per year, and eggs hatch within 32 – 43 days (Kirschbaum and Watkins 2000). Home range size varies from 2,471 – 3,459 ac (10 – 14 km^2), depending on the season (Poole et al. 2002). Osprey are almost exclusively piscivorous (Kirschbaum and Watkins 2000) and are known to forage along the Merced River and have been observed in locations surrounding the Action Area.

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

Double-crested Cormorant *Phalacrocorax auritus*
The Double-crested Cormorant is a large, dark waterbird with orange-yellow throat and eye regions. It is a year-round resident found along the coast of California as well as inland lakes, rivers, and estuaries (CDFW 2005). This species mainly consumes fish, and in the CV it rests and roosts overnight on steep cliffs and in dead tree branches and snags near water. In California it breeds primarily from April to July using nests on cliffs or in trees besides water (CDFW 2005). The Double-crested Cormorant is a colonial nester. Before DDT was banned, Double-crested Cormorants in southern California suffered extensive reproductive failure; however, the Double-crested Cormorant breeding population in California appears to be stable when comparing estimates from 1989-1991 to 2008 (Adkins and Roby 2010). The Double-crested Cormorant may be found within the Action Area, but no impacts are expected due to Proposed Project activities because no large trees suitable for nesting would be disturbed. However, wildlife surveys would be performed before construction activities to determine if there are nesting sites on or nearby the site (**BIO-3 – Monitor for Fish and Wildlife to Prevent Impacts**). If Double-crested Cormorant nesting is confirmed, a no-disturbance buffer would be created a minimum of 0.25 mi (0.40 km) around the nest. CDFW would also be contacted to discuss implementation changes and/or additional avoidance measures.

The riparian habitat within the Action Area may be used by nesting raptors and migratory birds. Project construction activities may overlap with the breeding season for some raptors and migratory birds (1 February – 31 August), resulting in the potential for adverse impacts. The potential adverse impacts include removal of habitat serving as nesting, roosting, or foraging locations and disturbance from construction equipment, including noise, and human presence during construction activities. These adverse impacts are **potentially significant**.

Pre-construction wildlife surveys would be performed annually before the start of any construction activities to determine if there are special status birds nesting in or nearby the Action Area (**BIO-3 – Monitor for Fish and Wildlife to Prevent Impacts**). If special status bird nesting is confirmed, an appropriately sized, no-disturbance buffer would be created around each nest. Implementation of **BIO-4 - Protect and Compensate for Native Trees, BIO-5 - Work Outside of Critical Periods or Monitor for Sensitive Species,** and **BIO-3 - Monitor for Fish and Wildlife to Prevent Impacts** would reduce impacts to special status birds to **less than significant**.

Special status Mammals

Pallid Bat *Antrozous pallidus*
The Pallid Bat is a large, light colored bat with large prominent ears. It is common in desert and grassland habitats throughout the southwestern U.S., especially in areas near water (Hermanson and O'Shea 1983). The Pallid Bat roosts in small colonies in rock crevices and man-made structures, and rarely in caves. Diurnal roosts may be shared with other bat species such as the Brazilian Free-tailed Bat and Yuma myotis (Hermanson and O'Shea 1983). The Pallid Bat forages between 0.5 and 2.5 km from the day roost. Although locally common, populations are very sensitive to disturbance of roosting sites. The Pallid Bat has been documented within the Snelling quadrangle and four adjacent quadrangles in the CNDDB database. Neighboring bridges may serve as a summer maternity roost for this species, with the adjacent riparian corridor serving as summer foraging habitat.

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

Western Mastiff Bat *Eumops perotis californicus*
The Western Mastiff Bat is a very large free tailed bat. Two of its distinguishing characteristics are long narrow wings and large rounded ears that are joined at the mid-line across the forehead and project forward, extending beyond the nose. An additional characteristic is the tail, which extends far beyond the interfemoral membrane. The color of the body and membranes are dark to brownish gray while slightly paler below. This is an uncommon bat in California's arid and semiarid lowlands in the lower Sonoran life zone. This bat is not likely to occur in the Action Area.

Silver-haired Bat *Lasionycteris noctivagans*
The Silver-haired Bat is dark in color with white-tipped dense fur, giving it a silver or frosty appearance. The silver-haired bat is distributed in foothill and mountainous areas throughout California. Summer habitat includes coastal and montane coniferous forests, valley foothill woodlands, pinyon-juniper woodlands, and valley foothill and montane riparian habitats. This species typically forages in or near coniferous and/or mixed deciduous forests adjacent to ponds or other sources of water (Davis and Schmidly 1994). The silver-haired bat is known to roost in tree cavities or in crevices on tree trunks. This species has not been observed in the Proposed Project quadrangles within the CNDDB (2021) database; therefore, is unlikely to be present.

Western Red Bat *Lasiurus blossevillii*
The Western Red Bat has an upper body that is brick red to rusty red washed with white; males are usually more brightly colored than females. This species is locally common in some areas of California, occurring from Shasta County to the Mexican border, west of the Sierra Nevada/Cascades Crest, and deserts. Roosting habitat includes forests and woodlands between sea level and mixed coniferous forest. Preferred roost sites are in edge habitat adjacent to streams, fields, or urban areas. Roost sites are usually solitary and can be between 2 ft and 40 ft (0.6 m and 12.2 m) from the ground. The Western Red Bat has been observed in the Snelling quadrangle and three adjacent quadrangles within the CNDDB database (CDFW 2021). Cottonwood riparian habitat associated with the Merced River provides significant roosting and foraging habitat for reproductive female Western Red Bats during the summer, and the species may be present within the Action Area.

American Badger *Taxidea taxus*
The American Badger is a large, gray to reddish colored member of the weasel family (Mustelidae). This species is short and stout with a flattened body that is built for digging. Adults range from 20.5 – 34.4 in (52.0 – 87.5 cm) in length and may weigh up to 26.5 lb (12 kg) (Shefferly 1999). The American Badger is common in the Great Plains region of North America,

but can be found throughout central and western Canada, the western U.S., and northern Mexico. The eastern limit of the species' range is Ontario, Canada (Kurta 1995; Long 1999). The American Badger prefers dry, open grasslands, but can also be found in mountain and desert regions (Long 1999). This species is primarily active at night when it digs burrows in search of rodent prey (Shefferly 1999). Dens are up to 9.8 ft (3 m) below the surface and may contain up to 32.8 ft (10 m) of tunnels (Kurta 1995; Long 1999). Home ranges are typically small (395 to 593 acres; Shefferly 1999) but expand during mating season in late summer through early autumn (Long 1999). The American Badger may be present within the Action Area.

Giant Kangaroo Rat *Dipodomys ingens*
The Giant Kangaroo Rat is the largest of the 20 species of kangaroo rats, measuring nearly six inches from the tip of its snout to the end of its tufted tail. Kangaroo rats are small mammals that get around by hopping like miniature kangaroos, a case of convergent evolution. Members of the family Heteromyidae, kangaroo rats have tan to brown bodies, large heads and eyes, and strong hind limbs for hopping at high speeds. The Giant Kangaroo Rat can be distinguished from similar species by the size of their hindfeet and the number of hind toes. Each hindlimb is at least 47 mm in length with five toes (Grinnell 1922). The species lives in colonies in dry grasslands or saltscrub and is nocturnal. Individuals leave their burrows for about 15 minutes per night, to gather seeds and forbs which they will cure in shallow burrows before storing them deeper underground (Braun 1985). Giant Kangaroo Rats are a keystone species in habitats where they are found; they are an important prey source for San Joaquin Kit Fox, American Badgers, Burrowing Owls, and other species. Their burrows are often used by Blunt-nosed Leopard Lizards and other species (Williams 1992). The species federally listed as endangered due to habitat loss (USFWS 2021); they are estimated to occupy less than two percent of their historical range (Williams 1992). The Giant Kangaroo Rat was historically present in Merced County, but there are no known extant populations in the area. The species is likely to be absent from the Action Area.

Fresno Kangaroo Rat *Dipodomys nitratoides* ssp. *exilis*
All three sub-species of the San Joaquin Kangaroo Rat (*Dipodomys nitratoides*) are federally listed as endangered due to habitat loss (USFWS 2021). Historically, the species was present in much of Merced County, but their range has contracted to the southwestern edge of the boundary separating Merced and Fresno counties (Hafner 1998). The species is likely to be absent from the Action Area.

San Joaquin Kit Fox *Vulpes macrotis mutica*
The San Joaquin Kit Fox is the largest of the eight subspecies of kit fox and is comparable in size to a large cat. The San Joaquin Kit Fox is primarily nocturnal, but is occasionally active during the day, and pups may be seen playing near the den. A mated kit fox pair may use up to 39 dens in a single year, although a fox usually spends its primarily solitary life within a 1 – 2 square mile area. It either digs the dens itself or enlarges a squirrel or badger den. Natal dens, generally the largest and most complex type of den, may be constructed over a period of several years (Morrell 1972). Kit fox are also known to use manmade structures, such as small-diameter culverts. The San Joaquin Kit Fox historically inhabited the semi-arid regions of California's Central Valley and adjacent foothills. Much of this range has been reduced as a result of agricultural and urban development, and the San Joaquin Kit Fox is now primarily found in the grasslands and scrub habitats of the southern San Joaquin Valley. They are also found in and adjacent to agricultural

and urban areas (Spiegel et al. 1996). In 1965, the California Fish and Game Commission classified the San Joaquin kit fox as a protected furbearer, and in 1971 the State classified it as "rare" (now Threatened) under the 1970 California ESA. The U.S. Secretary of the Interior listed the subspecies as Federally Endangered under the Endangered Species Protection Act of 1973, as amended.

In the north, habitat is so fragmented by urbanization and agriculture that this portion of the population is very close to extinction. Throughout their range, the San Joaquin Kit Fox are also subject to disease, predation, roadkill, off-road vehicles, shooting, trapping, and rodenticide mortality. The San Joaquin Kit Fox has not been observed in the Snelling quadrangle but was documented in the adjacent La Grange quadrangle (CDFW 2021). Potential habitat for the San Joaquin Kit Fox is present within a mile of the Action Area in remnant expanses of intact grassland habitat; however, this habitat does not exist within the Action Area, nor does it have the friable soils needed for denning. The species is not likely to occur within the Action Area.

Fisher *Pekania pennanti*
The Fisher is a member of the weasel family (Mustelidae). They have been trapped since the 1700's to supply the fur trade and were extirpated from large swaths of the United States. The Southern Sierra Nevada distinct population segment (SSN DPS) is federally listed as endangered (85 FR 29532; USFWS 2021). The SSN DPS is found in Mariposa, Madera, Tulare, and Kern counties with the approximate northern boundary being the Tuolumne River in Yosemite National Park and the southern boundary the forested lands in the Kern River watershed (85 FR 29532). The eastern limit is the high elevation granite dominated landscape and the western boundary is the low elevation extent of the mixed-conifer forest (85 FR 29532). Fisher in the SSN DPS are typically found from 4,000 to 8,000 feet associated with mixed-conifer forest (Spencer et al. 2015). . The species is likely to be absent from the Action Area due to a lack of suitable habitat (mixed conifer forest).

Riparian vegetation in the Action Area may provide roosting and foraging habitat for special status bat species, including the Pallid Bat and the Western Red Bat. Proposed Project construction activities would overlap with the bat breeding season (1 April – 15 August) resulting in the potential for adverse impacts. The potential adverse impacts include removal of roosting habitat and disturbance from construction equipment, including noise, and human presence during construction activities. It is not anticipated that any trees that could potentially be used by bats for roosting would be removed as the Proposed Project would avoid removing large riparian trees. However, disturbance of roosting special status bats is a **potentially significant** impact.

Pre-construction bat surveys would be conducted annually prior to Proposed Project initiation and, if roosting bats are observed, a minimum 300 ft (91.4 m) buffer of roosting bats, maternity roosts or winter hibernacula until all young bats have fledged (**BIO-6 - Monitor for Bats to Prevent Impacts**). Implementation of **BIO-4 - Protect and Compensate for Native Trees, BIO-5 - Work Outside of Critical Periods or Monitor for Sensitive Species,** and **BIO-6 - Monitor for Bats to Prevent Impacts** would reduce impacts to special status bats to **less than significant.**

Special Status Fish Species

The quantity and quality of salmonid habitat in the Merced River below Crocker-Huffman Diversion Dam has been greatly affected by anthropogenic disturbance. Spawning and rearing habitat are degraded by numerous historical and current impacts including; gold and gravel mining, development, diking of floodplains, and overall alteration of the LMR system. Without inundation, the floodplains cannot provide terrestrial food for juvenile salmon or organic matter that helps produce more food within the river. Moreover, the lack of peak flood flows allows encroachment of riparian vegetation, which along with the engineered levees, tend to confine flows to the river channel. This in turn accelerates the rate that gravel is scoured from spawning and rearing habitat. With higher scour rates, spawning and rearing habitat tends to erode away and the river tends to incise (Kondolf et al. 1996).

Special-status fish species are defined as taxa that are: 1) designated as threatened or endangered by the state or federal governments; 2) proposed or petitioned for federal threatened or endangered status; 3) state or federal candidate species; or 4) identified by the CDFW as Species of Special Concern. Of the special-status species identified by the USFWS or from the California Natural Diversity Data Base, only fall-run Chinook Salmon, *O. mykiss*, Pacific Lamprey, River Lamprey, Kern Brook Lamprey, Western Brook Lamprey, Splittail, Riffle Sculpin, and Hardhead may occur in the Action Area.

Riffle Sculpin *Cottus gulosus*

The Riffle Sculpin is a CDFW species of special concern. The population present in the San Joaquin River and its tributaries is genetically distinct from other populations (Baumsteiger 2013). In the San Joaquin River watershed they are found in most tributaries on the east side of the valley from the Mokelumne River south to the Kaweah River (Moyle et al. 2015). Riffle Sculpin show considerable genetic differences among populations in the San Joaquin River tributaries, suggesting that each tributary contains an isolated population with little historic gene flow to other populations (Baumsteiger 2013, Moyle et al. 2015). The Riffle Sculpin is only found in permanent cold water streams (Moyle et al. 2015). Individuals can reach 16 cm in total length and live for 4 or more years, but most adults are 6 to 8 cm long and 2 to 3 years old (Moyle et al. 2015). The Riffle Sculpin spawns in February, March, and April; spawning occurs under rocks in riffles or in the cavities of submerged logs (Moyle et al. 2015). Both larvae and adults have poor dispersal ability, with larvae being benthic and remaining close to where they were born (Moyle et al. 2015). Due to poor dispersal, the Riffle Sculpin is found in increasingly isolated watersheds in the CV (Moyle et al. 2015). The Riffle Sculpin feeds mostly at night, primarily consuming benthic invertebrates, particularly mayflies, caddisflies, and stoneflies (Moyle et al. 2015). The Riffle Sculpin may be present in the LMR within the Action Area, however it has not been observed.

Pacific Lamprey *Entosphenus tridentatus*

The Pacific Lamprey is a CDFW species of special concern and a federal species of concern. This species is distributed around the Pacific Rim from Japan to Baja California. It is a large lamprey, reaching 80 cm TL and anadromous and parasitic. The Pacific Lamprey does not appear to home to natal streams, as little genetic variation has been observed in populations from British Columbia to southern California (Goodman et al. 2008). Instead, they appear to detect pheromones released by ammocoetes present in the river, and do not migrate upstream in a river that lacks ammocoetes

(Goodman and Reid 2012). The result is a source –sink dynamic for Pacific Lamprey, in which large river systems containing robust populations serve as sources for smaller rivers and streams that can be sinks (Moyle et al. 2015).

The Pacific Lamprey has diverse life histories, with some rivers containing two distinct runs; one that returns in the spring and spawns immediately after upstream migration and another that migrates upstream in the fall and would spawn the following spring (Moyle et al. 2015). Most adult Pacific Lamprey spawning migrations occur between March and late June, with upstream movement typically occurring during the night (Moyle et al. 2015). Spawning typically occurs from April to July in low gradient stream reaches, with both sexes working together to create a nest in the gravel present in the tailouts of pools and riffles (Goodman and Reid 2012). The deposited eggs in the nest hatch into ammocoetes which are transported downstream to a low gradient silty area where they burrow in tail first and filter feed on detritus, diatoms, and algae (Goodman and Reid 2012, Moyle et al. 2015). Throughout the ammocoete life stage, individuals leave their burrows and drift to a new area at night (Moyle et al. 2015). After 4 to 7 years, ammocoetes metamorphose into macropthalmia in which they develop large eyes, a sucking disc, and silvery coloration as well as physiological changes that allow them to survive in salt water (Moyle et al. 2015). Once metamorphosis is complete macropthalmia migrate downstream to the ocean, typically during high flow events of winter and spring (Goodman and Reid 2012). Pacific lamprey in the ocean are parasitic on fishes and smooth skinned marine mammals (Goodman and Reid 2012).

Pacific Lamprey populations have declined in the Pacific Northwest and California (Goodman and Reid 2012). In California, the Pacific Lamprey has been extirpated from 55% of their historical habitat north of Point Conception primarily due to impassable dams (Goodman and Reid 2012). The Pacific Lamprey has undergone a range contraction northward, with no viable populations currently existing south of the Big Sur River (Goodman and Reid 2012). The primary threats to the Pacific Lamprey in California are passage barriers, flow management, and water and habitat quality issues (Goodman and Reid 2012). The Merced River population, as part of the lower middle San Joaquin Unit, was ranked as vulnerable by the Pacific Lamprey Assessment and Template for Conservation Measures in California (Goodman and Reid 2012). The Pacific Lamprey is still present in the LMR (CFS unpublished data) and may be present within the Action Area, however it has not been observed.

San Joaquin Roach *Lavinia symmetricus*

Also known as the California Roach, the San Joaquin Roach is a small, chunky-bodied minnow with a narrow caudal peduncle found throughout the Sacramento-San Joaquin drainages (Moyle 2002). They can be distinguished from similar species by their small scales and the origin of their small dorsal fin (7-9 rays), which is behind the origin of their anal fin (6-8 fin rays). The San Joaquin Roach is listed as a CDFW species of special concern (CDFW 2021). The species is omnivorous and known to feed on algae, benthic invertebrates, and aquatic insects. San Joaquin Roach are found in a diversity of habitats, but high population densities are most commonly found in small, warm streams and isolated pools. The species cannot tolerate saltwater, but is highly tolerant of high temperatures and low dissolved oxygen (DO), allowing them to survive in waters where other native fishes cannot. Individuals reach maturity at 2-3 years of age at around 45-60

mm in length. They have a maximum observed age of six years and rarely exceed 100mm in length (Moyle 2002). Presence of the San Joaquin Roach is possible within the Action Area.

River Lamprey *Lampetra ayresii*
The River Lamprey is a CDFW species of special concern. This species is small, reaching 12 in TL, anadromous and parasitic. It is found in coastal rivers and streams from just north of Juneau, Alaska to San Francisco Bay (Moyle et al. 2015). The river lamprey tends to be found in the lower reaches of larger rivers such as the Fraser, Columbia, Klamath, Eel, and Sacramento rivers (USFWS 2004). However, the River Lamprey has been little studied throughout its range and detailed information on life history, distribution and abundance is lacking (USFWS 2004). River lamprey adults make their spawning migration in the fall and then spawn in the winter or spring (Moyle et al. 2015). The species spawns in small, gravel bottomed tributary streams at the upstream end of riffles, with both sexes working together to build the nest (USFWS 2004, Moyle et al. 2015). Ammocoetes filter feed in low velocity, depositional areas containing fine sediment for 3 to 5 years. Metamorphosis into adults starts during the summer and can take up to 10 months with entry into the ocean occurring in late spring (Moyle et al. 2015). The River Lamprey spends 3 to 4 months in the ocean parasitizing primarily herring and salmon (Moyle et al. 2015). There is a lack of knowledge regarding River Lamprey in California, particularly regarding their habitat requirements and environmental tolerances (Moyle et al. 2015). In the Sacramento River system, the River Lamprey has been observed spawning in Cache Creek and captured in the Knight's Landing rotary screw trap (Moyle et al. 2015). The river lamprey may be present in the LMR in some years, including within the Action Area, however it has not been observed.

Kern Brook Lamprey *Lampetra hubbsi*
The Kern Brook Lamprey is a CDFW species of special concern found in the lower reaches of the Merced, Kaweah, Kings and San Joaquin river systems (CDFW 2021, Stillwater Sciences 2005). Like all brook lamprey species, the Kern Brook Lamprey is small and non-predatory, reaching a maximum total length of 140 mm as adults. Brook lamprey spend the majority of their lives as larvae, or ammocoetes. During this stage, the lamprey is eyeless and toothless, and lives burrowed tail-first into the substrate where it filter feeds from its environment using its gills. Much is still unknown about lamprey, including how to differentiate the various brook lamprey species as ammocoetes or the factors that slow and speed maturation. Adult Kern Brook Lamprey can be differentiated from other species by their poorly developed teeth; the supraoral plate, or tooth, usually has two cusps, the single-cusped lateral teeth number 3-4 on each side of the oral disk (Moyle 2002). The species prefers silty backwaters in large rivers and ammocoetes are usually found in shallow pools along the edge of runs, burrowed into the sand, gravel, or rubble (Moyle et al. 1995). The Kern Brook Lamprey is impacted by the fragmentation and reduction of habitats from channelization (Moyle et al. 1995). The species may be present in the Action Area, but no impacts are expected due to project activities. Improvement in overall habitat condition for native fish is expected following construction.

Western Brook Lamprey *Lampetra richardsoni*
The Western Brook Lamprey is a CDFW species of special concern found throughout coastal drainages along the North American Pacific Coast, and populations extend far inland in large estuary systems, including the Sacramento-San Joaquin Delta (CDFW 2021). Adults can be identified by their teeth: the supraoral plate, or tooth, is broad with a cusp at either end, the

infraoral plate has 6-9 toothlike cusps, and there are three circumoral plates on either side of the mouth, of which the middle one has 2-3 cusps (Moyle 2002). The species is small and non-predatory, with a maximum total length of 180 mm in adults. Ammocoetes prefer back-waters and pools with sandy, silty substrates, where they spend an average of 3-4 years. Adults spawn in gravel riffles and die shortly afterwards (Moyle 2002). The species may be present in the Action Area, but no impacts are expected due to project activities. Improvement in overall habitat condition for native fish is expected following construction.

Hardhead *Mylopharodon conocephalus*
The Hardhead is a special status freshwater fish native to California and limited to the Sacramento-San Joaquin and Russian river systems (Moyle 2002). This species is a large minnow with a slender, deeper body and pointier snout compared to the Sacramento Pikeminnow. The Hardhead is brown or dusky bronze in color. The Hardhead is typically found in small to large streams in a low to mid-elevation environment. It is an omnivore and eat benthic invertebrates, aquatic plants, and algae, in general. Juvenile Hardhead may be found at various temperature gradients, in shallow regions and deeper lake habitats. Spawning occurs in May and June in the sand, gravel and rocky areas of pools and side pools. Juveniles feed on plankton, insects, and small snails (Reeves 1964). Moyle and Nichols (1973) reported that the overall population of Hardhead has been declining rapidly. The Hardhead is present in the LMR, and has been captured in recent seine surveys immediately downstream from the Action Area (CFS unpublished data).

Splittail *Pogonichthys macrolepidotus*
The Splittail is a CDFW species of special concern. It is a large, elongate cyprinid, exceeding 40 cm standard length (Moyle et al. 2015). Splittail rear in brackish water of the Delta and San Francisco Estuary, particularly Suisun Marsh, and spawn on floodplains and river edges (Moyle et al. 2015). Adults migrate upstream during flow events during November through February and spawn during March and April (Moyle et al. 2015). As flows decrease during April and May, juveniles migrate downstream from the flooded areas to the brackish areas where they rear for 1-2 years before making their first spawning migration (Moyle et al. 2015). Splittail can live for 7 to 10 years (Moyle et al. 2015). They mostly feed on aquatic invertebrates (Moyle et al. 2015). No impact to Splittail are anticipated because this species is not likely to be present in the Action Area as none were captured by the lower Yuba River rotary screw trap during seven years of trapping and they rarely enter the lower Feather River (Moyle et al. 2015). The Proposed Project would improve habitat for Splittail, if they are present, by reducing predator habitat and eliminating direct mortality at diversion sites.

California Central Valley steelhead *Oncorhynchus mykiss*
The CCV steelhead distinct population segment (DPS) includes all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and tributaries. Propagated stocks from Coleman National Fish Hatchery on Battle Creek and the Feather River Hatchery are also included in the CCV steelhead DPS (NMFS 2014). CCV steelhead critical habitat is designated in CV rivers and streams from the Sacramento River in the north to the Merced River in the south.

O. mykiss have the greatest diversity of life history patterns of any Pacific salmonid species, including varying degrees of anadromy, differences in reproductive biology, and plasticity of life history within a genetic lineage. For anadromous *O. mykiss*, adult migration from the ocean to CV

spawning grounds occurs during much of the year, with peak migration occurring in the fall or early winter. Migration through the Sacramento River main stem begins in July, peaks at the end of September, and continues through February or March (Bailey 1954; Hallock et al. 1961; as cited in McEwan and Jackson 1996). CCV steelhead are mostly 'winter steelhead'; that is, they mature in the ocean and arrive on the spawning grounds nearly ready to spawn. Winter steelhead prefer cold water between 55°F – 70°F (13°C – 21°C) that is saturated with DO. In the Merced River, two forms of *O. mykiss* potentially exist: the resident form that remains in the river its entire life, and the anadromous form that migrates to the ocean and returns to the river to spawn, potentially multiple times. However, no data collected to date has confirmed that the anadromous form is currently present in the Merced River (Pearse and Garza 2015; Zimmerman et al. 2009).

While little information has been collected on migration patterns for the San Joaquin River tributaries, migration has been observed on the lower Mokelumne River as early as August and as late as May, with peaks in January and February (Workman 2005). CCV steelhead typically return from the ocean at ages two or three, weighing 2 – 12 lbs (0.9 – 5.4 kg) (Reynolds et al. 1993). Steelhead are generally iteroparous, so some may return to the ocean and repeat the spawning cycle (Narum et al. 2008).

CCV steelhead typically use riffle transitions and riffles for spawning. *O. mykiss* in the Merced River likely spawn during a similar timeframe to other *O. mykiss* populations in CV rivers, but formal spawning surveys have not been conducted. The number of days required for CCV steelhead eggs to hatch is inversely proportional to water temperature and varies from about 19 days at 60°Fahrenheit (F; 15.6 ° Celsius[C]) to about 80 days at 42°F (5.6°C). Embryo incubation occurs from January through May, and fry typically emerge from the gravel two to three weeks after hatching (Barnhart 1986). Upon emerging from the gravel, fry rear in stream margin habitats and move gradually into pools and riffles as they grow larger. In the Merced River, juvenile *O. mykiss* begin to emerge from upper reaches likely by April (CFS unpublished data). Older fry establish territories which they defend. Cover is an important habitat component for juvenile salmonids, both as velocity refuge and as a means of avoiding predation (Shrivell 1990: Meehan and Bjornn 1991; Beechie et al. 2005). Larger CCV steelhead fry, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young CCV steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles.

Optimal temperatures for steelhead growth range between 50°F and 68°F (10°C and 20°C), and juvenile CCV steelhead have an upper lethal limit of 75°F (24°C; Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Myrick and Cech 2005). However, they can survive up to 80°F (26.7°C) for short time intervals with saturated DO conditions and a plentiful food supply. Snorkel surveys conducted for monitoring associated with the Merced River Ranch and Henderson Park restoration projects from 2010 to 2016 generally observed the first *O. mykiss* fry (fork length ≤ 50 mm) in April (CFS unpublished data).

There is very little monitoring focused on CCV steelhead; as a result, population trends and status are largely unknown. However, analyses of CCV steelhead abundance across the DPS indicate that naturally reproducing stocks are suffering severe and long-term declines throughout their range. In the San Joaquin River tributaries, the CCV steelhead populations are very small, with

most fish apparently demonstrating the resident phenotype (Zimmerman et al. 2009). Recent genetic analysis of *O. mykiss* in the LMR suggests that the population is largely comprised of a resident *O. mykiss* hatchery strain (Pearse and Garza 2015). Chipps Island trawl data also suggests that natural CCV steelhead production is very low (NMFS 2016).

The Proposed Project's in-channel construction activities would occur outside of the spawning and incubation period for CCV steelhead. Although no sustainable populations of steelhead have been observed in the Merced River, implementation of the Project is expected to benefit the quality and quantity of spawning, incubation, and rearing habitat within the Action Area.

Chinook Salmon *Oncorhynchus tshawytscha*
CV fall- and late fall-run Chinook Salmon are considered by NMFS to be in the same Evolutionary Significant Unit (ESU) (64 FR 50394). NMFS determined in 1999 that listing this ESU as a threatened species was not warranted (64 FR 50394), but subsequently classified this ESU as a Federal Species of Concern because of specific risk factors, including population size and hatchery influence in 2004 (69 FR 19975). In the CV, fall-run Chinook Salmon are the most numerous of the four salmon runs, and continue to support commercial and recreational fisheries of significant economic importance. Because of their commercial importance, fall-run Chinook Salmon and their designated essential fish habitat (EFH) are managed under the MSA. In the Merced River, EFH is designated downstream of Crocker-Huffman Diversion Dam. In the Merced River, CV fall-run Chinook Salmon occur from below Crocker-Huffman Diversion Dam downstream to the confluence with the San Joaquin River.

CVfall-run Chinook Salmon spend most of their lifecycle in the coastal waters of the Pacific United States but must return to freshwater to reproduce (Merz et al. 2013). During immigration, adults stop feeding, causing them to live on body fat reserves. Although cues triggering adult return to spawning grounds are not well understood it is thought that the ability to find their way is mainly related to long-term olfaction memory (Dittman and Quinn 1996). Homing ability may also be aided by vision (Healey 1991), celestial and magnetic compass orientation (Quinn 1980), and may be stimulated by changes in streamflow, turbidity, temperature, and oxygen content (Allen and Hassler 1986). Numerous issues, such as predation, harvest, and water quality affect an adult's ability to reach spawning areas and complete successful spawning (Hillemeier 1999; Beamesderfer 2000; Goniea et al. 2006).

In general, Chinook Salmon spawn in stream gravels with a median diameter up to about 10% of their body length (Zeug et al. 2014; Kondolf and Wolman 1993). Proximity to cover and flow shear zones provide important refuge from predation and resting zones for energy conservation (Merz 2001; Wheaton et al. 2004). During spawning, females force gravel and fine sediment into the water column; this action coarsens the spawning substrate, forming an oval depression with a mound of bed material located immediately downstream (Crisp and Carling 1989). Often several males will court the female and her eggs may be fertilized by more than one male. Chinook Salmon spawn once and then die (semelparity) although individuals may survive for days to weeks after spawning completion.

Fecundity and egg size differs among salmon stocks inhabiting different geographic areas (Fleming and Gross 1990; Myers et al. 1998). For example, the average number of eggs per

female CV fall-run Chinook Salmon from the Mokelumne River is 5,423 (range: 2,132-9,492) while the average for the Sacramento River is 7,423 eggs (range: 4795-11,012) (Healey and Heard 1984; Kaufman et al. 2009). Density dependent (e.g., disease, redd superimposition) and independent variables (e.g. temperature, flow) can affect spawning success and health of gametes released to the stream (Patterson et al. 2004; Tierney et al. 2009). Since available spawning areas are limited, late spawners may superimpose redds on previously constructed sites. Superimposition can be a major mortality factor for incubating embryos causing a density dependent relationship where fry production is inversely related to adult spawner numbers (McNeil 1964: Heard 1978: Buklis and Barton 1984: Parenskiy 1990: Chebanov 1991).

Female salmon bury fertilized eggs in redds where they develop in gravel interstices. Incubation generally lasts from 40 to 90 days at water temperatures of 40 to 54 °F (4.4 to 12.2 °C; Bams 1970; Heming 1982; Bjornn and Reiser 1991; Geist et al. 2006). Alevins may remain in the gravel for 4 to 6 weeks after hatching, receiving nutrients and energy from their yolk sacs before emerging to the water column (Moyle 2002). Incubation is highly dependent on water temperature, DO, and substrate permeability (Merz et al. 2004). For successful incubation, gravel must be sufficiently fine sediment free to adequately bring DO to embryos, carry off metabolic wastes, and not hinder emergence (Tappel and Bjornn 1983; Chevalier et al. 1984; Groot and Margolis 1991). Other water quality-related parameters (e.g. disease, contaminants) can further affect development and survival (Merz and Moyle 2006).

Newly emerged young are often found in shallow, slow-moving water and transition to deeper, faster water as they increase in size (see Cramer and Ackerman 2009). Habitat complexity (e.g., woody debris, overhanging vegetation, seasonally inundated areas) provides juvenile hiding, resting, and feeding habitat, increasing ability to grow, mature, and survive emigration. Juvenile diets often vary by habitat type, but terrestrial and aquatic invertebrates, and larval fish and eggs are important prey for juvenile salmon upstream of the Delta (Sasaki 1966; Merz and Vanicek 1996; Sommer et al. 2001). Prey size and ingestion rates are affected by juvenile size and water temperature (Merz 2002). At times, floodplains may provide better juvenile rearing opportunities because they often create optimum temperatures, rich in prey items away from salmon predators and high flows (Sommer et al. 2001; Jeffres et al. 2008). Habitat availability, water quality, and predation are examples of environmental parameters that can affect successful rearing (Lindley and Mohr 2003).

When and how emigrants leave a natal stream depends on individual genetics, social cues, and environmental factors individuals are exposed to as they emerge, rear, and migrate downstream. Within the CV, fall-run Chinook Salmon emigration size varies extensively. For example, juvenile CV fall-run emigrate as fry (<55 mm [2.2 in] Fork Length [FL]), parr (>55 mm [2.2 in] FL and <75 mm [3 in] FL), or smolts (>75 mm [3 in] FL) (Brandes and McLain 2000; Williams 2001). In some systems, the proportion of salmon leaving as fry, parr, or smolts may shift from year to year. While several researchers have questioned if fry migrants make a significant contribution to adult populations (Brandes and McLain 2000; Williams 2001), Miller et al. (2010) demonstrated that fry-sized CV Chinook Salmon emigrants are a viable life history strategy. Flow, temperature, water quality, diversion, and predation are thought to be key parameters affecting successful emigration (Sabal et al. 2016; Cavallo et al. 2013).

CV fall-run Chinook Salmon are present within the Action Area. CV fall-run Chinook Salmon primarily spawn during October to December in the upper reaches of the LMR between Crocker-Huffman Diversion Dam and the Hwy 59 bridge (CFS, unpublished data). Juvenile CV fall-run Chinook Salmon in the nearby Stanislaus River primarily outmigrate as fry during wet years and fry and smolts during dry years (Sturrock *et al*. 2015) with a similar pattern likely occurring in the Merced River. According to snorkel and seining data, CV fall-run Chinook Salmon emergence and rearing period generally extends from mid-January through June, and outmigration may occur throughout this period (CFS, unpublished data).

The following special status fish species are likely to occur in the Action Area: fall-run Chinook Salmon, Pacific Lamprey, Western River Lamprey, Western Brook Lamprey, Kern Brook Lamprey, Riffle Sculpin, San Joaquin Roach, and Hardhead. Project construction activities have the potential to adversely impact these special status fish species and their habitat. The special status salmonids have similar habitat requirements therefore they are considered together in the impact analysis of the Project. Likewise, Pacific Lamprey, Western River Lamprey, Western Brook Lamprey, and Kern Brook Lamprey have similar habitat requirements and so they are considered together. The potentially adverse effects expected during Project construction activities are temporary loss of benthic macroinvertebrates, unintentional spread of non-native invasive species, sediment mobilization and increase in turbidity, temporary loss of riparian vegetation, disturbance or harassment from construction equipment including noise, and potential spills of toxic substances.

Turbidity and Sedimentation

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

High concentrations of suspended sediment can have both direct and indirect effects on salmonids and other special status fishes. The severity of these effects depends on the sediment concentration, duration of exposure, and sensitivity of the affected life stage. Based on the types and duration of proposed in-water construction methods, short-term increases in turbidity and suspended sediment may disrupt feeding activities or result in avoidance or displacement of fish from preferred habitat. Juvenile salmonids have been observed to avoid streams that are chronically turbid (Lloyd 1987) or move laterally or downstream to avoid turbidity plumes (Sigler et al. 1984). Bisson and Bilby (1982) reported that juvenile Coho Salmon (*Oncorhynchus kisutch*) avoid turbidities exceeding 70 Nephelometric turbidity unit(s) (NTU). Sigler et al. (1984) found that prolonged exposure to turbidities between 25 and 50 NTUs resulted in reduced growth and increased emigration rates of juvenile Coho Salmon and CCV steelhead compared to controls. These findings are generally attributed to reductions in the ability of salmon to see and capture prey in turbid water (Water 1995).

Chronic exposure to high turbidity and suspended sediment may also affect growth and survival by impairing respiratory function, reducing tolerance to disease and contaminants, and causing physiological stress (Water 1995). Berg and Northcote (1985) observed changes in social and foraging behavior and increased gill flaring (an indicator of stress) in juvenile Coho Salmon at moderate turbidity (30-60 NTUs). In this study, behavior returned to normal quickly after turbidity was reduced to lower levels (0-20 NTU). In addition to direct behavioral and physical effects on fish, increased sedimentation can alter downstream substrate conditions, as suspended sediment settles and increases the proportion of fine particles in the system. Adult salmonids require coarse substrate (gravel and small cobbles) to construct redds, and deposition of fine substrate may reduce egg and alevin survival and lead to decreased production of the macroinvertebrate prey of juvenile salmonids (Chapman 1988; Phillips et al. 1975; Colas et al. 2013). Deposited fine sediment can impair growth and survival of juvenile salmonids (Suttle et al. 2004; Harvey et al. 2009). However, minor accumulations of deposited sediment downstream of construction zones are generally removed during normal annual high flow events (Anderson et al. 1996).

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

The number of juvenile salmonids and other special status fishes potentially residing in the Action Area during in-water construction is expected to be low because of the time of year and low quality of existing habitat (CFS unpublished data). Individual fish that encounter increased turbidity or sediment concentrations would be expected to move laterally, downstream, or upstream of the affected areas. For juveniles, this may increase their exposure to predators if they are forced to leave protective habitat.

The impacts of sedimentation and turbidity from construction on fish species are **potentially significant.** However, with implementation of **WQ-1 - Monitor Water Quality and Prevent Impacts,** the Proposed Project's sedimentation and turbidity impacts on special status fish species and their habitat would be **less than significant**.

Contaminants

During construction activities, the potential exists for spills or leakage of toxic substances that could enter the Merced River. Refueling, operation, and storage of construction equipment and materials could result in accidental spills of pollutants (e.g., fuels, lubricants, concrete, sealants, and oil). High concentrations of contaminants can cause adverse direct (sublethal to lethal) and indirect effects on fish. Direct effects include mortality from exposure or increased susceptibility to disease that reduces the overall health and survival of the exposed fish. The severity of these effects depends on the contaminant, the concentration, duration of exposure, and sensitivity of the affected life stage. A potential indirect effect of contamination is reduced prey availability; invertebrate prey survival could be reduced following exposure, therefore making food less available for fish. Fish consuming infected prey may also absorb toxins directly.

For special status fishes, potentially significant direct and indirect effects of reduced water quality during construction would be addressed by avoiding construction during times when fish are most likely to be present, utilization of vegetable-based lubricants and hydraulic fluids in equipment operated in the wet channel, and by implementing the construction housekeeping measures described in the SWPPP (see **WQ-1 - Monitor Water Quality and Prevent Impacts)**. These measures include provisions to control erosion and sedimentation, as well as a Spill Prevention and Response Plan to avoid, and if necessary, clean up accidental releases of hazardous materials. The construction contractor would be responsible for complying with all conditions of these commitments. Implementation of the measures discussed above and **WQ-2 – Use Clean Equipment and Bio-degradable Lubricants,** the direct and indirect impacts of contaminants on special status fish species would be **less than significant**.

Non-native invasive species can be considered a biological contaminant because many species have adverse impacts on the community that they invade. For example, the thick, filamentous algae Didymo (*Didymosphenia geminata*) is thought to have a significant effect on ecosystems due to its ability to alter abundance and distribution of organisms at the base of the aquatic food web (e.g., Gillis and Chalifour, 2010; Anderson et al. 2014). In waters where Didymo is abundant, macroinvertebrate taxonomic composition tends to shift from a highly diverse assemblage of large-bodied taxa to a less diverse assemblage of smaller-bodied taxa such as diptera, especially Chironomidae (Mundie and Crabtree, 1997; Blanco and Ector, 2009; Gillis and Chalifour, 2010; James et al., 2010). Likewise, molluscs such as the Overbite Clam (*Corbula amurensis*) and New Zealand Mud Snail (*Potamopyrgus antipodarum*) can out-compete native benthic invertebrates that dominate the diets of juvenile salmonids and other salmonids (Feyrer et al. 2003; Brenneis et al. 2011; Merz et al. 2016). These species are often spread by aquatic vehicles or other equipment, which carry propagules from one watershed to another. Because equipment would be working within the river channel during Proposed Project construction, this is a potentially significant impact. However, implementation of **BIO-7 - Prevent Spread of New Zealand Mudsnails and other Aquatic Invasive Species** would reduce this impact to **less than significant.**

Noise

Noise generated by heavy equipment and personnel during construction activities could adversely affect special status fish species. The potential direct effects of underwater noise on fish depend on a number of biological characteristics (e.g., fish size, hearing sensitivity, behavior) and the physical characteristics of the sound (e.g., frequency, intensity, duration) to which fish are exposed. Potential direct effects include behavioral effects, physiological stress, physical injury (including hearing loss), and mortality. The loudest noise generated is expected from the sorting of sediment with a mobile sorting plant. Loud noise would also be generated during placement of gravel to create/enhance spawning riffles and other habitat features. Using experienced heavy equipment operators would help minimize the noise impact during gravel augmentation. Diesel engines will also generate noise within the Action Area. No diesel engines or their exhaust systems would come into contact with the flowing channel. Any fish present in the vicinity of the active construction area would be expected to detect and temporarily avoid the area as a result of the noise and disturbance. Implementation of **BIO-5 – Work Outside of Critical Periods or Monitor for Sensitive Species** and **NOISE-1 - Reduce Impacts from Noise**, would reduce the impact of noise on special status fish to **less than significant**.

Instream Construction Activities
In-stream construction activities are expected to cause juvenile salmonids and other special status fish species to temporarily migrate away from the disturbance zone to avoid construction impacts in areas where fish relocation does not occur. In-stream construction activities are not expected to affect juvenile Chinook Salmon because construction activities would occur after nearly all juvenile fall-run Chinook Salmon have migrated out of the Merced River. The only juvenile fall-run Chinook Salmon that may be affected would be demonstrating the yearling life history strategy, and the yearling life history strategy for fall-run Chinook Salmon in the Merced River is extremely rare (CFS unpublished data).

Fish that temporarily or permanently relocate in response to in-stream construction activities may endure short term stress from being forced to migrate away from their rearing area and needing to locate a new rearing area downstream. Fish may endure some short-term stress from crowding and competition with resident fish for food and habitat. Fish may also be subject to increased predation risk while they are locating a new rearing area. However, this effect would be temporary, and predation risks associated with diversions are expected to decrease once the Proposed Project is complete. A small number of juvenile *O. mykiss*, Hardhead, San Joaquin Roach, or Riffle Sculpin may be displaced if they are present (CFS unpublished data). Given the limited size of the Action Area sites and small number of individual fish that may be affected, is not expected that the temporary displacement of fish or the competition they endure would affect the survival of individual fish or the population as a whole.

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

Instream construction activities are expected to cause disturbance of benthic aquatic macroinvertebrates as coarse sediment is placed into the river channel. However, these effects would be temporary because construction activities would be relatively short in duration and over a limited area. Rapid recolonization (approximately two weeks to two months) of the new sediment is expected (Merz and Chan, 2005; CFS unpublished data). Implementation of **BIO-5 – Work Outside of Critical Periods or Monitor for Sensitive Species** would result in a **less than significant** impact of instream construction activities on special status fish species.

Physical Habitat Modification
Construction activities would modify bank habitat by removing nonnative and native vegetation along the bank, re-siting diversions as necessary, moving screens to the main channel in accordance with current best practices, and by eliminating deep, slow habitats that currently harbor non-native aquatic vegetation and non-native fish predators of salmonids. To the maximum extent practicable, existing riparian habitat would be retained and disturbance would be minimized. Following construction, all disturbed or exposed soils would be stabilized and/or planted with native woody and herbaceous vegetation to control erosion and offset any loss of vegetation. Non-native plant species would be replaced with native riparian plants. Some short-

term loss of mature riparian vegetation may occur during construction; however, natural riparian vegetation recruitment is expected to occur rapidly following construction (Sellheim et al. 2016), resulting in an increase in the amount and extent of riparian habitat within the Action Area. This increase in riparian habitat is expected to provide increased rearing habitat, complexity, and cover for fall-run Chinook Salmon and other native fishes in the Action Area.

Large woody material will also be added to the floodplain and side channels to serve as structural cover and velocity refuge for juvenile salmonids, and serve a variety of geomorphic functions including scour protection, scour enhancement, sediment deposition and sorting. Large woody material added as part of the Proposed Project would increase instream habitat diversity and complexity within the Action Area, which is expected to result in a beneficial impact to salmonids and other native fishes.

When complete, the Proposed Project is expected to improve migration conditions for fish in the main channel of the Merced River by minimizing adverse effects from diversion activities and improving habitat upstream of diversions. Overall, completion of the Proposed Project is expected to provide higher quality and quantity of habitat for juvenile and adult salmonids and other native fishes. Although some short-term disturbance may occur when cobble and gravel are added to the main channel, these effects would be minimized through implementing **BIO-5 – Work Outside of Critical Periods or Monitor for Sensitive Species** and therefore impacts on special status fish species would be **less than significant**. Indirect and long-term effects on salmonids and their habitat would be beneficial.

Critical Habitat and Essential Fish Habitat

The instream construction is expected to have short term effects on the Critical Habitat Physical and Biological Features (PBFs) of freshwater rearing habitat, spawning habitat, and freshwater migration corridors and the EFH Habitat Areas of Particular Concern (HAPC) of complex channels and floodplain habitats, spawning habitat, and migration corridors through construction disturbance and modification as well as the removal of some riparian trees and shrubs. Freshwater rearing habitat, spawning habitat, and migration corridors would be temporarily disturbed during the addition of cobble and gravel to create/enhance salmonid spawning riffles, eliminate non-native fish holding pools, and other main channel habitat features.

These habitats may be impacted by temporary increases to turbidity and suspended sediment as well as release of contaminants; however, these impacts are expected to be localized, minor, and short term. Implementation of a SWPPP with a spill prevention and response plan, construction BMPs, and performing work outside of critical periods for special status species would result in a **less than significant** impact to critical habitat and EFH.

Long-term direct effects on designated critical habitat and EFH are beneficial, including: improved screening of four existing diversions, reduced in-water work in future years related to annual diversion maintenance, reduced predator habitat upstream of diversions, reduced opportunity for salmonid predation due to diversion modernization, reduced migration costs for juvenile and adult salmonids, and increased spawning and rearing habitat near diversions through gravel augmentation and riffle construction. These modifications would result in a beneficial effect on special status fish by minimizing adverse effects of diversions and by converting existing low quality habitats associated with diversions targeted by the Proposed Project into rehabilitated

riffle and riparian habitat. Spawning habitat quality and quantity would be increased through addition of appropriately sized salmonid spawning gravel in several locations in the main channel with suitable depths and velocities for spawning. The main channel within the Action Area would continue to function as a freshwater migration corridor by providing adequate passage for adults and juvenile salmonids. The Proposed Project would provide additional high quality rearing and spawning habitat for Chinook Salmon. In summary, the Proposed Project may have significant short-term impacts on special-status species. However, with implementation of the EC's these impacts are expected to be **less than significant**.

b) The Proposed Project construction activities, including gravel augmentation, riffle construction, and re-siting of diversions as necessary would have temporary impacts which are potentially significant on these sensitive natural communities. This includes some limited removal of riparian vegetation to access the bank for diversion and habitat enhancements. However, most of the construction activities will occur in areas that are currently poorly vegetated. Ultimately, the Proposed Project will increase the extent of native riparian vegetation along the banks of the LMR.

Riparian planting will occur as part of the Proposed Project, including species such as Fremont cottonwood, elderberry, alder, and willow. In addition, the topographic manipulations are expected to reduce habitat for non-native aquatic vegetation and improve recruitment of native riparian vegetation within the Action Area (Sellheim et al. 2016).

Riparian planting and predicted natural recruitment, as well as **BIO-4 - Protect and Compensate for Native Trees** and **BIO-1 - Adaptive Construction Approach to Protect Elderberry Plants and Mitigate for Loss** would reduce impacts to sensitive natural communities to **less than significant**. Overall, implementation of the Proposed Project is expected to improve quality and quantity of riparian vegetation, including the vegetation alliances of Great Valley mixed riparian forest within the Action Area.

c) Implementation of the Proposed Project would result in main channel and riparian rehabilitation to improve habitat for fall-run Chinook Salmon and other native fishes. Within the Cowell 2 Action Area there are 0.15 acres of emergent wetland, 50.83 acres of riparian wetland, 0.04 acres of pond, 29.97 acres of perennial channel, 3.96 acres of irrigation canal, 3.99 acres of irrigation pond, 1.44 acres of seasonal irrigation pond, and 0.03 acres of irrigation headgate **(**Error! R eference source not found.). Within the Cowell 1 Action Area there are 0.56 acres of emergent wetland, 11.66 acres of riparian wetland, 0.75 acres of pond, 9.61 acres of perennial channel, and 0.84 acres of irrigation canal. Within the Cuneo Action Area there are 0.42 acres of emergent wetland, 6.09 acres of riparian wetland, 6.94 acres of perennial channel, and 0.48 acres of irrigation canal.

Table 7. The existing and Proposed Project acreage of aquatic resource types for each of the three sites (Cowell 2, Cowell 1, and Cuneo) with the change in acres for the Propose Project condition in parentheses.

	Cowell 2	Cowell 1	Cuneo
Aquatic Resource Type	**Existing Acreage**		
Emergent Wetland	0.15	0.56	0.42
Riparian Wetland	50.83	11.66	6.09
Pond	0.04	0.75	0
Perennial Channel	29.97	9.61	6.94
Irrigation Canal	3.96	0.84	0.48
Irrigation Pond	3.99	0	0
Seasonal Irrigation Pond	1.44	0	0
Irrigation Headgate	0.03	0	0
Seasonal Floodplain	0	0	0
Side Channel	0	0	0
Total	**90.41**	**23.43**	**13.92**
	Project Acreage (Change)		
Emergent Wetland	0.15	0.53 (-0.03)	0.42
Riparian Wetland	48.89 (-1.94)	9.27 (-2.39)	5.94 (-0.15)
Pond	0.04	0.22 (-0.53)	0
Perennial Channel	28.98	9.61	6.93 (-0.01)
Irrigation Canal	3.96	0.58 (-0.26)	0.47 (-0.01)
Irrigation Pond	0 (-3.99)	0	0
Seasonal Irrigation Pond	0.74 (-0.70)	0	0
Irrigation Headgate	0.03	0	0
Seasonal Floodplain	6.17 (+6.17)	10.36	0.63 (+0.63)
Side Channel	5.58 (+5.58)	0	0
Total	**94.54**	**30.57**	**14.39**

Implementation of the Proposed Project would result in creation of new aquatic resources, permanent change of aquatic resource types, and permanent and temporary impacts. More specifically, Cowell 2 implementation result in the creation of 3.00 acres of new side channel and 2.51 acres on new floodplain aquatic resources, permanent change of 0.40 acres of riparian wetland, and 3.26 acres of irrigation pond to floodplain, permanent change of 1.53 acres of riparian wetland, 0.53 acres of irrigation pond, and 0.70 acres of seasonal irrigation pond, permanent impact through fill to improve fish habitat to 5.4 acres of perennial channel and 0.55 acres of riparian wetland, permanent impact through excavation to improve fish habitat to 0.09 acres of riparian wetland and 0.20 acres of perennial channel, and permanent loss of 0.02 acres of riparian wetland through pipe installation **(Table 8**Error! Reference source not found.). Implementation of Cowell 1 would result in 9.64 acres of new floodplain aquatic resource, permanent change of 0.46 acres of riparian wetland and 0.25 acres of pond to floodplain, permanent impact through fill to improve fish habitat to 0.93 acres of riparian wetland, 0.003 acres of emergent wetland, 4.125 acres of perennial channel, 0.02 acres of pond, and 0.19 acres of irrigation canal, and permanent loss of 1.0 acres of riparian wetland, 0.03 acres of emergent wetland, 0.003 acres of perennial channel, 0.07 acres of irrigation canal, and 0.27 acres of pond (**Table 8**). Implementation of Cuneo would result in creation of 0.57 acres of new floodplain aquatic resource, permanent change of 0.05 acres of riparian forest to floodplain, permanent impact through fill to improve fish habitat to 0.22 acres of riparian wetland and 1.62 acres of

perennial channel, and permanent loss through pipe installation to 0.09 acres of riparian wetland, 0.01 acres of perennial channel, and 0.01 acres of irrigation canal (**Table 8**).

Table 8. The type of impacts (acres) the Project would have on the aquatic resource types present within the Action Area.

Aquatic Resource Type	Temporary	Permanent (pipe)	Permanent (fill)	Permanent Change (floodplain excavation)	Permanent Change (fill)	Permanent Change (side channel creation)	New
Cowell 2							
Emergent Wetland	0	0	0	0	0	0	0
Riparian Wetland	0	0.02	0.55	0.4	0	1.53	0
Perennial Channel	0	0	5.40	0	0	0	0
Irrigation Canal	0	0	0	0	0	0	0
Irrigation Pond	0	0	0	0	3.26	0.35	0
Seasonal Irrigation Pond	0	0	0	0	0	0.70	0
Seasonal Floodplain	0	0	0	0	0	0	2.51
Side Channel	0	0	0	0	0	0	3.00
Cowell 1							
Emergent Wetland	0	0.03	0.003	0	0	0	0
Riparian Wetland	0	1.00	0.93	0.46	0	0	0
Perennial Channel	0	0.003	4.125	0	0	0	0
Pond	0	0.27	0.02	0.25	0	0	0
Irrigation Canal	0	0.07	0.20	0	0	0	0
Seasonal Floodplain	0	0	0	0	0	0	9.64
Cuneo							
Riparian Wetland	0	0.09	0.22	0.05	0	0	0
Perennial Channel	0	0.01	1.62	0	0	0	0
Irrigation Canal	0	0.01	0	0	0	0	0
Seasonal Floodplain	0	0	0	0	0	0	0.57

Implementation of the Proposed Project would result in a net gain in Waters of the U.S. and is expected to ease navigation by moving screens onto the main channel and eliminating the need for temporary in-channel berms; the Proposed Project is also expected to reduce agricultural water demands in the LMR by increasing diversion efficiency. Overall, implementation of the Proposed Project would result in no net change to Waters of the U.S. Therefore, the impact on jurisdictional Waters of the U.S. would be **less than significant**.

d) The LMR and the adjacent riparian areas within the Action Area serve as a migration corridor for wildlife. Likewise, the river serves as a migratory corridor for resident and anadromous fish. Wildlife may experience some temporary disturbance to movement corridors from the construction activities. Construction activities would occur primarily from 7:00 am to 5:00 pm, allowing wildlife to migrate without disturbance outside of the Proposed Project work hours. Resident and migratory fish may experience short term migration disturbance when course substrate is being added to the river. Therefore, the course substrate addition would occur outside of the migration window for juvenile and adult salmonids. Course substrate addition would occur for up to a month within each construction year, from 7:00 am to 5:00 pm. Adult and juvenile anadromous salmonids generally migrate from dusk until dawn so, if salmonids are present, peak migration times would not overlap with Proposed Project work hours. Implementation of the Proposed Project would have long term beneficial impacts on riparian habitat and instream habitat for special status fish species. Therefore, adverse impacts to wildlife or fish movement or wildlife migration corridors would be **less than significant**.

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

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

Documentation:

Adkins, J.Y. and Roby, D.D., 2010. A Status Assessment of the Double-crested Cormorant (*Phalacrocorax auritus*) in Western North America: 1998-2009.

Allen, M.A. and T.J. Hassler. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest) - Chinook Salmon. U.S. Fish and Wildlife Service, Biological Report 82 (11.49). U.S. Army Corps of Engineers, TR EL-82-4.

Anderson, C.W., F.R. Rinella, and S.A. Rounds. 1996. Occurrence of selected trace elements and organic compounds and their relation to land use in the Willamette river basin, Oregon, 1992-94.

Anderson, I.J., M.K. Saiki, K.L. Sellheim, and J.E. Merz. 2014. Differences in benthic macroinvertebrate assemblages associated with a bloom of *Didymosphenia geminata* in the Lower American River, California. The Southwestern Naturalist 59(3): 389-395.

Ashton, D.T., A.J. Lind, and K.E. Schlick. 1997. Western pond turtle (*Clemmys marmorata*). Natural History. USDA Forest Service, Pacific Southwest Research Station, Arcata, CA.

Ashton, D.T., J.B. Bettaso, H.H. Welsh Jr, and H. Hartwell. 2011. Comparative ecology of Western Pond Turtle (*Actinemys marmorata*) populations on the free-flowing South Fork and regulated Main Fork Trinity River: demography, size, and body condition comparisons, thermal ecology, and spatial dynamics. Final Report to the Trinity River Restoration Program, United States Department of the Interior, Bureau of Reclamation.

Bailey, E.D. 1954. Time pattern of 1953–54 migration of salmon and steelhead into the upper Sacramento River. CDFG unpublished report. 4 p.

Bams, R.A. 1970. Evaluation of a revised hatchery method tested on pink and chum salmon fry. Journal of the Fisheries Board of Canada 27(8):1429-1452.

Barnhart, R.A. and M.S. Busby. 1986. Chinook salmon populations and related biological parameters, Mattole River lagoon, June 1986-October 1986. Summary Report to Bureau of Land Management, Arcata Resource Area, Arcata, CA. California Cooperative Fishery Research Unit, Humboldt State University, Arcata, CA.

Barr, C.B. 1991. The distribution, habitat, and status of the valley elderberry longhorn beetle *Desmocerus californicus dimorphus*. U.S. Fish and Wildlife Service, Sacramento, CA.

Baumsteiger, J.D. 2013. Diversification, speciation, and phylogeography of freshwater sculpins (*Cottus Cottopsis*) in California. Doctoral dissertation, University of California, Merced.

Beamesderfer, R.C.P. 2000. Managing fish predators and competitors: deciding when intervention is effective and appropriate. Fisheries 25(6):18-23.

Berg, L. and T. G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (Oncorhynchus kisutch) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42(8): 1410-1417.

Beechie, T.J., M. Liermann, E.M. Beamer, and R. Henderson. 2005. A classification of habitat types in a large river and their use by juvenile salmonids. Transactions of the American Fisheries Society 134(3):717-729.

Bisson, P.A. and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile Coho Salmon. North American Journal of Fisheries Management 2(4): 371-374.

Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. American Fisheries Society 19:83-138.

Blanco, S. and L. Ector. 2009. Distribution, ecology and nuisance effects of the freshwater invasive diatom *Didymosphenia geminata* (Lyngbye) M. Schmidt: a literature review. Nova Hedwigia 88(3–4): 347–422.

Brandes, P.L. and J.S. McLain. 2000. Juvenile Chinook salmon abundance, distribution, and survival in the Sacramento-San Joaquin Estuary. Department of Fish and Game.

Braun, S.E. 1985. Home range and activity patterns of the giant kangaroo rat, Dipodomys ingens. J. Mammal. 66:1-12.

Brenneis, V.E., A. Sih, and C.E. de Rivera. 2011. Integration of an invasive consumer into an estuarine food web: direct and indirect effects of the New Zealand Mud Snail. Oecologia 167(1): 169-179.

Buklis L.S. and L.H. Barton. 1984. Yukon River fall chum salmon biology and stock status. Informational Leaflet 239. Available at the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 25526, Juneau, Alaska 99802, U.S.A.

CDFW. 2018. California Natural Diversity Database. Sacramento, CA. http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp. Accessed 10 February 2021.

CNPS. 2021. Inventory of rare and endangered plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 10 February 2021]

Cavallo, B., J. Merz, and J. Setka. 2013. Effects of predator and flow manipulation on Chinook salmon (*Oncorhynchus tshawytscha*) survival in an imperiled estuary. Environmental Biology of Fishes 96(2):393-403.

Chapman, D.W. 1988. Critical review of variables used to define effects of fines in redds of large salmonids. Transactions of the American Fisheries Society 117(1): 1-21.

Chebanov, N. 1991. The effect of spawner density on spawning success, egg survival, and size structure of the progeny of the sockeye salmon, *Oncorhynchus nerka*. Journal of Ichthyology 31:101-106.

Cheatham, N.D. 1976. Conservation of vernal pools. Pages 87-89 in, S. Jain, ed. Vernal Pools: Their Ecology and Conservation. Institute of Ecology Publication No. 9, University of California Davis.

Chevalier, B.C., C. Carson, and W.J. Miller. 1984. Report of engineering and biological literature pertaining to the aquatic environment: with specific emphasis on dissolved oxygen and sediment effects on salmonid habitat. Colorado State University, Department of Agriculture and Chemical Engineering. ARS Project 5602-208130-008A, Fort Collins.

Colas, F., J. Baudoin, M. Danger, P. Usseglio-Polatera, P. Wagner, and S. Devin. 2013. Synergistic impacts of sediment contamination and dam presence on river functioning. Freshwater Biology 58:320-336.

Cramer, S.P. and N.K. Ackerman. 2009. Linking stream carrying capacity for salmonids to habitat features. In American Fisheries Society Symposium 71:225-254.

Crisp, D.T. and P.A. Carling. 1989. Observations on siting, dimensions and structure of salmonid redds. Journal of fish biology 34(1):119-134.

Davis, W.E. and D.J. Schmidly. 1994. The mammals of Texas. Texas Parks and Wildlife Press, Austin. 338 pp.

Dewey, T. and V. Perepelyuk. 2000. "*Accipiter cooperii*". Animal Diversity Web. Accessed April 22, 2012.

Dittman, A. and T. Quinn. 1996. Homing in Pacific salmon: mechanisms and ecological basis. Journal of Experimental Biology 199(1):83-91.

Dixon, J.B., R.E. Dixon, and J.E. Dixon. 1957. Natural history of the White-tailed Kite in San Diego County, California. The Condor 59(3):156-165.

Dunk, J.R. 1995. White-tailed Kite (*Elanus leucurus*). In A. Poole and F. Gill (eds.), The Birds of North America, No. 178. The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, DC U.S.A.

Eckerle, K.P. and C.F. Thompson. 2001. Yellow-breasted Chat (*Icteria virens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/575doi:bna.575

Eng, L.L., D. Belk, and C.H. Eriksen. 1990. California Anostraca: Distribution, habitat, and status. Journal of Crustacean Biology 10(2):247-277.

Eriksen, C.H. and D. Belk. 1999. Fairy shrimps of California's puddles, pools and playas. Mad River Press, Inc., Eureka, CA.

Feyrer, F., B. Herbold, S.A. Matern, and P.B. Moyle. 2003. Dietary shifts in a stressed fish assemblage: consequences of a bivalve invasion in the San Francisco Estuary. Environmental Biology of Fishes 67(3): 277-288.

Finkelstein, Myra, Zeka Kuspa, Noel F. Snyder and N. John Schmitt. 2015. California Condor (*Gymnogyps californianus*), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA.

Fisher, R.G., R.W. Hansen, G. Hansen, and G. Stewart. 1994. Giant Garter Snake: Conservation and Recovery. Page 285 in C.G. Thelander and M. Crabtree (eds.), Life on the Edge: a Guide to California's Endangered Natural Resources and Wildlife. Santa Cruz, CA: Biosystems Books.

Fleming, I.A. and M.R. Gross. 1990. Latitudinal clines; a tradeoff between egg number and size of Pacific salmon. Ecology 71:1-11.

Geist, D.R., C.S. Abernethy, K.D. Hand, V.I. Cullinan, J.A. Chandler, and P.A. Groves. 2006. Survival, development, and growth of fall Chinook Salmon embryos, alevins, and fry exposed to variable thermal and dissolved oxygen regimes. Transactions of the American Fisheries Society 135(6):1462-1477.

Gillis, C.A. and M. Chalifour. 2010. Changes in the macrobenthic community structure following the introduction of the invasive algae Didymosphenia geminata in the Matapedia River (Quebec, Canada). Hydrobiologia 647: 63–70.

Grinnell, J. 1922. A geographical study of the kangaroo rats of California 21. University of California Press.

Groot, C. and L. Margolis. 1991. Pacific Salmon life histories. Vancouver: UBC Press.

Goniea, T.M., M.L. Keefer, T.C. Bjornn, C.A. Peery, D.H. Bennett, and L.C. Stuehrenberg. 2006. Behavioral thermoregulation and slowed migration by adult fall Chinook salmon in response to high Columbia River water temperatures. Transactions of the American Fisheries Society 135(2):408-419.

Goodman, D.H., S.B. Reid, M.F. Docker, G.R. Haas, and A.P. Kinziger. 2008. Mitochondrial DNA evidence for high levels of gene flow among populations of a widely distributed anadromous lamprey *Entosphenus tridentatus* (Petromyzontidae). Journal of Fish Biology 72:400-417.

Goodman, D.H. and S.B. Reid. 2012. Pacific Lamprey (*Entosphenus tridentatus*) assessment and template for conservation measures in California. US Fish and Wildlife Service, Arcata, California.

Hafner, David J. (1998). North American Rodents: Status Survey and Conservation Action Plan. IUCN. pp. 76–78. ISBN 978-2-8317-0463-0.

Hallock, R. J., W.F. Van Woert, and L. Shapovalov. 1961. An evaluation of stocking hatchery reared steelhead rainbow trout (*Salmo gairdnerii gairdnerii*) in the Sacramento River system. California Department of Fish and Game 114. 74 pp.

Halstead, B.J., G.D. Wylie, and M.L. Casazza. 2014. Ghost of habitat past: historic habitat affects the contemporary distribution of giant garter snakes in a modified landscape. Animal Conservation 17(2):144-153.

Harvey, B.C., J.L. White, and R.J. Nakamoto. 2009. The effect of deposited fine sediment on summer survival and growth of rainbow trout in riffles of a small stream. North American Journal of Fisheries Management 29:434-440.

Healey, M.C. 1991. Life history of Chinook Salmon (*Oncorhynchus tshawytscha*). Pages 311–393 in C. Groot and L. Margolis, editors. Pacific salmon life histories. University of British Columbia Press, Vancouver, British Columbia.

Healey, M.C., and W.R. Heard. 1984. Inter-and intra-population variation in the fecundity of Chinook Salmon (*Oncorhynchus tshawytscha*) and its relevance to life history theory. Canadian Journal of Fisheries and Aquatic Sciences 41:476-483.

Heath, Shane R., Erica H. Dunn and David J. Agro. 2009. Black Tern (*Chlidonias niger*), version 2.0. In The Birds of North America (P. G. Rodewald, editor). Cornell Lab of Ornithology, Ithaca, New York, USA.

Heard, W.R. 1978. Probable case of streambed overseeding: 1967 Pink Salmon, *Oncorhynchus gorbuscha*, spawners and survival of their progeny in Sashin Creek, southeastern Alaska. National Oceanic and Atmospheric Administration (United States) Fishery Bulletin 76:569-582.

Helm, B.P. 1998. Biogeography of eight large branchiopods endemic to California. In Ecology, conservation, and management of vernal pool ecosystems− proceedings from a 1996 conference. California Native Plant Society, Sacramento, CA (pp. 124-139).

Heming, T.A. 1982. Effects of temperature on utilization of yolk by chinook salmon (*Oncorhynchus tshawytscha*) eggs and alevins. Canadian Journal of Fisheries and Aquatic Sciences 39(1):184-190.

Hermanson, J.W. and T.J. O'Shea. 1983. *Antrozous Pallidus*. Mammalian Species 213:1-8.

Hillemeier, D. 1999. An assessment of pinniped predation upon fall-run Chinook salmon in the Lower Klamath River, CA, 1997. Yurok Tribal Fisheries Program Report.

Hokanson, K.E.F, C.F. Kleiner, and T.W. Thorslund. 1977. Effects of constant temperatures and diel temperature fluctuations on specific growth and mortality rates and yield of juvenile rainbow trout, *Salmo gairdneri*. Journal of the Fisheries Board of Canada 34(5):639-648.

Holland, D.C. 1994. The Western Pond Turtle: Habitat and History. Final Report. Portland, OR: U.S. Department of Energy, Bonneville Power Administration.

Howell, C.A., J.K. Wood, M.D. Dettling, K. Griggs, C.C. Otte, L. Lina, and T. Gardali. 2010. Least Bell's Vireo breeding records in the Central Valley following decades of extirpation. Western North American Naturalist 70(1):105-113.

James, D.A., S.H. Ranney, S.R. Chipps, and B.D. Spindler. 2010. Invertebrate composition and abundance associated with Didymosphenia geminata in a montane stream. Journal of Freshwater Ecology 25:235–241.

Jeffres, C.A., J.J. Opperman, and P.B. Moyle. 2008. Ephemeral foodplain habitats provide best growth conditions for juvenile Chinook Salmon in a California river. Environmental Biology of Fishes 83:449–458.

Jennings, M.R., M.P. Hayes, and D.C. Holland. 1992. A petition to the US Fish and Wildlife Service to place the California Red-legged Frog (*Rana aurora draytonii*) and the Western Pond Turtle (*Clemmys marmorata*) on the list of endangered and threatened wildlife and plants. US Fish and Wildlife Service, Portland, OR.

Jepson Flora Project. 2018. Jepson eFlora, http://ucjeps.berkeley.edu/eflora/, accessed on August 23, 2018.

Johnsgard, P. 1990. Hawks, Eagles, and Falcons of North America. Washington, DC: Smithsonian Books.

Johnson, L.A. 2013. *Navarretia nigelliformis* subsp. *radians*, in Jepson Flora Project (eds.) Jepson eFlora, Revision 1, http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=51677, accessed on May 25, 2018.

Kalinowski, R.S. and M.D. Johnson. 2010. Influence of Suburban Habitat on a Wintering Bird Community in Coastal Northern California. The Condor 112(2):274-282.

Kaufman, R.C., A.G. Houck, M. Workman, and J.J. Cech. 2009. Chinook Salmon length/fecundity : A regression model for the Mokelumne River, California. California Fish and Game 95:88-105.

Kelley, R.B., M.G. Simpson, K.E. Hasenstab-Lehman. 2012. *Cryptantha mariposae*, in Jepson Flora Project (eds.) Jepson eFlora, viewed 10 May 2018. http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=21258

Kellner, C.V. 1992. The presence of the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) in the San Joaquin Valley, California. Pages 143–147 in Endangered and sensitive species of the San Joaquin Valley, California: their biology, management and conservation, D. F. Williams, S. Byrne and T. A. Rado, Eds. California Energy Commission.

King, J.L., M.A. Simovich, and R.C. Brusca. 1996. Species richness, endemism and ecology of crustacean assemblages in northern California vernal pools. Hydrobiologia 328:85-116.

Kirschbaum, K. and P. Watkins. 2000. *Pandion haliaetus* (On-line), Animal Diversity Web. Available: http://animaldiversity.ummz.umich.edu/site/accounts/information/Pandion_ haliaetus.html

Koch, Jonathan, James Strange, and Paul Williams. 2012. Bumble Bees of the Western United States: a product of the United States Forest Service and the Pollinator Partnership with funding from the National Fish and Wildlife Foundation. 144 pages.

Kondolf, G.M. and M.G. Wolman. 1993. The sizes of salmonid spawning gravels. Water Resources Research 29(7):2275-2285.

Kondolf, G.M., J.C. Vick, and T.M. Ramirez. 1996. Salmon spawning habitat rehabilitation on the Merced River, California: an evaluation of project planning and performance. Transactions of the American Fisheries Society 125(6):899-912.

Kurta, A. 1995. Mammals of the Great Lakes Region. Ann Arbor: University of Michigan Press.

Kus, B.E. 2002. Fitness consequences of nest desertion in an endangered host, the Least Bell's Vireo. The Condor 104(4):795-802.

Lewis, H. and M.E. Lewis. 1955. The genus *Clarkia*. Univ. Calif. Pub. Bot. 20 (4):241–392.

Limas, B. 2001. *Circus cyaneus* (On-line), Animal Diversity Web. Available: http://animaldiversity.ummz.umich.edu/site/accounts/information/Circus_cyaneus.html

Lindley, S.T. and M.S. Mohr. 2003. Modeling the effect of striped bass (*Morone saxatilis*) on the population viability of Sacramento River winter-run chinook salmon (Onchorhynchus tshawytscha). Fishery Bulletin 101(2):321-331.

Lindley, S.T., R.S. Schick, A. Agrawal, M. Goslin, T.E. Pearson, E. Mora, J.J. Anderson, B. May, S. Greene, C. Hanson, and A. Low. 2006. Historical population structure of Central Valley steelhead and its alteration by dams. San Francisco Estuary and Watershed Science 4(1).

Lloyd, D.S. 1987. Turbidity as a water quality standard for salmonid habitats in Alaska. North American Journal of Fisheries Management: Vol. 7, No. 1 pp. 34–45.

Long, C. 1999. American badger: *Taxidea taxus*. Pp. 177-179 in D.E. Wilson, S. Ruff, eds. The Smithsonian Book of North American Mammals. Washington, D.C.: Smithsonian Institution Press.

Macwhirter, R. and K. Bildstein. 1996. Northern Harrier. The Birds of North America, 210:1-25.

McCaskie, G., P. De Benedictis, R. Erickson, and J. Morlan. 1979. Birds of northern California, an annotated field list. 2nd ed. Golden Gate Audubon Soc., Berkeley. 84pp.

McEwan, D. and T.A. Jackson. 1996. Steelhead restoration and management plan for California. California Department of Fish and Game, Inland Fisheries Division, Sacramento, Management Report.

McNeil, W.J. 1964. Redd superimposition and egg capacity of pink salmon spawning beds. Journal of the Fisheries Board of Canada, 21(6):1385-1396.

Meehan, W.R. and T.C. Bjornn. 1991. Salmonid distributions and life histories. Transactions of the American Fisheries Society 19.

Merz, J.E. 2001. Diet of juvenile fall-run Chinook Salmon in the lower Mokelumne River, California. California Fish and Game 87:102–114.

Merz, J.E. 2002. Comparison of diets of prickly sculpin and juvenile fall-run Chinook Salmon in the lower Mokelumne River, California. Southwestern Naturalist 47:195–204.

Merz, J.E., J.D. Setka, G.B. Pasternack, and J.M. Wheaton. 2004. Predicting benefits of spawning-habitat rehabilitation to salmonid (*Oncorhynchus* spp.) fry production in a regulated California river. Canadian Journal of Fisheries and Aquatic Sciences 61:1433-1446.

Merz, J.E. and L.K. Chan. 2005. Effects of gravel augmentation on macroinvertebrate assemblages in a regulated California river. River Research and Applications 21:61-74.

Merz, J.E. and P.B. Moyle. 2006. Salmon, wildlife, and wine: marine-derived nutrients in human-dominated ecosystems of Central California. Ecological Applications 16:999-1009.

Merz, J.E. and C.D. Vanicek. 1996. Comparative feeding habits of juvenile Chinook salmon, steelhead, and Sacramento squawfish in the lower American River, California. California Fish and Game 82(4):149-159.

Merz, J.E., M. Workman, D. Threloff, and B. Cavallo. 2013. Salmon lifecycle considerations to guide stream management: examples from California's Central Valley. San Francisco Estuary and Watershed Science 11(2).

Merz, J.E., D.G. Delaney, J.D. Setka, and M.L. Workman. 2016. Seasonal Rearing Habitat in a Large Mediterranean-Climate River: Management Implications at the Southern Extent of Pacific Salmon (*Oncorhynchus* spp.). River Research and Applications 32(6): 1220-1231.

Miller, J.A., A. Gray, and J. Merz. 2010. Quantifying the contribution of juvenile migratory phenotypes in a population of Chinook Salmon (*Oncorhynchus tshawytscha*). Marine Ecology Progress Series 408:227–240.

Morrell, S. 1972. Life history of the San Joaquin kit fox. California Department of Fish and Game. 58:162-174.

Moyle, P.B. 2002. Inland fishes of California. Revised and expanded. University of California Press, Berkeley and Los Angeles, CA. 502 pp.

Moyle, P.B. and R. Nichols. 1973. Ecology of some native and introduced fishes of the Sierra-Nevada foothills in Central California. Copeia 1973:478-490.

Moyle, P.B., R.M. Quinones, J.V. Katz, and J. Weaver. 2015. Fish Species of Special Concern in California, Third Edition. California Department of Fish and Wildlife, Sacramento, CA.

Moyle, P. B., R. M. Yoshiyama, J. E. Williams, and E. D. Wikramanayake. 1995. Fish species of special concern in California. Final Report. Prepared by Department of Wildlife and Fisheries Biology, University of California, Davis, for CDFG, Inland Fisheries Division, Rancho Cordova, CA.

Mundie, J.H. and D.G. Crabtree. 1997. Effects on sediments and biota of cleaning a salmonid spawning channel. Fisheries Management and Ecology 4: 111–126.

Myers, J.M., R.G. Kope, and G.J. Bryant. 1998. Status review of Chinook Salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA.

Myrick, C.A. and J.J. Cech Jr. 2005. Effects of temperature on the growth, food consumption, and thermal tolerance of age-0 Nimbus-strain steelhead. North American Journal of Aquaculture 67(4):324-330.

Narum, S.R., J.S. Zendt, D. Graves, and W.R. Sharp. 2008. Influence of landscape on resident and anadromous life history types of *Oncorhynchus mykiss*. Canadian Journal of Fisheries and Aquatic Sciences 65(6):1013-1023.

National Marine Fisheries Service (NMFS). 1996. Factors for decline; a supplement to the notice of determination for West Coast Steelhead under the federal ESA. Portland, Oregon.

NMFS. 2006. Biological Opinion for the Sacramento River Flood Control Project, Critical Levee Erosion Repair Project. 151422SWR2006SA00115:HLB. Long Beach, CA. June.

NMFS. 2014. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and California Central Valley Steelhead. West Coast Region. Sacramento, CA. July 2014.

NMFS. 2016. Biological opinion and conference opinion and Fish and Wildlife Coordination Act Recommendations for the Mendota Pool Bypass and Reach 2B Improvements Project. Section 7 Consultation with the U.S. Bureau of Reclamation. Available: http://www.restoresjr.net/?wpfb_dl=1605

Parenskiy, V.A. 1990. Relation between the spawning success of Sockeye Salmon, *Oncorhynchus nerka*, and behavior on spawning grounds. Journal of Ichthyology 30:48–58.

Patterson, D.A., H. Guderley, P. Bouchard, J.S. Macdonald, and A.P. Farrell. 2004. Maternal influence and population differences in activities of mitochondrial and glycolytic enzymes in emergent Sockeye Salmon (*Oncorhynchus nerka*) fry. Can J Fish Aquat Sci 61:1225–1234.

Pearse, D.E. and J.C. Garza. 2015. You can't unscramble an egg: Population genetic structure of *Oncorhynchus mykiss* in the California Central Valley inferred from combined microsatellite and single nucleotide polymorphism data. San Francisco Estuary and Watershed Science 13(4).

Pennack, R.W. 1989. Freshwater invertebrates of the United States from Protozoa to Mollusca. 3rd Edition. Wiley, NY.

Peterson, P.M. and M.J. Harvey 2014. *Agrostis hendersonii*, in Jepson Flora Project (eds.) Jepson eFlora, Revision 2, http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=12291, accessed on May 08, 2018.

Peterson, R. and V. Peterson. 2002. A field guide to the birds of Eastern and Central North America, Fifth Edition. New York: Houghton Mifflin Company.

Phillips, R.W., R.L. Lantz, E.W. Claire, and J.R. Moring. 1975. Some effects of gravel mixtures on emergence of coho salmon and steelhead trout fry. Transactions of the American Fisheries Society 104(3): 461-466.

Poole, A. 1989. Ospreys: A Natural and Unnatural History. New York: Cambridge University Press.

Poole, A.R., R.O. Bierregaard, and M. Martell. 2002. Osprey (*Pandion haliaetus*). A. Poole, F. Gill, eds. The Birds of North America, Vol. 683. Philadelphia, PA: The Birds of North America, Inc.

Preston, R.E., M.S. Park, and L. Constance. 2012a. *Eryngium racemosum*, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=25097, accessed on May 10, 2018.

Preston, R.E., M.S. Park, and L. Constance. 2012b. *Eryngium spinosepalum*, in Jepson Flora Project (eds.) Jepson eFlora, http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=25099, accessed on May 10, 2018.

Quinn, T.P. 1980. Evidence for celestial and magnetic compass orientation in lake migrating sockeye salmon fry. Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology 137(3):243-248.

Reeves, J.E. 1964. Age and growth of hardhead minnow *Mylopharodon conocephalus* (Baird and Girard), in the American River basin of California, with notes of its ecology. M.S. Thesis, U.C. Berkeley, Berkeley, CA.

Reynolds, F.L., T.J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley streams: a plan for action. California Department of Fish and Game, Sacramento, California.

Robins, J.D., and J.E. Vollmar. 2002. Livestock grazing and vernal pools. Wildlife and Rare Plant Ecology of Eastern Merced County's Vernal Pool Grasslands. pp. 402-430.

Sabal, M., S. Hayes, J. Merz, and J. Setka. 2016. Habitat alterations and a nonnative predator, the Striped Bass, increase native Chinook Salmon mortality in the Central Valley, California. North American Journal of Fisheries Management 36(2):309-320.

Sasaki, S. 1966. Distribution and food habits of king salmon, *Oncorhynchus tshawytscha*, and steelhead rainbow trout, *Salmo gairdnerii,* in the Sacramento-San Joaquin Delta. California Department of Fish and Game. Fish Bulletin 136:108-14.

Sellheim, K.L., M. Vaghti, and J.E. Merz. 2016. Vegetation recruitment in an enhanced floodplain: Ancillary benefits of salmonid habitat enhancement. Limnologica-Ecology and Management of Inland Waters 58:94-102.

Servizi, J.A. and D.W. Martens. 1992. Sublethal responses of coho salmon (Oncorhynchus kisutch) to suspended sediments. Canadian Journal of Fisheries and Aquatic Sciences 49(7):1389-1395.

Shefferly, N. 1999. *Taxidea taxus* (On-line), Animal Diversity Web. Available: http://animaldiversity.ummz.umich.edu/site/accounts/information/Taxidea_taxus.html

Shrivell, C.S. 1990. Role of instream rootwads as juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*O. mykiss*) cover habitat under varying streamflows. Canadian Journal of Fisheries and Aquatic Sciences 47(5):852-861.

Shuford WD, Gardali T. 2008. California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1: Western Field Ornithologists, Camarillo, CA, and California Department of Fish and Game, Sacramento, CA.

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelheads and coho salmon. Transactions of the American Fisheries Society 113(2): 142-150.

Smith, H.M. and E.D. Brodie, Jr. 1982. A guide to Field Identification: Reptiles of North America. Golden Press, New York.

Snyder, N. and H. Snyder. 1991. Birds of Prey: Natural History and Conservation of North American Raptors. Stillwater, MN: Voyageur Press.

Sommer, T.R., M.L. Nobriga, W.C. Harrell, W. Batham, and W.J. Kimmerer. 2001. Floodplain rearing of juvenile Chinook Salmon: evidence of enhanced growth and survival. Canadian Journal of Fisheries and Aquatic Sciences 58:325-333.

Spencer, W.D., S.C. Sawyer, H.L. Romsos, W.J. Zielinski, R.A. Sweitzer, C.M. Thompson, K.L. Purcell, D.L. Clifford, L. Cline, H.D. Safford, S.A. Britting, and J.M. Tucker. 2015. Southern Sierra Nevada fisher conservation assessment. Unpublished report produced by Conservation Biology Institute.

Spiegel, L.K. 1996. Studies of the San Joaquin kit fox in undeveloped and oil-developed areas. California Energy Commission, 1996.

Spinks, P.Q., R.C. Thomson, and H.B. Shaffer. 2014. The advantages of going large: genome-wide SNPs clarify the complex population history and systematics of the threatened Western Pond Turtle. Molecular Ecology 23(9):2228-2241.

Stebbins, Robert C., and Samuel M. McGinnis. 2012. *Field Guide to Amphibians and Reptiles of California: Revised Edition* (California Natural History Guides) University of California Press.

Stillwater Sciences. 2005. Conceptual restoration design for the Merced River Ranch. Volume I: conceptual design report. Stillwater Sciences, Berkeley, California..

Sturrock, A.M., J.D. Wikert, T. Heyne, C. Mesick, A.E. Hubbard, T.M. Hinkelman, P.K. Weber, G.E. Whitman, J.J. Glessner, and R.C. Johnson. 2015. Reconstructing the migratory behavior and long-term survivorship of juvenile Chinook salmon under contrasting hydrologic regimes. PloS one 10(5): e0122380.

Suttle, K.B., M.E. Power, J.M. Levine, and C. McNeely. 2004. How fine sediment in riverbeds impairs growth and survival of juvenile salmonids. Ecological applications 14(4): 969-974.

Tappel, P.D. and T.C. Bjornn. 1983. A new method of relating size of spawning gravel to salmonid embryo survival. North American Journal of Fisheries Management 3(2): 123-135.

Tierney K.B., D.A. Patterson, and C.J. Kennedy. 2009. The influence of maternal condition on offspring performance in Sockeye Salmon *Oncorhynchus nerka*. Journal of Fish Biology 75:1244–1257.

USFWS. 1997. Guidance on site assessment and field surveys for California red-legged frogs. 6 pp.

USFWS. 1999. Conservation guidelines for the Valley elderberry longhorn beetle. U.S. Fish and Wildlife Service, Sacramento, California, July 1999. 13 pp.

USFWS. 2004. 90-Day finding on a petition to list three species of lamprey as threatened or endangered. Federal Register: December 27, 2004 (Volume 69, Number 2) Proposed Rules pages 77158-77167.

USFWS. 2005. Recovery plan for vernal pool ecosystems of California and Southern Oregon. Portland, OR.

USFWS. 2006a. Least Bell's Vireo (*Vireo bellii pusillus*) 5 year review summary and evaluation. Carlsbad, CA. September 2006.

USFWS. 2006b. Final Critical Habitat for Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)-Vernal Pool Species. Sacramento, CA.

USWFS. 2009. Species Account: California Tiger Salamander *Ambystoma californiense*. Sacramento Fish & Wildlife Office. 29 July 2009. Available:

https://www.fws.gov/sacramento/es_species/Accounts/Amphibians-Reptiles/ca_tiger_salamander/documents/california_tiger_salamander.pdf

USFWS. 2012. *Sidalcea keckii* (Keck's Checkermallow). 5-year review: summary and evaluation. Sacramento, CA. June 2012.

USFWS. 2014. Endangered and threatened wildlife and plants; Withdrawal of the proposed rule to remove the Valley Elderberry Longhorn Beetle from the Federal List of Endangered and Threatened wildlife. Federal Register 74:55874-55917.

USFWS. 2017. Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*). U.S. Fish and Wildlife Service; Sacramento, California. 28 pp.

USFWS. 2021. Information for Planning and Consultation: Environmental Conservation Online System. Accessed: 25 January 2021. https://ecos.fws.gov/ipac/

U.S. Geological Survey (USGS). 2004. Habitat Assessment and Baseline Surveys for the Western Spadefoot (*Spea hammondii*) and the Western Pond Turtle (*Emys marmorata*) on the Irvine Ranch Land Reserve. Prepared for The Nature Conservancy and The Irvine Company. October 2004. Available: https://sdmmp.com/upload/SDMMP_Repository/0/p7zfjg0vqt3y4k25d9rm8csxw6bnh1.pdf

Vaghti, M.G., M. Holyoak, A. Williams, T.S. Talley, A.K. Fremier, and S.E. Greco. 2009. Understanding ecology of blue elderberry to inform landscape restoration in semiarid river corridors. Environmental Management 43: 28-37.

Water, T.F. 1995. Sediment in streams; sources, biological effects and controls. American Fisheries Society Monograph 7. Bethesda, MA: American Fisheries Society.

Wheaton, J.M., G.B. Pasternack, and J.E. Merz. 2004. Spawning Habitat Rehabilitation – II. Using hypothesis development and testing in design, Mokelumne River, California, U.S.A. International Journal of River Basin Management 2:1:21-37.

Wheeler, B. and W. Clark. 1987. The Peterson Field Guide Series: A Field Guide to Hawks of North America. Boston: Houghton Mifflin Company.

Williams, D.F. 1992. The conservation status of the endemic mammals of the San Joaquin Faunal Region, California. Pp. 329-348, in Endangered and sensitive species of the San Joaquin Valley, California (D.F. Williams, S. Byrne, and T.A. Rado, eds.). California Energy Commission, Sacramento, 388 pp.

Williams, J.G. 2001. Chinook salmon in the lower American River, California's largest urban stream. In R. Brown, editor, Contributions to the biology of anadromous salmonids of the Central Valley, California. Fish Bulletin 179(2):1-37.

Wood, D.A., B.J. Halstead, M.L. Casazza, E.C. Hansen, G.D. Wylie, and A.G. Vandergast. 2015. Defining population structure and genetic signatures of decline in the giant gartersnake (*Thamnophis gigas*): implications for conserving threatened species within highly altered landscapes. Conservation Genetics 16(5):1025-1039.

Workman, M.L. 2005. Downstream Fish Migration Monitoring at Woodbridge Irrigation District Dam Lower Mokelumne River, January 2004 through June 2004 September 2004. East Bay Municipal Utility District, Lodi, California.

Wurtsbaugh, W.A. and G.E. Davis. 1977. Effects of temperature and ration level on the growth and food conversion efficiency of *Salmo gairdneri*, Richardson. Journal of Fish Biology, 11:87–98.

Zeug, S.C., K. Sellheim, C. Watry, J.D. Wikert, and J. Merz. 2014. Response of juvenile Chinook Salmon to managed flow: lessons learned from a population at the southern extent of their range in North America. Fisheries Management and Ecology 21(2):155-168.

Zimmerman, C.E., G.W. Edwards, and K. Perry. 2009. Maternal origin and migratory history of steelhead and rainbow trout captured in rivers of the Central Valley, California. Transactions of the American Fisheries Society 138(2): 280-291

Mitigation:

BIO-1. Adaptive Construction Approach to Protect Elderberry Plants and Mitigate for Loss.

To avoid direct mortality to VELB from crushing by heavy equipment or through destruction of their elderberry shrub habitat during construction, a qualified biologist shall clearly mark elderberry plants prior to construction and intrusion into the prescribed 20-foot buffer zone shall be avoided, as possible.

The 20-foot buffer shall be inspected weekly during ground disturbing activities and monthly after ground-disturbing activities until the project is complete or until the fences are removed. The qualified biologist will be responsible for ensuring that the contractor maintains construction stanchion and flagging around elderberry shrubs in the Project footprint. Biological inspection reports shall be provided to the lead agency and USFWS.

BIO-2. Transplant Unavoidable Elderberry Plants to Suitable Locations and Monitor Survival.

Elderberries that cannot be avoided using a 20-foot buffer will be transplanted to a suitable location during project construction, following consultation with U.S. Fish and Wildlife Service, and will be monitored in years 1, 2, and 3 and 10 with a target minimum survival rate of at least 60%. If necessary, replacement plants will be added to the restoration area to maintain survival above 60%. If any mortality of elderberry shrubs occurs, USFWS shall be consulted immediately and appropriate mitigation will be implemented.

BIO-3. Monitor for Fish and Wildlife to Prevent Impacts.

Pre-construction surveys shall be conducted by qualified wildlife biologists, who shall determine the use of the Action Area by special status wildlife species. Surveys shall focus on identification of potential American badger (*Taxidea taxus*) dens and other potential wildlife species within the construction footprint and a minimum 500 ft (152.4 m) buffer around the construction footprint. If American badger dens are located within the construction footprint or buffer area, CDFW shall be consulted prior to initiation of construction for further instruction on methods to avoid direct

impacts to American badger. Pre-construction surveys shall also determine the use of the Proposed Project construction footprint by San Joaquin kit fox (*Vulpes macrotis mutica*). These surveys shall focus on identification of potential, atypical, active, and natal kit fox dens. If potential kit fox dens are located within the construction or buffer area, a minimum of five consecutive nights of camera/scent stations and track stations shall be placed by the den entrances in order to determine if the den is in use by kit fox. If active or natal dens are confirmed, CDFW and USFWS shall be consulted for further instructions on methods to avoid direct impacts to this species.

Protocol-level surveys shall also be implemented for other state and federally-listed species including Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), bald eagle (*Haliaeetus leucocephalus*), yellow-breasted chat (*Icteria virens*), tri-colored blackbird (*Agelaius tricolor*), least Bell's vireo (*Vireo bellii pusillus*), Chinook Salmon, CCV steelhead, and western pond turtle (*Actinemys marmorata*). This includes pre-construction surveys conducted no more than 10 days before Proposed Project implementation by qualified wildlife and fisheries biologists. A minimum no-disturbance buffer of 250 feet around active nests of non-listed bird species; a 500-foot no-disturbance buffer around migratory bird species; and a half mile buffer for nest of listed species and fully protected species (including Swainson's hawk, white-tailed kite, and bald eagle) shall be established until breeding season is over or young have fledged. If such a buffer cannot be reasonably accomplished, CDFW shall be consulted. Fish surveys shall be conducted by a qualified biologist and if spawning salmon are observed within the construction footprint, construction shall cease and CDFW and USFWS contacted immediately to determine the appropriate course of action.

BIO-4. Protect and Compensate for Native Trees.
Native trees, such as Fremont Cottonwood, willows, and alder, with a dbh of 6 in (15.2 cm) or greater shall be protected with 30-ft (9.1-m), 10-ft (3-m), and 10-ft (3-m) buffers, respectively. Native trees shall be marked with flagging if close to the work area to prevent disturbance. To compensate for the removal of riparian shrubs and trees during Proposed Project implementation, the plans shall identify tree and shrub species to be planted, how, where, and when they would be planted, and measures to be taken to ensure a minimum performance criterion of 70% survival of planted trees. Irrigation shall not be used, as the improvements in diversion efficiency are expected to promote survival and growth of native riparian species. The tree plantings shall be based on native tree species compensated for in the following manner:

- Oaks having a dbh of 3 – 5 in (7.6 – 12.7 cm) shall be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a dbh of greater than 5 in shall be replaced in-kind at a ratio of 5:1.
- Riparian trees (i.e., willow, cottonwood, poplar, alder, ash, etc.) and shrubs shall be replaced in-kind within the Action Area, at a ratio of 3:1, and planted in the nearest suitable location to the area where they were removed.

BIO-5. Work Outside of Critical Periods or Monitor for Special Status Species.
No in-stream work would be conducted after 15 October to avoid impacts to spawning Chinook Salmon. Nesting birds and raptors are protected under the MBTA and CDFG Code, and trees and shrubs within the Action Area likely provide nesting habitat for songbirds and raptors. If

construction activities occur during the potential breeding season (February through August) a qualified biologist shall conduct surveys for active nests and/or roosts within a ½ mile radius of the Action Area no more than 10 days prior to the start of construction. A minimum no disturbance buffer shall be delineated around active nests (size of buffer will depend on species encountered) until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.

BIO-6. Monitor for Bats to Prevent Impacts.
Before any ground disturbing activities, a qualified biologist shall survey for the presence of associated habitat types for the bat species of concern. If bats are present, the biologist shall apply a minimum 300 ft (91.4 m) no-disturbance buffer around roosting bats, maternity roosts or winter hibernacula until all young bats have fledged.

BIO-7. Prevent Spread of New Zealand Mudsnails and other Aquatic Invasive Species
New Zealand mudsnails are an introduced species that has been identified in numerous rivers of the Central Valley, including in the Merced River. To minimize the chance that the snails may be transported and spread to other water bodies on equipment, construction specifications shall require that equipment be steam cleaned immediately after the work is completed and before being used in other water bodies. An Invasive Species Risk Assessment and Planning (ISRAP) protocol shall be developed, and all appropriate staff shall be trained as to its purpose and implementation before construction begins. The ISRAP shall be used to prevent the spread of invasive species during Proposed Project construction.

NOISE-1. Reduce Impacts from Noise.

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

- restrict construction activities to time periods between 7:00 am and 5:00 pm when there is the least potential for disturbance.
- locate the sorting station away from edge of property and adjacent homes.
- install and maintain sound-reducing equipment and muffled exhaust on all construction equipment.

WQ-1. Monitor Water Quality and Prevent Impacts
During in river work, turbidity and total suspended solids shall be monitored with intermittent grab samples from the river, and construction curtailed if turbidity exceeds criteria established by the Regional Water Quality Control Board in its Clean Water Act (CWA) §401 Water Quality Certification for the Proposed Project. Specifically, sampling shall be performed immediately upstream from the Action Area and approximately 300 feet downstream of the active work area during construction.

Activities will not cause in surface waters:

a) turbidity to exceed 2 NTU's where natural turbidity is less than 2 NTU;
b) where natural turbidity is between 1 and 5 NTUs, increases exceeding 1 NTU;
c) where natural turbidity is between 5 and 50 NTUs, increase exceeding 20 percent;
d) where natural turbidity is between 50 and 100 NTUs, increases exceeding 10 NTUs;
e) where natural turbidity is greater than 100 NTUs, increase exceeding 10 percent.

Activities shall not cause settleable material to exceed 0.1 ml/L in surface waters as measured in surface waters downstream from the Action Area. Activities shall not cause pH to be depressed below 6.5 nor raised above 8.5 as measured in surface waters downstream from the Action Area.

The Proposed Project shall not discharge petroleum products into surface water. The Central Valley Water Board shall be notified immediately of any spill of petroleum products. During gravel processing, gravel shall be cleaned prior to placement within the riverbed in a manner that removes any fine-grained sediment (< 6mm size fraction) (fines) that could potentially contain concentrations of mercury. Daily fines samples shall be collected from processed material and analyzed for total mercury. Borrow areas shall be re-graded to ensure the areas do not become potential mercury methylation spots. Fines separated from gravel shall not re-enter the Merced River. Riverbanks shall be revegetated to minimize transport of any mercury-containing sediment, as described in the Proposed Project BMP's.

Sediment fencing shall be used along the river corridor to capture floating materials or sediments mobilized during construction activities and prevent water quality impacts. Stream bank impacts shall be isolated and minimized to reduce bank sloughing. Banks shall be stabilized with revegetation following Proposed Project activities, as appropriate.

A SWPPP shall be developed as part of the BMPs. All pertinent staff shall be trained on and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them shall be made available onsite and staff shall be trained in its use. Spill prevention kits shall be in close proximity to construction areas, and workers trained in their proper use.

WQ-2. Use Clean Equipment and Biodegradable Lubricants.
All equipment shall be clean and use biodegradable lubricants and hydraulic fluids. All equipment working within the stream channel shall be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs). Vehicles shall be fueled and lubricated in a designated staging area located outside the stream channel and banks. Clean gravels shall be added to the river using the front-end loaders. Front-end loaders shall be wheeled (i.e. rubber tires) to minimize impacts. Construction specifications shall require that any equipment used in or near the river is properly cleaned to prevent any hazardous materials from entering the river, and containment material shall be available onsite in case of an accident. Spill prevention kits shall be located close to construction areas, with workers trained in its use. Contracted construction managers shall regularly monitor construction personnel to ensure environmental compliance.

V. Cultural Resources	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource which is either listed or eligible for listing on the National Register of Historic Places, the California Register of Historic Resources, or a local register of historic resources?	☐	☐	☒	☐
b) Cause a substantial adverse change in the significance of a unique archaeological resources (i.e., an artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it contains information needed to answer important scientific research questions, has a special and particular quality such as being the oldest or best available example of its type, or is directly associated with a scientifically recognized important prehistoric or historic event or person)?	☐	☐	☒	☐
c) Disturb or destroy a unique paleontological resource or site?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☒	☐

Discussion:

a) As part of the preparation for the Proposed Project, a cultural resource study was conducted by Horizon Water and Environment (HWE 2021). Compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966 (16 United State Code [USC] § 470f [2008]) is required, whereby any federal undertaking must "take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register." The implementing regulations for Section 106 are found under 36 Code of Federal Regulations (CFR) § 800, as amended (2001). Cultural resources may also be considered separately under the National Environmental Protection Act (42 USC) Section 4321-4327, whereby federal agencies are required to consider potential environmental impacts and appropriate mitigation measures for projects with federal involvement. Also, impacts to cultural resources are considered if the resource is "significant" or "important" or "unique archaeological resource" under the provisions of CEQA Sections 15064.5 and 15126.4. The policies of the Merced County General Plan (Merced County 2013) also apply to the Project. Cultural resources are addressed under the Recreation and Cultural Resources Element of the general plan. The purpose of the Cultural, Archeological, and Historical Resources goal (RCR-2) is to "Protect and preserve the cultural, archeological, and historic resources of the County in order to maintain its unique character." Even with these measures undertaken, it is possible that during construction activities unknown cultural resources could be unearthed.

No known historic properties would be affected by the Proposed Project and no historical resources, as defined by CEQA, would be impacted by the Proposed Project (HWE 2021). The

only structures within Action Areas that will be impacted by the Proposed Project are the diversion facilities targeted for enhancement; so there are no human built architectural resources that could be impacted. However, if any objects of cultural significance are unearthed during the construction process, work would be halted until a qualified archeologist can assess the significance of the new find (see **CR-1- Inadvertent Discoveries of Objects of Cultural Significance**). If human remains are unearthed during the construction process, the Proposed Project team would comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98. With this EC in place, the Proposed Project is expected to have **a less than significant impact** on historical resources.

b) No cultural resources considered to be historic properties or historical resources were recorded in the Action Area as a result of the records search and field survey (HWE 2021). However, the Proposed Project's construction activities would include grading and excavation of areas, primarily dredge tailings, covered by cobble and gravel. Subsurface cultural objects could be unearthed during the grading and excavation activities which is a potentially significant impact. If any objects with potential cultural significance are unearthed during the construction process, work would be halted within the vicinity of the inadvertent discovery until a qualified archeologist (and Native American representative if the find is potentially pre-historic) can assess the significance of the new find (see **CR-1- Inadvertent Discoveries of Objects of Cultural Significance**) and prescribe measures to reduce potential impacts to be **less than significant**. The final disposition of archaeological, historical, and paleontological resources recovered on State lands under the jurisdiction of the State Lands Commission must be approved by the Commission.

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

d) No potential burial grounds were determined to be present in the Area of Potential Effects during the records search and field survey. As discussed in impact 3.5-2, construction activities for the Project would include excavation and grading which have the potential to unearth subsurface human remains which is a potentially significant impact. If human remains are unearthed during the construction process, work would be halted within the vicinity of the human remains, the Coroner contacted, and **CR-1 - Inadvertent Discoveries of Objects of Cultural Significance** would be implemented. This EC would reduce potential impacts to a **less than significant** level. The Proposed Project would comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.

Documentation:

Horizon Water and Environment, LLC. 2021. Cultural Resources Assessment Report. Merced River Agricultural Diversion and Fish Habitat Enhancement Project. Prepared for Merced Irrigation District. October 2021.

Merced County. 2013. 2030 Merced County General Plan. 10 December 2013. Available: https://www.co.merced.ca.us/100/General-Plan.

Mitigation:

CR-1. Inadvertent Discoveries of Objects of Cultural Significance
If any objects of cultural significance are unearthed during the construction process, work shall be halted immediately until a qualified archeologist can assess the significance of the new find. If human remains are unearthed during the construction process, the Proposed Project team shall comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.

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

Discussion:
a) Energy consumption during Proposed Project construction would be minimal and restricted to that required for operating heavy machinery to move material for gravel augmentation. The impact would be **less than significant.**

b) The Proposed Project would not interfere with a state or local plan for renewable energy or energy efficiency. There would be **no impact**.

Documentation:
None required.

Mitigation:
None Required.

VII. Geology and Soils	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in **Table 1**8-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒

Discussion:

a) The Action Area is in the Great Valley geomorphic province of California. This geomorphic province consists of deep marine basins filled with large volumes of sediment eroded during the Jurassic to Quaternary periods from the western Sierra Nevada Range and eastern Coast Range. The Action Area consists of bedrock and alluvial cobbles, gravels, and sand deposited by the Merced River which have been altered and disturbed by dredge mining.

The nearest active fault is the San Andreas Fault which is located approximately 70 miles west of the Action Area in foothills of the eastern slope of the Coastal Range. The Bear Mountain faults are approximately 15 miles east of the Action Area and are considered inactive (Miller and Paterson 1991). No active faults or Earthquake Fault Zones are located within or adjacent to the Action Area.

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

b) The Action Area is primarily agricultural, with some dredge tailings piles, which are composed of cobble and gravel. The Proposed Project design includes excavating and sorting tailings piles to create riffles, fill-in predator habitat, and for in-channel gravel augmentation. In addition, some diversion entrances may be redesigned or relocated to enhance diversion efficiency while decreasing deleterious effects on fish and their habitat. The excavation of tailings piles would remove approximately 65,000 yd^3 with 38,500 yd^3 of material returned to the channel to create habitat features and spawning riffles. Approximately 26,500 yd^3 of fine sediment (sediment smaller than gravel) obtained from sediment sorting would be placed in select upland areas to enhance riparian vegetation recruitment and growth. Prior to restoration activities, each diversion will require approximately 1,000-2,000 yd^3 for existing berm maintenance. These activities are not expected to substantially increase soil erosion or the loss of topsoil. The Proposed Project would remove the need for annual in-channel construction of temporary berms and would increase diversion efficiency, which is expected to improve conditions for native riparian vegetation. Therefore, the impact is **less than significant**.

c) The Proposed Project will not occur on strata or soil that is unstable or would become unstable as a result of the Proposed Project. Soils in the Action Area are predominantly tailings piles composed of gravel and cobble, which are stable and well drained. A review of a map of expansive soils in California (Olive et al. 1989) indicated that the Proposed Project will not occur on expansive soil. Therefore, there would be **no impact**.

d) The Proposed Project is not located on expansive soil creating substantial risks to life or property. **No impact** is expected.

e) The Proposed Project does not require sewers, septic tanks, or alternative wastewater disposal systems. **No impact** is expected.

f) The Proposed Project would not result in the loss of a unique geologic feature. **No impact** is expected.

Documentation:

Miller, R.B. and S.R. Paterson. 1991. Geology and tectonic evolution of the Bear Mountains fault zone, Foothills terrane, central Sierra Nevada, California. Tectonics, 10(5), pp.995-1006.

Olive, W.W., A.F. Chleborad, C.W. Frahme, J. Schlocker, R.R. Schneider, and R.L Shuster. 1989. Swelling clays map of the conterminous United States. U.S. Geological Survey.

Mitigation:
No mitigation required.

VIII. Greenhouse Gas Emissions	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☒

Discussion:

a) The construction activities from the Proposed Project would emit greenhouse gases from the earth moving equipment and mobile sediment screening plant. Using the SMAQMD Road Construction Emissions Model, the Proposed Project's estimated CO_{2e} emissions are 550.05 metric tons (606.32 tons) in Year 1 (Cowell 2) and 657.37 metric tons (724.61 tons) in Year 2 (Cowell 1 and Cuneo) for a total of 1,207.42 metric tons (1,330.94 tons) over the two years of the Project (Appendix E). However, the implementation of the Proposed Project also has the potential to store a significant amount of carbon through an increase in the quality and quantity of riparian vegetation (Sellheim et al. 2016, Matzek et al. 2015, Gorte 2009) and salmon (Merz and Moyle 2006) and macroinvertebrate production (Duffy and Kahara 2011). Over the life of the Proposed Project, a substantial amount of carbon would likely be sequestered in tree production alone. The Proposed Project's estimated maximum yearly emission of 657.37 metric tons (724.61) in Year 2 of the Proposed Project is below the significance threshold of annual emissions of 1,100 metric tons (1213 tons) of CO_{2e} therefore the GHG emissions are **less than significant**.

b) The Proposed Project does not conflict with an applicable plan adopted for the purpose of reducing GHG emissions. **No impact** is expected.

Documentation:

Duffy, W.G. and S.N. Kahara. 2011. Wetland ecosystem services in California's Central Valley and implications for the Wetland Reserve Program. Ecological Applications 23(3): S18-S30.

Gorte, R.W. 2009. Carbon sequestration in forests. DIANE Publishing.

Matzek, V., C. Puleston, and J. Gunn. 2015. Can carbon credits fund riparian forest restoration? Restoration ecology, 23(1): 7-14.

Merz, J.E. and P.B. Moyle. 2006. Salmon, wildlife, and wine: marine-derived nutrients in human-dominated ecosystems of Central California. Ecological Applications 16:999-1009.

Sellheim, K.L., M. Vaghti, and J.E. Merz. 2016. Vegetation recruitment in an enhanced floodplain: Ancillary benefits of salmonid habitat enhancement. Limnologica-Ecology and Management of Inland Waters 58:94-102.

Mitigation:

No mitigation required.

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

Discussion:

a) Materials and waste are considered hazardous if they are poisonous, ignitable, corrosive, or reactive. California law (Health and Safety Code 6.95, Section 25501(o)) defines “hazardous material” as any material that, because of quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment. Soils having concentrations of contaminants that are higher than acceptable levels as

a result of past spills or leaks must be handled and disposed as hazardous waste during excavation, transportation, and disposal. The characteristics that would cause soil to be classified as hazardous waste are found in the California Code of Regulations, Title 22, Section 66261.20-24.

The California EPA Cortese List is used to comply with CEQA requirements in providing information about the location of hazardous materials release sites (EPA 2018). The Cortese List data resources were searched to determine if any hazardous waste facilities or sites are located within or near the Action Area. The Cortese List data resources are the following: list of hazardous waste and substance sites from the DTSC EnviroStor database, list of leaking underground storage tank sites from the Water Board geo tracker database, list of solid waste disposal sites identified by Water Board with waste constituents above hazardous waste levels outside the waste management unit, list of active Cease and Desist Orders and Cleanup and Abatement Orders from the Water Board, and list of hazardous waste facilities subject to corrective action pursuant to Section 25187.5 of the Health and Safety Code as identified by DTSC. The Cortese List data resources were searched in October 2021 with no listed sites being located within 0.5 miles of the Action Area (EPA 2021).

The heavy equipment and vehicles used for Proposed Project construction would use potentially hazardous substances including diesel, gasoline, oil, grease, hydraulic fluid, and solvents. These hazardous substances are similar or identical to those used in heavy equipment and vehicles for other construction projects in Merced County. All equipment that is used within the Merced River's stream corridor would be properly cleaned before being transported to the Action Area to prevent release of any hazardous materials into the river, riparian areas, wetlands, or other sensitive areas. Oil and grease used in equipment would be vegetable based, or another material that does not affect beneficial uses. All equipment working within the stream corridor would be inspected daily for fuel, lubrication, and coolant leaks and for leak potentials. All equipment would be free of fuel, lubrication, and coolant leaks before working. All equipment would be stored in staging areas and away from the river, riparian areas, or other wetlands. A Spill Prevention and Response Plan would be prepared for the Proposed Project and spill prevention kits would be kept close to construction areas and workers would be trained in their use. A search of the Cortese List data resources in October 2021 determined that the Action Area is not on a list of hazardous sites compiled pursuant to Government Code Section 65962.5 (EPA 2018). Therefore, the Proposed Project would have a **less than significant** impact.

b) The Proposed Project does not create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the likely release of hazardous materials into the environment. Therefore, the Proposed Project would have **no impact**.

c) The Action Area is not within one-quarter mile of an existing or proposed school. The nearest school is the Snelling-Merced Falls Elementary School which is approximately 3 miles west of the Cowell 1 diversion. In addition, emissions resulting from the Proposed Project would be limited to diesel and gasoline engine exhaust and fugitive dust. The Proposed Project construction would occur outside in a rural area such that all diesel and gasoline engine exhaust is expected to dissipate rapidly and not reach concentrations that are hazardous to public health. Fugitive dust would be controlled through periodic wetting of access roads and work areas as necessary. The Action Area is not located within an airport land use plan or within two miles of a public airport or private airstrip. The nearest public airport to the Action Area is the Turlock Municipal Airport

which is approximately eight miles east of the Cowell 2 diversion. The Cowell 2 diversion is the closest of the targeted diversions to an airport or private airstrip. Therefore, the Proposed Project would have **no impact**.

d) The Action Area is not located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would not create a significant hazard to the public or the environment. Therefore, the Proposed Project would have **no impact**.

e) There are no public airports or private airstrips near the Action Area. The nearest public airport is Merced County's Castle Airport being approximately five miles away with the next nearest public airport being the Turlock Municipal Airport which is approximately eight miles away. Therefore, the Proposed Project would have **no impact**.

f) Traffic created implementing the Proposed Project would include the mobilization and demobilization of heavy equipment (loaders, excavator, articulated haulers, and mobile screen plant) for each of the two construction seasons it would take to complete the Proposed Project. Once the heavy equipment is onsite, it would travel within the Action Area using temporary access roads and be stored at the staging area. It is possible that in the middle of one of the construction seasons that heavy equipment may need to be transported via public roads from the staging area on the north side to the south side of the Merced River or vice versa. Additional traffic on public roads during Proposed Project implementation would be limited to daily trips for personnel and service and supply vehicles. No sediment would be imported or exported from the Action Area, resulting in limited driving of heavy trucks on public roads as a result of the Proposed Project. Construction activities would be conducted and managed to not interfere with emergency response or evacuation plans. The impact on emergency response or evacuation plans would be **less than significant.**

g) The Proposed Project construction would create a wildfire ignition risk. However, the majority of the Action Area is comprised of poorly vegetated banks which contain minimal vegetation fuel resulting in a low wildfire risk. There are also some dredge tailings piles, which act as fuel breaks and would inhibit the spread of fire. In addition, the majority of vegetation within the Action Area is riparian vegetation, which has low ignition risk due to high moisture content. If riparian areas do ignite then the wildlife usually spreads slowly as an underburn due to the relatively moist, green vegetation. The Action Area is designated as a moderate fire hazard severity zone (CalFire 2007). Fire extinguishers would be present onsite in vehicles to quickly put out any vegetation that ignites as a result of a spark from heavy equipment. Any tall, dried grass present on the staging areas or temporary access roads would be cleared prior to being used by vehicles or heavy equipment. In the long-term the Proposed Project would not alter the existing fire hazard conditions. The Proposed Project would result in additional areas of riparian vegetation which have low fire hazard risk. These additional areas of riparian vegetation would not change the overall wildfire risk. Therefore, the impact of the Proposed Project on wildfire risk is **less than significant**.

Documentation:

California Environmental Protection Agency. 2021. Cortese List. Department of Toxic Substances Control. 5 October 2021.

CalFire. 2007. Fire Hazard Severity Zone Maps. Available: http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones

Mitigation:

No mitigation required.

X. Hydrology and Water Quality	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	☐	☐	☒	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such the project may impede sustainable groundwater management of the basin?	☐	☐	☐	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
(i) result in substantial erosion or siltation on- or off-site;	☐	☐	☒	☐
(ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☐	☐	☒
(iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	☐	☐	☐	☒
(iv) impede or redirect flood flows?	☐	☐	☐	☒
d) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☐	☐	☒
e) Place structures within a 100-year floodplain structures which would impede or redirect flood flows?	☐	☐	☐	☒
f) Place housing within a 100-year floodplain, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒

Discussion:

a) The existing designated beneficial uses of surface water in the LMR are: municipal and domestic water supply, stock watering, industrial process and service supply, hydropower generation, contact and non-contact recreation, canoeing and rafting, warm and cold freshwater habitat, migration of warmwater and coldwater fishes, migration of warmwater and coldwater aquatic organisms, and wildlife habitat. Water quality is a concern in areas of Merced County where it has been degraded through contamination.

The LMR below Crocker-Huffman Diversion Dam is listed under Section 303(d) of the CWA as water quality limited for the following pollutants with their listed source in parentheses:

- Water temperature (unknown source)
- Escherichia coli (*E. coli*; unknown source)
- Mercury (resource extraction)
- Chlorpyrifos (agriculture)
- Diazanon (agriculture)
- Group A pesticides (agriculture)
- Unknown toxicity (unknown source)

DO measurements in the LMR generally meet water quality requirements (FERC 2015). DO measurements immediately downstream of Crocker-Huffman Diversion Dam and below Snelling Bridge always met the 8 mg/L objective (FERC 2015). In general, daily average water temperatures at Crocker-Huffman Diversion Dam range from approximately 8 to 17°C annually (FERC 2015). In 2015, at the height of the drought, daily average water temperature at Crocker-Huffman Diversion Dam exceeded 20°C during August and September. Maximum daily temperatures also regularly approached 20°C in summer 2021.

The Proposed Project has the potential to effect water quality in the Action Area. Chemical constituents would be limited to those present at the Action Area. The pH would not be changed, and no pesticides would be used or mobilized during Proposed Project activities. Salinity and radioactivity would not be changed due to Proposed Project activities. Temperature conditions would not be elevated during construction activities; however, temperature may be improved (reduced) by the completed Proposed Project due to changes in depths and velocity of water moving through the project site and increased subsurface flow due to gravel augmentation. The DO levels would not be reduced below levels specified in the water quality objectives (CRWQCB 1998). Within the gravel augmentation areas, sub-surface DO levels are likely to improve after Proposed Project implementation because inter-gravel permeability will be improved.

Proposed Project construction may temporarily increase or contribute to the amount of suspended sediment and turbidity in the Merced River. Actions likely to temporarily impact turbidity include: re-siting diversions as necessary and placing clean gravel and cobble in the river channel to enhance spawning riffles and create gravel bars and other instream habitat features. In-stream construction would be performed in a manner that minimizes sediment discharge. Turbidity associated with Proposed Project construction activities would not exceed turbidity objectives in the San Joaquin River Basin (CRWQCB 1998). Instream construction would be temporarily halted to allow turbidity to decrease when necessary. Where feasible, a silt curtain would be

installed in the channel to capture floating material or sediment mobilized during construction activity to minimize water quality impacts. However, a channel-spanning silt curtain is not likely to be possible due to high flow velocities.

To minimize construction related water quality impacts, the Proposed Project's proponents would obtain and implement a SWPPP prepared in accordance with NPDES. All access and staging areas would be treated with erosion control measures at the end of each construction season. Erosion control measures would include erosion control fabric, coir logs, and hay or straw spreading. At the end of the Proposed Project, native grass mix and riparian vegetation would be planted in select locations including locations disturbed by construction. The contractor would be required to follow all construction BMPs in the SWPPP to minimize water quality impacts. The Proposed Project must comply with the water quality and waste discharge requirements of the CVRWQCB, which would be outlined in the Section 401 Water Quality Certification for the Proposed Project. Complying with water quality standards and implementing **WQ-1 - Monitor Water Quality and Prevent Impacts** and **WQ-2 - Use Clean Equipment and Biodegradable Lubricants** would reduce water quality impacts to **less than significant**. Rehabilitation activities are ultimately expected to result in elevated DO, as turbulence and temperature amelioration, contributing to improve water quality. Improved water quality is among the overall Proposed Project objectives.

b) The Merced River is a source of water for and divides the Turlock Groundwater Sub-basin and the Merced Groundwater Sub-basin. The Turlock Groundwater Sub-basin is a 347,000 acre basin between the Tuolumne River to the north, the San Joaquin River to the west, crystalline basement rock of the Sierra Nevada foothills to the east, and the Merced River to the south. The southern boundary stretches westerly along the Madera-Merced County line to the northern boundary of the Sierra Water District, which is followed westerly to the San Joaquin River (AMEC 2008). Groundwater use is primarily for irrigation of agricultural crops, with some urban and municipal use. The primary source of recharge is mostly percolating excess irrigation water and infiltration of precipitation (TGBA 2008). Groundwater recharge also occurs along the Tuolumne and Merced rivers, other eastside foothill streams, and surrounding areas where alluvial deposits allowing rapid percolation are present. No net deficit in aquifer volume or a lowering of the local groundwater table level (i.e., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted) would occur because of the Proposed Project.

The Proposed Project would not reduce groundwater recharge by converting pervious surfaces to impervious surfaces. The improvements in diversion efficiency could increase groundwater recharge within the Action Area. The Proposed Project would not pump any groundwater or cause any groundwater to be pumped. Therefore, the Proposed Project would have **no impact** with respect to groundwater resources.

c) The drainage pattern would not be altered by the Proposed Project. No change in the 100-year flood water surface elevation is anticipated for any of the three sites due to the nature of the design elements. This will be confirmed with flood assessment prior to Proposed Project implementation, as a submittal requirement for Central Valley Flood Board Permit acquisition.

The Proposed Project would not increase the area of impermeable surfaces, and erosion and siltation would be minimized by implementing a SWPPP, treating all access and staging areas

with erosion control measures at the end of each construction season, and at the end of the Proposed Project, planting native grass mix and riparian vegetation in select locations including locations disturbed by the rehabilitation activities. Additionally, the contractor would be required to follow all construction BMPs in the SWPPP to minimize water quality impacts. Implementing the above and **WQ-1 - Monitor Water Quality and Prevent Impacts** would reduce erosion and sedimentation impacts to **less than significant.**

d) The Proposed Project does not conflict the implementation of another water quality control plan or groundwater management plan. Therefore, **no impact** is expected.

e-f) The Proposed Project would not place any housing within a 100-year flood hazard area nor would it place any structures or features that would impede or redirect flood flows. No significant change in 100-year flood water surface elevation is anticipated and this will be confirmed with flood assessment prior to Proposed Project implementation. WSE would not any impact any onsite infrastructure or adjacent properties. The Proposed Project is expected to, on average, reduce the 100-year flood risk, therefore the impact is **less than significant**.

Documentation:

AMEC. 2008. Merced groundwater basin groundwater management plan update, Merced County, CA.

California Regional Water Quality Control Board (CRWQCB). 1998. Water quality control plan (basin plan) for the Sacramento River and San Joaquin River basins, 4th Ed. Central Valley Region, Sacramento, CA.

ESA Associates (ESA). 2016. Merced River Channel and Floodplain Restoration Options Analysis Report. Technical memorandum to Merced Irrigation District. 5 October 2016.

ESA. 2017. Merced River Salmon Habitat Restoration Project- Hydraulic Analysis. Technical memorandum to Cramer Fish Sciences. 24 February 2017.

Federal Energy Regulatory Commission (FERC). 2015. Draft Environmental Impact Statement for the Merced River and Merced Falls Hydroelectric Projects (P-2179 and P-2467. Issued March 30, 2015. 514pp. + appendices.

Turlock Groundwater Basin Association (TGBA). 2008. Groundwater Management Plan. 18 March 2008. 68pp. + appendices.

Mitigation:

WQ-1. Monitor Water Quality and Prevent Impacts

During in river work, turbidity and total suspended solids shall be monitored with intermittent grab samples from the river, and construction curtailed if turbidity exceeds criteria established by the Regional Water Quality Control Board in its CWA §401 Water Quality Certification for the Proposed Project. Specifically, sampling shall be performed immediately upstream from the Action Area and approximately 300 feet downstream of the active work area during construction.

Activities shall not cause in surface waters:

a) turbidity to exceed 2 NTU's where natural turbidity is less than 2 NTU;
b) where natural turbidity is between 1 and 5 NTUs, increases exceeding 1 NTU;
c) where natural turbidity is between 5 and 50 NTUs, increase exceeding 20 percent;
d) where natural turbidity is between 50 and 100 NTUs, increases exceeding 10 NTUs;
e) where natural turbidity is greater than 100 NTUs, increase exceeding 10 percent.

Activities shall not cause settleable material to exceed 0.1 ml/L in surface waters as measured in surface waters downstream from the Action Area. Activities shall not cause pH to be depressed below 6.5 nor raised above 8.5 as measured in surface waters downstream from the Action Area.

The Proposed Project shall not discharge petroleum products into surface water. The Central Valley Water Board shall be notified immediately of any spill of petroleum products. During gravel processing, gravel shall be cleaned prior to placement within the riverbed in a manner that removes any fine-grained sediment (< 6mm size fraction) (fines) that could potentially contain concentrations of mercury. Daily fines samples shall be collected from processed material and analyzed for total mercury. Borrow areas shall be re-graded to ensure the areas do not become potential mercury methylation spots. Fines separated from gravel shall not re-enter the Merced River. Stream bank impacts shall be isolated and minimized to reduce bank sloughing. Banks shall be stabilized with revegetation following Proposed Project activities, as appropriate. Sediment fencing shall be used along the river corridor to capture floating materials or sediments mobilized during construction activities and prevent water quality impacts.

A SWPPP shall be developed as part of the BMPs. All pertinent staff shall be trained on and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them shall be made available onsite and staff shall be trained in its use. Spill prevention kits shall be in close proximity to construction areas, and workers trained in their proper use.

WQ-2. Use Clean Equipment and Biodegradable Lubricants.
All equipment shall be clean and use biodegradable lubricants and hydraulic fluids. All equipment working within the stream channel shall be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs). Vehicles shall be fueled and lubricated in a designated staging area located outside the stream channel and banks. Clean gravels shall be added to the river using the front-end loaders. Front-end loaders shall be wheeled (i.e. rubber tires) to minimize impacts. Construction specifications shall require that any equipment used in or near the river is properly cleaned to prevent any hazardous materials from entering the river, and containment material shall be available onsite in case of an accident. Spill prevention kits shall be located close to construction areas, with workers trained in its use. Contracted construction managers shall regularly monitor construction personnel to ensure environmental compliance.

XI. Land Use and Planning	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural communities' conservation plan?	☐	☐	☐	☒

Discussion:

a) The Proposed Project would not divide an established community. The Proposed Project would enhance diversions and rehabilitate instream habitat in the Merced River to minimize adverse diversion effects on salmonids and improve the quality and quantity of salmonid spawning and rearing habitat within the Action Area. Therefore, there would be **no impact**.

b) The general plan and zoning designations of the land within the Action Area allow habitat rehabilitation projects. The Proposed Project is consistent with the Merced County General Plan (Merced County 2013), with habitat rehabilitation projects being an allowable use on lands designated as Agricultural. The Proposed Project does not conflict with the zoning by Merced County of the land as agricultural exclusive as habitat rehabilitation projects are an accepted use. Implementation of the Proposed Project would not conflict with land uses adjacent to the Action Area. Therefore, implementation of the Proposed Project would have **no impact**.

c) The Proposed Project does not include land covered by any habitat conservation plans or natural community conservation plans. Therefore, the Proposed Project would have **no impact**.

Documentation:

Merced County. 2013. 2030 Merced County General Plan. 10 December 2013. Available: https://www.co.merced.ca.us/100/General-Plan.

Mitigation:
No mitigation required.

XII. Mineral Resources	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Result in the loss of availability of a known mineral resource classified MRZ-2 by the State Geologist that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Discussion:

a) Merced County contains a variety of mineral resources (USGS 2018). Mineral resources found within the vicinity of the Action Area include gold, silver, platinum, iridium, ruthenium, rhodium, palladium, osmium and sand and gravel (USGS 2018). The Snelling District is a gold placer deposit district that is approximately 9 miles long and one-half to one and one-half miles wide extending from Merced Falls to a few miles west of Snelling. The Snelling District was dredge mined for gold, likely multiple times, intermittently from 1907 to 1952 (USGS 2018) leaving behind the tailings piles that are currently present. Three of the four targeted diversions lie within the Snelling District, therefore nearly all gold and other associated mineral resources have been removed from within the Action during the intensive dredge mining activities. The remaining tailings piles are comprised of primarily cobble and gravel with a small component of finer sized sediments making them a potential source of construction aggregate as well as native sediment for salmonid habitat rehabilitation projects. The Action Area is not within a delineated mineral resources recovery site resulting in **no impact**.

b) The Proposed Project would impact only a small amount (7.8 acres) of the tailings piles present in the Snelling District (5760 acres), and most of the valuable mineral resources have been removed by historical dredge mining, resulting in **no** impact on mineral resources.

Documentation:

United States Geological Survey (USGS). 2018. Mineral Resources Online Spatial Data. Available: Mrdata.usgs.gov/mrds/. Accessed 21 July 2018.

Mitigation:
No mitigation required.

XIII. Noise	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels?	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☐	☒
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Discussion:

a) The Proposed Project would operate construction equipment (e.g., rubber-tired front-end loaders, excavators, and articulated haulers, etc.) in the Action Area as part of construction. The construction equipment would generate noise during their operation. The types of construction equipment used for the Proposed Project would typically generate noise levels ~75 decibels above the reference noise at a distance of 50 ft (15.2 m). The mobile onsite sediment screening plant would also generate noise levels ~75 decibels above the reference noise at a distance of 50 ft (15.2 m). Construction equipment would be properly equipped and maintained to reduce noise levels. The Proposed Project would not expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance (80 decibels maximum for Industry; Merced County General Plan 2013), or applicable standards of other agencies. Vibration would increase during operation of construction equipment, but no construction equipment would be used that is known to cause excessive vibration levels (impact and vibratory pile drivers, vibratory rollers, large bulldozers, hydraulic breakers, and jackhammers). All changes in noise and vibration levels would occur in a mostly rural and relatively unpopulated area. The impact is still considered potentially significant because there would be increases in noise levels at the Action Area. The impact would be mitigated to a **less than significant** level with implementation of **NOISE-1 - Reduce Impacts from Noise.**

b-d) The Project would support a temporary increase in noise levels, as gravel is hauled onto the site and placed into the main channel of the Merced River. These noise levels would be higher

than the current ambient noise levels in the area, but would be temporary in nature and not excessive. The maximum noise levels allowed by agricultural activity in the Merced County General Plan are 80 decibels. The Proposed Project may create noise at or near this level for a temporary time period (up to four months). The Proposed Project would have a limited and temporary impact on noise levels in the immediate area, so the impact of noise is expected to be **less than significant**.

e-f) There is not a public airport within two miles of the Action Area. The Proposed Project would have **no impact** on air traffic or airport activity.

Documentation:

Merced County. 2013. 2030 Merced County General Plan. 10 December 2013. Available: https://www.co.merced.ca.us/100/General-Plan.

Mitigation:

NOISE-1. Reduce Impacts from Noise.
To mitigate noise related impacts, the Project shall require all contractors to comply with the following operational parameters:

- restrict construction activities to time periods between 7:00 am and 5:00 pm when there is the least potential for disturbance;
- locate the sorting station away from edge of property and adjacent homes; and

install and maintain sound-reducing equipment and muffled exhaust on all construction equipment.

XIV. Population and Housing	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion:
a) The Action Area is in a rural area and does not currently have any houses, businesses, or other structures present. Implementation of the Proposed Project would provide temporary employment for several people during Proposed Project construction and post-project monitoring. New permanent jobs would not be created that would induce substantial population growth. Implementation of the Proposed Project would not indirectly induce population growth. Therefore, there will be **no impact**.

b-c) The Proposed Project would occur on mining disturbed, undeveloped land. Implementation of the Proposed Project in the Merced River does not displace housing or residents or cause the construction of replacement housing in another location. There will be **no impact.**

Documentation:
No documentation required.

Mitigation:
No mitigation required.

XV. Public Services	**Potentially Significant Impact**	**Less Than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
(i) Fire protection?	☐	☐	☐	☒
(ii) Police protection?	☐	☐	☐	☒
(iii) Schools?	☐	☐	☐	☒
(iv) Parks?	☐	☐	☐	☒
(v) Other public facilities?	☐	☐	☐	☒

Discussion:
a) The Proposed Project has **no impact** on fire protection for the area.
b) The Proposed Project is of limited duration and is located in a rural area. It has **no impact** on police protection for the area.
c) The Proposed Project is not near a school. Therefore, it has **no impact** on schools.
d) The Proposed Project is not near a park. Therefore, it has **no impact** on parks.
e) The Proposed Project has **no impact** on any other public facilities. The Proposed Project has no impact on public services.

Documentation:
No documentation required.

Mitigation:
No mitigation required.

XVI. Recreation	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☒	☐	☐

Discussion:
a) The Proposed Project would not improve the public river access within the Action Area or construct any facilities which may increase the public use. Implementation of the Proposed Project may enhance the floating experience within the Action Area by increasing the number of riffles, reducing the area of slow, deep pools, and eliminating the need for temporary in-channel berms to direct water into diversions. However, the Project will not fundamentally change the overall recreational experience of floating on the Merced River, therefore it is expected to result in a negligible increase in recreational use of the river and **no impact** is expected.

b) Construction activities for the Proposed Project would include operation of heavy equipment (front-end loaders and articulated haul trucks) in the channel of the Merced River within the Action Area. There is a potentially significant impact on public safety to persons floating down the river in the same area where heavy equipment is being operated in the channel. The peak recreational use by river floaters is on weekends and holidays during the summer. Construction activities would not typically occur on weekends or holidays and only occur during the week during normal working hours (7 am to 5 pm) when most people are working as well thereby reducing the potential for interaction between floaters and heavy equipment. In addition, instream

activities would only take up to 20 days each construction year. **REC-1 – Signs and construction monitor to warn public of rehabilitation activity** would be implemented for the Proposed Project. Signs would also be placed at the closest public river access to diversions being enhanced in a given construction season. A sign would be placed on the bank approximately 100 feet upstream of instream construction activity within easy view of public floaters warning them of upcoming instream activity and directing them to a side of the channel (if needed). In addition, during all instream construction activity, a construction monitor with a radio would be positioned upstream of the instream construction activity and next to the channel in order to communicate with public floaters as well as over the radio with heavy equipment operators to warn them that a group of floaters is coming down and to temporarily halt instream activity. With implementation of **REC-1 – Signs, construction monitor, and communication to warn public of rehabilitation activity** there would be a **less than significant impact**.

Documentation:
No documentation required.

Mitigation:

REC-1. Signs and construction monitor to warn public of construction activity.
Signs shall be placed during Proposed Project construction, informing the public about the Proposed Project and warning them that potentially dangerous heavy equipment is being operated. A highly visible warning sign shall be placed on the bank approximately 100 feet upstream of instream construction activity, informing any individuals floating down the river about the construction activity and directing them to a safe path to avoid construction activity. In addition, during all instream construction activity, a construction monitor with a radio shall be positioned upstream of the instream construction activity and next to the channel to communicate with the public and with heavy equipment operators to ensure safe passage through the construction area.

XVII. Transportation	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☒	☐
b) Conflict with an applicable congestion management program, including but not limited to level of service standards, and travel demand measures, or other standards, established by the county congestion management agency for designated roads or highways?	☐	☐	☒	☐

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Conflict with adopted policies, plans or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☐	☐	☐	☒

Discussion:
a-b) The Proposed Project would cause a minor, short-term, temporary increase in traffic volume as a result of daily commutes by workers to the Action Area during the construction season and occasional supply deliveries. A few days of additional traffic would occur at the beginning and end of each construction season during transport of heavy equipment to the Action Area during annual mobilization and demobilization. Individual drivers may experience minor delays if they are travelling behind a truck transporting heavy equipment on a two-lane road. The Proposed Project's temporary traffic would primarily center on State Route 59, Turlock Road, Snelling Road, Merced Falls Road, and their intersections with the dirt access roads. All worker vehicles would be parked and heavy equipment would be stored in staging areas where there would be sufficient room for all of the vehicles and equipment; the Proposed Project would not displace any existing parking. Therefore, the Proposed Project would have a **less than significant impact**.

c) The Proposed Project will not occur within two miles of a public airport or private airstrip and construction workers would not travel to the Action Area via airplane. The Proposed Project would not construct any structures or perform activities that would interfere with air traffic patterns. Therefore, the Proposed Project would have **no impact** on air traffic safety.

d) The Proposed Project would not modify any public roads or intersections and no incompatible vehicles would be used. The Proposed Project would not interfere with or increase safety risk for pedestrian and bicycle use of public roads. Therefore, there would be **no impact**.

e) The Proposed Project would not change the existing emergency access to the Action Area resulting in **no impact**.

f) The Proposed Project would not conflict with adopted policies, plans, or programs supporting alternative transportation; therefore, there would be **no impact**.

Documentation:
No documentation required.

Mitigation:
No mitigation required.

XVIII. Tribal Cultural Resources	Potentially Significant Impact	Less Than Significant with Mitigation	Less Than Significant Impact	No Impact
Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource which is either listed or eligible for listing on the National Register of Historic Places, the California Register of Historic Resources, or a local register of historic resources?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of a unique archaeological resources (i.e., an artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it contains information needed to answer important scientific research questions, has a special and particular quality such as being the oldest or best available example of its type, or is directly associated with a scientifically recognized important prehistoric or historic event or person)?	☐	☐	☐	☒
c) Disturb or destroy a unique paleontological resource or site?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

As part of the preparation for the Proposed Project, a cultural resource study was conducted by Horizon Water and Environment (HWE 2021). During Section 106 consultation, pursuant to the regulations at 36 CFR § 800.3(f)(2), Reclamation identified the Amah Mutsun Tribal Band, North Valley Yokuts Tribe, ad Southern Sierra Miwuk Nation as Indian tribes who might attach religious and cultural significance to historic properties within the APE. On November 25, 2020, letters were sent to tribal leaders that included a project description and invited the participation of these tribes in the Section 106 process pursuant to 36 CFR § 800.4(a)(4) (HWE 2021). To date, no sites of tribal cultural significance have been identified through consultation with these Indian tribes and Native American organizations.

On October 15, 2020 the Merced ID submitted an AB52 consultation request form to the Native American Heritage Commission. The following local Tribes were identified: Amah Mutsun Tribal Band, North Valley Yokuts Tribe, and Southern Sierra Miwuk Nation. A letter was sent to representatives of each of these Tribes on November 25, 2020, containing the project description, project location, lead agency contact info, and a notification that the tribe has 30 days to request consultation (HWE 2021). To date, no response has been received from these Tribes.

No known historic properties would be affected by the Proposed Project and no historical resources, as defined by CEQA, would be impacted by the Proposed Project. The Action Area does not contain any buildings or structures; therefore, there are no human built architectural resources that could be impacted. However, if any objects of cultural significance are unearthed during the construction process, work would be halted until a qualified archeologist can assess the significance of the new find (see **CR-1- Inadvertent Discoveries of Objects of Cultural Significance**). If human remains are unearthed during the construction process, the Project team would comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98. With this EC in place, the Proposed Project is expected to have **a less than significant impact** on historical resources.

b) No cultural resources considered to be historic properties or historical resources were recorded in the Action Area as a result of the records search and field survey. However, the Proposed Project's construction activities would include grading and excavation of areas, primarily dredge tailings, covered by cobble and gravel. Subsurface cultural objects could be unearthed during the grading and excavation activities which is a potentially significant impact. If any objects with potential cultural significance are unearthed during the construction process, work would be halted within the vicinity of the inadvertent discovery until a qualified archeologist (and Native American representative if the find is potentially pre-historic) can assess the significance of the new find (see **CR-1- Inadvertent Discoveries of Objects of Cultural Significance**) and prescribe measures to reduce potential impacts to be **less than significant**. The final disposition of archaeological, historical, and paleontological resources recovered on State lands under the jurisdiction of the State Lands Commission must be approved by the Commission.

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

d) No potential burial grounds were determined to be present in the Area of Potential Effects during the records search and field survey. As discussed in impact 3.5-2, construction activities for the Project would include excavation and grading which have the potential to unearth subsurface human remains which is a potentially significant impact. If human remains are unearthed during the construction process, work would be halted within the vicinity of the human remains, the Coroner contacted, and **CR-1 - Inadvertent Discoveries of Objects of Cultural Significance** would be implemented. This EC would reduce potential impacts to a **less than significant** level. The Proposed Project would comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.

Documentation:
Horizon Water and Environment, LLC. 2018. Cultural Resources Assessment Report. Merced River Habitat Restoration Project #4: Gage 52. Prepared for Merced Irrigation District. August 2018.

Mitigation:

CR-1. Inadvertent Discoveries of Objects of Cultural Significance
If any objects of cultural significance are unearthed during the construction process, work shall be halted immediately until a qualified archeologist can assess the significance of the new find. If human remains are unearthed during the construction process, the Project team shall comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.

XIX. Utilities and Service Systems	**Potentially Significant Impact**	**Less Than Significant with Mitigation**	**Less Than Significant Impact**	**No Impact**
Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☒	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒

d) Are sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒	☐
e) Has the wastewater treatment provider which serves or may serve the project determined that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒

Discussion:

a) The Project team would prepare a SWPPP as required to obtain a Storm Water Construction General Permit from the CVRWQCB. The SWPPP contains BMPs to minimize impacts to surface water quality from erosion or contaminants. The construction contractor would be required to implement the BMPs in the SWPPP to minimize impacts to water quality. With these measures in place, the impact is **less than significant**.

b) The Proposed Project does not require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects. Therefore, the Proposed Project will have **no impact.**

c) The Proposed Project does not require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects. Therefore, the Proposed Project will have **no impact.**

d) The Proposed Project would comply with Section 401 of the CWA and obtain certification from the Regional Water Quality Control Board. The Proposed Project would maintain water quality in the Action Area. With implementation of the Water Quality Certification requirements, the Proposed Project will have a **less than significant impact**.

e) The Proposed Project does not require increased wastewater treatment capacity or a landfill. The Proposed Project has **no impact** on utilities and service systems.

Documentation:

No documentation required.

Mitigation:

No mitigation required.

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

Discussion:

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

b) The Proposed Project construction would create a wildfire ignition risk. However, the majority of the Action Area is comprised of diversion canals and poorly vegetated banks which contain minimal vegetation fuel resulting in a low wildfire risk. There are also some dredge tailings piles that essentially act as fuel breaks and would inhibit the spread of fire. In addition, the majority of vegetation within the Action Area is riparian vegetation which has a low ignition risk due to high moisture content. If riparian areas do ignite then the wildlife usually spreads slowly as an underburn due to the relatively moist, green vegetation. The Action Area is designated as a moderate fire hazard severity zone (CalFire 2007). Fire extinguishers would be present onsite in vehicles to quickly put out any vegetation that ignites as a result of a spark from heavy equipment. Any tall, dried grass present on the staging areas or temporary access roads would be cleared prior to being used by vehicles or heavy equipment. In the long-term the Proposed Project would not alter the existing fire hazard conditions. The Proposed Project would result in additional areas of riparian vegetation which have low fire hazard risk. These additional areas of riparian vegetation would not change the overall wildfire risk. Therefore, the impact of the Proposed Project on wildfire risk is **less than significant**.

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

d) The Proposed Project would not expose people or structures to significant risks to wildfire. The Proposed Project would occur in an area comprised primarily of mine tailings and would be of limited duration. Therefore, **no impact** is expected.

Documentation:
CalFire. 2007. Fire Hazard Severity Zone Maps. Available: http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_zones

Mitigation:
No mitigation required.

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

Discussion:
a) The Proposed Project does not have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number, or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory. Limited short-term impacts are expected, but these will be mitigated with implementation of the EC's described above. Therefore, the Proposed Project would have **a less than significant impact.**

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

Other related activities aimed at salmonid production, enhancement, rehabilitation, and mitigation are being planned and implemented for the Merced River system and Central Valley under directives of the DWR, CDFW, CVPIA, USFWS AFRP, and Reclamation. These activities include gravel additions, floodplain creation, riparian habitat rehabilitation, and other enhancement actions. The magnitude of cumulative effects under all current and proposed salmonid habitat improvement actions is undetermined at this time, but the impacts are expected to be beneficial.

Together, the Proposed Project and other rehabilitation projects and actions would improve environmental quality. Therefore, **no significant cumulative impacts to the environment are expected** if the Proposed Project is implemented.

d) The Proposed Project would improve the environmental conditions in the area by reducing direct mortality at diversion sites and enhancing spawning habitat. There would be **no impact** to human beings.

Documentation:
No documentation required.

Mitigation:
No mitigation required.

5 References

Beechie, T.J., M. Liermann, E.M. Beamer, and R. Henderson. 2005. A classification of habitat types in a large river and their use by juvenile salmonids. Transactions of the American Fisheries Society 134(3): 717-729.

Bernstein, B.B. and J. Zalinski. 1983. An optimum sampling design and power tests for environmental biologists. Journal of Environmental Management, *16*(1), pp.35-43.

CALFED Bay-Delta Program. 2000. Ecosystem Restoration Program. CALFED Bay-Delta Program, Sacramento, CA.

California Department of Conservation (CDC). 2016. Farmland Mapping and Monitoring Program. 2016 Field Report. 6pp.

California Department of Fish and Game (CDFG). 1990. Central Valley salmon and steelhead restoration and enhancement plan. State of California, Resources Agency, Department of Fish and Game.

CDFG. 1993. Restoring Central Valley streams: A plan for action. State of California, Resources Agency, Department of Fish and Game.

CDFG. 1996. Steelhead restoration and management plan for California. State of California, Resources Agency, Department of Fish and Game. Available: http://friendsofventurariver.org/wp-content/themes/client-sites/venturariver/docs/steelhead-restoration-mgmt-ca-df&g.pdf

CDFG. 2002. California Salmonid Stream Habitat Restoration Manual. Appendix S: Fish Screen Criteria. December 2002.

CDFG. 2005. Life History Account for the Golden Eagle. California Wildlife Habitat Relationships System. Available : https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=1681

Cramer, S.P. and N.K. Ackerman. 2009. Linking stream carrying capacity for salmonids to habitat features. In American Fisheries Society Symposium, vol. 71: 225-254.

Cramer Fish Sciences (CFS). 2018. Draft Merced Salmonid Habitat Drought Restoration Project. Prepared for Merced Irrigation District. 16pp.

Cramer Fish Sciences (CFS). 2020. Merced River Agricultural Diversion and Fish Habitat Enhancement Project. Prepared for Merced Irrigation District. March 2020.

Department of Water Resources (DWR). 1994. Comprehensive needs assessment for Chinook Salmon habitat improvement projects in the San Joaquin River Basin. Prepared for CDFG by DWR under contract #FG20841F.

Downs, P.W., Singer, M.S., Orr, B.K., Diggory, Z.E. and Church, T.C., 2011. Restoring ecological integrity in highly regulated rivers: the role of baseline data and analytical references. Environmental Management, 48(4), pp.847-864.

Gale, S. B., A. V. Zale, and C. G. Clancy. 2008. Effectiveness of fish screens to prevent entrainment of westslope cutthroat trout into irrigation canals. North American Journal of Fisheries Management 28(5):1541–1553.

Green, R.H. 1979. Sampling design and statistical methods for environmental biologists. John Wiley & Sons.

Herren, J. R., and S. S. Kawasaki. 1998. Inventory of water diversions in four geographic areas in California's Central Valley. Fish Bulletin 179:343–355.

Kondolf, G.M. 1995. Five elements for effective evaluation of stream restoration. Restoration ecology, 3(2), pp.133-136.

Kondolf, G.M., J.C. Vick, and T.M. Ramirez. 1996. Salmon spawning habitat rehabilitation on the Merced River, California: an evaluation of project planning and performance. Transactions of the American Fisheries Society 125(6):899-912.

Moyle, P.B. 2002. Inland fishes of California. Revised and expanded. University of California Press, Berkeley and Los Angeles, CA. 502 pp.

Moyle, P. B., and D. White. 2002. Effects of screening diversions on fish populations in the Central Valley: What do we know? (January):1–13.

NMFS (National Marine Fisheries Service). 1997. Fish Screening Criteria for Anadromous Salmonids. January 1997.

NMFS. 2011. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

NMFS. 2014. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and California Central Valley Steelhead. West Coast Region. Sacramento, CA. July 2014.

Nobriga, M. L., Z. Matica, and Z. P. Hymanson. 2004. Evaluating entrainment vulnerability to agricultural irrigation diversions: a comparison among open-water fishes. American Fisheries Society Symposium 39:281–295.

Nordlund, B. 2008. Designing fish screens for fish protection at water diversions. Lacey, WA.

Pasternack, G.B. 2008. SHIRA-Based River analysis and field-based manipulative sediment transport experiments to balance habitat and geomorphic goals on the lower Yuba River. Cooperative Ecosystems Studies Unit (CESU), 81332(6), p.J002.

Roni, P. and E. Quimby, eds. 2005. Monitoring stream and watershed restoration. CABI.

Sabal, M., S. Hayes, J. Merz, and J. Setka. 2016. Habitat alterations and a nonnative predator, the Striped Bass, increase native Chinook Salmon mortality in the Central Valley, California. North American Journal of Fisheries Management 36:309–320.

San Joaquin River Management Plan. 1995. The Resources Agency, advisory council established by Assembly Bill #3603.

Sawyer, A.M., G.B. Pasternack, J.E. Merz, M. Escobar, and A.E. Senter. 2009. Construction constraints on geomorphic-unit rehabilitation on regulated gravel-bed rivers. River Research and Applications 25: 416-437.

Schneider, K. 2015. Fish screens are part of the answer to saving Sacramento river salmon. https://www.circleofblue.org/2015/world/fish-screens-ao-river-salmon/.

Sellheim, K.L., M. Vaghti, and J.E. Merz. 2016. Vegetation recruitment in an enhanced floodplain: Ancillary benefits of salmonid habitat enhancement. Limnologica-Ecology and Management of Inland Waters 58: 94-102.

Shrivell, C.S. 1990. Role of instream rootwads as juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*O. mykiss*) cover habitat under varying streamflows. Canadian Journal of Fisheries and Aquatic Sciences 47(5): 852-861.

Simpson, W. G., and K. G. Ostrand. 2012. Effects of entrainment and bypass at screened irrigation canals on juvenile steelhead. Transactions of the American Fisheries Society 141(3):599–609.

Smith, E.P. 2002. BACI design. In 'Encyclopedia of Environmetrics. Vol. 1'.(Eds AH El-Shaarawi and WW Piegorsch.) pp. 141–148.

Stewart-Oaten, A., W.W. Murdoch, and K.R. Parker. 1986. Environmental impact assessment:" Pseudoreplication" in time?. Ecology, 67(4), pp.929-940.

Stillwater Sciences. 2002. Merced River Corridor Restoration Plan. Stillwater Sciences, Berkeley, California. 245 pp.

Stillwater Sciences. 2006. Merced River corridor restoration plan phase IV: dredger tailings reach technical memorandum #7 baseline monitoring of the Merced River dredge tailings reach. Prepared for CALFED ERP Sacramento, CA. Recipient Agreement No. ERP=02-P12-D. 192 pp.

United States Bureau of Reclamation (Reclamation). 1999. Central Valley Project Improvement Act: Final Programmatic Environmental Impact Statement. Executive Summary. Sacramento, CA.

Reclamation. 2001. Central Valley Project Improvement Act: Record of Decision. Sacramento, CA.

United States Fish and Wildlife Service (USFWS). 1995. Working Paper on restoration needs: habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume 1. Prepared for the U.S. Fish and Wildlife Services under the direction of the Anadromous Fish Restoration Program Core Group. Stockton, CA.

USFWS. 2001. Final Restoration Plan For The Anadromous Fish Restoration Program. A plan to increase natural production of anadromous fish in the Central Valley of California. Prepared for the Secretary of the Interior by the USFWS with assistance from the Anadromous Fish Restoration Program core group under authority of the Central Valley Project Improvement Act. 146 pp.

USFWS. 2017. Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*). U.S. Fish and Wildlife Service; Sacramento, California. 28 pp.

Vaghti, M.G., M. Holyoak, A. Williams, T.S. Talley, A.K. Fremier, and S.E. Greco. 2009. Understanding ecology of blue elderberry to inform landscape restoration in semiarid river corridors. Environmental Management 43: 28-37.

Vaghti, M. 2021. Merced Irrigation District Diversions Restoration Project special status plant survey report. Prepared for Cramer Fish Sciences. September 2021.

Vogel, D.A. 2003. Merced River Water Temperature Feasibility Investigation: Reconnaissance Report. Contract report prepared for the U.S. Fish and Wildlife Service Anadromous Fish Restoration Program. Natural Resource Scientists, Inc., Red Bluff, CA. December 2003. 89 p.

Vogel, D. 2007. A feasibility investigation of reintroduction of anadromous Salmonids above Crocker-Huffman Dam on the Merced River. Report prepared for the USFWS Anadromous Fish Restoration Program. 274 pp.

Vogel, D. 2011. Insights into the problems, progress, and potential solutions for Sacramento River Basin anadromous fish restoration. Red Bluff, CA.

Wheaton, J.M., G.B. Pasternack, and J.E. Merz. 2004a. Spawning habitat rehabilitation – I. Conceptual Approach & Methods. International Journal of River Basin Management 2:1:3-20.

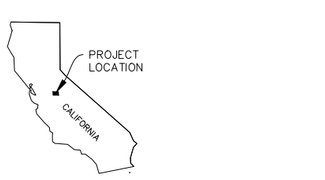
Wheaton, J.M., G.B. Pasternack, and J.E. Merz. 2004b. Spawning Habitat Rehabilitation – II. Using hypothesis development and testing in design, Mokelumne River, California, U.S.A. International Journal of River Basin Management 2:1:21-37.

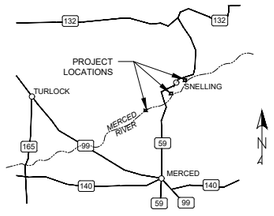
Appendix A. 30% Design for Cowell 1 and Cowell 2

MERCED RIVER AGRICUTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

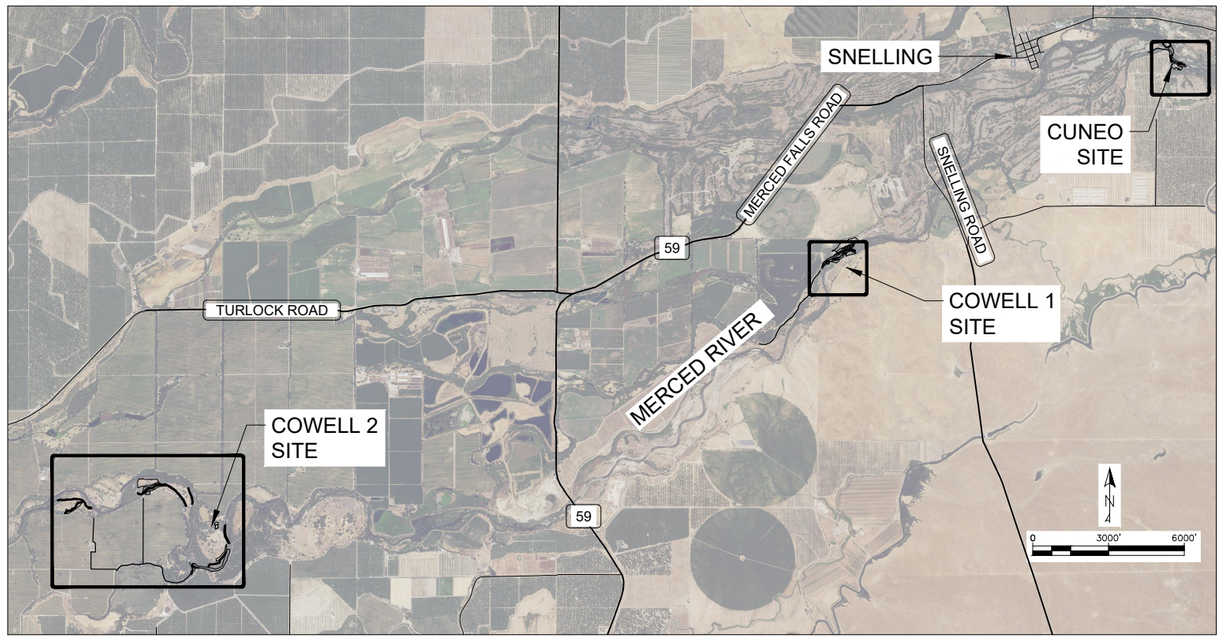
MERCED IRRIGATION DISTRICT &
CALIFORNIA DEPARTMENT OF WATER RESOURCES

30% SUBMITTAL





VICINITY MAP
NTS



LOCATION MAP
1" = 3000'

SHEET INDEX

SHEET #	SHEET	TITLE
1	G-01	TITLE SHEET
2	G-02	GENERAL NOTES, ABBREVIATIONS, & LEGEND
3	G-03	SITE ACCESS ROUTES
4	G-04	EXISTING SITE PLAN – COWELL 1
5	G-05	DIVERSION STRUCTURE PLAN – COWELL 1
6	G-06	EXISTING SITE PLAN & ACCESS – COWELL 2
7	G-07	DIVERSION STRUCTURE PLAN – COWELL 2
8	G-08	RIVER & CHANNEL PROFILES – COWELL 2
9	G-09	EXISTING SITE PLAN & ACCESS – CUNEO
10	G-10	DIVERSION STRUCTURE PLAN – CUNEO
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16	C-05	NORTH SIDE CHANNEL AREA PLAN & PROFILE – COWELL 2
17	C-06	PUMP 11 AREA PLAN & PROFILE – COWELL 2
18	C-07	PUMP 12 AREA PLAN & PROFILE – COWELL 2
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20	C-09	ENHANCEMENT PLAN – CUNEO
21	C-10	CHANNEL PROFILES – CUNEO
22	C-11	TYPICAL DETAILS
23	Z-01	CONE SCREEN LAYOUT

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT
MERCED COUNTY, CALIFORNIA

TITLE SHEET

DRAFT NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

G-01
SHEET 1 OF 23

G-01 TITLE.DWG 6/8/2021 10:59 AM

DEFINITIONS

PROJECT SPONSOR:	CALIFORNIA DEPARTMENT OF WATER RESOURCES RIVERINE STEWARDSHIP PROGRAM
PROPERTY OWNER:	PROPERTY OWNERSHIP IS SHOWN ON SHEETS G-04, G-05 & G-09
PROJECT LEAD:	MERCED IRRIGATION DISTRICT (MID)
DESIGN CONSULTANT & ENGINEER:	CRAMER FISH SCIENCES (CFS)
OWNERS'S REPRESENTATIVE	TO BE IDENTIFIED BY THE OWNER TO COORDINATE DIRECTLY WITH CONTRACTOR AND DESIGN CONSULTANT DURING CONSTRUCTION.

ABBREVIATIONS

APPROX	APPROXIMATE
BM	BENCHMARK
℄	CENTERLINE
CP	CONTROL POINT
DBH	DIAMETER AT BREAST HEIGHT
DIA	DIAMETER
EL	ELEVATION
EX	EXISTING
EG	EXISTING GRADE
FG	FINISH GRADE
FT	FEET, FOOT
HORIZ	HORIZONTAL
MAX	MAXIMUM
MIN	MINIMUM
NTS	NOT TO SCALE
PIP	PROTECT IN PLACE
SHT	SHEET
STA	STATION
TYP	TYPICAL
VAR	VARIES
VERT	VERTICAL
VIF	VARIFY IN FIELD
W/	WITH
W/O	WITHOUT
2:1	SLOPE (HORIZONTAL: VERTICAL)

GENERAL NOTES

GENERAL

1. THE PURPOSE OF THE PROJECT IS TO UPGRADE EXISTING FISH SCREENING TECHNOLOGY AT THREE DIVERSIONS ON THE MERCED RIVER. NEW DIVERSION STRUCTURES, FISH SCREENS AND ASSOCIATED WORKS WILL BE CONSTRUCTED. ADJACENT IN-CHANNEL AND FLOODPLAIN AREAS WILL BE ENHANCED BY EXCAVATION AND PLACEMENT OF GRAVELS AND COBBLE IN THE RIVER TO MAINTAIN FLOW CONDITIONS AT THE DIVERSIONS AND ENHANCE RIPARIAN HABITAT FOR SALMONID SPECIES.
2. CONTRACTOR SHALL BE AWARE THAT PROTECTED FISH AND WILDLIFE SPECIES MAY BE PRESENT DURING THE CONSTRUCTION PERIOD. CONTRACTOR SHALL BE FULLY AWARE OF AND UNDERSTAND ALL ENVIRONMENTAL PROTECTION REQUIREMENTS SET FORTH IN THE ENVIRONMENTAL PERMITS.
3. WORK WILL BE REQUIRED ADJACENT TO AND WITHIN THE WETTED AREA OF THE MERCED RIVER. FLOWS IN THE RIVER FLUCTUATE LARGELY BASED ON RELEASES FROM DAMS UPSTREAM OF THE PROJECT SITE. THE CONTRACTOR SHALL BE AWARE OF AND MONITOR FLOWS IN THE RIVER DURING THE CONSTRUCTION PERIOD AND COORDINATE WITH OWNER'S REPRESENTATIVE TO CONFIRM APPROPRIATE PERIODS OF WORK ADJACENT TO AND IN THE RIVER.
4. THE MERCED RIVER MAIN CHANNEL SHALL NOT BE UTILIZED AS A CORRIDOR FOR MOVEMENT OF CONSTRUCTION EQUIPMENT, BEYOND THAT NEEDED TO PLACE MATERIALS IN THE RIVER CHANNEL.
5. CONTRACTOR SHOULD BE AWARE THAT THE MERCED RIVER IS UTILIZED BY THE PUBLIC FOR RECREATIONAL ACTIVITIES DURING THE EXPECTED CONSTRUCTION PERIOD. CONTRACTOR SHALL SECURE THE SITE TO PROTECT THE SAFETY OF THE PUBLIC AS WELL AS THE CONSTRUCTION AREA. THE CUNEO SITE IS IMMEDIATELY ADJACENT TO HENDERSON PARK.
6. ALL WORK SHALL CONFORM TO THE "STANDARD SPECIFICATIONS OF THE STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION," MOST RECENT EDITION (HEREINAFTER REFERRED TO AS STANDARD SPECS), EXCEPT AS MODIFIED IN THE DRAWINGS OR THE TECHNICAL SPECIFICATIONS, OR AS DESCRIBED IN WRITING BY THE OWNER'S REPRESENTATIVE.
7. WORK HOURS SHALL BE MONDAY THROUGH FRIDAY 7:00AM TO 5:00 PM.

ACCESS AND MOBILIZATION

8. SITE ACCESS IS INDIVIDUAL TO EACH SITE AND IS SHOWN ON THE ACCESS PLANS.
9. CONTRACTOR SHALL COORDINATE WITH THE PROPERTY OWNERS REGARDING ACCESS TO PROJECT SITES. THIS SHALL INCLUDE TIMING AND DELIVERY OF EQUIPMENT AND MATERIALS.
10. CONTRACTOR SHALL BE AWARE THAT THE SITES ARE ADJACENT TO AGRICULTURAL FIELDS AND THE WORK SHALL NOT INTERFERE OR INHIBIT AGRICULTURAL ACTIVITIES.
11. ALL TRAFFIC CONTROL, IF REQUIRED, SHALL CONFORM TO THE LATEST EDITION OF THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES. A TRAFFIC CONTROL PLAN SHALL BE SUBMITTED TO THE OWNER FOR APPROVAL PRIOR TO MOBILIZATION.
12. UTILITY LOCATIONS ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING LOCATIONS AND CONTACTING LOCAL UTILITY PROVIDERS FOR LOCATING UTILITIES IN THE AREA OF WORK AND CONSTRUCTION ACCESS.

TOPOGRAPHY

13. EXISTING SITE TOPOGRAPHY IS BASED ON SURVEYS CONDUCTED BY CRAMER FISH SCIENCES USING RTK-GPS, LiDAR, ECHO SOUNDER AND UNMANNED AERIAL VEHICLE SURVEY EQUIPMENT (AUGUST 2020). ADDITIONAL LiDAR SURVEY DATA WAS USED TO SUPPLEMENT AREAS OUTSIDE OF THE CHANNEL CORRIDOR (SOURCE: HDR 2016).
14. THE COORDINATE SYSTEM IS NORTH AMERICAN DATUM OF 1983, CALIFORNIA STATE PLANE ZONE III, US FOOT. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), FEET.
15. BENCHMARKS WERE ESTABLISHED AT THE TIME OF THE CFS AUGUST 2020 SURVEY AND ARE SHOWN ON THE PLANS FOR REFERENCE.
16. AERIAL IMAGERY SHOWN REFLECTS THE SITE CONDITIONS AT THE TIME OF THE FLIGHT AND IS SHOWN FOR REFERENCE ONLY. SOURCE CFS (JUNE - AUGUST 2020) AND NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP, 2018).
17. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SURVEY CONTROL NEEDED TO LAYOUT AND COMPLETE THE WORK.

EARTHWORK & EXCAVATION

18. CONTRACTOR SHALL BE AWARE OF AND CONFIRM ALL DIMENSIONS AND GRADES SHOWN ON THE PLANS PRIOR TO COMMENCING ANY WORK. CONTRACTOR TO RECTIFY ANY DISCREPANCIES WITH OWNER OR OWNER'S REPRESENTATIVE PRIOR TO COMMENCING WORK.
19. EXCAVATION OF MATERIAL FROM THE PROJECT SITE SHALL BE LIMITED TO THAT NEEDED TO COMPLETE THE WORK TO THE LINES AND GRADES SHOWN ON THE PLANS. THIS INCLUDES SOILS AND VEGETATION.
20. SOILS AT THE SITE ARE KNOWN TO PRIMARILY CONSIST OF GRAVEL, COBBLE AND SAND.
21. CONTRACTOR SHALL ANTICIPATE FIELD ADJUSTMENTS FOR DESIGN ELEMENTS INCLUDING GRADING CONNECTIONS, GRADING TO AVOID EXISTING VEGETATION. CONTRACTOR WILL WORK WITH OWNER'S REPRESENTATIVE TO IDENTIFY SPECIFIC LOCATIONS AND EXTENT OF FIELD FITTING DURING CONSTRUCTION.
22. EXCAVATED MATERIALS TO REMAIN ONSITE AND GRADED AS SHOWN ON THE PLANS.
23. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER OR OWNER'S REPRESENTATIVE IF ANY CULTURAL RESOURCES ARE ENCOUNTERED DURING THE WORK.
24. THE OWNER IS NOT AWARE OF ANY ITEMS BURIED WITHIN THE SITE THAT WOULD REQUIRE SPECIAL EQUIPMENT FOR REMOVAL, SPECIAL HANDLING OR DISPOSAL OFFSITE.
25. MATERIAL TO BE USED FOR IN-CHANNEL PLACEMENT MAY BE OBTAINED FROM A NUMBER OF LOCAL SOURCES. ONLY POTENTIAL SOURCES ARE SHOWN ON THESE PRELIMINARY PLANS.
26. ANY MATERIAL EXCAVATED FOR SORTING AND PLACEMENT IN THE CHANNEL MAY NOT BE TRANSPORTED ON PUBLIC ROADWAYS.

FISH SCREEN & DIVERSION STRUCTURE

27. THE FISH SCREEN SCHEMATIC SHOWN ON THESE PLANS WILL BE REVISED TO SHOW DETAILED SIZING, COMPONENTS, ELEVATIONS AND MATERIALS AS PART OF THE SUBSEQUENT PHASE OF THE DESIGN.
28. IT IS ANTICIPATED THAT CONE SCREEN FISH TECHNOLOGY WILL BE IMPLEMENTED AT EACH PROJECT SITE.
29. FISH SCREEN INSTALLATION WILL BE CONDUCTED BY SCREEN MANUFACTURER. CONTRACTOR SHALL COORDINATE WITH SCREEN MANUFACTURE REGARDING INSTALLATION OF THIS COMPONENT.

ENVIRONMENTAL PROTECTION

30. CONTRACTOR SHALL PERFORM ALL WORK IN A MANNER THAT COMPLIES WITH ALL PERMITS AND IS PROTECTIVE OF THE ENVIRONMENT, INCLUDING AIR AND WATER QUALITY, FISH AND WILDLIFE, VEGETATION, AND HUMAN HEALTH. PERMITTING HAS NOT BEEN COMPLETED AND SOME MODIFICATIONS MAY BE REQUIRED TO WHAT IS SHOWN HEREIN TO MEET REGULATORY REQUIREMENTS. PERMITS TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORK INCLUDE:
31. ENVIRONMENTAL PERMITS WILL BE COMPLETED PRIOR TO COMMENCEMENT OF ANY WORK. CONTRACTOR SHALL REVIEW AND BE FAMILIAR WITH ALL PERMIT REQUIREMENTS. IT IS ANTICIPATED THAT THE FOLLOWING PERMITS WILL BE REQUIRED:
    - NOAA SECTION 7 BIOLOGICAL OPINION
    - US ARMY CORPS OF ENGINEERS SECTION 404 AND 408 PERMITS
    - RWQCB SECTION 401 WATER QUALITY CERTIFICATION
    - CDFW 1600 STREAMBED ALTERATION AGREEMENT
    - CENTRAL VALLEY FLOOD CONTROL BOARD ENCROACHMENT PERMIT
    - CEQA AND NEPA DOCUMENTATION
    - STATE HISTORIC PRESERVATION OFFICE SECTION 106 PERMIT
32. CONTRACTOR SHALL UTILIZE APPROPRIATE BEST MANAGEMENT PRACTICES TO PREVENT WIND- OR WATER-BORNE EROSION, AND SEDIMENT LADEN RUNOFF FROM LEAVING THE CONSTRUCTION SITE.
33. CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ANY AND ALL ADDITIONAL PERMITS REQUIRED TO COMPLETE THE WORK.
34. ALL INSTREAM WORK WILL BE LIMITED TO THE PERIOD OF JULY 15TH THROUGH OCTOBER 31ST.

LEGEND

- CONSTRUCTION ACCESS
- EX GRADE CONTOUR
- EX GRADE (PROFILE & SECTION)
- FINISH GRADE CONTOUR - MAJOR
- FINISH GRADE CONTOUR - MINOR
- FINISH GRADE (PROFILE & SECTION)
- PARCEL BOUNDARY (APPROX)
- CANAL IMPROVEMENTES
- PIPE OR CULVERT
- STAGING AREA
- GRAVEL BAR
- CHANNEL FILL
- SIDE CHANNEL
- ENGINEERED RIFFLE
- FLOODPLAIN ENHANCEMENT
- ENGINEERED BANK
- 0.10% FG SLOPE
- FLOW FLOW DIRECTION
- BM1 BENCHMARK

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

GENERAL NOTES, ABBREVIATIONS & LEGEND

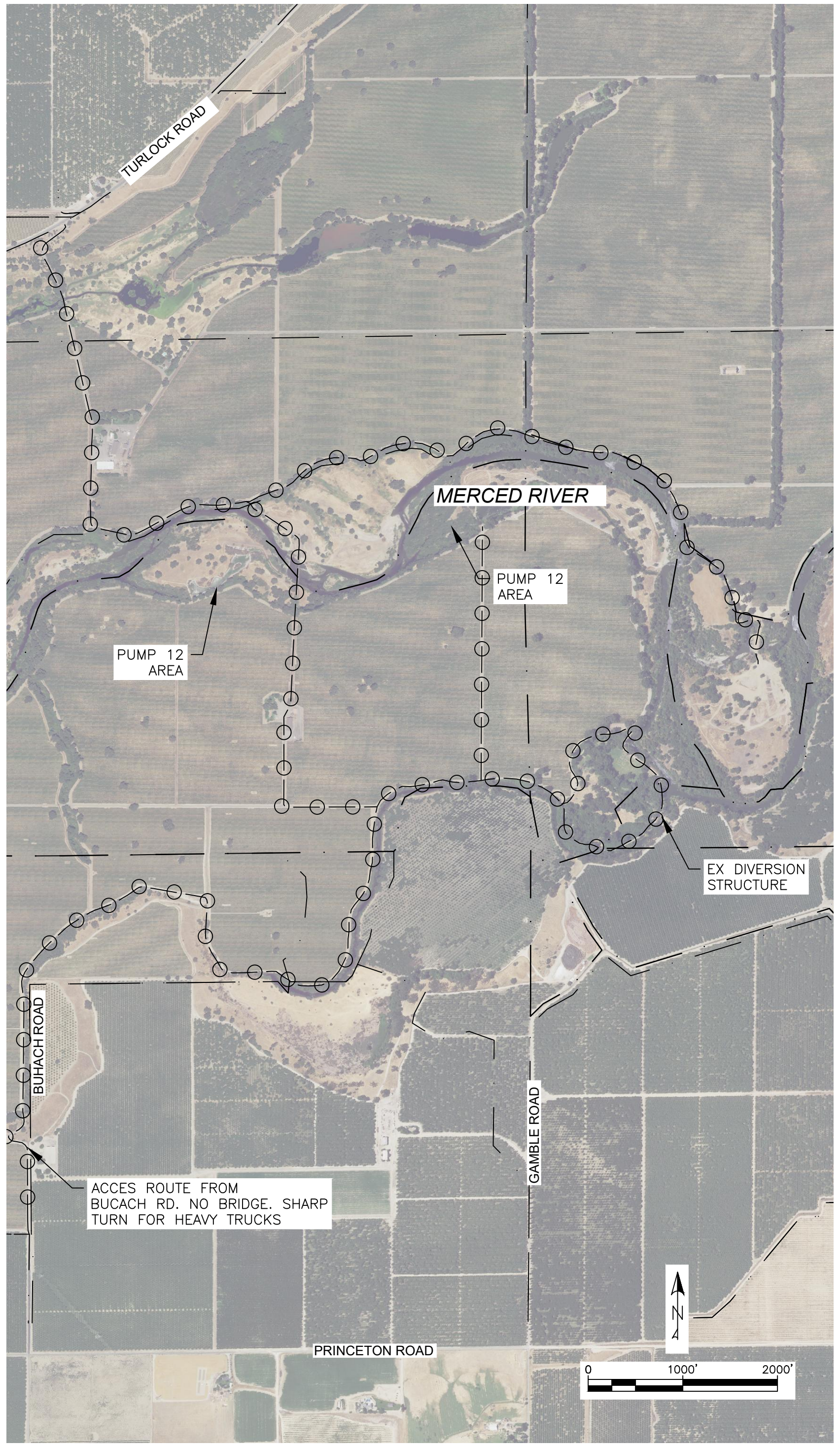
DRAFT NOT FOR CONSTRUCTION

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	N/A

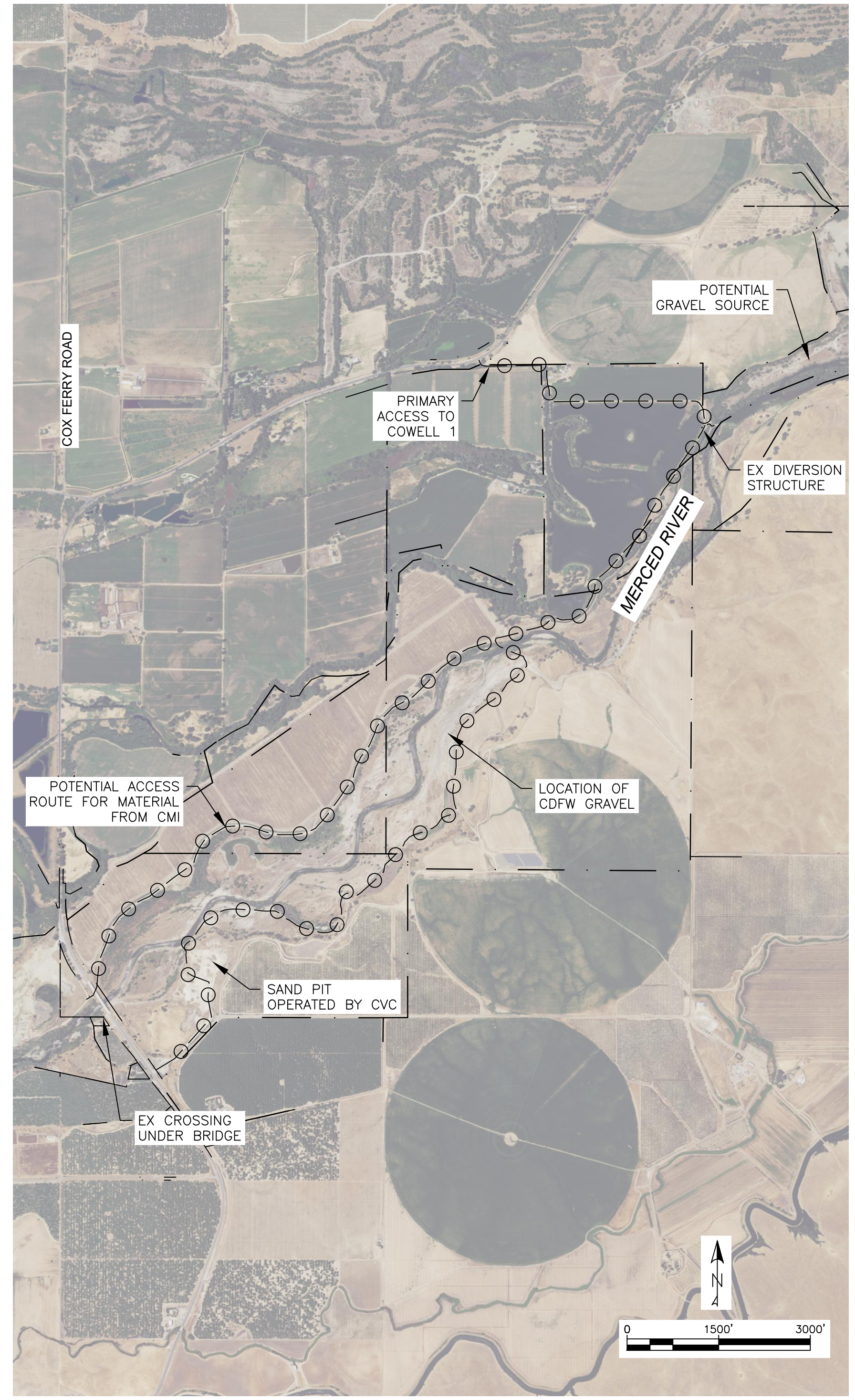
G-02

SHEET 2 OF 23



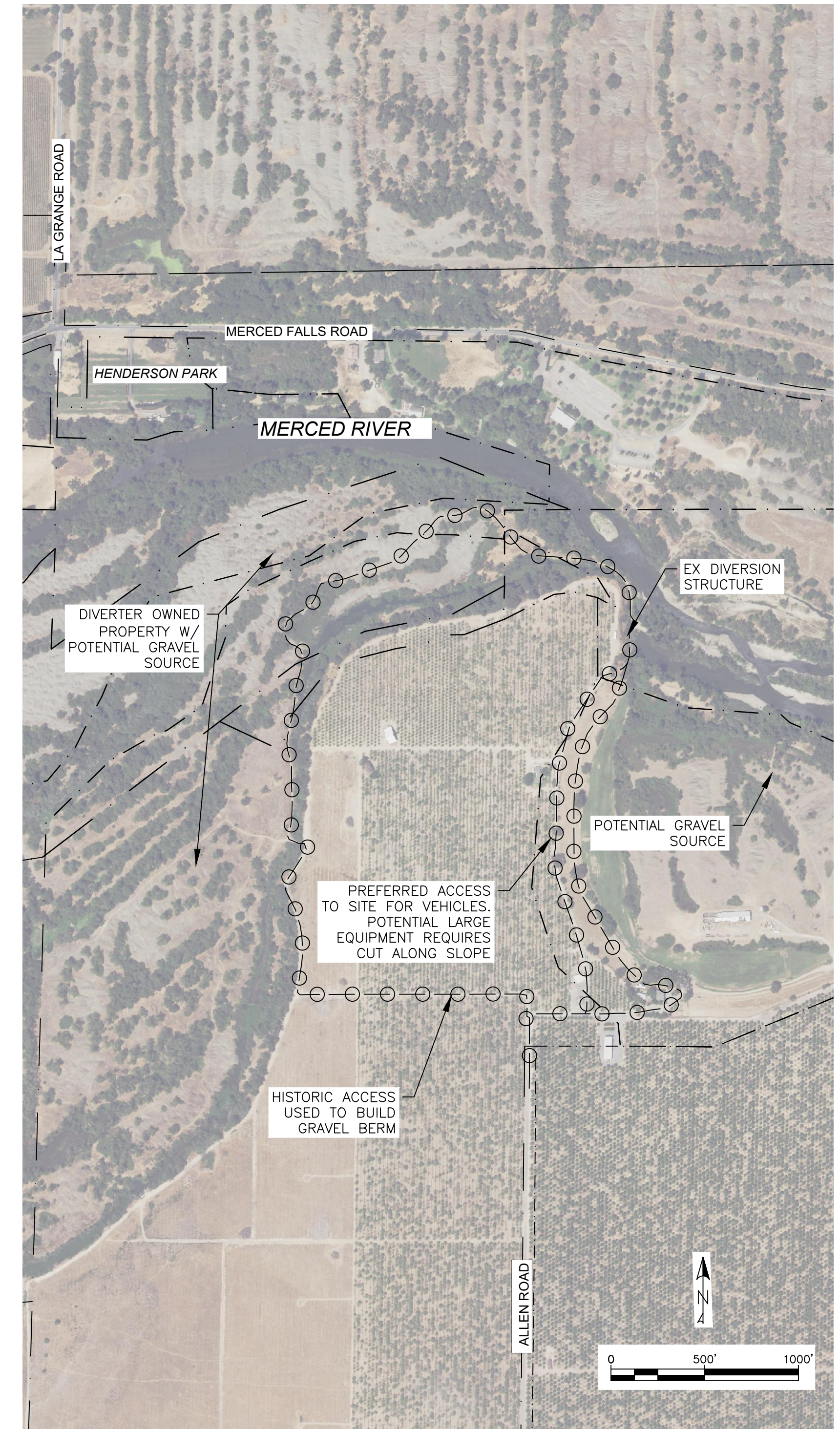
COWELL 2 SITE ACCESS

PLAN VIEW SCALE: 1" = 1000'



COWELL 1 SITE ACCESS

PLAN VIEW SCALE: 1" = 1500'



CUNEO SITE ACCESS

PLAN VIEW SCALE: 1" = 500'

NOTES:

1. THE LOCATIONS OF POTENTIAL ACCESS ROUTES AND POTENTIAL GRAVEL SOURCES WERE PROVIDED BY MID BASED ON COORDINATION WITH LANDOWNERS AND EXISTING EASEMENTS. ALL ACCESS ROUTES TO BE CONFIRMED BY LANDOWNERS AND MID PRIOR TO MOBILIZATION. THIS INFORMATION IS ALSO SHOWN TO SUPPORT INITIAL ENVIRONMENTAL SURVEYS.
2. ACCESS ROADS ARE TYPICALLY DIRT AND GRAVEL AND MAY REQUIRE VARYING LEVELS OF IMPROVEMENT PRIOR TO CONSTRUCTION AND DEPENDING ON VEHICLES TO USE EACH ROUTE.
3. THERE IS A BRIDGE CROSSING OVER THE MERCED RIVER ON THE NORTHERN ACCESS ROUTE AT THE COWELL 2 SITE.
4. ACCESS ROADS SHALL BE MAINTAINED TO PROVIDE NECESSARY EQUIPMENT ACCESS THROUGHOUT CONSTRUCTION PERIOD. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ACCESS ROUTES TO PRE-PROJECT CONDITIONS, AS NECESSARY.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

SITE ACCESS ROUTES

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MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

G-03

G-03 SITE ACCESS.DWG 6/8/2021 11:01 AM

TABLE OF BENCHMARKS				
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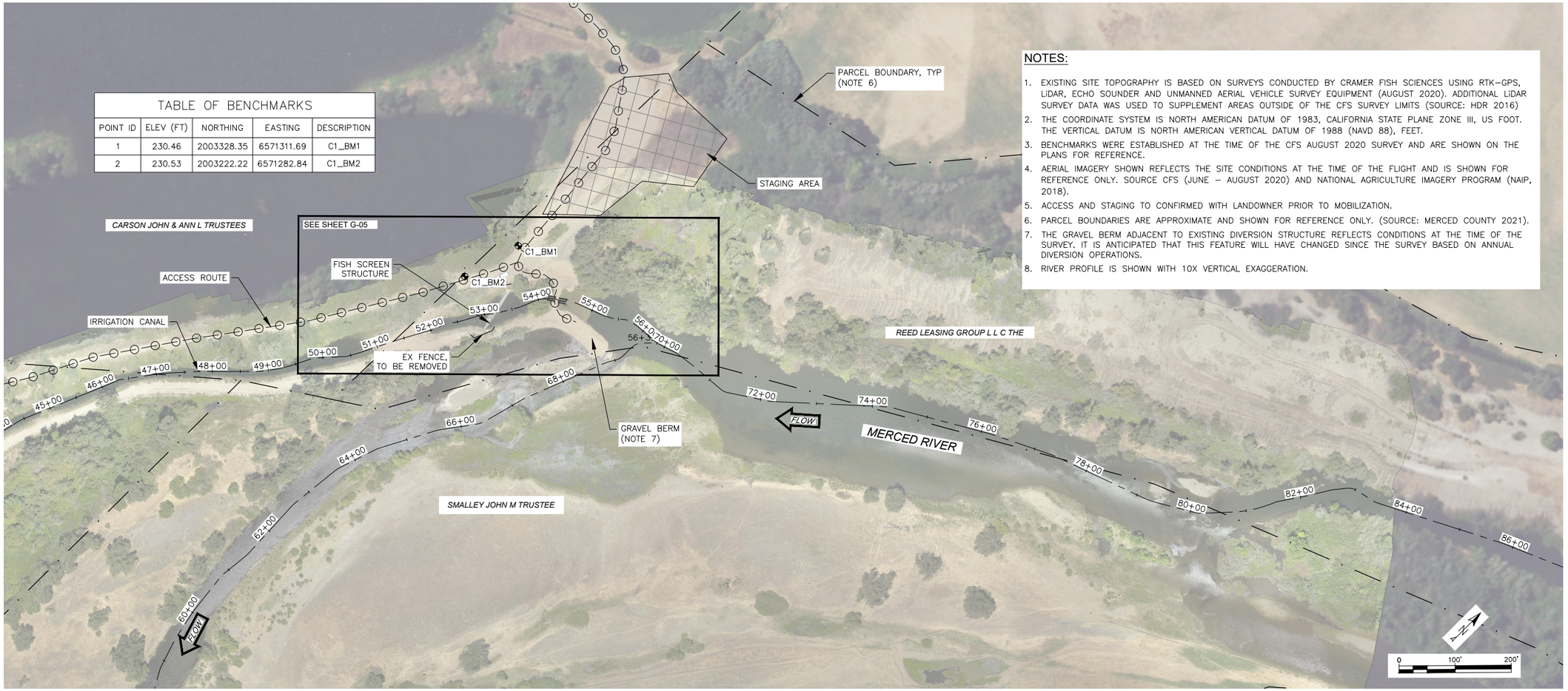
2	230.53	2003222.22	6571282.84	C1_BM2

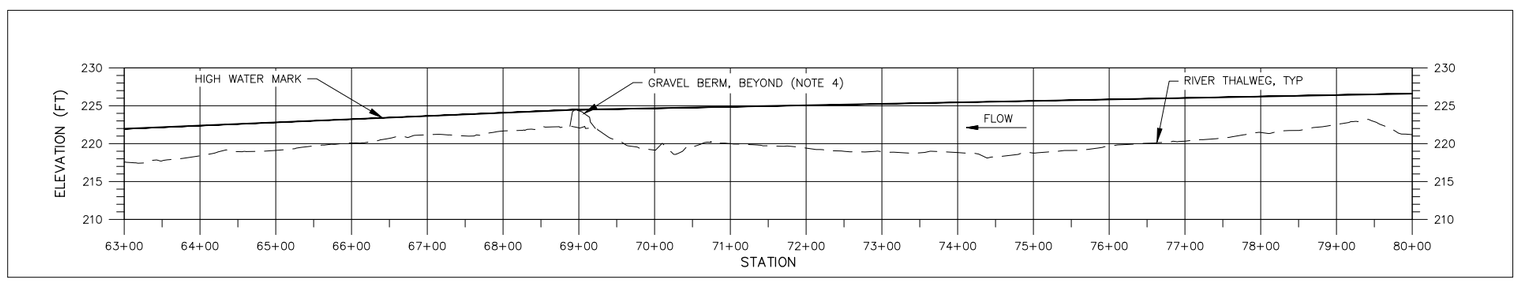


NOTES:

1. EXISTING SITE TOPOGRAPHY IS BASED ON SURVEYS CONDUCTED BY CRAMER FISH SCIENCES USING RTK-GPS, LiDAR, ECHO SOUNDER AND UNMANNED AERIAL VEHICLE SURVEY EQUIPMENT (AUGUST 2020). ADDITIONAL LiDAR SURVEY DATA WAS USED TO SUPPLEMENT AREAS OUTSIDE OF THE CFS SURVEY LIMITS (SOURCE: HDR 2016)
2. THE COORDINATE SYSTEM IS NORTH AMERICAN DATUM OF 1983, CALIFORNIA STATE PLANE ZONE III, US FOOT. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), FEET.
3. BENCHMARKS WERE ESTABLISHED AT THE TIME OF THE CFS AUGUST 2020 SURVEY AND ARE SHOWN ON THE PLANS FOR REFERENCE.
4. AERIAL IMAGERY SHOWN REFLECTS THE SITE CONDITIONS AT THE TIME OF THE FLIGHT AND IS SHOWN FOR REFERENCE ONLY. SOURCE CFS (JUNE – AUGUST 2020) AND NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP, 2018).
5. ACCESS AND STAGING TO CONFIRMED WITH LANDOWNER PRIOR TO MOBILIZATION.
6. PARCEL BOUNDARIES ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY. (SOURCE: MERCED COUNTY 2021).
7. THE GRAVEL BERM ADJACENT TO EXISTING DIVERSION STRUCTURE REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.
8. RIVER PROFILE IS SHOWN WITH 10X VERTICAL EXAGGERATION.

EXISTING SITE CONDITIONS - COWELL 1

PLAN VIEW SCALE: 1" = 100'



MERCED RIVER

PROFILE HORIZ SCALE 1" = 100'
VERT SCALE 1" = 10'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

EXISTING
SITE PLAN
COWELL 1

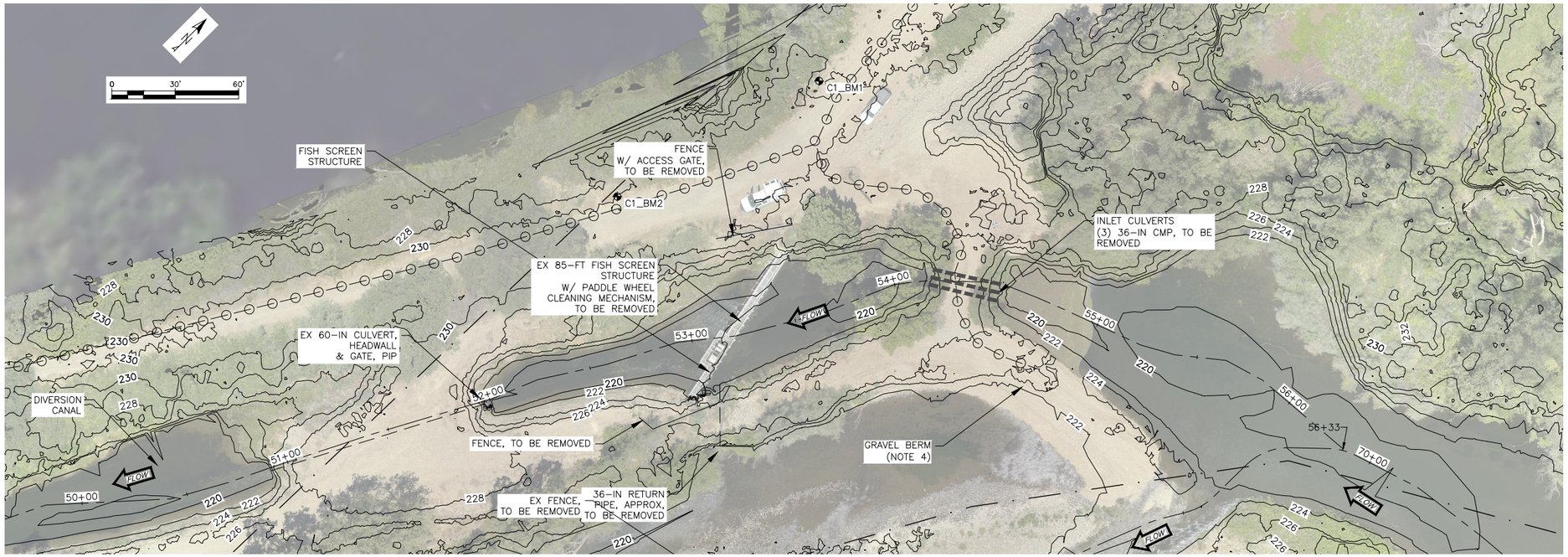
DRAFT
NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
CIVIL
6/8/22

MERCED IRRIGATION DISTRICT &
CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

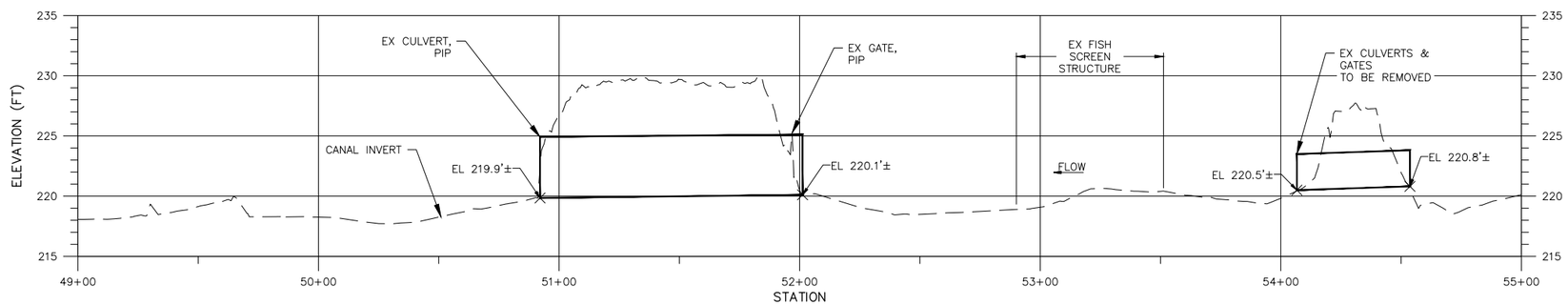
G-04
SHEET 4 OF 23

G-04-05 EX COND COWELL 1.DWG 6/8/2021 9:36 AM



EXISTING DIVERSION STRUCTURE

PLAN SCALE 1" = 30'



DIVERSION CANAL

PROFILE HORIZ SCALE 1" = 30'
VERT SCALE 1" = 6'

NOTES:

1. EXISTING RIVER THALWEG IS SHOWN FOR REFERENCE.
2. PROFILES ARE SHOWN WITH 5X VERTICAL EXAGGERATION.
3. CONTOURS ARE SHOWN AT A 2-FT INTERVAL FOR CLARITY
4. THE GRAVEL BERM ADJACENT TO EXISTING DIVERSION STRUCTURE REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.
5. INFRASTRUCTURE TO BE REMOVED SHALL BECOME THE RESPONSIBILITY OF THE CONTRACTOR TO PROPERLY DISPOSE OF UNLESS OTHERWISE DIRECTED BY THE OWNER'S REPRESENTATIVE TO SALVAGE AND LEAVE ON SITE.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

DIVERSION STRUCTURE PLAN COWELL 1

DRAFT
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STATE OF CALIFORNIA
CIVIL

MERCED IRRIGATION DISTRICT &
CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

G-05
SHEET 5 OF 23

G-04-05 EX COND COWELL 1.DWG 6/8/2021 9:37 AM

TABLE OF BENCHMARKS				
POINT ID	ELEV (FT)	NORTHING	EASTING	DESCRIPTION
1	168.91	1991196.10	6546342.13	C2_BM1
2	168.41	1991569.08	6546249.70	C2_BM2
3	166.61	1992208.28	6547406.83	C2_BM3
4	168.29	1991057.35	6546373.29	4.5 Gallo Zoo

NOTES:

1. EXISTING SITE TOPOGRAPHY IS BASED ON SURVEYS CONDUCTED BY CRAMER FISH SCIENCES USING RTK-GPS, LiDAR, ECHO SOUNDER AND UNMANNED AERIAL VEHICLE SURVEY EQUIPMENT (AUGUST 2020). ADDITIONAL LiDAR SURVEY DATA WAS USED TO SUPPLEMENT AREAS OUTSIDE THE CFS SURVEY LIMITS (SOURCE: HDR 2016).
2. THE COORDINATE SYSTEM IS NORTH AMERICAN DATUM OF 1983, CALIFORNIA STATE PLANE ZONE III, US FOOT. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), FEET.
3. BENCHMARKS WERE ESTABLISHED AT THE TIME OF THE CFS AUGUST 2020 SURVEY AND ARE SHOWN ON THE PLANS FOR REFERENCE.
4. AERIAL IMAGERY SHOWN REFLECTS THE SITE CONDITIONS AT THE TIME OF THE FLIGHT AND IS SHOWN FOR REFERENCE ONLY. SOURCE CFS (JUNE – AUGUST 2020) AND NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP 2018).
5. ACCESS AND STAGING TO CONFIRMED WITH LANDOWNERS PRIOR TO MOBILIZATION.
6. PARCEL BOUNDARIES ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY. (SOURCE: MERCED COUNTY 2021, https://www.co.merced.ca.us/441/GIS-Services-and-Mapping).
7. THE GRAVEL BERM CROSSING AT NORTHERN SIDE CHANNEL REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.

EXISTING SITE CONDITIONS

PLAN VIEW SCALE: 1" = 300'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

EXISTING SITE PLAN & ACCESS COWELL 2

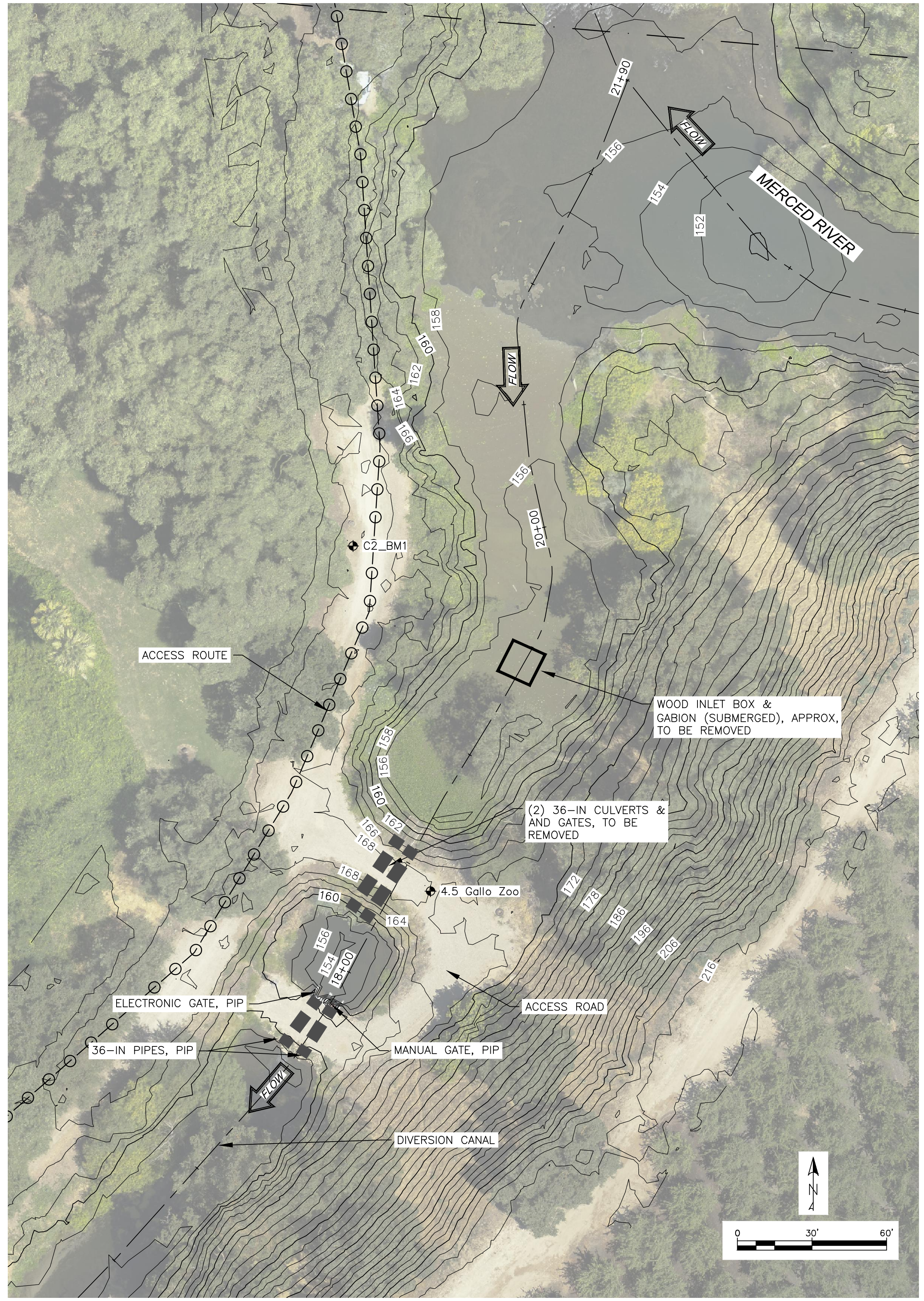
DRAFT NOT FOR CONSTRUCTION

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	1" = 300'

G-06
SHEET 6 OF 23

G-06-08 EX COND COWELL 2.DWG 6/8/2021 11:04 AM



NOTES:

1. CONTOURS ARE SHOWN AT A 2-FT INTERVAL FOR CLARITY.
2. INFRASTRUCTURE TO BE REMOVED SHALL BECOME THE RESPONSIBILITY OF THE CONTRACTOR TO PROPERLY DISPOSE OF UNLESS OTHERWISE DIRECTED BY THE OWNER'S REPRESENTATIVE TO SALVAGE AND LEAVE ON SITE.

DIVERSION STRUCTURE - COWELL 2

PLAN VIEW SCALE 1" = 30'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

CRAMER FISH SCIENCES
An Employee Owned Consulting Company
3300 Industrial Blvd., Suite 100
West Sacramento, CA 95691
888.224.1221

MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

DIVERSION STRUCTURE PLAN COWELL 2

DRAFT NOT FOR CONSTRUCTION

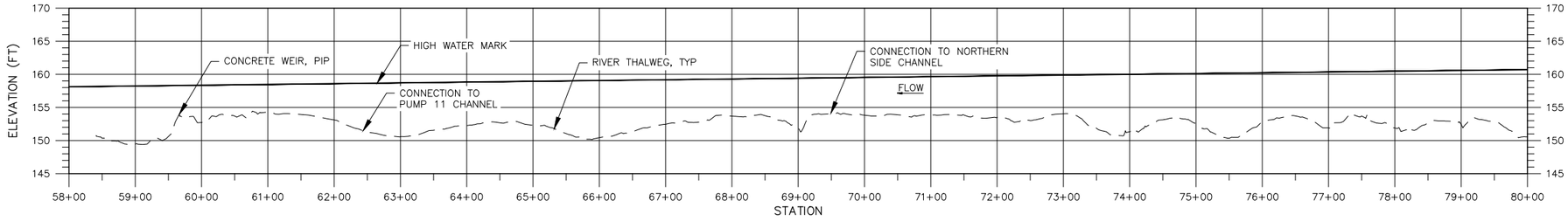
MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

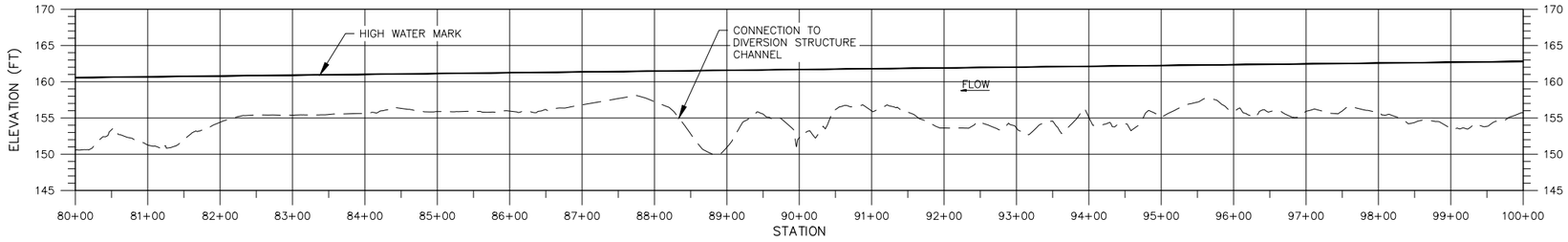
DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

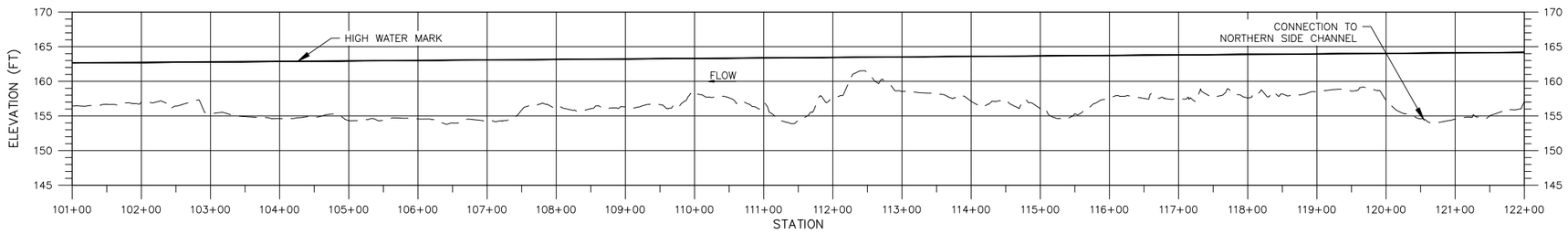
G-07

SHEET 7 OF 23

G-06-08 EX COND COWELL 2.DWG 6/8/2021 11:04 AM

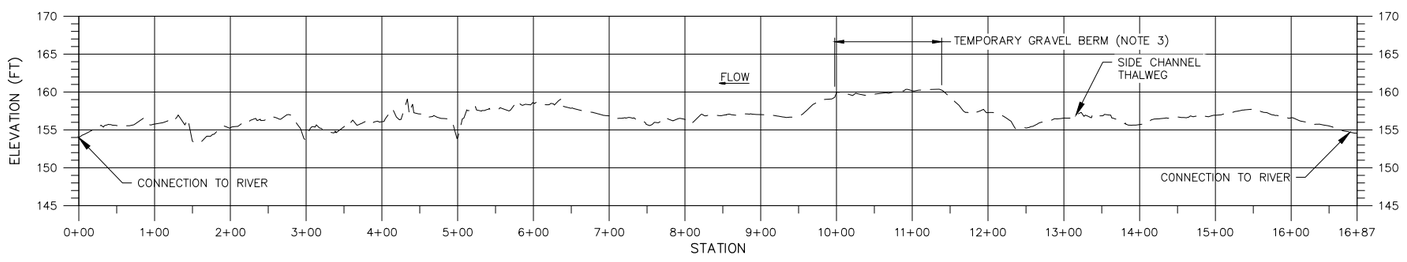






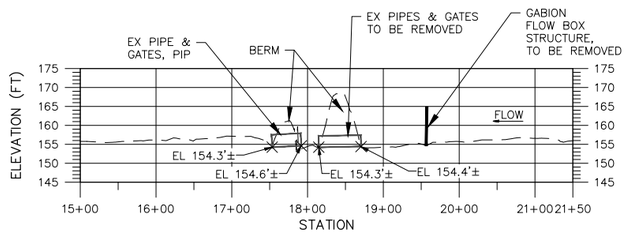
MERCED RIVER

PROFILE — HORIZ SCALE 1" = 100'
VERT SCALE 1" = 10'



MERCED RIVER - NORTHERN SIDE CHANNEL

PROFILE — HORIZ SCALE 1" = 100'
VERT SCALE 1" = 10'



DIVERSION CANAL

PROFILE — HORIZ SCALE 1" = 100'
VERT SCALE 1" = 10'

NOTES:

1. EXISTING RIVER PROFILE IS SHOWN FOR REFERENCE.
2. PROFILES ARE SHOWN WITH 10X VERTICAL EXAGGERATION.
3. THE GRAVEL BERM CROSSING AT NORTHERN SIDE CHANNEL REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

CRAMER FISH SCIENCES
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West Sacramento, CA 95691
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MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

RIVER & CHANNEL
PROFILES
COWELL 2

DRAFT
NOT FOR CONSTRUCTION
6/7/2021
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

MERCED IRRIGATION DISTRICT &
CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

G-08
SHEET 8 OF 23

G-06-08 EX COND COWELL 2.DWG 6/8/2021 11:05 AM

TABLE OF BENCHMARKS				
POINT ID	ELEV (FT)	NORTHING	EASTING	DESCRIPTION
1	271.11	2011817.79	6585736.24	BM101
2	286.42	2011769.23	6586119.31	BM102
3	276.66	2011670.82	6586471.45	BM103
4	278.87	2011261.88	6585056.14	BM104
5	307.00	2011246.83	6584995.79	BM105

NOTES:

1. EXISTING SITE TOPOGRAPHY IS BASED ON SURVEYS CONDUCTED BY CRAMER FISH SCIENCES USING RTK–GPS, LiDAR, ECHO SOUNDER AND UNMANNED AERIAL VEHICLE SURVEY EQUIPMENT (AUGUST 2020). ADDITIONAL LiDAR SURVEY DATA WAS USED TO SUPPLEMENT AREAS OUTSIDE OF THE LIMITS OF THE CFS SURVEY (SOURCE: HDR 2016).
2. THE COORDINATE SYSTEM IS NORTH AMERICAN DATUM OF 1983, CALIFORNIA STATE PLANE ZONE III, US FOOT. THE VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), FEET.
3. BENCHMARKS WERE ESTABLISHED AT THE TIME OF THE CFS AUGUST 2020 SURVEY AND ARE SHOWN ON THE PLANS FOR REFERENCE.
4. AERIAL IMAGERY SHOWN REFLECTS THE SITE CONDITIONS AT THE TIME OF THE FLIGHT AND IS SHOWN FOR REFERENCE ONLY. SOURCE CFS (JUNE – AUGUST 2020) AND NATIONAL AGRICULTURE IMAGERY PROGRAM (NAIP, 2018).
5. ACCESS AND STAGING TO CONFIRMED WITH LANDOWNER PRIOR TO MOBILIZATION.
6. PARCEL BOUNDARIES ARE APPROXIMATE AND SHOWN FOR REFERENCE ONLY. (SOURCE: MERCED COUNTY 2021).
7. THE GRAVEL BERM ADJACENT TO THE EXISTING DIVERSION STRUCTURE REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.
8. MATERIAL SORTED AS PART OF THE HENDERSON PARK HABITAT ENHANCEMENT PROJECT WAS STOCKPILED IN THIS LOCATION AND MAY BE AVAILABLE FOR USE AT THIS SITE.

EXISTING SITE CONDITIONS

PLAN VIEW — SCALE: 1" = 80'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

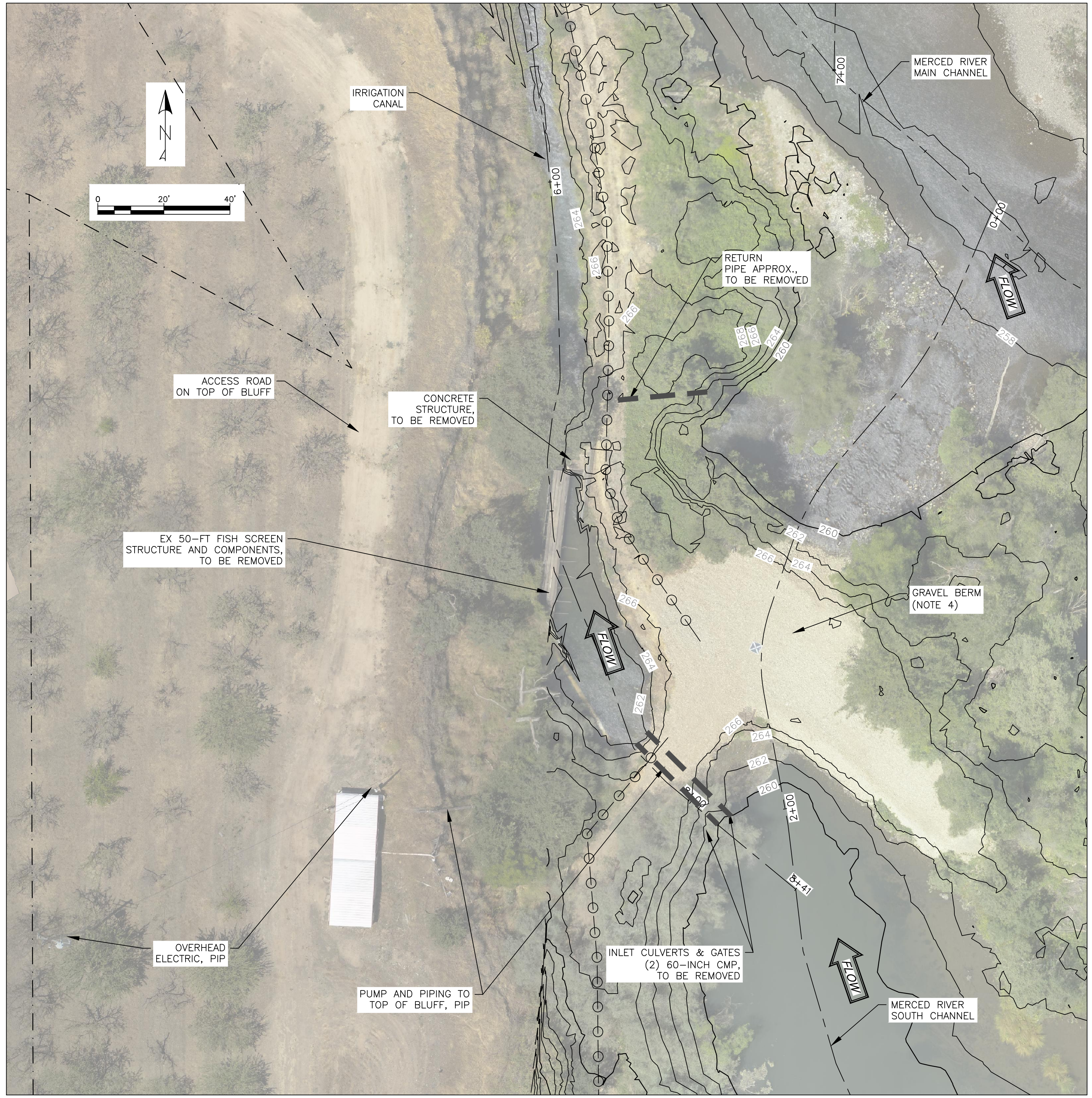
EXISTING SITE PLAN & ACCESS CUNEO

DRAFT NOT FOR CONSTRUCTION

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	1" = 80'

G-09



NOTES:

1. CONTOURS ARE SHOWN AT A 2-FT INTERVAL FOR CLARITY
2. THE GRAVEL BERM ADJACENT TO EXISTING DIVERSION STRUCTURE REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.
3. INFRASTRUCTURE TO BE REMOVED SHALL EITHER BECOME RESPONSIBILITY OF THE CONTRACTOR TO PROPERLY DISPOSE OF UNLESS OTHERWISE DIRECTED BY THE OWNER'S REPRESENTATIVE TO SALVAGE AND LEAVE ON SITE.
4. THE GRAVEL BERM ADJACENT TO THE EXISTING DIVERSION STRUCTURE REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.

EXISTING CUNEO DIVERSION STRUCTURE

PLAN SCALE 1" = 20'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

G-09-11 EX COND CUNEO.DWG 6/8/2021 11:06 AM

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

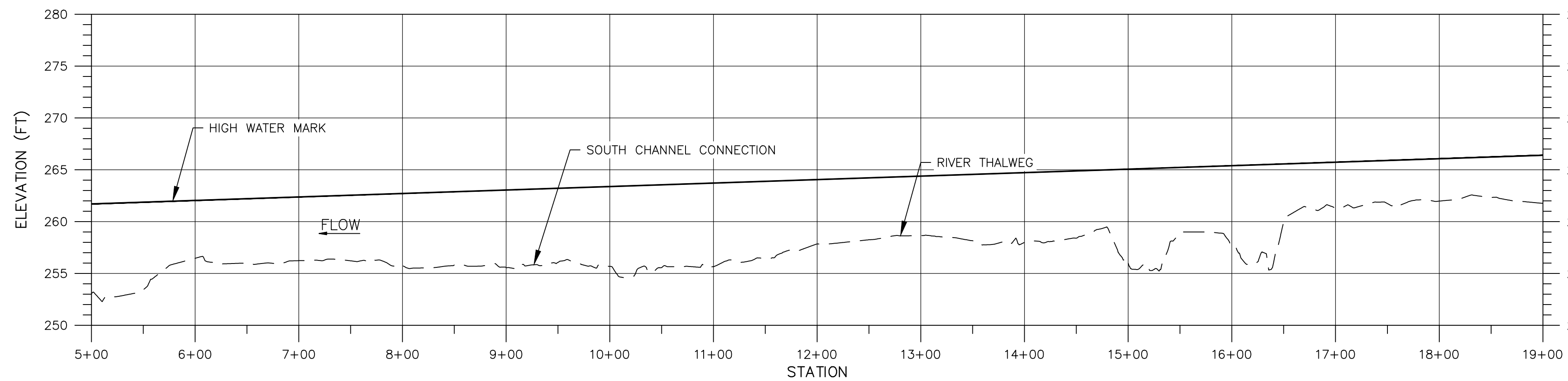
DIVERSION STRUCTURE PLAN CUNEO

DRAFT NOT FOR CONSTRUCTION

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	1" = 20'

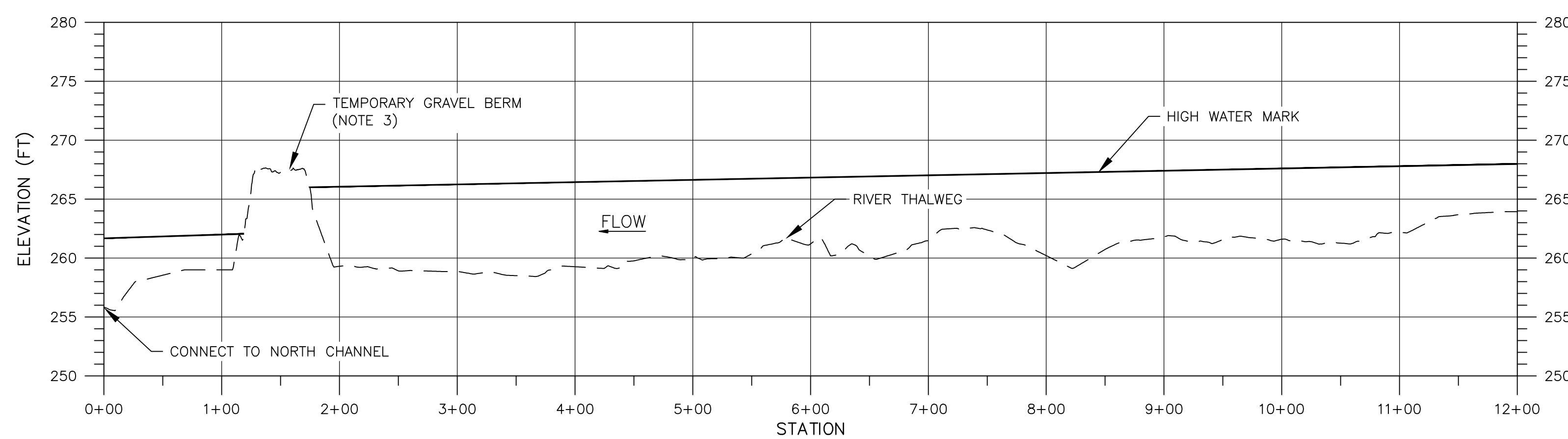
G-10



MERCED RIVER

PROFILE

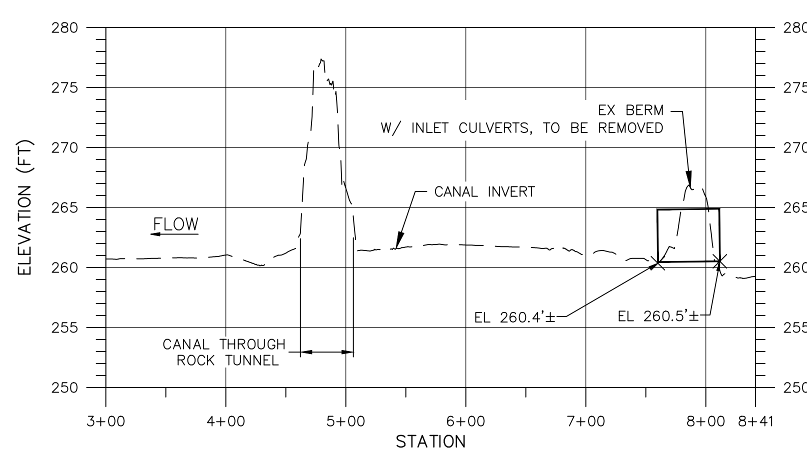
HORIZ SCALE 1" = 80'
VERT SCALE 1" = 8'



MERCED RIVER - SOUTH CHANNEL

PROFILE

HORIZ SCALE 1" = 80'
VERT SCALE 1" = 8'



DIVERSION CANAL

PROFILE

HORIZ SCALE 1" = 80'
VERT SCALE 1" = 8'

NOTES:

1. EXISTING RIVER PROFILE IS SHOWN FOR REFERENCE.
2. PROFILES ARE SHOWN WITH 10X VERTICAL EXAGGERATION.
3. THE GRAVEL BERM ADJACENT TO THE EXISTING DIVERSION STRUCTURE REFLECTS CONDITIONS AT THE TIME OF THE SURVEY. IT IS ANTICIPATED THAT THIS FEATURE WILL HAVE CHANGED SINCE THE SURVEY BASED ON ANNUAL DIVERSION OPERATIONS.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
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MERCED RIVER
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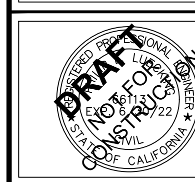
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

RIVER
PROFILES
CUNEO



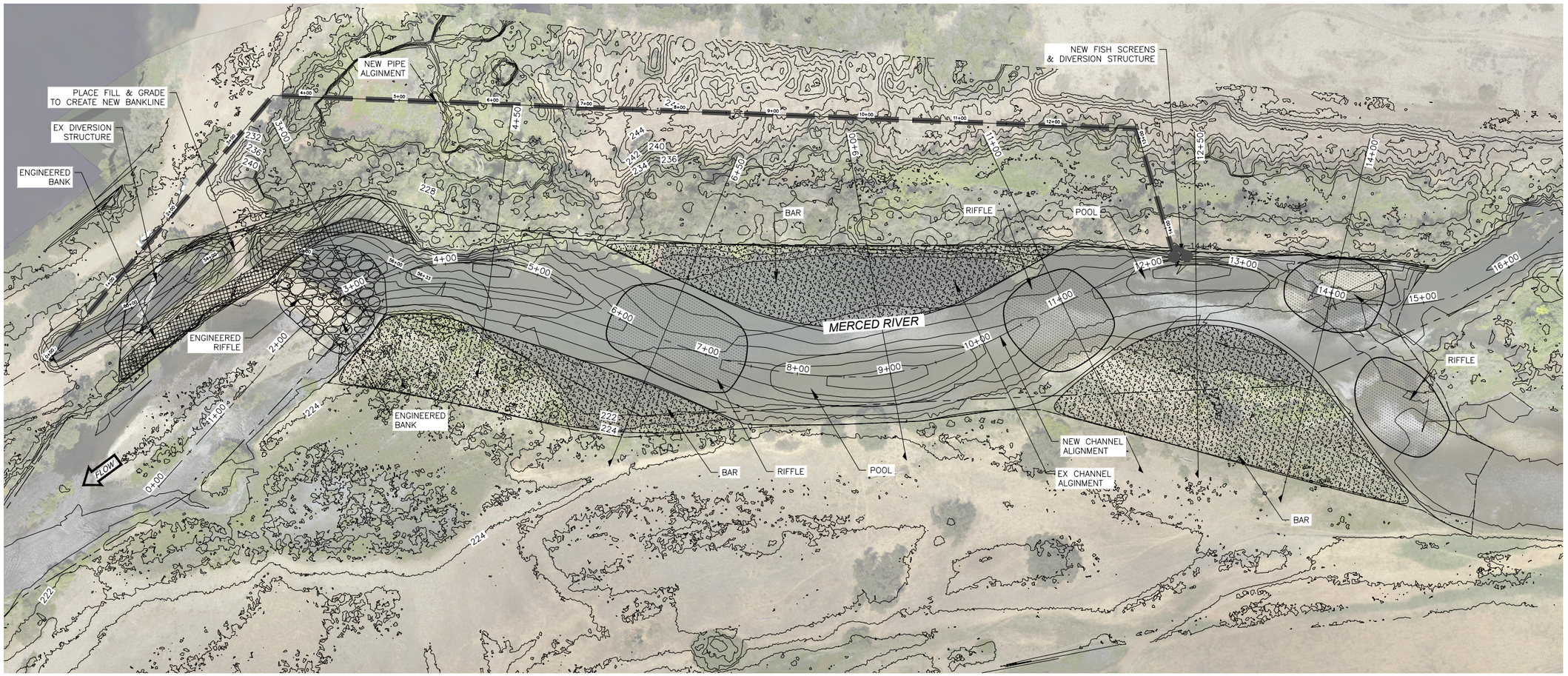
MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

G-11

SHEET 11 OF 23

G-09-11 EX COND CUNEO.DWG 6/8/2021 11:06 AM



CHANNEL ENHANCEMENT - COWELL 1

PLAN VIEW SCALE: 1" = 60'

NOTES:

1. GRADE TO CREATE SMOOTH TRANSITIONS BETWEEN FINISH GRADE AND EXISTING GRADE.
2. POOL AND RIFFLE DIMENSIONS AND ELEVATIONS ARE APPROXIMATE AND WILL BE REFINED BASED ON DETAILED HYDRAULIC MODELING.
3. EXISTING GRADE CONTOURS ARE SHOW AT 2-FT INTERVAL FOR CLARITY.
4. THE PROPOSED DIVERSION STRUCTURE INCLUDES TWO CONE FISH SCREENS, 12-FT DIA. EXACT PLACEMENT IN MAIN CHANNEL TO BE DETERMINED. SEE SHEET Z-01 FOR CONE SCREEN SCHEMATIC.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

ENHANCEMENT PLAN COWELL 1

DRAFT NOT FOR CONSTRUCTION

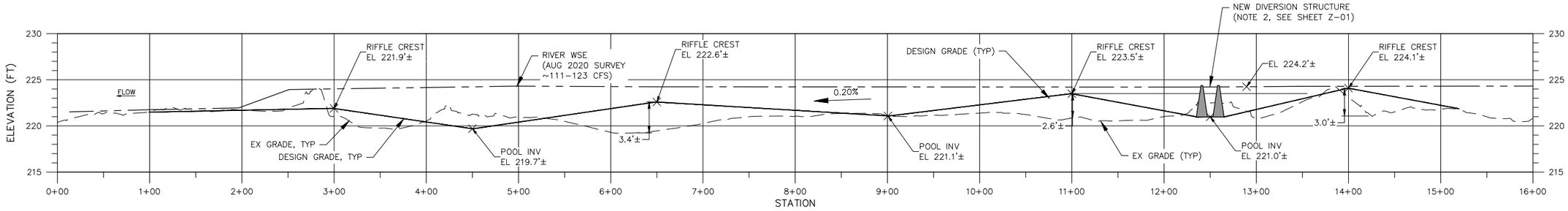
MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	1" = 60'

C-01

SHEET 12 OF 23

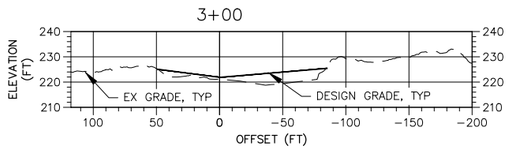
C-01-02 COWELL-1_DG.DWG 6/8/2021 11:07 AM

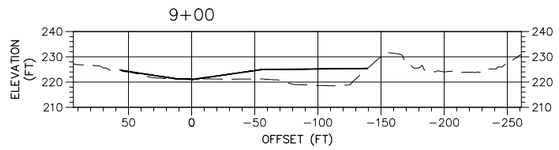


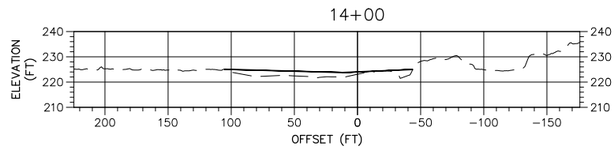
CHANNEL GRADING - COWELL 1

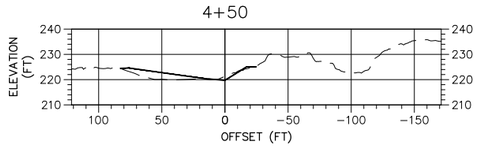
PROFILE

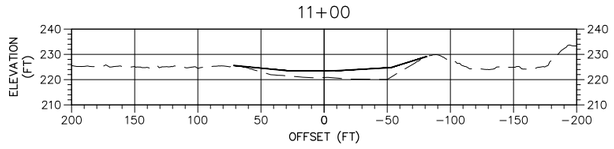
HORIZ SCALE 1" = 60'
VERT SCALE 1" = 6'

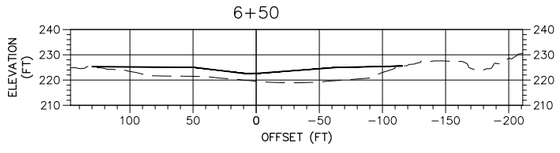


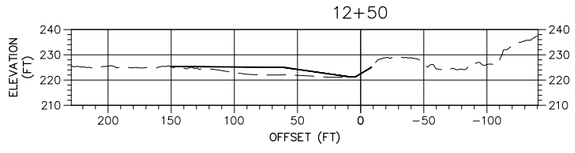












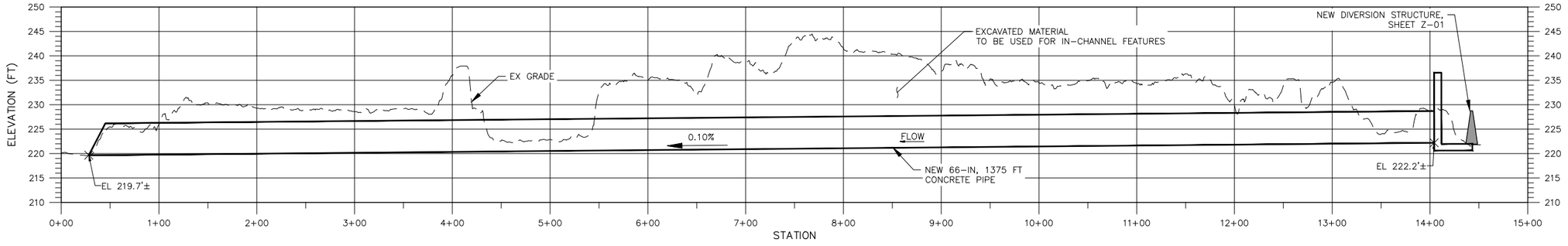
CHANNEL GRADING - COWELL 1

SECTIONS

HORIZ SCALE 1" = 60'
VERT SCALE 1" = 30'

NOTES:

1. THE EXISTING GRADE ELEVATION IS NOT EQUIVALENT TO THE THALWEG OF THE MAIN RIVER CHANNEL. THE PROFILE SHOWN IS FOR THE PROPOSED CHANNEL ALIGNMENT, WHICH VARIES FROM THE EXISTING THALWEG ALIGNMENT.
2. THE PROPOSED DIVERSION STRUCTURE INCLUDES TWO CONE FISH SCREENS, 12-FT DIA. EXACT PLACEMENT IN MAIN CHANNEL TO BE DETERMINED. SEE SHEET Z-01 FOR CONE SCREEN SCHEMATIC.
3. POOL AND RIFFLE DIMENSIONS AND ELEVATIONS ARE APPROXIMATE AND WILL BE REFINED BASED ON DETAILED HYDRAULIC MODELING.
4. PROFILES AND SECTIONS ARE SHOWN WITH VERTICAL EXAGGERATION AS INDICATED.
5. DIVERSION PIPE DIMENSIONS AND CONFIGURATIONS ARE PRELIMINARY AND SUBJECT TO CHANGE BASED ON DETAILED HYDRAULIC MODELING TO INFORM CHANNEL FEATURE DESIGN AND DESIGN OF THE DIVERSION STRUCTURE.



NEW DIVERSION PIPE - COWELL 1

PROFILE

HORIZ SCALE 1" = 60'
VERT SCALE 1" = 12'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

CHANNEL PROFILES
COWELL 1

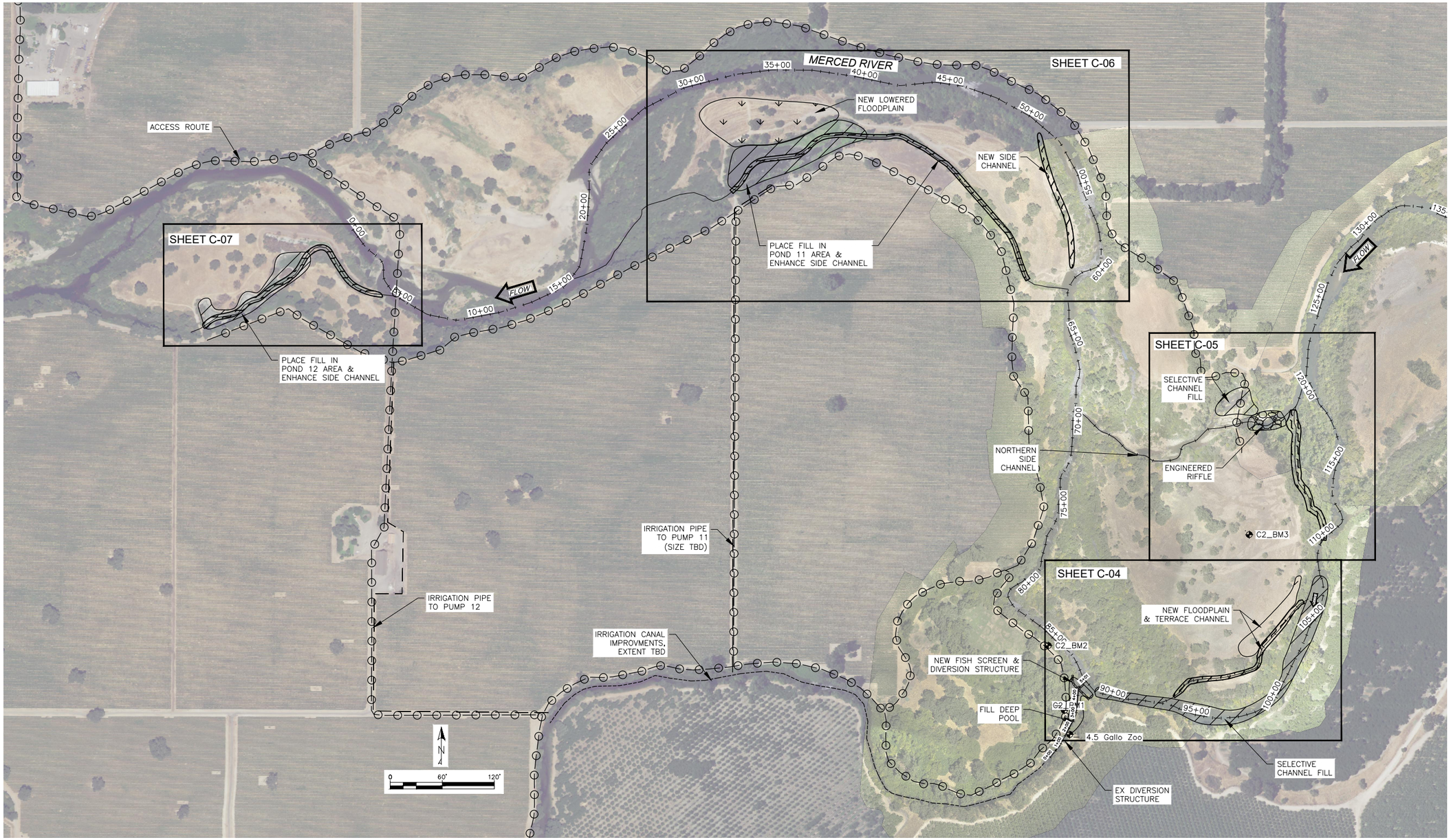
DRAFT
NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
PAUL L. LEMAN
No. 66111
EXP. 6/30/22
STATE OF CALIFORNIA
CIVIL

MERCED IRRIGATION
DISTRICT &
CALIFORNIA DEPT. OF
WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

C-02
SHEET 13 OF 23

C-01-02 COWELL-1_DG.DWG 6/8/2021 11:07 AM



NOTES:

1. GRADE TO CREATE SMOOTH TRANSITIONS BETWEEN FINISH GRADE AND EXISTING GRADE.
2. EXTENTS OF POOL AND RIFFLE FEATURES ARE APPROXIMATE AND WILL BE REFINED BASED ON DETAILED HYDRAULIC MODELING.
3. IRRIGATION INFRASTRUCTURE MODIFICAIONS (PUMP REMOVAL, PIPELINE RECONFIGURATIONS) TO BE COORDINATED WITH LANDOWNER. FEATURES SHOWN HERE ARE APPROXIMATE.

ENHANCEMENT PLAN - COWELL 2

PLAN VIEW SCALE: 1" = 300'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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West Sacramento, CA 95691
888.224.1221

MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

ENHANCEMENT
PLAN
COWELL 2

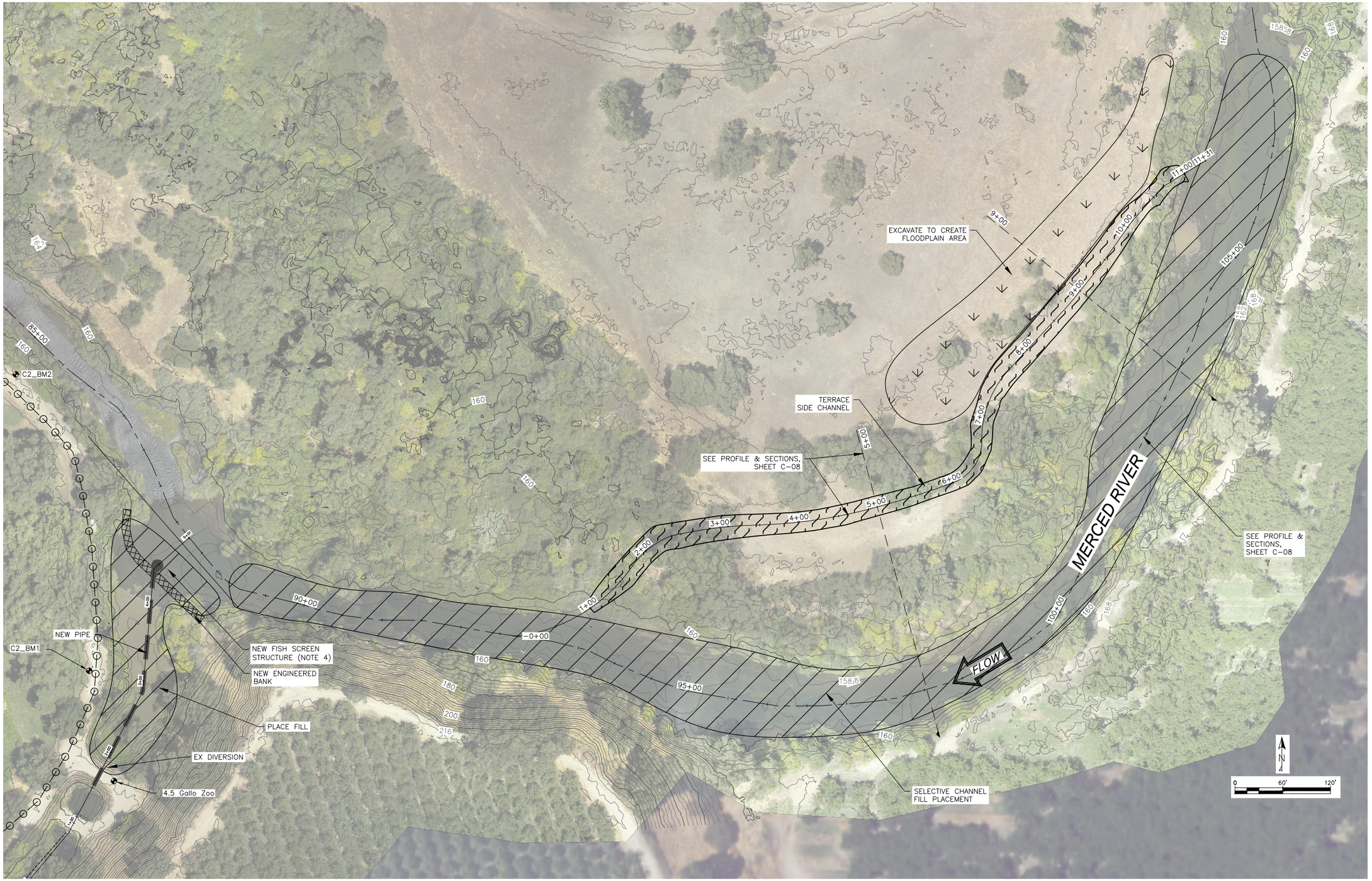
DRAFT NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
RICHARD A. BOGARD
No. 87722
CIVIL
STATE OF CALIFORNIA

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	04/30/2021
SCALE	1" = 300'

C-03
SHEET 14 OF 23

C-03-08 COWELL-2_DG.DWG 6/8/2021 11:09 AM



NOTES:

1. IN CHANNEL FILL PLACEMENT DIMENSIONS AND ELEVATIONS ARE APPROXIMATE AND WILL BE REFINED BASED ON DETAILED HYDRAULIC MODELING.
2. GRADE TO CREATE SMOOTH TRANSITIONS BETWEEN FINISH GRADE AND EXISTING GRADE.
3. EXISTING GRADE CONTOURS ARE SHOWN AT 2-FT INTERVAL FOR CLARITY.
4. THE PROPOSED DIVERSION STRUCTURE INCLUDES ONE CONE SCREEN, 14-FT DIA. EXACT PLACEMENT IN THE MAIN CHANNEL TO BE DETERMINED. SEE SHEET Z-01 FOR CONE SCREEN SCHEMATIC.

ENHANCEMENTS - MAIN CHANNEL

PLAN VIEW — SCALE: 1" = 60'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

MAIN CHANNEL
AREA PLAN
COWELL 2

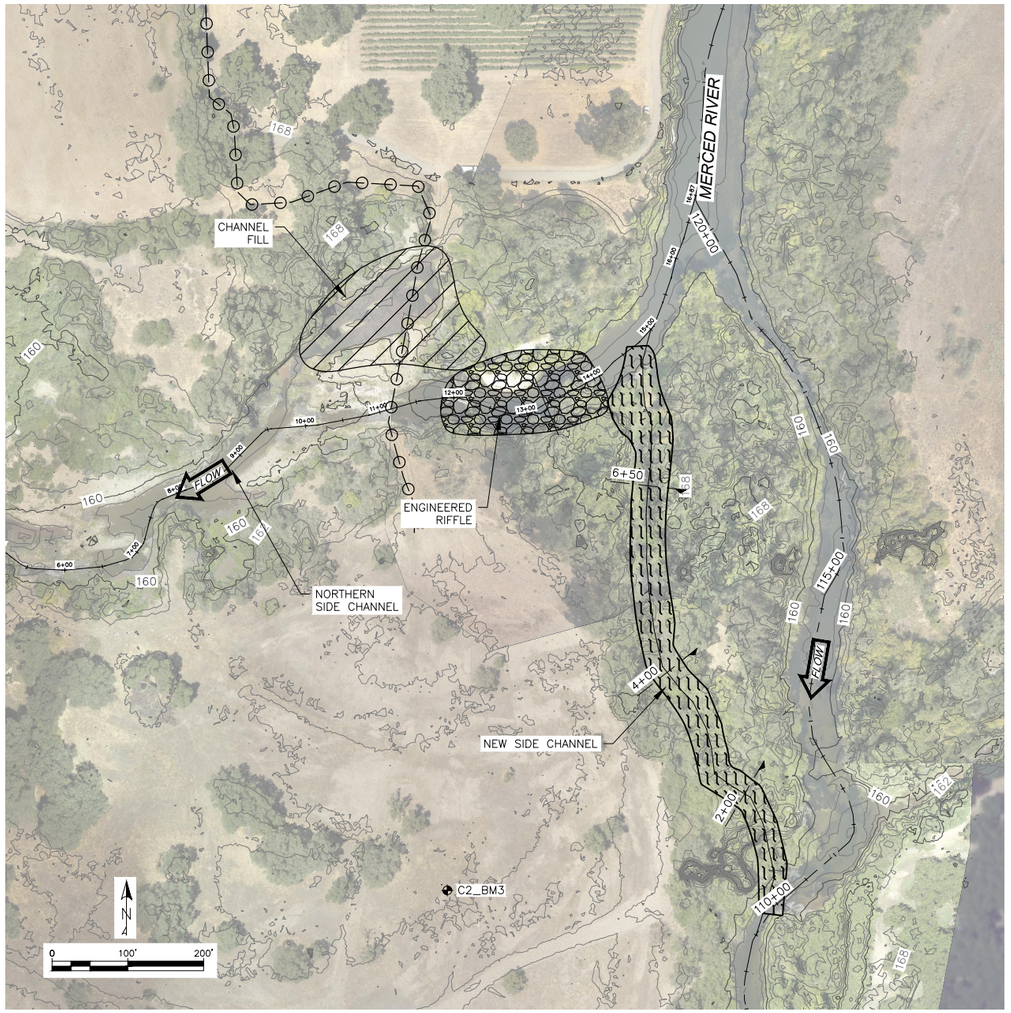
DRAFT
NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
EXP. 6/30/22
STATE OF CALIFORNIA

MERCED IRRIGATION DISTRICT &
CALIFORNIA DEPT. OF WATER RESOURCES

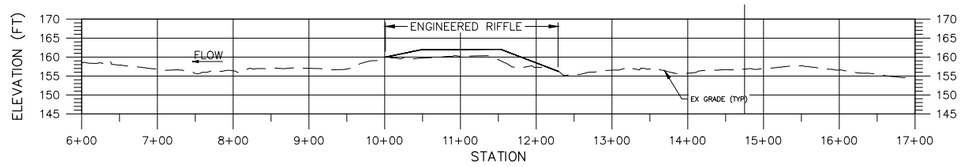
DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	1" = 60'

C-04
SHEET 15 OF 23

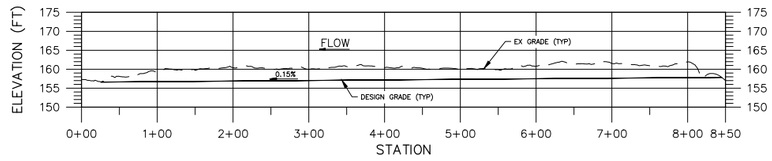
C-03-08 COWELL-2_DG.DWG 6/8/2021 11:10 AM



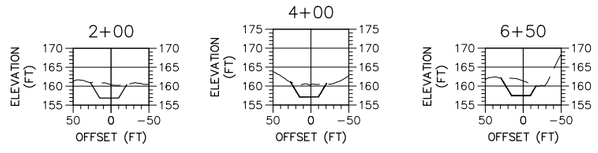
NORTH SIDE CHANNEL AREA
PLAN VIEW — SCALE: 1" = 100'



NORTHERN SIDE CHANNEL
PROFILE — HORIZ SCALE 1" = 100'
VERT SCALE 1" = 20'



NEW SIDE CHANNEL
PROFILE — HORIZ SCALE 1" = 100'
VERT SCALE 1" = 20'



NEW SIDE CHANNEL
SECTIONS — HORIZ SCALE 1" = 100'
VERT SCALE 1" = 20'

NOTES:

1. NEW CHANNEL AND CHANNEL FILL PLACEMENT DIMENSIONS AND ELEVATIONS ARE APPROXIMATE AND WILL BE REFINED BASED ON DETAILED HYDRAULIC MODELING.
2. GRADE TO CREATE SMOOTH TRANSITIONS BETWEEN FINISH GRADE AND EXISTING GRADE.
3. EXISTING GRADE CONTOURS ARE SHOWN AT 2-FT INTERVAL FOR CLARITY.
4. PROFILES AND SECTIONS ARE SHOWN WITH 5X VERTICAL EXAGGERATION.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

NORTH SIDE
CHANNEL AREA
PLAN & PROFILE
COWELL 2

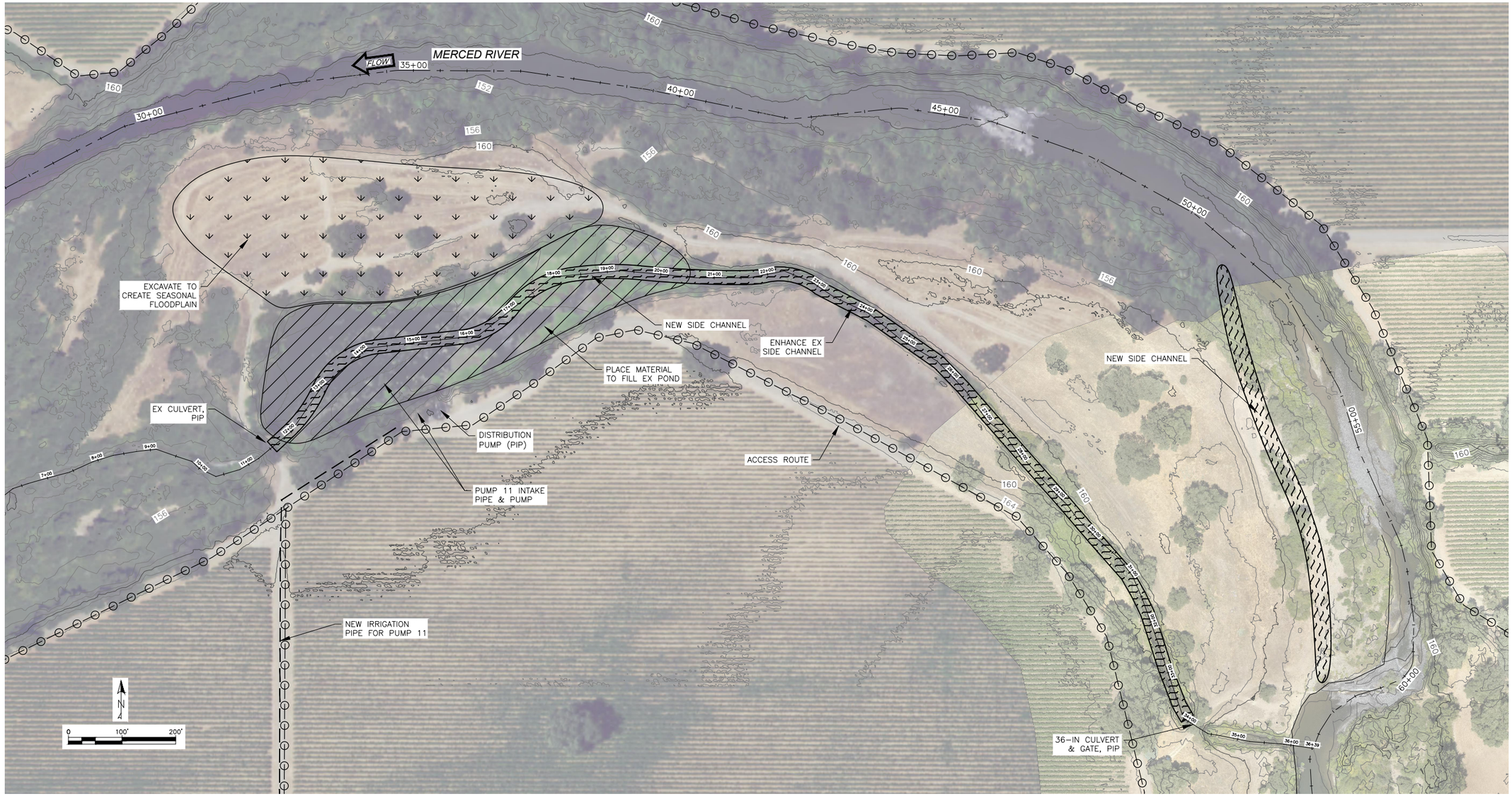
DRAFT
NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
EXP 6/30/22
STATE OF CALIFORNIA

MERCED IRRIGATION
DISTRICT &
CALIFORNIA DEPT. OF
WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

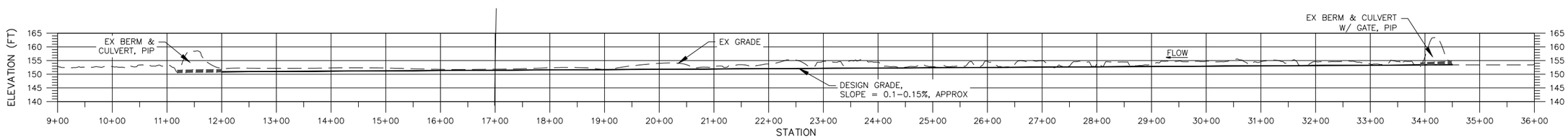
C-05
SHEET 16 OF 23

C-03-08 COWELL-2_DG.DWG 6/8/2021 11:10 AM



CHANNEL ENHANCEMENT - PUMP 11 AREA

PLAN VIEW — SCALE: 1" = 100'



CHANNEL ENHANCEMENT - PUMP 11 AREA

PROFILE — HORIZ SCALE 1" = 100'
VERT SCALE 1" = 20'

NOTES:

1. TOPOGRAPHY IS BASED ON LIDAR DATA (HDR 2016). THE WETTED AREAS AND POND BATHYMETRY CONTOURS MAY NOT REFLECT EXISTING CONDITIONS. ADDITIONAL SURVEY DATA IS NEEDED IN THE POND AREA.
2. EXISTING SITE TOPOGRAPHY SHOWN AT 2-FT CONTOUR INTERVAL FOR CLARITY.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

PUMP 11 AREA
PLAN & PROFILE
COWELL 2

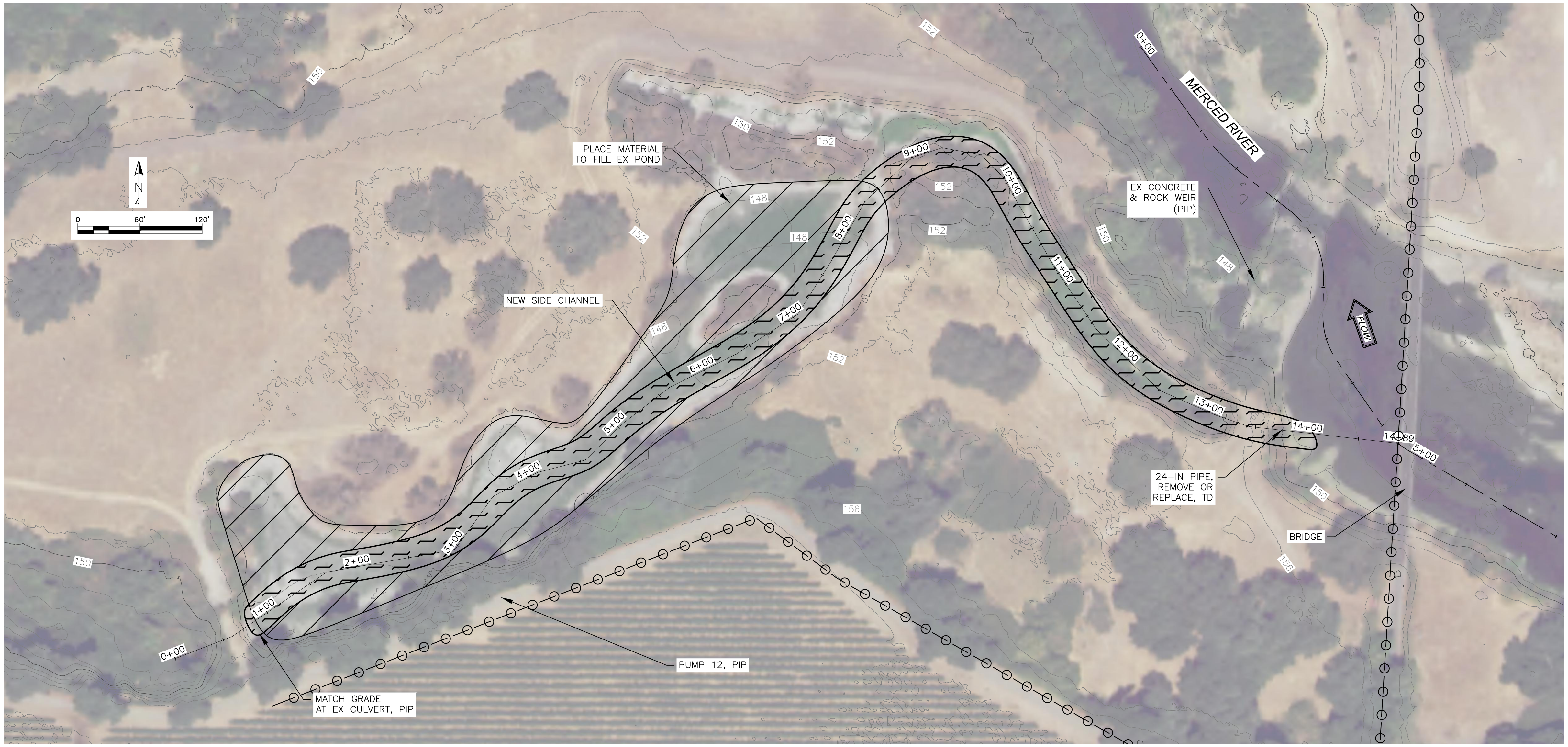
DRAFT
NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
CIVIL

MERCED IRRIGATION DISTRICT &
CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	04/30/2021
SCALE	1" = 100'

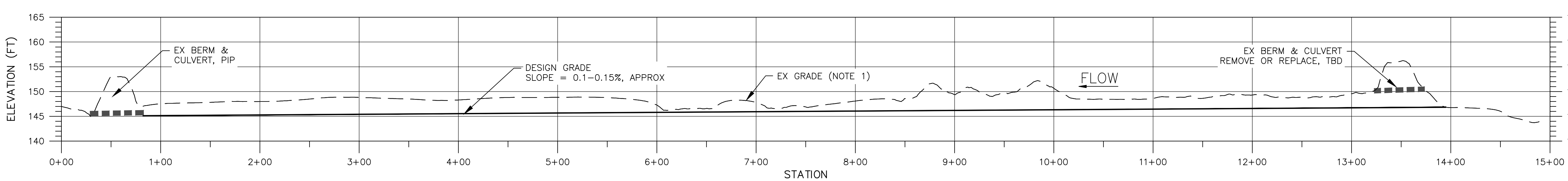
C-06
SHEET 17 OF 23

C-03-08 COWELL-2_DG.DWG 6/8/2021 11:10 AM



CHANNEL ENHANCEMENT - PUMP 12 AREA

PLAN VIEW — SCALE: 1" = 60'



CHANNEL ENHANCEMENT - PUMP 12 AREA

PROFILE — HORIZ SCALE 1" = 60'; VERT SCALE 1" = 12'

NOTES:

1. TOPOGRAPHY IS BASED ON LIDAR DATA (HDR 2016). THE WETTED AREAS AND POND BATHYMETRY CONTOURS MAY NOT REFLECT EXISTING CONDITIONS. ADDITIONAL SURVEY DATA IS NEEDED IN THE POND AREA.
2. EXISTING SITE TOPOGRAPHY SHOWN AT 2-FT CONTOUR INTERVAL FOR CLARITY.

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE — 0 1 — BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

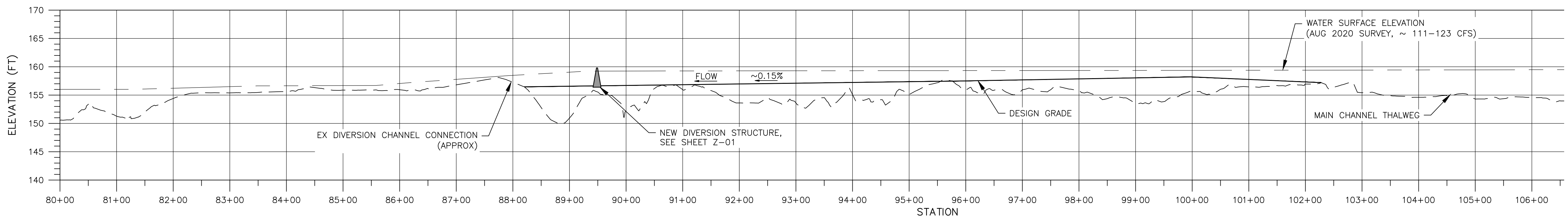
PUMP 12 AREA PLAN & PROFILE COWELL 2

DRAFT NOT FOR CONSTRUCTION

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

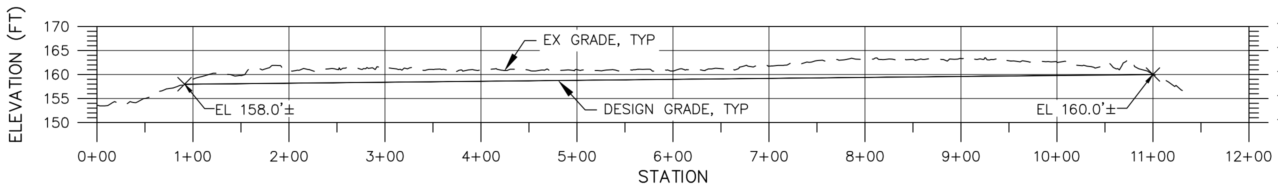
DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	04/30/2021
SCALE	1" = 60'

C-07



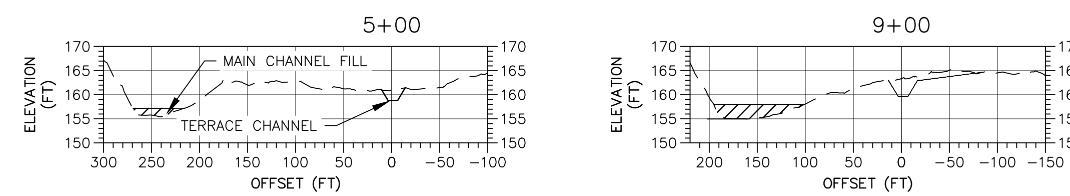
MERCED RIVER - MAIN CHANNEL AREA

PROFILE — HORIZ SCALE 1" = 100'; VERT SCALE 1" = 10'



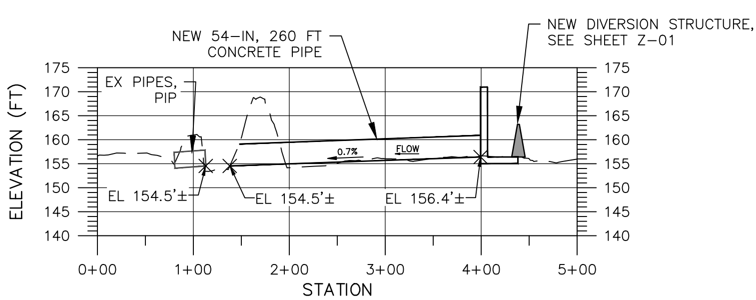
TERRACE SIDE CHANNEL

PROFILE — HORIZ SCALE 1" = 100'; VERT SCALE 1" = 20'



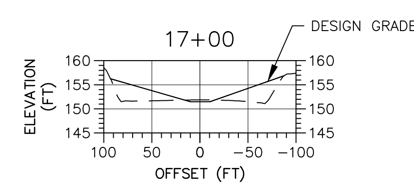
MAIN CHANNEL & TERRACE SIDE CHANNEL

SECTIONS — HORIZ SCALE 1" = 100'; VERT SCALE 1" = 20'



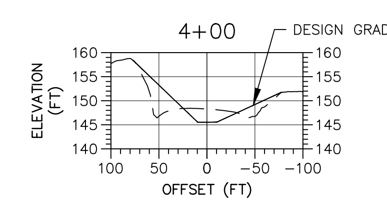
NEW DIVERSION PIPE - COWELL 2

TYPICAL SECTION — HORIZ SCALE 1" = 100'; VERT SCALE 1" = 20'



PUMP 11 CHANNEL

TYPICAL SECTION — HORIZ SCALE 1" = 100'; VERT SCALE 1" = 20'



PUMP 12 CHANNEL

TYPCIAL SECTION — HORIZ SCALE 1" = 100'; VERT SCALE 1" = 20'

NOTES:

1. EXISTING RIVER PROFILE IS SHOWN FOR REFERENCE.
2. PROFILES ARE SHOWN WITH 10X VERTICAL EXAGGERATION.
3. SECTIONS ARE SHOWN WITH 5X VERTICAL EXAGGERATION.
4. THE PROPOSED DIVERSION STRUCTURE INCLUDES ONE CONE SCREEN, 12-FT DIA. EXACT PLACEMENT IN THE MAIN CHANNEL TO BE DETERMINED. SEE SHEET Z-01 FOR CONE SCREEN SCHEMATIC.
5. TOPOGRAPHY IS BASED ON LIDAR DATA (HDR 2016). THE WETTED AREAS AND POND BATHYMETRY CONTOURS MAY NOT REFLECT EXISTING CONDITIONS. ADDITIONAL SURVEY DATA IS NEEDED IN THE POND AREAS.
5. DIVERSION PIPE DIMENSIONS AND CONFIGURATIONS ARE PRELIMINARY AND SUBJECT TO CHANGE BASED ON DETAILED HYDRAULIC MODELING TO INFORM CHANNEL FEATURE DESIGN AND DESIGN OF THE DIVERSION STRUCTURE.

C-03-08 COWELL-2_DG.DWG 6/8/2021 11:11 AM

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE — BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

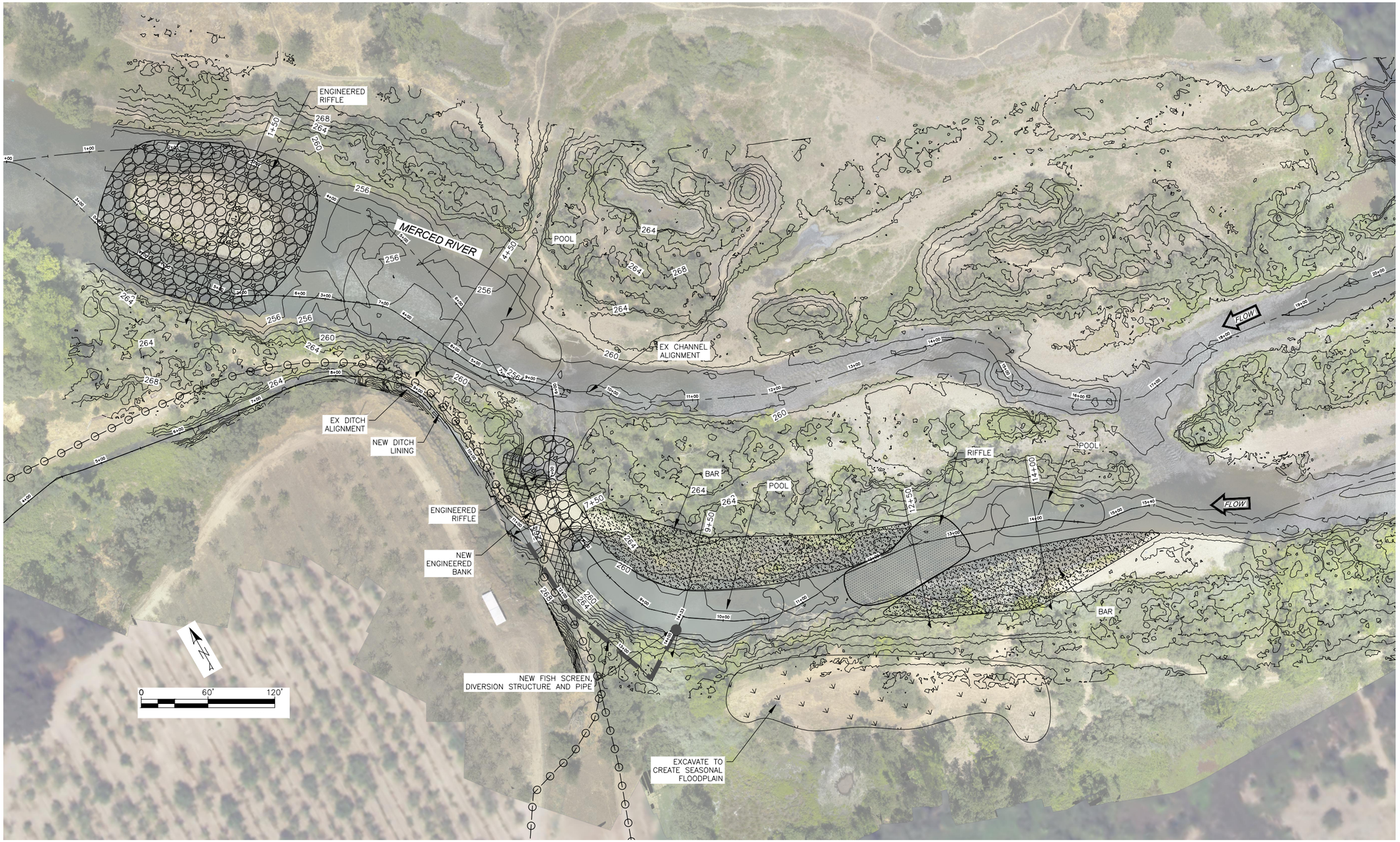
CHANNEL PROFILES & SECTIONS COWELL 2

DRAFT NOT FOR CONSTRUCTION

MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	PLL
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

C-08



NOTES:

1. GRADE TO CREATE SMOOTH TRANSITIONS BETWEEN FINISH GRADE AND EXISTING GRADE.
2. EXTENTS OF POOL AND RIFFLE FEATURES ARE APPROXIMATE AND WILL BE REFINED BASED ON DETAILED HYDRAULIC MODELING.
3. EXISTING GRADE CONTOURS ARE SHOWN AT 2-FT INTERVAL FOR CLARITY.
4. THE PROPOSED DIVERSION STRUCTURE INCLUDES ONE CONE FISH SCREEN, 12-FT DIA. EXACT PLACEMENT IN MAIN CHANNEL TO BE DETERMINED. SEE SHEET Z-01 FOR CONE SCREEN SCHEMATIC.

CHANNEL ENHANCEMENT - CUNEO

PLAN VIEW SCALE: 1" = 60'

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER
AGRICULTURAL DIVERSION
& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

ENHANCEMENT
PLAN
CUNEO

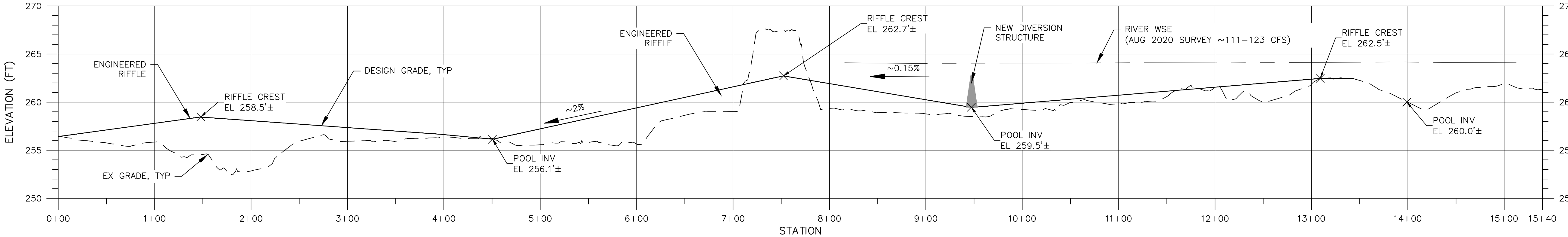
DRAFT
NOT FOR CONSTRUCTION
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
CIVIL

MERCED IRRIGATION DISTRICT &
CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	1" = 60'

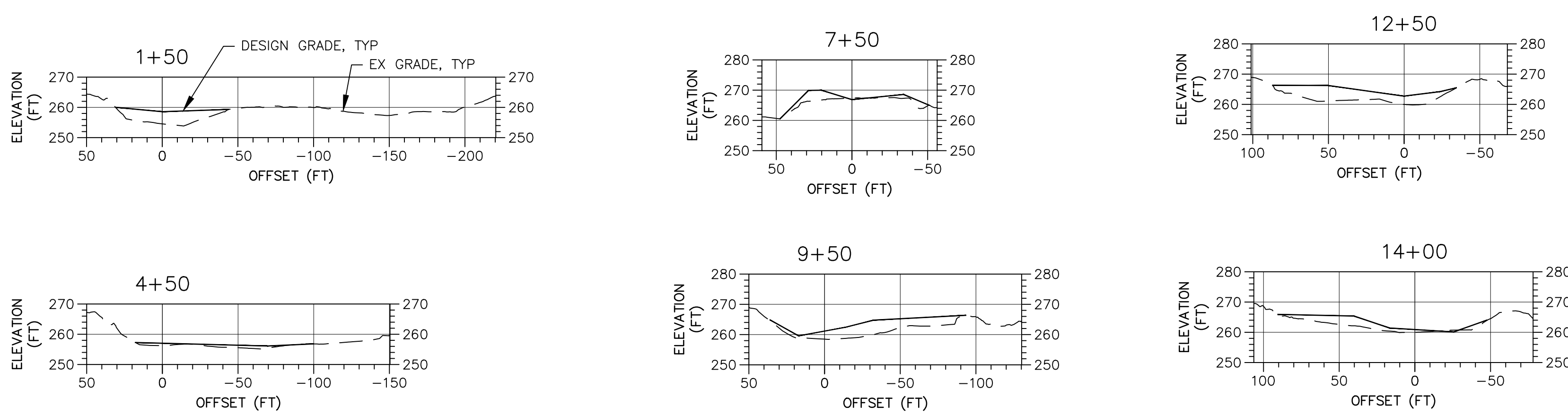
C-09
SHEET 20 OF 23

C-09-10-CUNEO_DG.DWG 6/8/2021 11:12 AM



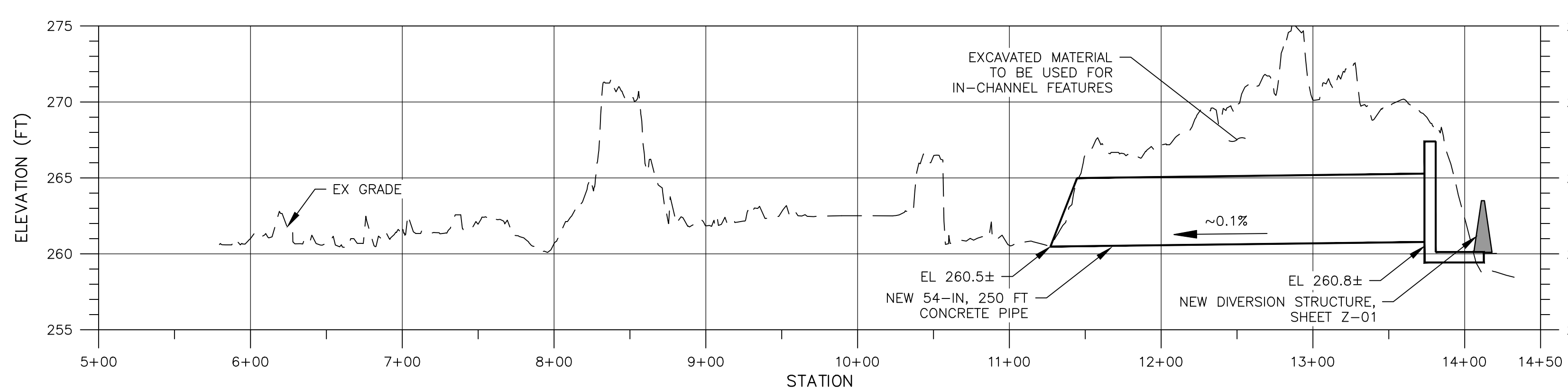
CHANNEL GRADING - CUNEO

PROFILE — HORIZ SCALE 1" = 60'; VERT SCALE 1" = 6'



CHANNEL GRADING - CUNEO

SECTIONS — HORIZ SCALE 1" = 60'; VERT SCALE 1" = 30'



NEW DIVERSION PIPE - CUNEO

PROFILE — HORIZ SCALE 1" = 60'; VERT SCALE 1" = 6'

NOTES:

1. THE EXISTING GRADE ELEVATION IS NOT EQUIVALENT TO THE THALWEG OF THE MAIN RIVER CHANNEL. THE PROFILE SHOWN IS FOR THE PROPOSED CHANNEL ALIGNMENT, WHICH VARIES FROM THE EXISTING THALWEG ALIGNMENT.
2. THE PROPOSED DIVERSION STRUCTURE INCLUDES ONE CONE FISH SCREEN, 12-FT DIA. EXACT PLACEMENT IN MAIN CHANNEL TO BE DETERMINED.
3. POOL AND RIFFLE DIMENSIONS AND ELEVATIONS ARE APPROXIMATE AND WILL BE REFINED BASED ON DETAILED HYDRAULIC MODELING.
4. PROFILES AND SECTIONS ARE SHOWN WITH VERTICAL EXAGGERATION AS INDICATED.
5. DIVERSION PIPE DIMENSIONS AND CONFIGURATIONS ARE PRELIMINARY AND SUBJECT TO CHANGE BASED ON DETAILED HYDRAULIC MODELING TO INFORM CHANNEL FEATURE DESIGN AND DESIGN OF THE DIVERSION STRUCTURE.

C-09-10-CUNEO_DG.DWG 6/8/2021 11:12 AM

30% SUBMITTAL
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VERIFY SCALE — BAR LENGTH IS ONE INCH IN ORIGINAL DRAWING. ADJUST SCALES ACCORDINGLY.

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MERCED RIVER AGRICULTURAL DIVERSION & FISH HABITAT ENHANCEMENT PROJECT
MERCED COUNTY, CALIFORNIA

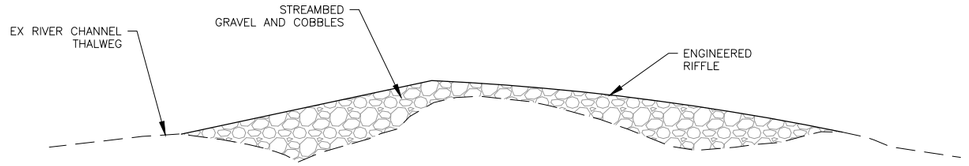
CHANNEL PROFILES CUNEO

DRAFT NOT FOR CONSTRUCTION

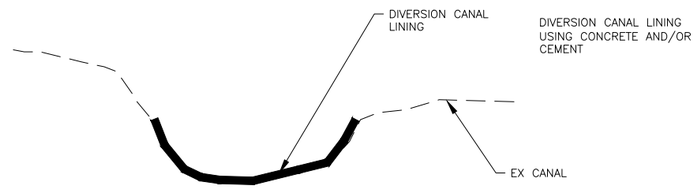
MERCED IRRIGATION DISTRICT & CALIFORNIA DEPT. OF WATER RESOURCES

DRAWN	JGS
CHECKED	RAB
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

C-10



1 ENGINEERED RIFFLE
TYPICAL SECTION
NOT TO SCALE



2 DIVERSION CANAL IMPROVEMENTS
TYPICAL SECTION
NOT TO SCALE

30% SUBMITTAL
NOT FOR CONSTRUCTION

VERIFY SCALE
0 1
BAR LENGTH IS ONE INCH
IN ORIGINAL DRAWING.
ADJUST SCALES ACCORDINGLY.

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MERCED RIVER
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& FISH HABITAT
ENHANCEMENT PROJECT

MERCED COUNTY, CALIFORNIA

TYPICAL DETAILS

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REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA
CIVIL
05/14/22

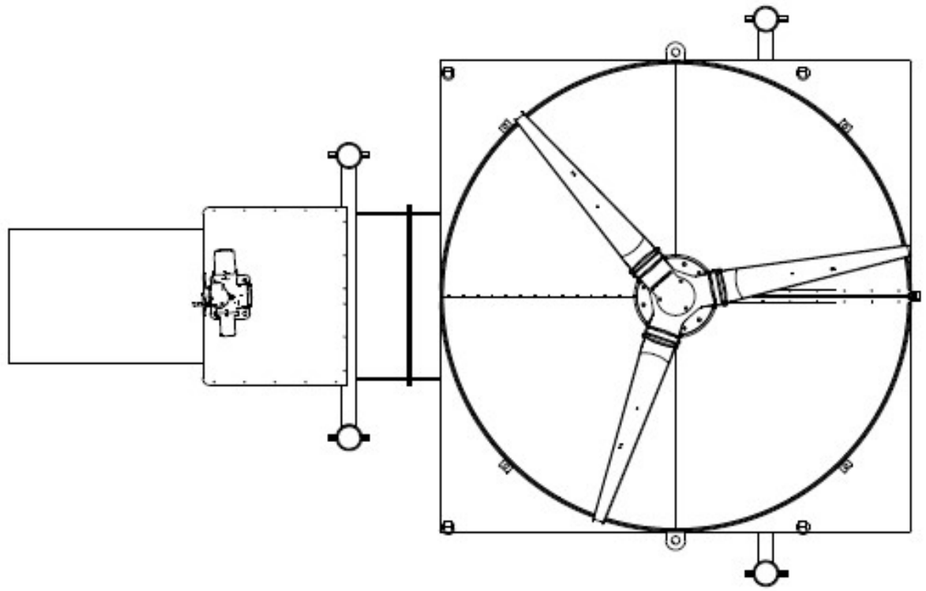
MERCED IRRIGATION
DISTRICT &
CALIFORNIA DEPT. OF
WATER RESOURCES

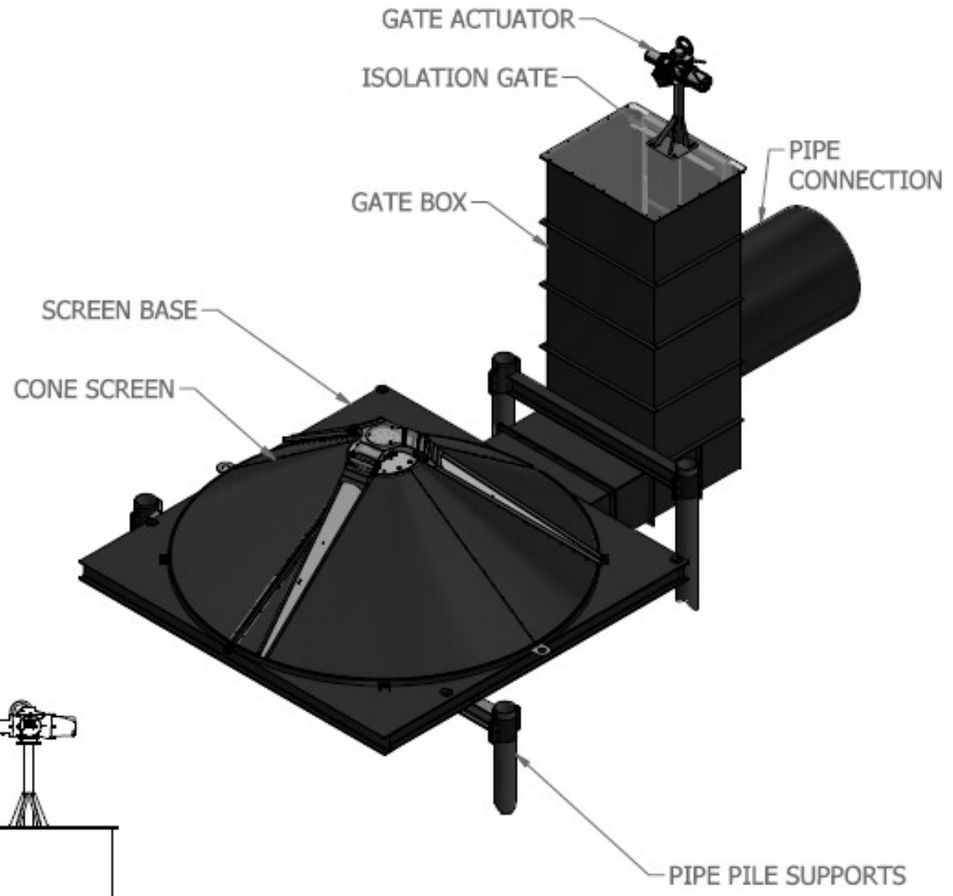
DRAWN	JGS
CHECKED	PLL
IN CHARGE	PLL
DATE	05/14/2021
SCALE	AS SHOWN

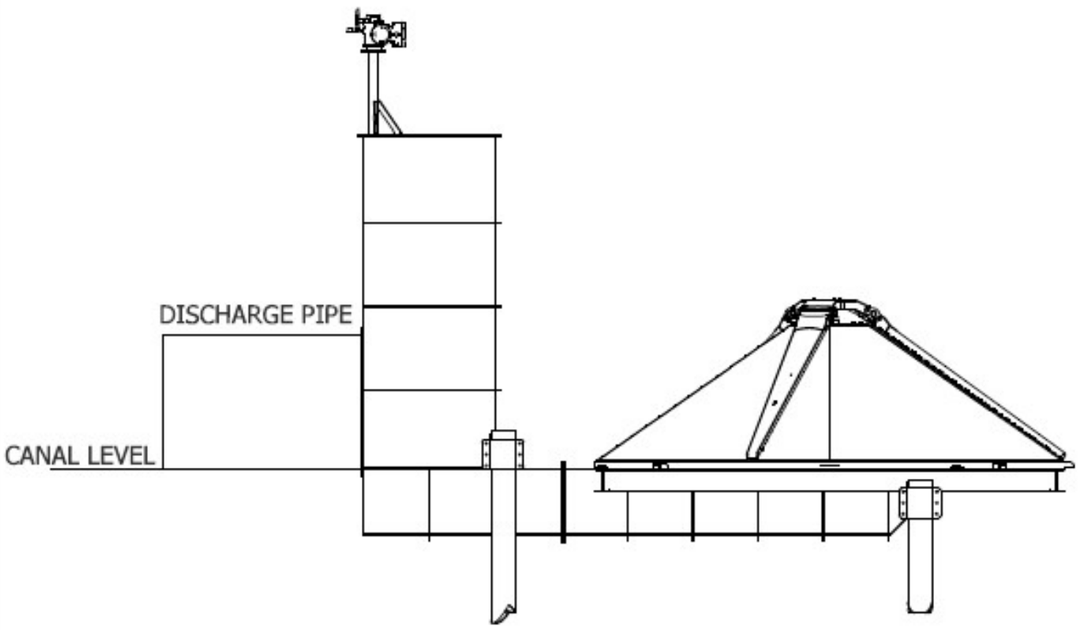
C-11

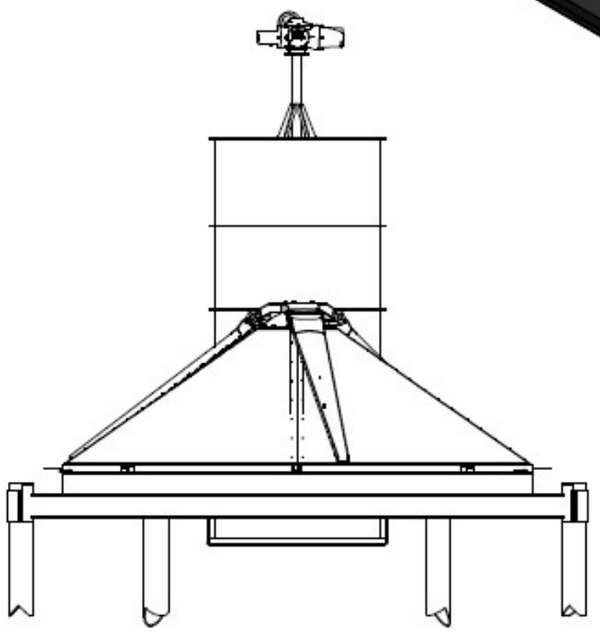
SHEET 22 OF 23

C-11 TYP DETAIL.DWG 6/8/2021 11:13 AM









30% SUBMITTAL
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DATE	APPROVED

ALL DIMENSIONS IN INCHES UNLESS NOTED

STANDARD TOLERANCES
Fractional Dimensions ± 1/32
Decimal Dimensions ± 0.005

www.intakescreensinc.com
CA C.L. 796197
ISI Intake Screens, Inc.
8417 River Road - Sacramento, California 95832
(916) 665-2727 (916) 665-2729 FAX

DATE 1/20/2021
APP'D BY RUSSELL BERRY IV
DRAWN BY JACOB CHAPIN
"B" SHEET SCALE

PROJECT

DESCRIPTION
ISI SCREEN

MATERIAL
CRAMER FISH SCIENCES

DRAWING NUMBER
CONE SCREEN LAYOUT

MASS

SHEET NUMBER
Z-01

Appendix B. Mitigation, Monitoring and Reporting Program

MITIGATION MONITORING AND REPORTING PROGRAM:

Merced River Agricultural Diversion and Fish Habitat Enhancement Project

MITIGATED NEGATIVE DECLARATION

This Mitigation Monitoring and Reporting Program (MMRP) was prepared in accordance with Section 15097 of the California Environmental Quality Act (CEQA) Guidelines. Section 15097 requires that a lead agency establish a program to report on or monitor measures adopted as part of the environmental review process to mitigate or avoid significant effects on the environment. The MMRP for the Merced River Agricultural Diversion and Fish Habitat Enhancement Project is presented here as **Table 1**.

This MMRP is designed to ensure that the mitigation measures necessary to reduce significant impacts identified in the Project Initial Study and Proposed Mitigated Negative Declaration (IS/MND) are implemented. The components of the MMRP **Table 1** are listed below:

Mitigation Measures: The mitigation measures are taken verbatim from the Project IS/MND.

Timing/Milestone: Identifies a schedule for conducting each mitigation action.

Responsible Entity: Identifies the entity responsible for implementing specific mitigation measures.

Mitigation Action: Identifies the specific action or actions that must be completed to implement the mitigation measure.

Monitoring and Enforcement Responsibility: Identifies the department/agency, consultant, or other entity responsible for overseeing that mitigation occurs.

Check off Date/Initials: To be filled out when individual mitigation is complete.

MITIGATION MONITORING AND REPORTING PROGRAM: Merced River Agricultural Diversion and Fish Habitat Enhancement Project					
Mitigation Measure(s)	Timing/ Milestone	Responsible Entity	Mitigation Action	Monitoring and Enforcement Responsibility	Check off Date/Initials
Air Quality					
AQ-1. Reduce Dust and Air Quality Impacts The following dust reduction measures shall be implemented during transport of materials from the borrow areas (islands) where sediment will be removed to berm construction location and secondary channels where filling is planned to occur to reduce construction-related emissions: • wet materials to limit visible dust emissions using water; provide at least 6 in (15.2 cm) of freeboard space from the top of the container; or, cover the container.	During construction	Project Applicant/ Contractor	Use qualified QSP and implement measures	Project Applicant/ Contractor	
Biological Resources					
BIO-1. Adaptive Construction Approach to Protect Elderberry Plants and Mitigate for Loss. To avoid direct mortality to VELB from crushing by heavy equipment or through destruction of their elderberry shrub habitat during construction, a qualified biologist shall clearly mark elderberry plants	Prior to and during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

prior to construction and intrusion into the prescribed 20-foot buffer zone shall be avoided, as possible. The 20-foot buffer shall be inspected weekly during ground disturbing activities and monthly after ground-disturbing activities until the project is complete or until the fences are removed. The qualified biologist will be responsible for ensuring that the contractor maintains construction stanchion and flagging around elderberry shrubs in the Project footprint. Biological inspection reports shall be provided to the lead agency and USFWS.					
BIO-2. Transplant Unavoidable Elderberry Plants to Suitable Locations and Monitor Survival. Elderberries that cannot be avoided using a 20-foot buffer will be transplanted to a suitable location during project construction, following consultation with U.S. Fish and Wildlife Service, and will be monitored in years 1, 2, and 3 and 10 with a target minimum survival rate of at least 60%. If necessary, replacement plants will be added to the restoration area to maintain survival above 60%. If any mortality of elderberry shrubs occurs, USFWS shall be consulted immediately and appropriate mitigation will be implemented.	During and after restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
BIO-3. Monitor for Fish and Wildlife to Prevent Impacts. Pre-construction surveys shall be conducted by qualified wildlife biologists, who shall determine the use of the Action Area by special status wildlife species. Surveys shall focus on identification of potential American badger (*Taxidea taxus*) dens and other	Before and during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

potential wildlife species within the construction footprint and a minimum 500 ft (152.4 m) buffer around the construction footprint. If American badger dens are located within the construction footprint or buffer area, CDFW shall be consulted prior to initiation of construction for further instruction on methods to avoid direct impacts to American badger. Pre-construction surveys shall also determine the use of the Proposed Project construction footprint by San Joaquin kit fox (*Vulpes macrotis mutica*). These surveys shall focus on identification of potential, atypical, active, and natal kit fox dens. If potential kit fox dens are located within the construction or buffer area, a minimum of five consecutive nights of camera/scent stations and track stations shall be placed by the den entrances in order to determine if the den is in use by kit fox. If active or natal dens are confirmed, CDFW and USFWS shall be consulted for further instructions on methods to avoid direct impacts to this species. Protocol-level surveys shall also be implemented for other state and federally-listed species including Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), bald eagle (*Haliaeetus leucocephalus*), yellow-breasted chat (*Icteria virens*), tri-colored blackbird (*Agelaius tricolor*), least Bell's vireo (*Vireo bellii pusillus*), Chinook Salmon, CCV steelhead, and western pond turtle (*Actinemys marmorata*). This includes pre-construction surveys conducted no more than 10 days before Proposed Project implementation by qualified wildlife and fisheries biologists. A minimum no-disturbance buffer of 250 feet around active nests of non-listed bird species; a 500-foot no-disturbance buffer around migratory bird species; and a					

half mile buffer for nest of listed species and fully protected species (including Swainson's hawk, white-tailed kite, and bald eagle) shall be established until breeding season is over or young have fledged. If such a buffer cannot be reasonably accomplished, CDFW shall be consulted. Fish surveys shall be conducted by a qualified biologist and if spawning salmon are observed within the construction footprint, construction shall cease and CDFW and USFWS contacted immediately to determine the appropriate course of action.					
BIO-4. Protect and Compensate for Native Trees. Native trees, such as Fremont Cottonwood, willows, and alder, with a dbh of 6 in (15.2 cm) or greater shall be protected with 30-ft (9.1-m), 10-ft (3-m), and 10-ft (3-m) buffers, respectively, as possible. Native trees shall be marked with flagging if close to the work area to prevent disturbance. To compensate for the removal of riparian shrubs and trees during Project implementation, the plans shall identify tree and shrub species to be planted, how, where, and when they would be planted, and measures to be taken to ensure a minimum performance criteria of 70% survival of planted trees. The tree plantings shall be based on native tree species compensated for in the following manner: • Oaks having a dbh of 3 – 5 in (7.6 – 12.7 cm) shall be replaced in-kind, at a ratio of 3:1, and planted during the winter dormancy period in the nearest suitable location to the area where they were removed. Oaks with a	During and after restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

dbh of greater than 5 in shall be replaced in-kind at a ratio of 5:1. • Riparian trees (i.e., willow, cottonwood, poplar, alder, ash, etc.) and shrubs shall be replaced in-kind within the Project boundary, at a ratio of 3:1, and planted in the nearest suitable location to the area where they were removed.					
BIO-5. Work Outside of Critical Periods for Special Status Species. No in-stream work would be conducted after 15 October to avoid impacts to spawning Chinook Salmon. Nesting birds and raptors are protected under the MBTA and CDFG Code, and trees and shrubs within the Action Area likely provide nesting habitat for songbirds and raptors. If construction activities occur during the potential breeding season (February through August) a qualified biologist shall conduct surveys for active nests and/or roosts within a ½ mile radius of the Action Area no more than 10 days prior to the start of construction. A minimum no disturbance buffer shall be delineated around active nests (size of buffer will depend on species encountered) until the breeding season has ended or until a qualified biologist has determined that the birds have fledged and are no longer reliant upon the nest or parental care for survival.	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

BIO-6. Monitor for Bats to Prevent Impacts. Before any ground disturbing activities, a qualified biologist shall survey for the presence of associated habitat types for the bat species of concern. If bats are present, the biologist shall apply a minimum 300 ft (91.4 m) no-disturbance buffer around roosting bats, maternity roosts or winter hibernacula until all young bats have fledged.	Before and during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
BIO-7. Prevent Spread of New Zealand Mudsnail and other Aquatic Invasive Species. New Zealand mudsnails are an introduced species that has been identified in numerous rivers of the Central Valley, including in the Merced River. To minimize the chance that the snails may be transported and spread to other water bodies on equipment, construction specifications shall require that equipment be steam cleaned immediately after the work is completed and before being used in other water bodies. An Invasive Species Risk Assessment and Planning (ISRAP) protocol shall be developed, and all appropriate staff shall be trained as to its purpose and implementation before construction begins. The ISRAP shall be used to prevent the spread of invasive species during Proposed Project construction.	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Cultural Resources					
CR-1. Inadvertent Discoveries of Objects of Cultural Significance.	Ongoing during	Project Applicant/ Contractor	Implement specified	Project Applicant/ Contractor	

If any objects of cultural significance are unearthed during the construction process, work shall be halted immediately until a qualified archeologist can assess the significance of the new find. If human remains are unearthed during the construction process, the Proposed Project team shall comply with the California Health and Safety Code Section 7050.5, which states that no further disturbance shall occur until the County Coroner has investigated the situation following the Public Resource Code Section 5097.98.	restoration activities		mitigation measures		
Noise					
NOISE-1. Reduce Impacts from Noise. To mitigate noise related impacts, the Project shall require all contractors to comply with the following operational parameters: • Restrict construction activities to time periods between 7:00 am and 5:00 pm when there is the least potential for disturbance; • install and maintain sound-reducing equipment and muffled exhaust on all construction equipment.	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	
Water Quality					
WQ-1. Monitor Water Quality and Prevent Impacts. During in river work, turbidity and total suspended solids shall be monitored with intermittent grab samples from the river, and construction curtailed if turbidity exceeds criteria established by the Regional Water Quality Control Board in its CWA §401 Water	Ongoing prior to, during and after restoration activities	Project Applicant/ Contractor	Use qualified QSP and implement measures	Project Applicant/ Contractor	

Quality Certification for the Proposed Project. Specifically, sampling shall be performed immediately upstream from the Action Area and approximately 300 feet downstream of the active work area during construction. Activities shall not cause in surface waters: a) turbidity to exceed 2 NTU's where natural turbidity is less than 2 NTU; b) where natural turbidity is between 1 and 5 NTUs, increases exceeding 1 NTU; c) where natural turbidity is between 5 and 50 NTUs, increase exceeding 20 percent; d) where natural turbidity is between 50 and 100 NTUs, increases exceeding 10 NTUs; e) where natural turbidity is greater than 100 NTUs, increase exceeding 10 percent. Activities shall not cause settleable material to exceed 0.1 ml/L in surface waters as measured in surface waters downstream from the Action Area. Activities shall not cause pH to be depressed below 6.5 nor raised above 8.5 as measured in surface waters downstream from the Action Area. The Proposed Project shall not discharge petroleum products into surface water. The Central Valley Water Board shall be notified immediately of any spill of petroleum products. During gravel processing, gravel shall be cleaned prior to placement within the riverbed in a manner that removes any fine-grained sediment (< 6mm size fraction) (fines) that could potentially contain concentrations of mercury. Daily fines samples shall be collected from processed material and analyzed for					

total mercury. Borrow areas shall be re-graded to ensure the areas do not become potential mercury methylation spots. Fines separated from gravel shall not re-enter the Merced River. Stream bank impacts shall be isolated and minimized to reduce bank sloughing. Banks shall be stabilized with revegetation following Proposed Project activities, as appropriate. Sediment fencing shall be used along the river corridor to capture floating materials or sediments mobilized during construction activities and prevent water quality impacts. A SWPPP shall be developed as part of the BMPs. All pertinent staff shall be trained on and familiarized with these plans. Copies of the plans and appropriate spill prevention equipment referenced in them shall be made available onsite and staff shall be trained in its use. Spill prevention kits shall be in close proximity to construction areas, and workers trained in their proper use.					
WQ-2. Use Clean Equipment and Biodegradable Lubricants. All equipment shall be clean and use biodegradable lubricants and hydraulic fluids. All equipment working within the stream channel shall be inspected daily for fuel, lubrication, and coolant leaks; and, for leak potentials (e.g. cracked hoses, loose filling caps, stripped drain plugs). Vehicles shall be fueled and lubricated in a designated staging area located outside the stream channel and banks. Construction specifications shall require that any equipment used in or near the river is properly cleaned to prevent any	Ongoing during restoration activities	Project Applicant/ Contractor	Implement specified mitigation measures	Project Applicant/ Contractor	

hazardous materials from entering the river, and containment material shall be available onsite in case of an accident. Spill prevention kits shall be located close to construction areas, with workers trained in its use. Contracted construction managers shall regularly monitor construction personnel to ensure environmental compliance.					

Appendix C. Effectiveness Monitoring Plan

CRAMER FISH SCIENCES®
An Employee Owned Consulting Company

MERCED RIVER AGRICULTURAL DIVERSION AND FISH HABITAT ENHANCEMENT PROJECT

Monitoring Plan

Prepared for:

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March 2020

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INTRODUCTION

Merced Irrigation District (MID), in coordination with the California Department of Water Resources (DWR), is undertaking the Merced River Agricultural Diversion and Fish Habitat Enhancement Project (Project) to improve the viability, habitat, and natural production of native anadromous fish populations in the San Joaquin River watershed while increasing diversion efficiency and reliability. The Project aims to modernize up to four (of 7 identified) water diversions located between Crocker Huffman Dam (river mile 52) and the Oakdale Road Bridge (river mile 43) on the lower Merced River (Figure 1) to provide both native fish and water user benefits and to create a framework for potential additional diversion enhancement here and elsewhere in the California Central Valley.

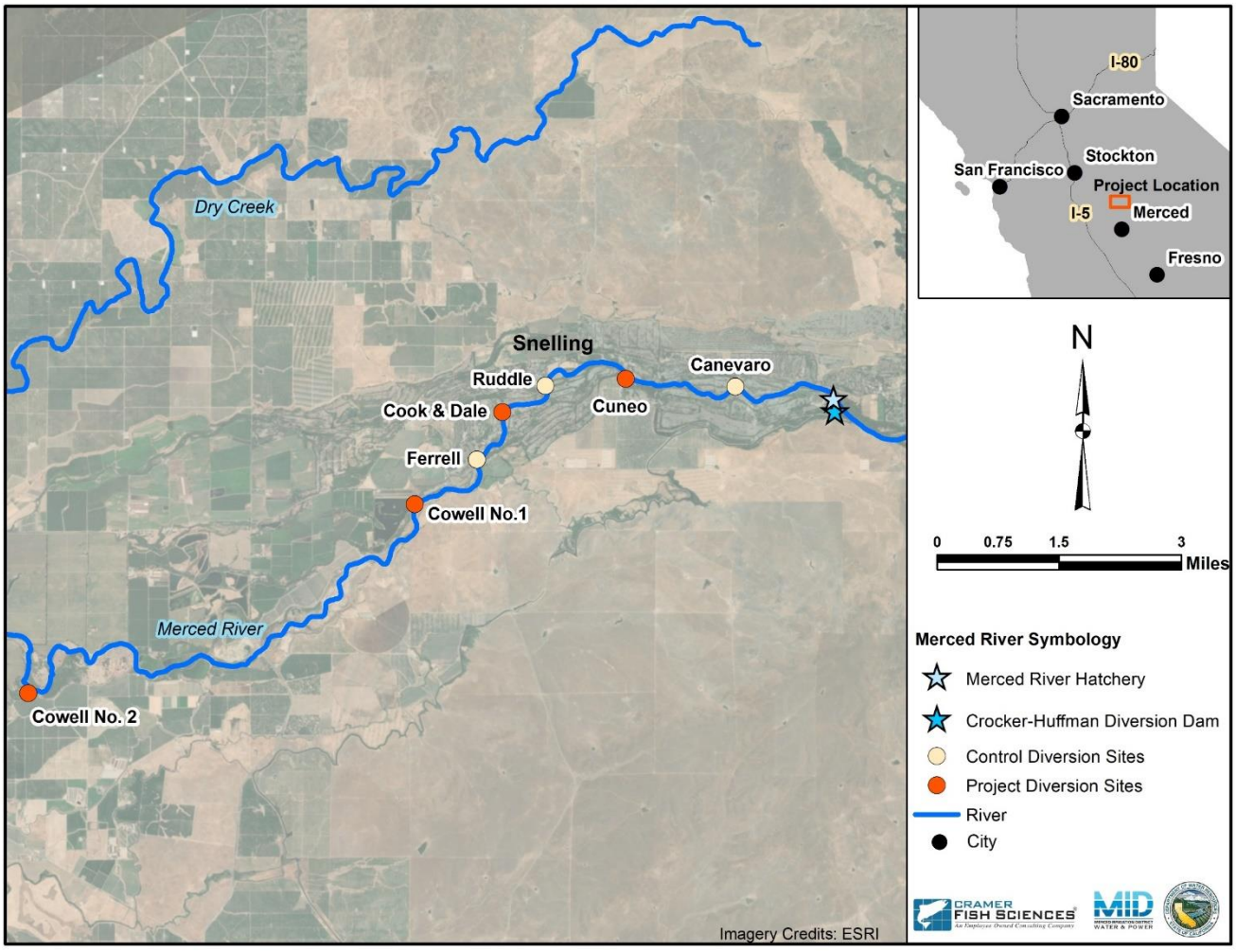

Figure 1 Locations of 7 diversions along the lower Merced River which will be monitored as part of the Merced River Agricultural Diversion and Fish Habitat Enhancement Project. Project diversion sites identify diversions targeted for enhancement; control diversion sites identify diversions which will not be enhanced but will be monitored for some metrics to facilitate documentation of enhancement effects.

This Project was developed by a team of restoration ecologists, fisheries biologists, geomorphologists, and engineers to address goals of the following programs:

- Riverine Stewardship Program (RSP), which aims to implement watershed-based riverine stewardship improvements that reduce flood risk, restore and enhance fish populations and habitat, improve water quality, achieve climate change benefits, and ensure resilient ecological functions within urban areas of California.
- San Joaquin Fish Population Enhancement Program (SJFPEP), a sub-program of the RSP whose goals include enhancement of native fish populations in the lower San Joaquin River watershed and reduced vulnerability of native fishes to water diversions, predation, and other impacts to populations at all life stages within or upstream of the Sacramento-San Joaquin Delta.
- Anadromous Fish Restoration Program (AFRP), whose goal is to implement a program which makes all reasonable efforts to ensure that natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991.

Statement of Problem

While further research is warranted, small diversions have been implicated in both direct and indirect impacts to Pacific salmonids (*Oncorhynchus* spp.) and other native fishes, within their natal streams (Moyle and Israel 2005; Gale et al. 2008). Direct effects can include fish loss to impingement against fish screens intended to prevent entrainment in diversion canals or entrainment into unscreened diversions or through improperly screened diversions (Reclamation 2006; Nordlund 2008). Diversions may also directly affect salmonids by increasing susceptibility to predation, either through concentration or delay of juvenile salmonids, creation of holding habitat for piscivorous predators near concentrated salmonids, and/or disorientation of fish exiting improperly designed returns (Reclamation 2006; Nordlund 2008; Sabal et al. 2016). Properly designed and screened diversions can increase fish survival and passage through diversion locations (Simpson and Ostrand 2012; Boys et al. 2013a, b). Indirect diversion effects on salmonids include a diverse array of alterations to or loss of spawning or rearing habitat through construction of unnatural instream features which feed water into diversion canals and through regular disturbance as a result of diversion operation, maintenance, or construction.

There are numerous agricultural diversions along the lower Merced River. These diversions are primarily gravity-fed, although smaller projects may be powered by electricity or diesel and have some level of fish screening (smaller individual pumps typically do not), although most are antiquated (Herren and Kawasaki 2001). Current Merced River diversions present two main issues. First, fish screening technology may not function properly, potentially leading to fish entrainment or impingement through or against the screen or may facilitate predation on salmonids and other native fishes as they exit returns. Second, diversion configurations are not designed to best meet the needs of either fish or water users. For example, many in channel diversion features are not properly sited, leading to increased costs associated with operations and maintenance, reductions in fish habitat near the diversion, and limited control and efficiency of water diverted from the river. Screens are often located off-channel and oriented almost perpendicular to flow, not taking advantage of sweeping velocities. As a result, they are chronically choked with debris, increasing maintenance costs and reducing screen function. Additional background on current diversion conditions are provided in the Project Plan (CFS in prep).

Project goals include:

1. Support state and federal fisheries goals for the San Joaquin River System, including enhancing native fish populations in the lower San Joaquin River watershed and reducing vulnerability of native fishes to water diversions, predation, and other impacts to their populations at all life stages within or upstream of the Sacramento-San Joaquin Delta while maintaining diversion efficiency and reliability for water users.
    a. Reduce loss of salmonids and other native species via avoiding impingement and entrainment and/or minimizing predation
    b. Increase quantity and quality of habitat for target species and life stages associated with poor project design/siting and overall habitat degradation within diversion site footprint
    c. Improve fish passage as it relates to facility configuration and operation
2. Improve infrastructure.
    a. Improve screen function and meet or exceed state and federal screening criteria and guidelines regulations
    b. Improve longevity of diversions to reduce operations, maintenance, and construction requirements
    c. Increase existing diversion reliability and efficiency by designing diversions to function over a range of flows and over time, by improving diverter control of the timing and amount of water diverted, and by reducing unnecessary water removal and loss within the Project areas

Adaptive Management

Restoration monitoring is necessary to ensure restoration actions are successful, to further restoration science, and to increase the efficiency of future restoration efforts. To that end, adaptive management is a systematic process for continually improving management policies and practices by monitoring and learning from the outcome of previous and ongoing restoration efforts (Figure 2; Delta Stewardship Council 2019). Its most effective form, active adaptive management, employs management programs designed to experimentally compare selected policies or practices by evaluating alternative hypotheses about managed systems. The aim of this document is to outline a monitoring plan which is carefully crafted to assess project success and test underlying scientific theory (**Error! Reference source not found.** step 5). The three main ingredients of an effective adaptive management plan in a restoration project are: (1) a clear goal statement, (2) a conceptual model, and (3) a decision framework. The goal drives project design and guides development of performance criteria by which the system can be judged. With the conceptual model, the knowledge base from the field of ecological science plays an active role in designing the project to meet the goal. A system-development matrix provides a simple decision framework to view the alternative states for the system during development, incorporate knowledge gained through the monitoring program, and formulate a decision on actions to take if the system is not meeting its goal.

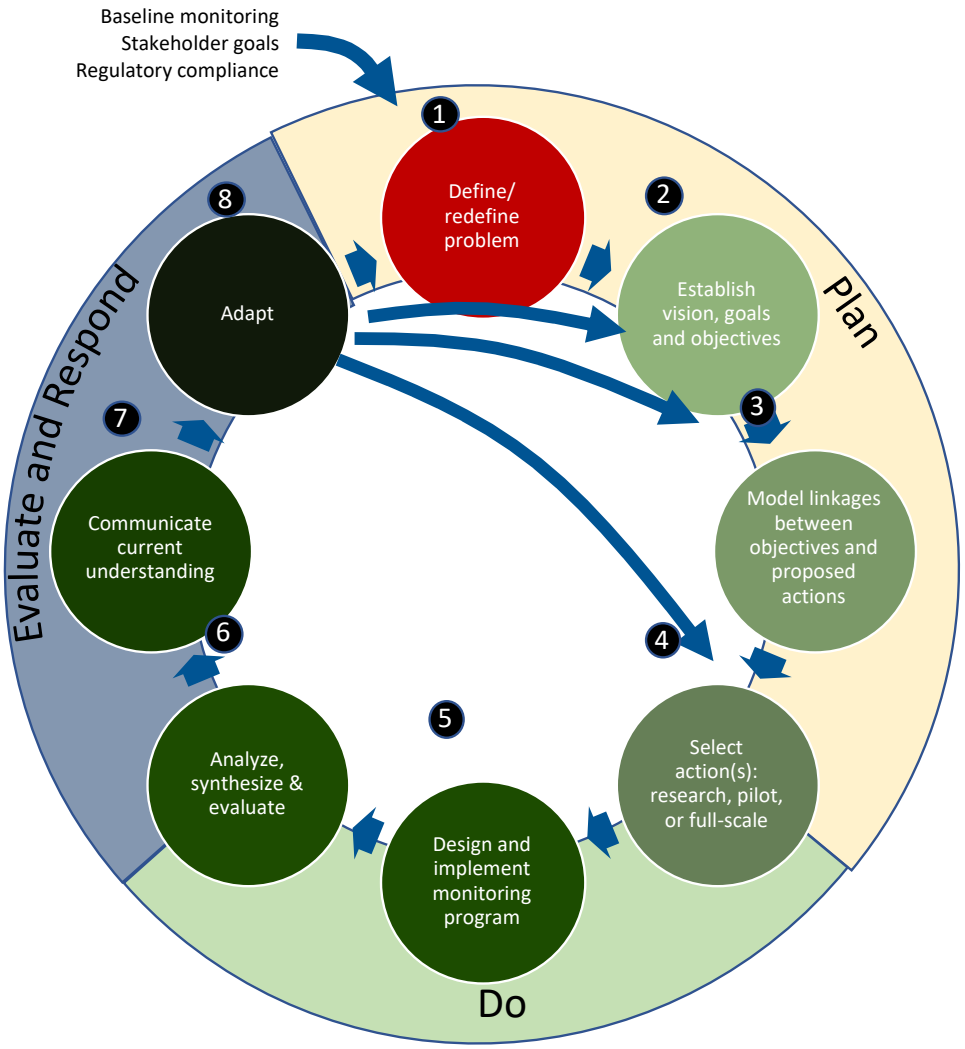

Figure 2 Adaptive Management Cycle. Revised from the Delta Stewardship Council, Delta Plan (2019).

MONITORING APPROACH

The science of habitat enhancement/restoration requires two basic tools: the ability to manipulate ecosystems to enhance a desired community or ecosystem function and the ability to evaluate whether the manipulation has produced the desired change (Palmer et al. 2014). The latter is often referred to as restoration monitoring.

To measure the progress and ultimate success of the Project, this Plan was developed to monitor structural and functional characteristics before, during, and after diversion enhancement in both reference and restored reaches to:

- Evaluate the physical habitat
- Evaluate existing natural populations of target organisms
- Understand the role that each physical characteristic plays in supporting target plants and animals, and
- Assess the interaction of organisms on and around the action areas

To facilitate this, we have broken this Monitoring Plan into four monitoring phases: pre-project assessment, implementation, effectiveness, and validation. Pre-project monitoring provides baseline conditions used to inform project design and documents the impaired condition of the project site. Pre-project assessment will be used to evaluate conditions before construction implementation and will be compared with post-project monitoring data to measure project success, including environmental response and enhanced habitat value. Implementation monitoring will determine if the project was installed per the design standards. Effectiveness monitoring will support determination of project effectiveness in recovering habitat conditions suitable for target species. The final monitoring phase will test hypotheses about the benefit of diversion design for fish and water users.

A range of physical and biological traits will be tracked before and after habitat enhancement to assess ecosystem function. These data will be collected following the Before-After-Control-Impact (BACI) study design structure to test for differences between unrestored and restored sites before and after Project implementation (Green 1979; O'Donnell and Galat 2008). This approach is ideal for evaluating enhancement project effectiveness because it utilizes a paired series of Control-Impact sites (in this case, "impact" is the diversion enhancement treatment and "control" is a main channel reach that will not be influenced by the enhancement action), subjected to a series of Before-After replicated measurements, allowing for discrimination between response to enhancement and stochastic environmental variability (Bernstein and Zalinski 1983; Stewart-Oaten et al. 1986; Smith 2002).

Diversion Sites

Diversion sites will consist of four diversions targeted for enhancement as well as the remaining three diversions which will be monitored as unenhanced controls (Figure 1). Within sites, sampling will be conducted in three habitat zones: the "impact" habitat immediately upstream of the berm feature, the diversion canal behind the existing fish screen, and the "control" habitat located upstream of the diversion outside berm influence. Replicate samples will be collected within each habitat zone. Figures 3-6 depict the habitat zones where sampling will occur within the four diversions targeted for enhancement.

Figure 3. Map of habitat zones within the Cuneo Diversion. Figure shows the diversion (i.e., impact) and canal habitats and the control habitat upstream of the impact zone. The control habitat zone measurements provide a way to account for background changes to the river reach or environmental differences between years (flow, temperature, etc.) that are unrelated to the enhancement action.

Figure 4. Map of habitat zones within the Scott, Cook & Dale Diversion.

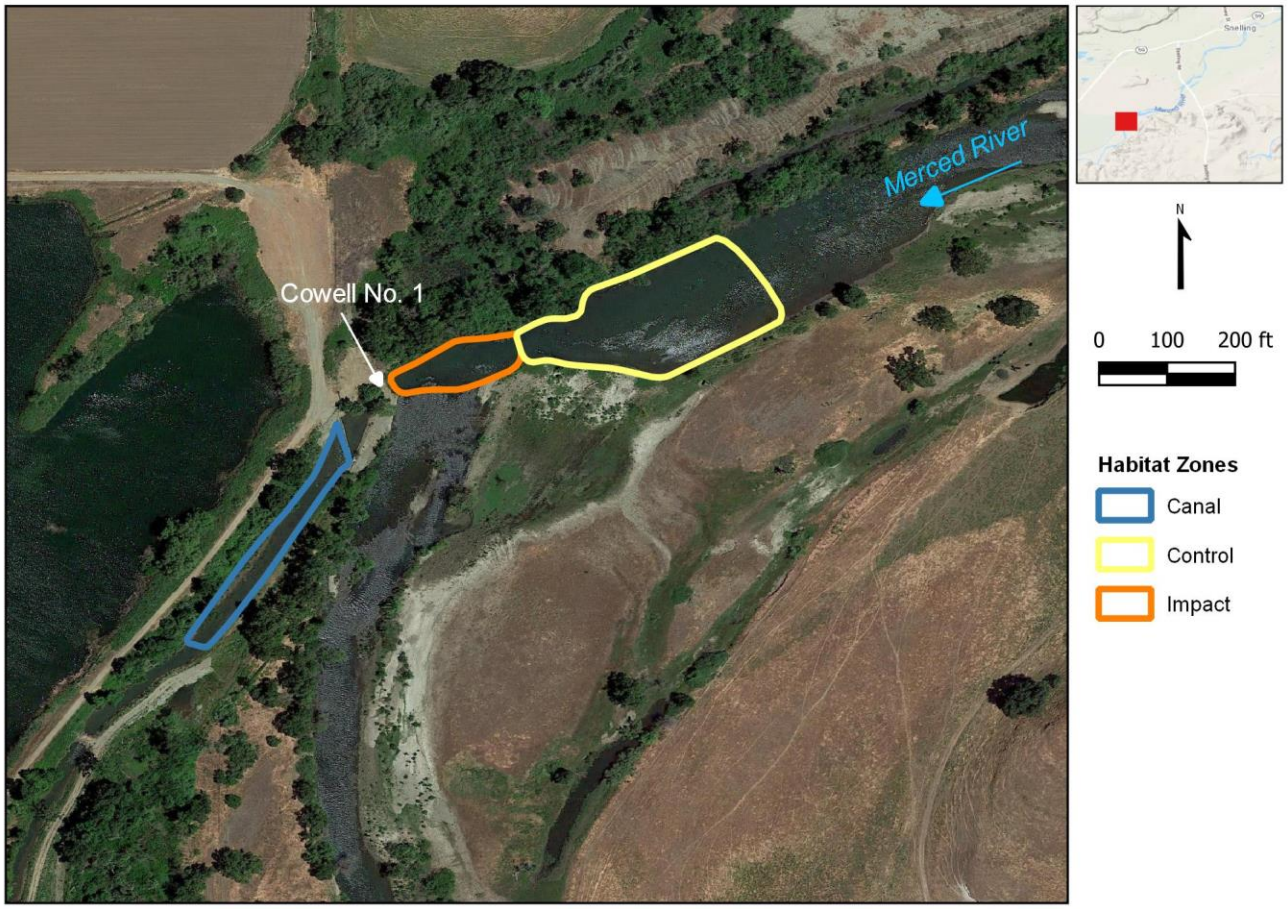

Figure 5. Map of habitat zones within the Cowell No. 1 Diversion.

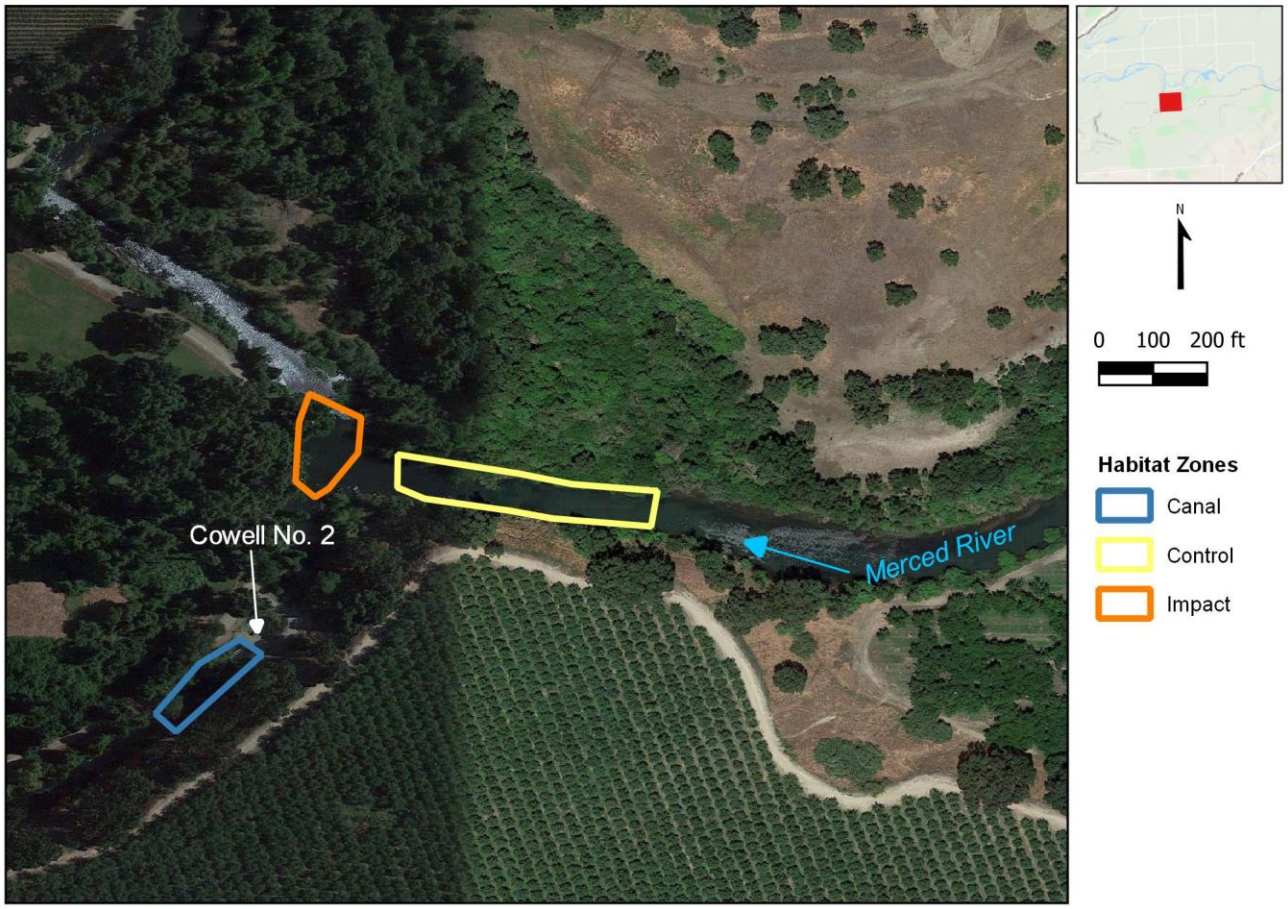

Figure 6. Map of habitat zones within the Cowell No. 2 Diversion.

Timeline and Sampling Effort

The timing of monitoring is critical to ensure data is collected in the right season (e.g., redd surveys conducted during the spawning season) and for a sufficient length of time to provide a robust dataset to test hypotheses. Project implementation is scheduled to occur summer 2022 and 2023 (Table 1). Pre-project monitoring must be conducted sufficiently far in advance of implementation to inform Project design and permitting requirements. We will collect a minimum of two years of pre-project monitoring data at both control and enhancement sites to establish a Project baseline (Table 2). Redd surveys will be conducted every three weeks throughout the salmonid spawning season in late fall and early winter. Fish community surveys and predation assays will occur multiple times throughout the spring salmonid rearing season. Implementation monitoring will take place after construction, with some aspects carried out during implementation as a check on design appropriateness. Post-project effectiveness and validation monitoring will be conducted for at least two years following implementation, and should be conducted for at least five years to increase the probability of capturing a range of environmental conditions (e.g., water year types, temperature, salmon escapement density). Longer-term monitoring of physical and biological habitat features over time is recommended to determine the long-term sustainability of the site and whether additional actions are needed to maintain and improve habitat function.

Table 1. Timeline for pre-project, implementation, effectiveness, and validation monitoring activities.

Month	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
type			pre-project																	implementation				implementation and post-project												post-project																				reporting					
Complaince monitoring																																																														
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Wildlife surveys								■																																																						
Wetland delineation								■															■									■	■											■	■																	
Bathymetry and topography																																																														
LiDaR and drone imagery								■	■														■									■	■											■	■																	
RTK-GPS and sonar surveys								■	■														■									■	■											■	■																	
Water surface elevation																																																														
Pressure transducers								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■						
Manual measurements								■	■														■									■	■											■	■																	
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Fish community				■	■	■	■									■	■	■	■									■	■	■	■									■	■	■	■									■	■	■	■							
Predation bioassays				■	■	■	■									■	■	■	■									■	■	■	■									■	■	■	■									■	■	■	■							

Table 2. Technique and sampling effort to assess restoration monitoring metrics.

Monitoring Metric	Technique(s)	Details of Sampling Effort
Compliance monitoring	• Plant surveys • Wetland delineation	Conducted once during appropriate season prior to project implementation throughout entire project area at project diversions
Bathymetry and topography	• LiDaR and drone imagery • RTK-GPS and sonar surveys • 2d hydraulic models • DEM differencing	Survey canal, adjacent channel, nearby floodplain at project diversions prior to implementation, immediately following implementation, and periodically during post-project monitoring; drone imagery will be collected at all diversions
Screen performance	• Handheld ADV • Stream flow gauges • Visual inspection	Non flow metrics (location, construction, screen openings) will be assessed during construction monitoring Flow metrics (approach and sweeping velocities, bypass entrance and exit) during withdrawals year following implementation Cleaning system functionality will be visually assessed during all seasons water is diverted year following implementation
Water surface elevation	• Pressure transducers • Manual measurements	Three transducers installed at each enhancement diversion in the impact and canal habitats and downstream of the diversion feature Numerous manual measurements taken in canal and active channel during RTK-GPS surveys
Flow	• Depth and velocity cross sections • LSPIV • Water diversion rate monitoring	Collected in canals and adjacent channel at project diversions at multiple flows prior to, immediately after, and one additional time after implementation MID will monitor water diversion rates using techniques TBD
Photo points	• Photos	Taken at one point at project diversions in four cardinal directions prior to and immediately following implementation and annually during post-project monitoring
Substrate	• Pebble counts • Substrate imagery	Counts taken in adjacent main channel at project diversions before and after implementation Photos taken on diversion features at project diversions before and after implementation
Spawning	• Redd surveys	Conducted biweekly from Oct-Jan at diversion features for 2 years before and 2 years following implementation

Fish Community	• Snorkel surveys	Multiple transects conducted in canal, impact, and control habitats 3 times throughout the spring for two years before and 2 years following implementation
Predation	• Bioassays	Conducted 3 times throughout the spring in impact and control habitats for two years before and 2 years following implementation

Pre-project monitoring

Pre-project monitoring establishes a baseline from which to measure change following an enhancement action (Roni et al. 2010). It is a critical component of the other monitoring phases because questions posed by effectiveness and validation monitoring can only be answered if the pre-project condition of enhancement and control sites is documented. Effectiveness and validation monitoring components are discussed in detail later in that section but monitoring of these during the pre-project phase will provide baseline data on diversion function. Pre-project monitoring is also a component of regulatory compliance at project diversions because pre-project wildlife and habitat surveys help resource agencies determine whether the project is likely to negatively impact special status plants and animals and mitigation measures needed to prevent these impacts. Monitoring efforts that address permitting requirements include special-status plant surveys, wetland delineation, standardized photo points to document change over time, and water quality measurements during site construction. These efforts are described here.

Special-Status Plant Surveys

A list of special-status plant species with potential to occur on the Project site will be compiled using available California Department of Fish and Wildlife (CDFW)'s California Natural Diversity Database and USFWS's Environmental Conservation Online System. A botanist will survey the entirety of Project sites during a time of year when the species are identifiable (generally March-June, but timing dependent on species-specific phenology). If any special-status plants are found, they will be marked with a GPS unit and appropriate mitigation measures will be developed so project-related impacts are less than significant.

Wetland Delineation

Wetlands are a critical natural resource because they provide essential habitat for a large diversity of native flora and fauna, many of which are federal or state special-status species (Ward et al. 1999; Grosholz and Gallo 2006). Widespread loss of wetland habitats in the United States has resulted in the passing of regulatory measures to protect these important resources. Federal Executive Order 11990 requires resource agencies to determine whether wetlands are threatened by a project and to implement measures to avoid, mitigate, and preserve wetlands. A wetland delineation must be completed prior to any project to determine whether wetlands occur at the project site.

A wetland delineation will be performed in accordance with the Minimum Standards for Acceptance of Preliminary Wetland Delineations (USACE 2001), the Corps of Engineers Wetland Delineation Manual (WTI 1995), and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Regional Supplement (USACE 2008). The boundaries of potential Waters of the U.S. will be delineated through aerial photograph interpretation and standard field methodologies (i.e., paired data set analyses). During the field assessment, the team will walk meandering transects across the site footprint during the wet season (January-April). Potential wetland habitat will be sampled to determine if

the three-parameter criteria (vegetation, soil, and hydrology) support a wetland or upland determination. A report will be submitted to the U.S. Army Corps of Engineers for review and final determination.

Substrate

Characterization of substrate will support site assessment and Project design, especially with respect to potential riffle enhancement. Two substrate data collection methods will be used to characterize the substrate composition at the diversion sites: substrate images and pebble counts. Wolman pebble counts (Wolman 1954) consist of randomly selecting sediment grains along a transect and passing them through a measuring board perpendicular to the intermediate axis of the grain. At each area of interest (e.g., existing riffles), several underwater images of the substrate will be taken, and a scale bar will be included in the image frame to scale images. Images will typically be collected during the mid-morning to optimize transparency through the water column and clarity of bedload sediment, as well as to minimize shadow obstruction. Digital images will be captured just below the water surface to maximize camera frame. Substrate images will be evaluated for grain size with ImageJ (Schneider et al. 2012), an open source computer software that sets scale parameters and measures objects within an image. A random point generator will be used to overlay points on each image to randomly select the sediment grains for analysis.

Implementation monitoring

Implementation monitoring will be conducted at project diversions to determine if the Project was built accurately to the design plan and met Project design goals. Generally, this monitoring occurs after construction completion; however, some aspects will be carried out during implementation as a check on design appropriateness (Kershner 1997). Mid-course corrections to implementation can be made as appropriate. In addition to tracking implementation success in terms of physical structure, we will also investigate restored fish habitat hydrological function. Flooding frequency and duration, which are determined by channel bathymetry and flow, are among the primary drivers of habitat productivity in terms of accessibility for fish, prey resource production, and habitat maintaining processes leading to increased survival (Hill et al. 1991; Tockner et al. 2000; Zeug et al. 2014). Detailed topographic and bathymetric surveys will be conducted and historic post-dam flow data used to inform the design process. To determine whether the project was implemented as planned, we will compare as-built surveys of bathymetry and topography at the Project sites after implementation with the design plans. Below, we describe methods used to collect and analyze these data.

Bathymetry and Topography

In-channel and floodplain topographic data will support several objectives, including Project design and implementation monitoring. To determine how closely to design the Project is constructed, as-built topographic information will be compared to the design surface. To facilitate this comparison, as-built topographic and bathymetric surveys will be conducted using a combination of Real-time Kinematic Global Positioning System (RTK-GPS), Light detection and ranging (LiDaR), sonar, and Structure-from-motion (SfM) photogrammetry techniques.

LiDaR (e.g., drone outfitted with RTK-GNSS receivers and a Velodyne VLP-16 LiDAR sensor) and aerial imagery flights (e.g., drone outfitted with DJI Phantom 4 Pro camera with a Polar Pro lens filter) may be performed at each diversion site to capture LiDaR data and aerial imagery for the diversion, the adjacent active channel of the Merced River, and the nearby floodplain. Aerial imagery will be adjusted for optimal brightness and contrast and then processed using SfM photogrammetry software to generate a DEM.

An RTK-GPS and sonar survey will be performed synchronously with the LiDaR and imagery flights at each diversion site to provide accurate topographic control for products of the Lidar and SfM products, as well as to capture coordinates of specific features and channel bathymetry. Generally, the RTK-GPS surveys will include ground control points for drone flights, features of the diversion, hydraulic or geomorphic features, channel bathymetry (sonar for depths >1.5 ft), and additional terrestrial locations capturing a range of representative conditions in order to assess accuracy of LiDaR and SfM products.

An as-built DEM will be constructed for each diversion site using the RTK-GPS and sonar survey point data, LiDaR data, and SfM DEM. At least two evaluations may be pursued to evaluate the extent to which the Project locations are built to the design plans. First, the design surface will be sampled to as-built RTK-GPS survey points collected after Project completion, and the deviations between surveyed elevations and the design surface will be compared using scatter plots or histograms. Second, the difference between the design surface raster and the as-built surface raster will be calculated (a technique known as DEM differencing) using a GIS to identify spatial patterns in the deviations. Areas of the differenced raster will be isolated where the as-built conditions are high or low compared to the design.

Fish Screen Performance

Fishways have been defined as any structure, including screens, deliberately created to facilitate safe and timely fish movement past an obstacle (Silva et al. 2018). Each site will have a unique design. Therefore, each site may have a unique screen technology or may even not require a screen at all. As a result, it is not feasible to list the exact screen performance criteria to be monitored at the time of this report and this section will be updated following the development of preliminary designs. In general, all screens will be designed to meet or exceed state (CDFG 2000) and federal (NMFS 1997) criteria for fish screen performance and will be surveyed to ensure they operate as intended for all criteria applicable for the chosen screening technology.

Screen criteria fall into two categories: non-flow and flow criteria. Non-flow criteria include installing screens to meet design standards (i.e. correct location and construction) and appropriate screen opening. These criteria will be assessed during as-built surveys conducted during the dry season following construction to confirm the Project was implemented as designed.

Flow criteria include approach and sweeping velocities, flow conditions at bypass entrances and exits, and that flow rates do not exceed flows for which the diversion and screen were designed. Monitoring of screen performance will take place during the irrigation season in the year following implementation in conjunction with flow monitoring (described below) and will be assessed across a range of flow values expected during the irrigation season.

Effectiveness and validation monitoring

Effectiveness monitoring will determine whether the Project effectively enhanced diversion function and fish habitat. Effectiveness monitoring is complex and requires evaluating the outcomes of multiple objectives relating physical, biological, and biogeochemical factors at work in the river ecosystem (Kondolf and Micheli 1995; Roni et al. 2002, 2008; Stillwater Sciences 2006; Wohl et al. 2005). Effectiveness monitoring is hypothesis-driven and pre-project monitoring (described above) is essential for effectiveness monitoring because it provides a baseline from which to compare post-project conditions. The primary question to be answered by the effectiveness monitoring is: was the Project effective at meeting the overall habitat enhancement objectives? Table 3 outlines hypotheses related to effectiveness monitoring and relevant parameters and monitoring methods. Below, we describe in greater detail the specific methods used to measure each parameter.

Validation monitoring will verify the underlying assumptions of the Project conceptual model, and consequently this type of monitoring has a research focus (Kershner 1997). The studies described below are designed to provide support to the previously stated hypothesis and to primarily address the following question: are the basic assumptions behind the Project conceptual model valid (i.e., does the Project provide benefits to both fish populations and water users on the Merced River)? Through validation monitoring, we seek to refine our understanding of how the completed project functions to improve future salmonid habitat enhancement projects' design.

Two years of effectiveness and validation monitoring are included under the scope of this Project. Restoration projects on Central Valley rivers have a mean life span of ~7 years during which they provide some level of intended benefits and can last up to 10 years. Longevity of project function is dependent on many factors including design, sediment budget, and environmental conditions (e.g., flow).

Table 3. Effectiveness and validation monitoring hypotheses and parameters.

Hypothesis	Parameter/monitoring method
Water removal beyond what is required by diverters will be reduced following diversion enhancement.	TBD water diversion monitoring Water surface elevation
Diversion design and screen improvements will reduce fish entrainment in canals.	Snorkel surveys Screen performance metrics
Spawning habitat quantity and redd construction within diversion footprints will increase following enhancement.	2D spawning habitat modeling Redd surveys Substrate Topographic surveys Pressure loggers Flow transects
Juvenile salmonid rearing capacity and abundance within diversion footprints will increase following enhancement.	2D rearing habitat modeling Snorkel surveys
Habitat conditions that favor nonnative predators and predation on juvenile salmonids will be reduced or eliminated following diversion enhancement.	2D predator habitat modeling Snorkel surveys Predation assays
Diversion enhancement will facilitate fish passage for in- and out-migrating salmonids.	2D habitat modeling of conditions during migration windows
Reconfiguration of spawning riffles that control diversion flow rates will persist under the current flow and sediment regime for 5-10 years (depending on hydrologic conditions)	Topographic surveys DEM differencing

Bathymetry and Topography

Topographic data collection methods previously described for Implementation Monitoring also support effectiveness monitoring. Primarily, topographic data support evaluations of salmonid habitat quality,

quantity, and evolution. Periodic, repeat topographic surveys will be performed after Project completion to develop DEMs of the diversion sites through time to be used in 2d hydraulic models and DEM differencing. Survey methods will be similar to those described for Implementation Monitoring.

Water Surface Elevation

To improve the reliability and efficiency of the diversions for both water users and fish, it is important to understand how much water is available at each diversion through time, how that water is distributed between the diversions and the main channel under current and post-project conditions, and how water depths near the diversion sites are affecting habitat quality. Pressure-transducers (e.g. Onset Computer, Inc. Hobo® U20) will be deployed at each diversion site to provide a continuous record of local water surface elevations in both the canal and the main channel. Pressure transducers will provide pre-project baseline data about hydrologic conditions, which will inform 2d hydraulic modeling and Project design, as well as serve as the basis for comparison to post-project conditions. For effectiveness monitoring, pressure transducer data will support the evaluation of diversion efficiency and habitat enhancements. Pressure transducer deployment configurations will facilitate the following objectives:

- measure water depth (as a proxy for inundation magnitude, duration, and timing) in the canal through time
- measure hydraulic gradient between the main channel of the Merced River and the canal across a range of flows
- measure the hydraulic gradient along the main channel of the Merced River from upstream to downstream of the diversion across a range of flows
- provide water surface elevation data across a range of flows for both upstream and downstream boundary conditions to support calibration of 2d hydraulic models

A single additional pressure transducer will be installed on the upland to continuously record local barometric pressure, and benchmark ‘pins’ will be established near each water pressure transducer to facilitate manual measurements of water surface elevations at the location of the loggers.

Additional water surface elevation measurements will be collected in association with topographic surveys using RTK-GPS. During each RTK-GPS survey, numerous water surface elevation measurements will be collected across the canal and main channel. These measurements will serve two purposes: they will capture greater point-in-time spatial variability in water surface elevations than the pressure transducer measurements and they will provide a quality control check for pressure transducer measurements.

Flow Measurements

Depth and velocity measurements will be performed at cross-sections in the main channel (if feasible) and canals at each diversion site. We have assumed three different pre-project flow conditions would be surveyed. To the extent possible, selected cross-sections will be in a relatively straight reach with uniform, positive, and laminar flow. A measuring tape will be stretched across the cross-section perpendicular to flow, and the cross-section will be divided into segments. For each segment, depth will be measured with a top-setting wading rod, and velocity will be measured with a flow meter (eg. Hach FH950 or similar). Discharge (Q) will then be calculated using the following formula:

$$Q = \sum (V*D*W \text{ for each segment})$$

where, V = average velocity, D = depth, W = width of segment

Depth and velocity transect data will be collected at multiple flows before and after implementation to determine the flow split between the main channel and canal at each site, and to determine whether depth and velocity conditions are within the preferred range for juvenile salmonid rearing. Depth and velocity data can also be used to validate the results of two dimensional hydraulic models of the site.

In addition to depth and velocity cross-section measurements, two-dimensional surface velocity patterns will be mapped using Large-Scale Particle Image Velocimetry (LSPIV). LSPIV is an image-based methodology that leverages the movement of particles or bubbles visible on the water surface to calculate water velocity. High-angle videos of the water surface are collected from a stable location with scaling features in the field of view. The video can then be processed using software (e.g., PIVlab) that compares and tracks particles or bubbles through a sequence of video still frames and calculates particle velocities for the entire visible flow field (Thielicke and Stamhuis 2014). If the video is collected at a location where channel bathymetry is known, discharge can be calculated from LSPIV results. LSPIV can be utilized in areas or at flows that would otherwise be dangerous or inaccessible for depth and velocity data collection.

MID will monitor water diverted into canals following implementation. Measurement may occur using water meters or another method to be determined during the design process. Measurement tools will be installed at diversion sites during Project construction.

Drone Imagery

Drone flights will be performed at each diversion site to capture aerial imagery of the canal, the adjacent active channel of the Merced River, and the nearby floodplain. Typically, a drone-mounted DJI Phantom 4 Pro camera with a Polar Pro lens filter will be used to collect aerial image sets in a grid-like pattern with a high degree of image overlap. Survey-grade coordinates of ground control points will be synchronously collected with RTK-GPS, to the extent practicable. Images will be adjusted for optimal brightness and contrast using Adobe Lightroom software and then processed using Pix4D photogrammetry software. Pix4D outputs typically include georeferenced orthomosaics and DEMs generated using Structure-from-Motion (SfM) photogrammetric techniques. Additional drone flights may periodically be performed to capture candid aerial imagery of the diversion sites.

Photo Points

Standardized photo points will be established throughout the Project duration. This imagery will provide a qualitative measure of habitat structural changes and are required for regulatory compliance. For the photo points, all photographs will be taken at the same height and in the four cardinal directions (i.e., North, South, East, West) at each sampling site with the photo point location recorded using a handheld GPS (Trimble Geo XT 6000 series). Photos will be labeled and stored as part of the ArcGIS spatial database developed during monitoring activities. Qualitative conditions can then be compared using the photo series and change due to habitat enhancement can be documented. Aerial drone imagery will also be used to document ecosystem change over time on a larger spatial scale when images are available.

Substrate

In addition to informing Project design, characterization of substrate will provide context for validating observations of the project design's performance, e.g., spawning habitat quality and redd construction data, and for developing improved project designs as part of the adaptive management process. Substrate images will be collected and analyzed following implementation as described under pre-project monitoring.

Spawning Surveys

A key goal of this Project is the enhancement of salmonid spawning habitat quantity and quality in main channel areas associated with diversion features and a subsequent increase in salmonid redd construction. To document changes in salmonid spawning, spawning surveys will be conducted from October-January at diversion sites before and after diversion enhancement. Surveys will be performed by two crew members, moving in parallel in an upstream direction following the general methods of Zeug et al. (2014). When a redd is observed, the spatial coordinates will be marked using a handheld GPS devices (Trimble GeoXT 2012 6000 Series or Arrow 100 Submeter GNSS Receiver) and surveyors will record the physical condition of redds, ambient depth and velocity, redd morphology, and the presence or absence of salmon.

Drone surveys will also be conducted twice annually to collect aerial images of salmonid redds (Groves et al. 2016; Roncoroni and Lan 2019; Harrison et al. 2020). The drone will be flown over the diversions sites to obtain footage of potential spawning area at, upstream, and downstream of the berm feature. The number of redds visible in the video footage will enumerated for each site. Redds will only be counted if an obvious pot and tail spill are visible. Although spawning data will be collected at discrete locations related to diversion locations (Figure 3-Figure 6), habitat enhancement is occurring within an open system and maybe impact habitat beyond the Project footprints. Additionally, spawning activity within Project footprints will depend on overall escapement within the LMR. Data from CDFW's redd and carcass surveys on the LMR will be used as available to standardize comparison of impact and control habitat relative to river-wide spawning rates.

Fish Community Surveys

A goal of this Project is to improve juvenile salmonid survival through diversion sites by reducing fish entrainment into diversion canals and nonnative fish predator habitat. Snorkel surveys will be conducted to assess juvenile salmonid and nonnative predator abundance at diversion sites. Surveys will be conducted in the spring and summer, coinciding with rearing for fall-run Chinook Salmon (*Oncorhynchus tshawytscha*) and rearing and holding for Rainbow Trout (*O. mykiss)*, respectively. Stream flow conditions must be considered prior to conducting a survey for safety precautions and to ensure adequate visibility during surveys. Snorkeling methods will be consistent with other studies (Edmundson et al. 1968; Hankin and Reeves 1988; Jackson 1992; McCain 1992; Dolloff et al. 1996; Cavallo et al. 2003). All surveys will be led by a biologist or senior technician with training and experience conducting snorkel surveys. Habitat zones will be snorkeled by two or three divers moving upstream adjacent to each other for margin habitats and downstream for mid-channel habitats. Fish will be observed, identified, and counted by size group as snorkelers proceed in parallel. Counts will later be converted to densities (fish/m^2) using the transect length and a standard width of 2 m/snorkeler to calculate total area sampled. Fish will be categorized by species and size classes (0 – 50 mm, 51 – 80 mm, 81 – 100 mm, 101 – 120 mm, 121 – 150 mm, 151 – 200 mm, 201 – 300 mm, and >301 mm).

Predation Assays

In-stream features that function to create head pressure above diversion canals (i.e., berms) often create deep, slow moving habitat conditions favorable to nonnative predators, resulting in high predation on rearing or out-migrating juvenile salmonids. Predation assays are a valuable experimental tool for assessing relative predation (Aronson and Heck Jr. 1995; Aronson et al. 2001) because they provide direct predation estimates not possible through other means (Sheaves 2001). Predation assays will be conducted in the spring to assess relative predation rates on juvenile salmonids before and after diversion enhancement. Assays will be conducted by deploying tethered juvenile hatchery Chinook Salmon in impact and control habitats. Salmon presence will be assessed at set time points after deployment. Control trials demonstrate salmon absence is a reliable indicator of predation (Cramer Fish Sciences, unpublished data) and missing individuals will be assumed to have been consumed by a predator. In addition, GoPro

cameras will be placed adjacent to a subset of tethered fish to confirm predation as the source of fish absence and identify dominant predator species consuming juvenile salmon.

Suggested monitoring

Although outside the scope and beyond the funding capacity of this work, several additional monitoring activities could contribute to assessment of diversion enhancement benefits. We provide a non-exhaustive list of such monitoring here and welcome opportunities for DWR or others to lead such efforts if and where possible.

While our monitoring plan addresses the effects of diversion enhancement on salmonid spawning, restoration efforts which improve spawning can also improve incubation criteria and egg and larvae survival (Merz et al. 2004, Merz et al. 2019). Enhancement is expected to improve incubation habitat quality immediately following implementation, although the degree of improvement may vary between projects and it is not permanent. Assessing bed permeability and hyporheic water quality could demonstrate the degree to which enhancements improve incubation habitat quality for salmonid eggs and alevin and monitoring fry production could investigate the effects of incubation habitat quality on survival (Merz et al. 2006). Monitoring these metrics could also document the longevity of these effects.

Dams on the Merced and other CV rivers have cut off upstream sediment supplies which historically nourished downstream habitats. Although enhanced habitats will be designed to remain stable under current conditions, without sediment augmentation, restored habitats will degrade over the long term. Restoration projects on Central Valley rivers often experience lifespans of 3-10 years and sediment budget is one important factor contributing to this range. Assessing bed mobility in greater detail, such as with force gages, scour chains, tracers, or bed load traps, could provide information on enhancement stability and anticipated longevity of habitat improvements (Merz et al. 2006).

Restoring hydrological linkages between aquatic and terrestrial habitats and redistribution of sediment size classes altered by mining can create conditions that promote rapid wetland plant colonization, enhancing biodiversity and improving ecosystem function (Sellheim et al. 2016). If floodplain habitat is created or enhanced, assessing native vegetation recruitment, growth, and survival would confirm habitat was designed at the appropriate elevation and document whether natural riparian processes are restored.

Some targeted diversions pull water above evapotranspiration demand of agricultural activities under current diversion configuration. This water may be returned downstream of locations of use or percolate into the ground and may experience a reduction in water quality. It is beyond the scope of this Project to monitor quantity or quality of water returned downstream of diversion points. However, improved delivery points will be designed to optimize diversions and maximize diverter control, reducing opportunities for excess water removal and water quality degradation. Water pulled out at the diversion points will be compliant with SB 88 regulations.

Diversion enhancement will also facilitate fish passage passed diversions for both out migrating juvenile and up migrating adult salmonids. Passage for outmigrating juveniles will be assessed through quantification of entrainment during snorkel surveys described above. Numerous metrics associated with fish willingness and ability to migrate past diversions, including passage time and rate, could be assessed to quantify enhancement impacts on passage by salmonids as well as other native and nonnative species (Silvia et al. 2018). Although such direct measurements of adult passage are outside the scope of this monitoring plan, the Project will be designed to meet federal criteria for fish passage (minimum depths of 1.0 m for adults and 0.5 m for juveniles, maximum velocities of 6.0 ft/s for adults and 1.0ft/s for juveniles;

NMFS 2011) and modeling will confirm Projects are implemented to meet these design standards at base flows.

MANAGEMENT IMPLICATIONS

Agricultural diversion management generally operates under a precautionary policy that diversions should be assumed to harm fish populations unless proven otherwise (Moyle and Israel 2005). Despite this widespread assumption of harm, there is little analysis on the effects of diversions on fish or on the efficacy of even the most common of mitigation practices (fish screens; Moyle and Israel 2005). Given the high cost to benefit ratio of many management efforts, it is important to incorporate strong evaluation and adaptive management efforts into new diversion enhancement projects. The monitoring plan described here will determine success of the Project while informing future habitat enhancement efforts by evaluating the feasibility of designing diversions to provision ecosystem services which contribute to both ecosystem health and to societal needs.

Diversions are currently configured to reduce within-year construction costs and are not designed to optimize maintenance costs, feature longevity, or diverter control of removed water. In addition, benefits for fish and aquatic organisms are not considered in diversion configurations, resulting in degradation of nearby habitats, fish loss to diversion operation, and enhanced opportunities for predation (Reclamation 2006; Nordlund 2008). Although the potential for properly designed diversions to improve both diversion function and to provision habitat opportunities has been considered, it has rarely been attempted or its success evaluated (Nordlund 2008). Monitoring efforts that demonstrate the success of diversion design to address needs of both fish and diverters will serve as a model for future enhancement efforts in the Merced River and in other salmon-bearing streams with agricultural diversions.

REFERENCES

Aronson, R. B., and K. L. Heck Jr. 1995. Tethering experiments and hypothesis testing in ecology. Marine Ecology Progress Series 121:307–309.

Aronson, R. B., K. L. Heck Jr., and J. F. Valentine. 2001. Measuring predation with tethering experiments. Marine Ecology Progress Series 214:311–312.

Bernstein, B. B., and J. Zalinski. 1983. Optimum sampling design and power tests for environmental biologists. Journal of Environmental Management 16:35–43.

Boys, C A., L. J. Baungartner, and M. Lowry. 2013a. Entrainment and impingement of juvenile silver perch, *Bidyanus bidyanus*, and golden perch, *Macquaria ambigua*, at a fish screen: effect of velocity and light. Fisheries Management and Ecology 20(4):362-373.

Boys, C. A., W. Robinson, L. J. Baumgartner, B. Rampano, and M. Lowry. 2013b. Influence of approach velocity and mesh size on the entrainment and contact of a lowland river fish assemblage at a screened irrigation pump. PLoS ONE 8(6):e67026.

California Department of Fish and Game. 2002. Appendix S Fish Screen Criteria. Pg S1-S16 in California Stream Habitat Restoration Manual.

Cavallo, B., R. Kurth, J. Kindopp, A. Seesholtz, and M. Perrone. 2003. Distribution and habitat use of steelhead and other fishes in the lower Feather River, 1999–2001. California Department of Water Resources, Division of Environmental Services, Interim Report SP-F10.Delta Stewardship Council. 2019. Appendix 1B Adaptive Management. Delta Plan.

Dolloff, A., J. Kershner, and R. Thurow. 1996. Underwater observation. Pg 533–554 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques. Second edition. American Fisheries Society, Bethesda, MD.

Edmundson, E., F. H. Everest, and D. W. Chapman. 1968. Permanence of station in juvenile Chinook Salmon and Steelhead Trout. Journal of the Fisheries Research Board of Canada 25:1453–1464.

Gale, S. B., A. V. Zale, and C.G. Clancy. 2008. Effectiveness of fish screens to prevent entrainment of westslope cutthroat trout into irrigation canals. North American Journal of Fisheries Management 28(5):1541-1553.

Green, R. H. 1979. Sampling design and statistical methods for environmental biologists. Wiley and Sons, New York.

Grosholz, E., and E. Gallo. 2006. The influence of flood cycle and fish predation on invertebrate production on a restored California floodplain. Hydrobiologia 568:91–109.

Groves, P. A., B. Alcorn, M. M. Wiest, J. M. Maselko, and W. P. Connor. 2016. Testing unmanned aircraft systems for salmon spawning surveys. Facet 1:187-204.

Hankin, D. G., and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Sciences 45:834–844.

Harrison, L. R., C. J. Legleiter, B. T. Overstreet, T. W. Bell, and J. Hannon. 2020. Assessing the potential for spectrally based remote sensing of salmon spawning locations. River Research and Applications. 38(8):1618-1632.

Herren, J. R., and S. S. Kawasaki. 2001. Inventory of water diversions in four geographic areas in California's Central Valley. Fish bulletin 179:343-355.

Hill, M. T., W. S. Platts, and R. L. Beschta. 1991. Ecological and geomorphological concepts for instream and out-of-channel flow requirements. Rivers 2:198–210.

Jackson, T. A. 1992. Microhabitat utilization by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in relation to stream discharges in the lower American River of California. Oregon State University.

Kershner, J. L. 1997. Monitoring and adaptive management. Pg 116-131 in J. E. Williams, C. A. Wood, and M. P. Dombeck, editors. Watershed restoration: principles and practices. American Fisheries Society, Bethesda, MD.

Kondolf, G. M., and E. R. Micheli. 1995. Evaluating stream restoration projects. Environmental Management 19:1–15.

McCain, M. E. 1992. Comparison of habitat use and availability for juvenile fall Chinook Salmon in a tributary of the Smith River, CA. USFS, R-5 Fish Habitat Relationship Technical Bulletin. Number 7. April 1992.

Merz, J. E., J. D. Setka, G. B. Pasternack, and J. M. Wheaton. 2004. Predicting benefits of spawning-habitat rehabilitation to salmonid (*Oncorhynchus* spp.) fry production in a regulated California river. Canadian Journal of Fisheries and Aquatic Sciences 61(8):1433-1446.

Merz, J., L. Caldwell, M. Beakes, C. Hammersmark, and K. Sellheim. 2019. Balancing competing life-stage requirements in salmon habitat rehabilitation: between a rock and a hard place. Restoration Ecology 27(3)661-671.

Merz, J.E., G. B. Pasternack, and J. M. Wheaton. 2006. Sediment budget for salmonid spawning habitat rehabilitation in a regulated river. Geomorphology 76(1-2)207-228.

Moyle, P. B., and J. A. Israel. 2005. Untested assumptions: effectiveness of screening diversions for conservation of fish populations. Fisheries 30(5):20-28.

National Marine Fisheries Service (NMFS) Northwest Region. 2011. Anadromous salmonid passage facility design.

NMFS Southwest Region. 1997. Fish Screening Criteria for Anadromous Salmonids.

Norlund, B. 2008. Designing fish screens for fish protection at water diversions. National Marine Fisheries Service.

O'Donnell, T. K., and D. L. Galat. 2008. Evaluating success criteria and project monitoring in river enhancement within an adaptive management framework. Environmental Management 41:90–105.

Palmer, M. A., S. Filoso, and T. M. Fanelli. 2014. From ecosystems to ecosystem services: stream restoration as ecological engineering. Ecological Engineering, 65:62-70.

Reclamation. 2006. Fish protection at water diversions: a guide for planning and designing fish exclusion facilities. Water Resources Technical Publication.

Roncoroni, M., and S. N. Lane. 2019. A framework for using small Unmanned Aircraft Systems (sUASs) and SfM photogrammetry to detect salmonid redds. Ecological Informatics 53:100976.

Roni, P., T. Beechie, R. E. Bilby, F. E. Leonetti, M. M. Pollock, and G. R. Pess. 2002. A review of stream restoration techniques and a hierarchical strategy for prioritizing restoration in Pacific Northwest Watersheds. North American Journal of Fisheries Management 22:1–20.

Roni, P., K. Hanson, and T. Beechie. 2008. Global review of the physical and biological effectiveness of stream habitat rehabilitation techniques. North American Journal of Fisheries Management 28:856–890.

Roni, P., G. Pess, and S. Morley. 2010. Monitoring Salmon stream restoration: guidelines based on experience in the American Pacific Northwest. Salmonid Fisheries 119-147.

Sabal, M., S. Hayes, J. Merz, and J. Setka. 2016. Habitat alterations and a nonnative predator, the Striped Bass, increase native Chinook Salmon mortality in the Central Valley, California. North American Journal of Fisheries Management 36:309–320.

Schneider, C. A., W. S. Rasband, and K.W. Eliceiri. 2012. NIH Image to ImageJ: 25 years of image analysis. Nature methods 9:671-675.

Sellheim, K. L., M. Vaghti, and J. E. Merz. 2016. Vegetation recruitment in an enhanced floodplain: Ancillary benefits of salmonid habitat enhancement. Limnologica 58:94-102.

Sheaves, M. 2001. Are there really few piscivorous fishes in shallow estuarine habitats? Marine Ecology Progress Series 222:279–290.

Silva, A. T., M. C. Lucas, T. Castro-Santos, C. Katopodis, L. J. Baumgartner, J. D. Thiem, K. Aarestrup, P. S. Pompeu, G. C. O'Brien, D. C. Braun, N. J. Burnett, D. Z. Zhu, H.-P. Fjeldstad, T. Forseth, N. Rajaratnam, J. G. Williams, and S. J. Cooke. 2018. The future of fish passage science, engineering, and practice. Fish and Fisheries 19:340-362.

Simpson, W. G., and K. G. Ostrand. 2012. Effects of entrainment and bypass at screened irrigation canals on juvenile steelhead. Transactions of the American Fisheries Society 141(3):599-609.

Smith, E. P. 2002. BACI Design. Pg 141–148 in A. H. El-Shaarawi and W. W. Piegorsch, editors. Encyclopedia of Environmetrics. John Wiley & Sons, Ltd, Chichester, England.

Stewart-Oaten, A., W. W. Murdoch, and K. R. Parker. 1986. Environmental impact assessment: "psuedoreplication" in time? Ecology 67:929–940.

Stillwater Science. 2002. Merced River Corridor Restoration Plan.

Thielicke, W., and E. J. Stamhuis.. 2014. PIVlab – towards user-friendly, affordable and accurate digital particle image velocimetry in MATLAB. Journal of Open Research Software 2(1):e30.

Tockner, K., F. Malard, and J. V. Ward. 2000. An extension of the flood pulse concept. Hydrological Processes 14:2861–2883.

U.S. Army Corps of Engineers (USACE). 2001. Minimum standards for acceptance of preliminary wetland delineations. Sacramento District, Technical Memorandum. 30 November 2001.

U.S. Army Corps of Engineers (USACE). 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0). (J. S. Wakeley, R. W. Lichvas, and C. V. Noble, Eds.). ERDC/EL TR-08-28. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Wetland Training Institute (WTI). 1995. Field guide for wetland delineation; 1987. U.S. Army Corps of Engineers manual. Glenwood, New Mexico.

Ward, J. V., K. Tockner, and F. Schiemer. 1999. Biodiversity of floodplain river ecosystems: ecotones and connectivity. Regulated Rivers: Research & Management 15:125–139.

Wohl, E., P. L. Angermeier, B. Bledsoe, G. M. Kondolf, L. MacDonnell, D. M. Merritt, M. A. Palmer, N. L. Poff, and D. Tarboton. 2005. River restoration. Water Resources Research 41.

Wolman, M. G. 1954. A method of sampling coarse bed material. American Geophysical Union, Transactions 35(6):951-956.

Zeug, S. C., K. Sellheim, C. Watry, J. D. Wikert, and J. E. Merz. 2014. Response of juvenile Chinook Salmon to managed flow: lessons learned from a population at the southern extent of their range in North America. Fisheries Management and Ecology 21:155–168.