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

May 31, 2023

TO ALL INTERESTED PARTIES:

Following the requirements of the National Environmental Policy Act (NEPA), a draft Supplemental Environmental Assessment I (SEA) for the San Joaquin River Basin, Lower San Joaquin River (LSJR) Project, Tenmile Slough Reach 30L (TS30L) Levee Improvements in San Joaquin County, California has been prepared and is now available for public review and comment at:

San Joaquin Area Flood Control Agency
22 East Weber Avenue, Suite 301, Stockton, CA 95202

Cesar Chavez Central Library
605 North El Dorado Street, Stockton, CA 95202

or online at:
https://www.spk.usace.army.mil/Media/USACE-Project-Public-Notices/

The LSJR Project was authorized for construction in America's Water Infrastructure Act of 2018 (Public Law [P.L.] 115-270), which expedited the completion of the feasibility study as described in Section 1322(b)(2)(F) of the Water Resources Development Act of 2016 (P.L. 114-322). The SEA describes the project refinements developed since the 2018 LSJR Integrated Interim Feasibility Study/Environmental Impact Statement/Environmental Impact Report pertaining to the design and mitigation at TS30L. The refinements evaluated in the SEA include the identification of a borrow site, haul route, and staging areas; an improved road on the waterside easement; an updated and expanded levee footprint shifted toward the waterside; mitigation sites being considered as compensation for TS30L habitat impacts; and alternatives to the Fourteenmile Slough Valley Elderberry Longhorn Beetle mitigation site.

The public review period for the draft SEA is Wednesday, May 31, 2023 through 5:00 P.M. on Monday, July 17, 2023. Please send your written comments to:

U.S. Army Corps of Engineers, Sacramento District
Attn: LSJR Project, Reach TS30L
1325 J Street
Sacramento, CA 95814

or via email to SPK-PAO@usace.army.mil

Please also include the name of a contact person if submitting comments on behalf of an agency, tribal group, or organization. All comments received, including names and addresses, will become part of the official administrative record and may be available to the public.

Both an in-person and a virtual public meeting will be conducted to receive comments on the adequacy of the analysis included in the Draft SEA. The meetings will be held on Monday June 26, 2023 from 11:30 A.M. to 1:00 P.M. (virtual) and 6:30 P.M. to 8:30 P.M. (in-person).

To join the virtual meeting on your computer or Zoom mobile application, please use the following link: https://bit.ly/LSJRP-TS30L.

The in-person session will be held at Residence Inn by Marriott Stockton, 3240 W March Lane, Stockton, CA 95219.

Sincerely,

HARPER.MARSHALL.KEVIN.1536114358

Digitally signed by HARPER.MARSHALL.KEVIN.1536114358
Date: 2023.05.26 13:48:15 -07'00'

Kevin Harper
Chief, Environmental Resources Branch

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

DRAFT FINDING OF NO SIGNIFICANT IMPACT

San Joaquin River Basin, Lower San Joaquin River, California, Project Tenmile Slough Reach 30L Supplemental Environmental Assessment I

The U.S. Army Corps of Engineers, Sacramento District (USACE) has prepared a Draft Supplemental Environmental Assessment (SEA) in accordance with the National Environmental Policy Act of 1969, as amended (NEPA). The San Joaquin River Basin, Lower San Joaquin River, California Project (Project) was authorized for construction by America's Water and Infrastructure Act of 2018 (P.L. 115-270) and will decrease the annual chance of flooding in North and Central Stockton. The enclosed Draft SEA supplements the San Joaquin River Basin, Lower San Joaquin River, CA Final Integrated Interim Feasibility Report/Environmental Impact Statement/Environmental Impact Report (LSJR IIFR/EIS/EIR), dated January 2018. The Draft SEA specifically addresses design refinements at Tenmile Slough, Reach 30L (TS30L) and the associated construction mitigation. TS30L will be the first reach of the Project to be constructed, and this Draft SEA is the first supplemental NEPA document to the 2018 LSJR IIFR/EIS/EIR. Subsequent Project reaches will require further environmental review as their designs are refined, which may result in the creation of additional supplemental documentation.

The Draft SEA, incorporated herein by reference, evaluated various alternatives that would reduce flood risk in the project area and mitigate for project impacts. The Proposed Action includes:

- Updated and expanded levee footprint shift towards waterside
- Improved road on the waterside easement of the levee
- Haul routes
- Two staging areas
- Stockton East Water District borrow site
- Alternatives to the Fourteenmile Slough Valley elderberry longhorn beetle mitigation site
- Mitigation sites proposed for TS30L habitat impacts
- Implementation of any required environmental compensatory mitigation and associated monitoring and mitigation area adaptive management plan, when applicable and appropriate. Monitoring will continue until any required mitigation has been determined to be successful based on the identified criteria within the Lower San Joaquin River Project Compensatory Mitigation Plan. Monitoring is expected to last no more than 10 years.

In addition to a "no action" alternative, the Proposed Action was evaluated. The no action alternative included the construction of Reach TS30L as described in Alternative 7a of the San Joaquin River Basin, Lower San Joaquin, CA Final IIFR/EIS/EIR. The Proposed Action includes elements developed which would modify the design of TS30L as compared to the 2018 LSJR IIFR/EIS/EIR (see Chapter 2 of the SEA).

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the Proposed Action are listed in Table 1:

Table 1: Summary of Potential Effects of the Recommended Plan

	Insignificant effects	Insignificant effects as a result of mitigation*	No effect to resource beyond what is described in the 2018 LSJR IIFR/EIS/EIR
Aesthetics	☒	☐	☐
Air Quality and GHG Emissions	☐	☒	☐
Wetlands and Other Waters of the U.S.	☒	☐	☐
Fisheries	☐	☐	☒
Vegetation and Wildlife	☐	☒	☐
Federal Special Status Species	☐	☒	☐
Cultural Resources	☒	☐	☐
Public Health and Environmental Hazards	☐	☐	☒
Hydrology and Hydraulics	☐	☐	☒
Land Use	☒	☐	☐
Noise	☒	☐	☐
Utilities and Public Services	☒	☐	☐
Socioeconomics and Environmental Justice	☒	☐	☐
Soils and Mineral Resources	☐	☐	☒
Water Quality	☐	☐	☒
Geology and Geomorphology	☐	☐	☒
Seismicity	☐	☐	☒
Groundwater	☐	☒	☐
Recreation	☐	☐	☒
Transportation and Circulation	☒	☐	☐

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the Proposed Action. Best management practices (BMPs) as detailed in the SEA will be implemented, if appropriate, to minimize impacts. Measures to reduce the effects to Air Quality and GHG Emissions include the required use of off-road equipment that meets Tier 4 emission standards, equipping vehicles and equipment with functioning emission-control devices, and implementation of dust abatement practices (see SEA Section 3.13.3). In order to reduce effects to Vegetation and Wildlife and Federal Special Status Species, a mitigation site including riparian and wetland habitat would be constructed in order to replace the habitat removed for the construction of TS30L. The selected mitigation site would be located in an area where the hydrology and topography would support riparian vegetation, and wetland areas would be graded to support wetland hydrology and associated vegetation. Plantings would be irrigated by drip irrigation to minimize water usage, reducing impacts to Groundwater resources.

Alternative 7a as described in the 2018 LSJR IIFR/EIS/EIR will result in unavoidable adverse impacts to Federal Special Status Species and Vegetation and Wildlife. The mitigation strategy proposed in that report included purchasing credits to compensate for impacts to the giant garter snake (*Thamnophis gigas*, GGS), transplanting elderberry shrubs to the setback levee at Fourteenmile Slough to reduce impacts to the Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*, VELB), and purchasing credits to compensate for the loss

of riparian and wetland habitat. The Project construction sequencing has changed, and TS30L will be constructed prior to the construction of the Fourteenmile Slough setback levee. In order to reduce effects to VELB, the elderberry shrubs within the TS30L construction footprint will instead be transplanted to a mitigation bank approved by the U.S. Fish and Wildlife Service (USFWS). Additionally, sufficient riparian and wetland habitat credits are unavailable for purchase. Therefore, in order to mitigate for the loss of such habitat in the TS30L footprint, the USACE will construct a habitat mitigation site with sufficient habitat acreage to meet the ratios recommended by FWS in the Fish and Wildlife Coordination Act Report. Four sites that would meet the mitigation needs of the project are under consideration; one site will be selected prior to construction.

Public review of the draft SEA and FONSI was completed on **DATE DRAFT EA AND FONSI REVIEW PERIOD ENDED**. All comments submitted during the public review period will be responded to in the Final SEA and FONSI.

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, USFWS issued a biological opinion, dated **DATE OF BIOP**, that determined that the recommended plan will not jeopardize the continued existence of the following federally listed species or adversely modify designated critical habitat: giant garter snake (*Thamnophis gigas*), Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). All terms and conditions, conservation measures, and reasonable and prudent alternatives and measures resulting from these consultations shall be implemented in order to minimize take of endangered species and avoid jeopardizing the species.

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the USACE determined that historic properties would not be adversely affected by the Proposed Action. The California State Historic Preservation Office concurred with the determination for the TS30L project footprint on 28 September 2021, for the proposed borrow site on 1 December 2021, for Parcel C and Wright-Elmwood Tract on 8 July 2022. For the proposed mitigation parcels A and B, the SHPO stated they would be unable to provide concurrence within 30 days of submittal of the consultation letter from USACE. Per the Project's Programmatic Agreement, failure of the SHPO to respond within 30 days would not preclude USACE from moving forward. On 18 April 2023, USACE advised the SHPO that a response would no longer be required, and the SHPO accepted this conclusion on the same date. Each of these correspondences can be found in Appendix D of the SEA.

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the Proposed Action has been found to be compliant with section 404(b)(1) Guidelines (40 CFR Part 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in **ENTER SECTION OR APPENDIX WITH 404(B)(1) EVALUATION** of the SEA.

A water quality certification pursuant to section 401 of the Clean Water Act will obtained from the Central Valley Regional Water Quality Control Board prior to construction of the selected mitigation site, if needed, and all conditions of the certification would be implemented in order to minimize adverse impacts to water quality.

All applicable environmental laws have been considered and coordination with appropriate agencies and officials has been completed. A comprehensive discussion of environmental compliance is included in Chapter 5 of the SEA.

All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Based on this report, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the Proposed Action would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date

Chad Caldwell
Colonel, Corps of Engineers
District Commander

DRAFT

Supplemental Environmental Assessment I

San Joaquin River Basin, Lower San Joaquin River, California Project
Tenmile Slough Reach 30L Levee Improvements



May 2023

US Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814

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ACRONYMS AND ABBREVIATIONS

APE	Area of Potential Effects
BO	Biological Opinion
BP	before present
CAA	Clean Air Act
CAR	Coordination Act Report
CARB	California Air Resource Board
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH_4	methane
City	City of Stockton
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
County	County of San Joaquin
CVFPB	Central Valley Flood Protection Board
CWA	Clean Water Act
Delta	Sacramento-San Joaquin Delta
DWR	California Department of Water Resources
EFH	Essential Fish Habitat
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
EJ	Environmental Justice
EO	Executive Order
EP	Engineer Pamphlet
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ETL	Engineer Technical Letter
Farmland	Prime Farmland, Unique Farmland, or Farmland of Statewide Importance
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
IIFR/EIS/EIR	Integrated Interim Feasibility Report/Environmental Impact Statement/Environmental Impact Report
GGS	giant garter snake
GHG	Greenhouse gas
HEP	Habitat Evaluation Procedure
I-5	Interstate 5
LERRD	Lands, Easements, Rights-of-Way, Relocations, and Disposal
LESA	Land Evaluation and Site Assessment
LSJR	Lower San Joaquin River

MBTA	Migratory Bird Treaty Act
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
N_2O	nitrous oxide
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
O&M	operations and maintenance
PA	Programmatic Agreement
PG&E	Pacific Gas and Electric Company
Phase I ESA	Phase I Environmental Site Assessment
P.L.	Public Law
PM	particulate matter
PM_{10}	PM equal to or less than 10 micrometers in diameter
$PM_{2.5}$	PM equal to or less than 2.5 micrometers in diameter
RCEM	Road Construction Emission Model
RD	Reclamation District
Reclamation	U.S. Bureau of Reclamation
SC-GHG	Social cost of greenhouse gases
SEA	Supplemental Environmental Assessment
SEWD	Stockton East Water District
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJAFCA	San Joaquin Area Flood Control Agency
SJR	San Joaquin River
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	sulfur dioxide
SPRR	Southern Pacific Railroad Company
SR	State Route
SSFM	Sanitary Sewer Force Main
SWPPP	Stormwater Pollution Prevention Plan
tpy	tons per year
TS30L	Tenmile Slough, Reach 30L
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VELB	Valley Elderberry Longhorn Beetle
VFZ	vegetation free zone
WAPA	Western Area Power Administration

Chapter 1 INTRODUCTION

1.1 Summary

The Lower San Joaquin River (LSJR), California, Project (Project) is a cooperative flood risk management effort by the U.S. Army Corps of Engineers (USACE) with its non-Federal sponsors (NFS) – the San Joaquin Area Flood Control Agency (SJAFCA) and the Central Valley Flood Protection Board (CVFPB), represented by California Department of Water Resources (DWR) – to reduce flood risk in the Stockton area. Seven alternatives were evaluated in a Final Integrated Interim Feasibility Report/ Environmental Impact Statement/Environmental Impact Report (IIFR/EIS/EIR), finalized January 2018. Alternative 7a was identified as the recommended alternative and includes construction of two closure structures, one on Fourteenmile Slough and one on Smith Canal, as well as levee repairs and new levee construction along 23 miles of the Delta Front, Calaveras River, San Joaquin River, French Camp Slough, Mosher Slough, and Duck Creek. The Chief's Report for the LSJR study was signed on July 31, 2018.

The 2018 LSJR IIFR/EIS/EIR discussed the overall impacts of the proposed levee repairs and closure structures but left specific details to be analyzed during design of each of the reaches. These include Project design elements such as borrow sites, haul routes, staging areas, and the final footprint. Additionally, environmental and cultural resource impacts were largely conducted by desktop analysis, with detailed field surveys to be conducted prior to Project construction. This Supplemental Environmental Assessment (SEA) supplements the 2018 LSJR IIFR/EIS/EIR and analyzes impacts from the proposed design refinements at Tenmile Slough, Reach TS30L (TS30L). This Draft SEA is the first supplemental document for the Project prepared in compliance with the National Environmental Policy Act (NEPA). Subsequent Project reaches will require further environmental review as their designs are refined, which may result in the creation of additional supplemental documentation.

The recommended plan in the 2018 LSJR IIFR/EIS/EIR for TS30L included fix-in-place improvements consisting of a cutoff wall, geometry improvements, all weather maintenance access roads, and erosion protection. The following elements not discussed in the 2018 LSJR IIFR/EIS/EIR, but refined and updated during design, are analyzed in this SEA: the Stockton East Water District (SEWD) borrow site and haul route, two staging areas, an improved road in the waterside easement, and a levee footprint shifted towards the waterside. Furthermore, the 2018 LSJR IIFR/EIS/EIR described a 14-acre mitigation site created by a setback levee at Fourteenmile Slough to receive the elderberry shrubs identified in Alternative 7a. Mitigation for impacted riparian and wetland habitats was to be accomplished through the purchasing of credits. Due to Project sequencing, the Fourteenmile Slough mitigation site has not been constructed yet. Additionally, credits for riparian and wetland habitats are not available for purchase at this time. USACE is considering constructing a new mitigation site to compensate for levee construction impacts to riparian and wetland habitats. These elements will be referred to as the Proposed Action.

1.2 Authority

Alternative 7a was authorized for construction in America's Water Infrastructure Act of 2018 (Public Law [P.L.] 115-270), which expedited the completion of the feasibility study and allowed the study to proceed directly to the preconstruction, engineering, and design phase of the Project, as described in Section 1322(b)(2)(F) of the Water Resources Development Act of 2016 (P.L. 114-322).

1.3 Project Purpose

The overall purpose of the Lower San Joaquin levee improvements is to decrease flood risk by decreasing the annual chance of flooding in North and Central Stockton. The improvements specific to TS30L address flood risk from the Sacramento - San Joaquin Delta, a large, tidally-influenced region over 1,000 square miles in area, and its tributaries. The Delta is fed by the Sacramento and San Joaquin Rivers, which receive runoff from winter storms and spring snowmelt from California's Central Valley and Sierra Nevada mountains. Reach TS30L is located along the Delta Front, a region that was determined by USACE, SJAFCA, and CVFPB to pose the greatest flood risk.

1.4 Need for Action

The 2018 LSJR IIFR/EIS/EIR did not identify specific Project elements, such as the borrow site location and haul routes, staging area locations, the specific levee footprint, and it described a different mitigation strategy. The general levee improvements were described for TS30L, but the final footprint was not yet known. The 2018 LSJR IIFR/EIS/EIR stated that placement of new material for levee slope reshaping was to occur on the landside of the levees. Due to the proximity of residential property lines to the landside toe, placing material and expanding the levee toward the landside is not feasible.

For mitigation, the 2018 LSJR IIFR/EIS/EIR stated that elderberry shrubs would be transplanted to a new mitigation site created by a setback levee at Fourteenmile Slough; however, the setback and mitigation area will not be constructed in time to receive the transplants. Permanent impacts to riparian and wetland habitat were to be compensated for through the purchase of credits at mitigation banks, which were available at the time of the 2018 LSJR IIFR/EIS/EIR. However, by the time of the Project's design, sufficient riparian and wetland mitigation credits were no longer available to compensate for impacts, therefore USACE and its NFS must formulate a new strategy to mitigate for impacts at Reach TS30L.

1.5 Proposed Action

The Proposed Action consists of the following elements associated with Reach TS30L that were not analyzed in the 2018 LSJR IIFR/EIS/EIR:

- A borrow site located nine miles east of TS30L, owned by SEWD

- Proposed haul route to transport materials from the borrow site to the construction site
- Two construction staging areas
- Improved all-weather access road within the 15-foot waterside easement
- Updated levee footprint resulting from the placement of material associated with the slope reshaping on the waterside slope instead of the landside, shifting the levee centerline towards the waterside
- Alternatives to Fourteenmile Slough Valley Elderberry Longhorn Beetle (VELB) mitigation site
- Sites being considered for mitigation construction for TS30L habitat impacts

1.6 Proposed Action Area

The Proposed Action is located in the City of Stockton in San Joaquin County, California (Figure 1). Reach TS30L is located on the west side of Stockton between Fourteenmile Slough and the San Joaquin River in an area referred to as the Delta Front. Reach TS30L is a dryland levee with a north-south orientation and is 5900 feet in length. The Brookside neighborhood is immediately to the east of TS30L (landside), and rice fields lie to the west (waterside). Farther west, beyond the rice fields, lies the San Joaquin Delta. An irrigation ditch parallels the levee along the entire length. The southern staging area is 1.7 acres in area and is located on March Lane, just to the east of TS30L. This staging area is owned by the City of Stockton and is considered part of the existing road right-of-way. The northern staging area is 9.8 acres and will be located on the adjacent rice field west of TS30L. The 110-acre SEWD borrow site is located among agricultural fields nine miles to the east of TS30L, requiring a haul route which crosses the city in an east to west direction. Potential mitigation sites are situated adjacent to the levee or at offsite locations within 3 miles.

1.7 Prior NEPA Documents

This SEA describes the first reach of the Lower San Joaquin River Project. The 2018 LSJR IIFR/EIS/EIR analyzed this reach using a conservative approach using typical cross sections and footprints for levee reaches, with the understanding that further design refinements would be completed during the reach design with the development of supplemental NEPA/CEQA documentation as needed.

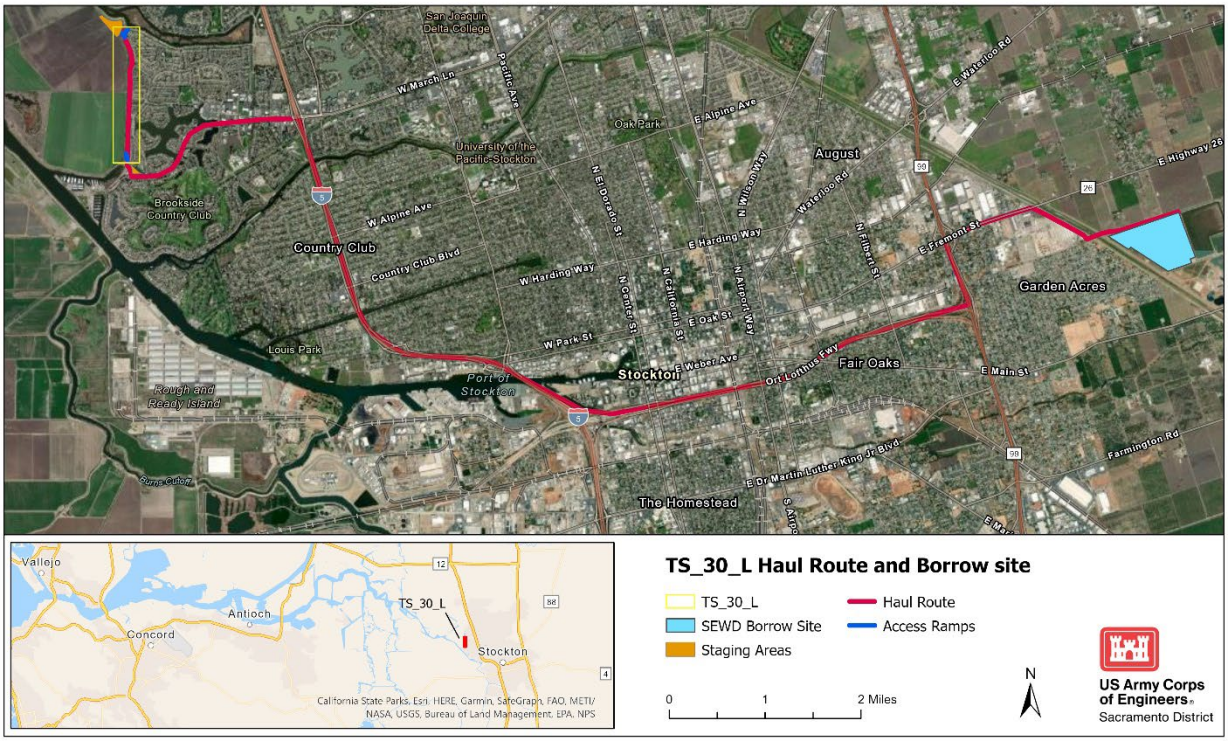


Figure 1. Location of Reach TS30L, staging areas, and haul route to and from SEWD borrow site.

1.8 Purpose of this SEA and Decision Needed

Under NEPA guidelines, a SEA is prepared to evaluate potential impacts of Project changes made after a Record of Decision. This SEA describes the refinements developed since the 2018 LSJR IIFR/EIS/EIR pertaining to the design and mitigation for the Reach TS30L levee improvements. The environmental effects of the Proposed Action and No Action Alternative are analyzed and disclosed for public review. Measures to lessen and mitigate for adverse environmental effects of the Proposed Action have been identified in order to ensure environmental effects are less than significant. This draft SEA will be released for a 45-day public review period from May 31 to July 17, 2023 to align with the California Environmental Quality Act (CEQA) addendum review period. All public comments received and responses to the comments will be included in Appendix A, Public Comments and Responses.

The District Engineer, Commander of the Sacramento District, must decide whether the Proposed Action qualifies for a Finding of No Significant Impact (FONSI) under NEPA guidelines, or whether a Supplemental EIS must be prepared.

Chapter 2 ALTERNATIVES

2.1 No Action Alternative

The No Action Alternative assumes the Reach TS30L levee improvements are constructed as described in Alternative 7a in the 2018 LSJR IIFR/EIS/EIR. The general levee improvements at TS30L included in Alternative 7a and analyzed in the 2018 IIFR/EIS/EIR were cutoff wall construction, geometry improvements (slope reshaping), and installation of waterside erosion protection. The improvements included construction of 20-foot-wide access roads on the levee crest and along the landside easement. The geometry improvements would entail clearing and grubbing the waterside levee crest edge and landside slope, then adding material to the landside levee slope to meet USACE levee design criteria for side slopes and crown width. Erosion protection (riprap) would be placed on the waterside slope at a thickness of two feet. The 15-foot waterside easement would be reseeded with native grasses and forbs to comply with USACE guidelines for levee vegetation unless a design deviation was granted to allow woody vegetation. To accommodate levee improvements, all vegetation within the grading limits would be removed.

Consistent with the original designs, a soil bentonite slurry seepage cutoff wall would be installed to an average depth of 21 feet below current ground surface. To construct the cutoff wall, the levee would be degraded by one-third to one-half of its current height. Then, a 12-foot-wide trench would be excavated in the levee centerline and filled with slurry. The trench would remain filled with slurry until the full depth of 21 feet below ground surface is reached. Subsequently, the soil bentonite mix would be used to backfill the trench and displace the slurry. After the soil-bentonite has cured, the levee would be reconstructed.

Borrow sites, haul routes, and staging areas were not known at the time the 2018 LSJR IIFR/EIS/EIR was published, and thus were not described in that document. Mitigation for elderberry shrubs was to occur by creating a levee setback at Fourteenmile Slough, the levee reach immediately to the north of TS30L. This 14-acre mitigation site was to receive transplanted elderberry shrubs and plantings of other riparian vegetation. Mitigation for impacts to wetland and riparian habitats were to be accomplished by purchasing mitigation bank credits.

2.2 Proposed Action

The Proposed Action consists of the following elements not previously analyzed due to new information developed during design: the borrow site and haul routes, two staging areas, refinements to the levee design, and mitigation sites for environmental impacts.

2.2.1 Staging Areas, Stockton East Water District Borrow Site, and Haul Routes

The staging areas, SEWD borrow site, and haul routes are depicted in Figure 1. The borrow site is located 11 miles east of TS30L on 110 acres of agricultural land; fill

material will be hauled by truck from this location in order to construct the levee improvements. The haul route from this property will utilize SEWD-owned roads, then cross over the Stockton Diverting Canal before using public streets to cross the city. The route will then follow Cardinal Avenue to State Route (SR) 26, then SR 99, SR 4, Interstate 5 (I-5), and the West March Lane exit. March Lane leads directly to the southern end of Reach TS30L. The borrow site will be used by the SEWD as a groundwater recharge basin after construction is completed.

The term “staging area” refers to areas used during construction for purposes such as storing equipment and supplies, stockpiling and processing of materials, parking, and construction offices. Their use is temporary and will be restored upon completion of construction. The southern staging area is a 1.7-acre corner lot located adjacent to March Lane and Brookside Road. The northern staging area is 9.8 acres and is located in a rice field at the northern end of Reach TS30L. The northern staging area will be allowed to dry and then leveled to facilitate equipment access. Temporary piping will be installed to convey water from an irrigation ditch along the perimeter to the surrounding rice fields. The existing 30-inch sanitary sewer force main would be protected and an adequate safety buffer would be maintained at all times. Both staging areas will require the construction of temporary access ramps. After construction is complete, the staging areas will be returned to preexisting conditions in which the landowner may continue its use for agriculture.

Riprap will be sourced from one or more commercial sources from the greater Stockton area or the Sierra foothills. All trips will utilize March Lane to access Reach TS30L.

2.2.2 Refinements to the Levee Design

The proposed improvements for TS30L (Figure 2) described under Alternative 7a in the 2018 LSJR IIFR/EIS/EIR include a cutoff wall, geometry improvements, and erosion protection. Geometry improvements involve clearing and grubbing the waterside levee crest edge and landside slope, then adding material to the landside to meet USACE levee design criteria for side slopes and crown width. Levees would have two access roads located along the levee crown and within the landside levee toe access easement. Erosion protection (riprap) would be placed on the waterside slope at a thickness of two feet.

During TS30L design, the levee was redesigned to achieve a waterside slope of 2.5H:1V and a landside slope of 3H:1V, reshaped from the current 3H:1V and 2H:1V, respectively. The reshaped levee would have a wider profile, with the levee centerline shifted 20 feet towards the waterside. The landside levee toe will be shifted 10 feet towards waterside to accommodate the 15-foot landside access road. The 2018 LSJR IIFR/EIS/EIR had previously described changes in levee slope and width as primarily occurring on the landside; in the current design, material will be added to the waterside in order to avoid impacting the residential neighborhood to the east.

Following levee reconstruction, rockslope protection consisting of a 2-foot-thick layer of 12-inch diameter riprap would be added to the waterside along its length from the crown to the patrol road. Riprap will be sourced from one or more commercial sources from the greater Stockton area or the Sierra foothills. The landside slope would be armored with 3 inches of 3/4-inch aggregate from the crown to the patrol road.

The levee crown would be armored with 6-inch-thick aggregate base covered with triple-pass chip seal to form the levee road The existing waterside agricultural ditch would be replaced upon completion of construction waterward of the new patrol road. The waterside patrol road would be slightly elevated above ground surface upon completion of the improvements to prevent flooding from the agricultural ditch. The waterside patrol road and land side patrol road and access ramps will be surfaced with 4” of aggregate base.

Piezometers would be installed along the new waterside toe, just inland of the patrol road, to a depth of approximately 6 to 10 feet below ground surface spaced every 500 feet to monitor soil pore pressure and compaction. The top of the piezometers would be at grade level. The piezometer network would remain in perpetuity.

Construction of the levee improvements would likely be phased as follows: mobilization, vegetation removal, earthwork to degrade the levee and move the levee centerline westward, installation of cutoff wall, levee reconstruction and compaction, placement of erosion protection, installation of maintenance roads, installation of piezometers, demobilization, and site clean-up.

USACE policy requires that new projects comply with Engineer Pamphlet (EP) 1110-2-18, which requires that levees be clear of woody vegetation that might impair levee integrity or maintenance access. This vegetation free zone (VFZ) extends 15 feet from the water side and 10 feet from the land side toes of the levee and includes the levee slopes and crown. Note that the 2018 LSJR IIFR/EIS/EIR discusses compliance with Engineer Technical Letter (ETL) 1110-2-583, which expired in 2019 and was superseded by EP 1110-2-18. Conversion from ETL 1110-2-583 to EP 1110-2-18 consisted of formatting changes only; no policy or substantive changes were incorporated in EP-1110-2-18.



Figure 2. Reach TS30L proposed footprint, including staging area locations, construction work area, new levee toe location and levee patrol roads.

The 2018 LSJR IIFR/EIS/EIR stated that all levees will be evaluated during the planning and design phase for suitability for a design deviation to allow 25% of woody vegetation on the 15-foot waterside easement and lower half of the waterside slope. If a design deviation is not granted, the VFZ would be seeded with a mixture of native grasses and forbs. A design deviation was not sought for TS30L because nearly all waterside vegetation will be removed from the levee slopes in order to accommodate the widening of the levee and the placement of riprap.

2.2.3 Mitigation for Environmental Impacts

Estimated permanent habitat impacts from the TS30L levee improvements include approximately 11.4 acres of riparian, 0.6 acres of wetland and giant garter snake (GGS) habitat, and ten elderberry shrubs, the host plant for the federally-threatened Valley Elderberry Longhorn Beetle (VELB). The riparian habitat consists of forest cover and Shaded Riverine Aquatic cover while the wetland patches are semi-perennial waters of an agricultural drainage ditched used by the adjacent rice field. Mitigation bank credit purchases were the proposed mitigation strategy for riparian, wetland, and GGS habitats in the 2018 LSJR IIFR/EIS/EIR, and elderberry shrubs were to be transplanted to a 14-acre mitigation area created by a levee setback at Fourteenmile Slough, located just to the northwest of Reach TS30L. However, riparian and wetland mitigation bank credits are not available, and the Fourteenmile Slough mitigation area will not be created prior to the TS30L construction. Per the 2016 Biological Opinion (BO) for the Lower San Joaquin River Feasibility Study, an up-front mitigation credit purchase for GGS has been completed prior to construction.

To provide compensatory mitigation for the riparian and wetland acreages, USACE proposes to construct one or more mitigation sites (Figure 3) to reestablish the habitat values to be impacted by Reach TS30L construction as part of the Proposed Action. The ten elderberry shrubs currently growing along the levee would be transplanted to an approved mitigation bank, and VELB credits would be purchased to cover impacts to that species.

A Habitat Evaluation Procedure (HEP) evaluation is being conducted at Reach TS30L by the U.S. Fish and Wildlife Service (USFWS) in order to inform the mitigation acreage needed. Properties being considered for mitigation would require USFWS approval and would be restored with USFWS input. Generally, properties adjacent to the impacted areas require less acreage to compensate for Project impacts. After construction, the mitigation site would become new riparian and wetland habitat, planted with native riparian trees, shrubs, and wetland vegetation. Elderberry plantings would be included in this mitigation site to minimize the number of VELB credits required. The created habitat would be protected in perpetuity.

The properties being considered are located on farmland within 3 miles of TS30L (Figure 3). The following mitigation options are being considered:

<u>Mitigation Option 1 – On-Site:</u> This option would create a mitigation site immediately adjacent to Reach TS30L and would require purchasing in fee approximately 25 acres

of privately-owned rice field. The exact acreage would be informed through input from the USFWS. On-site mitigation would likely require the lowest acreage because it is preferable to replace lost habitat in the same location. The mitigation site, depicted in Figure 3, would consist of a linear corridor immediately to the west of the levee toe and, after levee construction is completed, would overlay the northern staging area. An irrigation ditch and farm road, which lie between the levee and the rice fields, would be relocated outside the mitigation area. This measure would require maintaining a 30-foot sanitary sewer force main easement which bisects the corridor, upon which access for large vehicles must be maintained and no woody or wetland vegetation could be established. City of Stockton plans on installing a second future sanitary sewer force main that will run parallel to the existing sewer force main. They may also install a third main in the future, which would require additional land acquisition and easement area.

Mitigation Option 2 – Off-Site: Under Option 2, a mitigation site would be within 3 miles of Reach TS30L, requiring either the purchase in fee of private farmland or other open private land, or by obtaining a conservation easement on public land, or both. Offsite locations would require higher acreages in order to compensate for the distance from the impacted habitat. The following sites are currently under consideration:

Parcel A, San Joaquin River (SJR) East Site: This privately-owned 50-acre parcel is the closest to TS30L, at approximately 0.7 miles away. It surrounds the Pace Preserve, a 40-acre mitigation site managed by the Center for Natural Lands Management. It is currently planted with young olive trees and high voltage power lines run across the eastern portion of the site. The area beneath the power lines contains Western Area Power Administration (WAPA) and Pacific Gas and Electric (PG&E) easements, which would not be allowed to contain tree plantings. A levee separates the southwest edge of this parcel from the San Joaquin River. Habitat restoration would entail removing the olive trees, establishing wetland habitat (18 acres) within the easement area, and riparian (20 acres) habitat in the non-easement areas. The site could also provide GGS and VELB habitat.

Parcel B, SJR West Site: This privately-owned 257-acre parcel is located 1.7 miles from TS30L at the confluence of the San Joaquin River and White Slough but is separated from those waterbodies by a levee. Portions of the site are used as hay fields and the portions closest to the levee are fallow. Numerous irrigation ditches run through the site. Only 50 acres of the parcel would be acquired for mitigation. Habitat restoration plans include 2 acres of wetland habitat and 42 acres of riparian habitat. The site could also provide GGS and VELB habitat.

Parcel C, Fourteenmile Slough Pump Station: This 114-acre parcel is owned by the City of Stockton and is located adjacent to a wastewater pump station at the confluence of 14 Mile Slough and White Slough. A Phase 1 Environmental Site Assessment (Phase 1 ESA) was conducted in October 2022. The parcel was formerly used as sewage disposal ponds in the 1960s but is now covered in grass and shrub vegetation. Due to its former use, there is potential for contamination at this site. A Phase 2 Environmental Site Assessment will be

performed and is scheduled for June 2023. The assessment would reveal the extent of contamination, if any. High voltage power lines run across the western portion of the parcel, with the associated WAPA and PG&E easements. Seventy-five acres would be acquired for mitigation, either purchased in fee or held by the City of Stockton under a conservation easement and protected in perpetuity. Habitat restoration plans include establishing 7 acres of wetland habitat within the powerline easements and 63 acres of riparian habitat on the remaining area. The site could also provide GGS and VELB habitat.

Timing, legal and policy requirements, and scientific and technical standards have been used to develop screening criteria and would be used in mitigation site selection with consideration to circumstances and opportunities. Specifically, the following factors are included in screening criteria:

- It is USACE policy to acquire lands or interests in land for mitigation prior to construction of the project commences and the physical construction of the mitigation work is required to be carried out before or concurrently with project construction (Section 906(a) of WRDA 1986, as amended).
- Larger contiguous tracts may offer better habitat value to wildlife compared to smaller dispersed areas.
- If private land is used, it must be acquired in fee.
- For mitigation parcels to succeed, irrigation is required for the first 3-5 years; therefore, water rights must be included with the property.
- Since the mitigation must remain in perpetuity, a conservation easement is required for public land acquisitions.
- The greater the distance a proposed mitigation site is from the project impacts, the higher the mitigation ratio will be.
- Proposed mitigation sites adjacent to sites with an existing source population of a target species are presumed to have higher value than those more isolated.
- Proposed mitigation sites which offer connectivity for populations of target species or wildlife in general are presumed to have higher value than those more isolated.
- Climate change should be considered for the future sustainability of the proposed site.

After a mitigation site has been selected, additional studies would be conducted as part of developing detailed designs for the mitigation construction. These studies may include additional geotechnical analysis, hydraulic analysis, localized erosion and related sedimentation analysis, topographic and ground surveys, preconstruction surveys to avoid direct impacts to nesting birds and other sensitive species, and cultural resource surveys as appropriate.

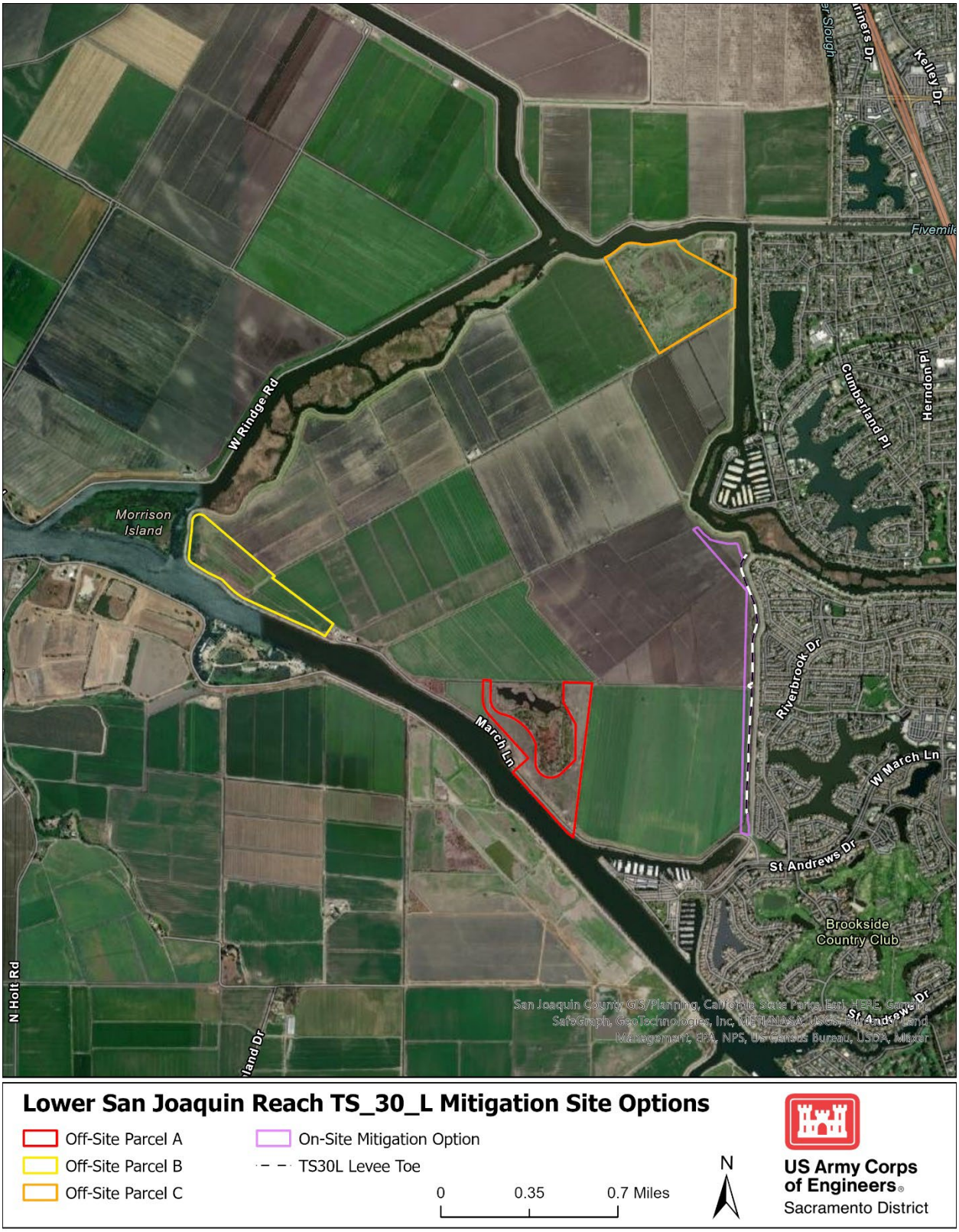


Figure 3. Mitigation site options being considered to compensate for environmental impacts caused by Reach TS30L construction.

It is expected that construction of the selected mitigation site would begin in May 2024. Soil surveys and professional elevation surveys would be conducted at the selected mitigation site to determine if soils would require amendment and depth to groundwater. Construction of the mitigation site would require minor earthwork to bring the site to appropriate grade. Material removed to lower grades to the appropriate elevation would be reused on other areas of the parcel to raise elevations. It is not anticipated that any material would need to be imported or exported from the site to achieve the habitat goals. Any existing ditches would be enhanced into wetlands and riparian habitat would be planted in the remainder of the site. Existing native trees would be retained, non-native and invasive species would be removed. Plant material would be sourced from local native plant nurseries; in the event a species of interest could not be acquired locally, the plants would be grown out by the contractor. Following earthwork and planting, beaver exclusion fencing, and deer friendly fencing would be placed around the perimeter of the site to allow plants to establish. Irrigation lines would be installed to ensure plant establishment. Following the plant establishment period, the fencing and irrigation lines would be removed. It is estimated that the plant establishment period would last between 3-to-5-years; however, achievement of ecological success criteria would be the determining factor in completion of the plant establishment period. Ecological success criteria would be developed jointly between USACE and USFWS in the long-term habitat management plan.

Maintenance and access roads would remain on the site. Signage designated the area as sensitive habitat would be installed around the site and remain in perpetuity.

2.2.4 Ongoing Operations and Maintenance Activities

Actions to maintain the levee in the proposed condition in perpetuity would include, but not be limited to, the following:

- Grouting of rodent burrows;
- Mowing of landside vegetation up to two times per year;
- Replacement of riprap, as needed; up to 600 cubic yards of material per occurrence;
- Replacement of aggregate, as needed; up to 600 cubic yards of material per occurrence;
- Replenishment of chip seal;
- Repair and re-compaction of patrol roads, up to one cumulative mile per occurrence;
- Removal of encroachments (fences, decks, patios, etc.), as needed;
- Removal of woody vegetation from the levee crown and slopes, up to twice per year;
- Noxious weed abatement, about twice per year, but more frequently as needed;
- Repairs to the levee structure during emergency flood operations including sandbagging on the landside, as needed;
- Minor repair and replacement of piezometer network; and,
- Personnel access for inspections, minimum of twice per year, but likely more often.

Chapter 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Approach to Analysis

Alternative 7a, the recommended alternative in the 2018 LSJR IIFR/EIS/EIR, is the No Action Alternative for this SEA. The existing conditions and regulatory setting were fully described in the above document. The resource impacts were sufficiently analyzed as well, with the exception of impacts related to the Proposed Action. The avoidance, minimization, and mitigation measures described in the 2018 LSRP IIFR/EIS/EIR are applicable to the No Action Alternative and the Proposed Action. As a supplemental NEPA document, this SEA focuses its analysis on changes to the No Action Alternative; specifically the SEWD borrow site, haul routes, staging areas, waterside patrol road, refinements to the levee design, and environmental mitigation. The following resources are likely to be affected by the Proposed Action: Groundwater, Wetlands and other Waters of the United States, Aesthetic Resources, Vegetation and Wildlife, Federal Special Status Species, Socioeconomics and Environmental Justice, Utilities and Public Service, Land Use, Transportation and Circulation, and Air Quality and Greenhouse Gas Emissions.

3.2 Regulatory Setting

The Affected Environment and Environmental Consequences chapter of the 2018 LSJR IIFR/EIS/EIR adequately characterizes the regulatory setting for each resource affected by the Proposed Action.

3.3 Resources Not Discussed in Detail

The following resources were eliminated from further analysis in this SEA because effects are negligible or the refinements described in the Proposed Action would not create additional impacts to these resources: geology and geomorphology; seismicity; soils and mineral resources; hydrology and hydraulics; water quality; fisheries; recreation; noise; and public health and environmental hazards. These resources and their previous analyses are shown in Table 1. Note that these resources would still have effects under the No Action Alternative, however they are not being discussed further as they have been sufficiently discussed in the 2018 LSJR IIFR/EIS/EIR.

Table 1. Resources not discussed in detail in this document and where to find previous analyses

Resource	Section of 2018 LJSR IIFR/EIS/EIR
Geology and Geomorphology	5.1
Seismicity	5.2
Soils and Mineral Resources	5.3
Hydrology and Hydraulics	5.4
Water Quality	5.5
Fisheries	5.11
Recreation	5.17
Public Health and Environmental Hazards	5.20

3.4 Groundwater

3.4.1 Existing Conditions

The environmental and regulatory framework described in Section 5.7.1 of the 2018 LSJR IIFR/EIS/EIR covering groundwater is generally applicable to the analysis in this SEA and therefore is not repeated here.

3.4.2 Environmental Effects

No Action Alternative

Potential effects to groundwater related to cutoff wall installation was analyzed in Section 5.6.4 of the 2018 LSJR IIFR/EIS/EIR. Impacts to groundwater movement and supply were determined to be less than significant. The development and implementation of a Bentonite Slurry Spill Contingency Plan, or frac-out plan, would reduce the risk of groundwater contamination due to the use of bentonite material to less than significant.

Proposed Action

Impacts to groundwater due to the updated levee construction design would be similar to those analyzed in the 2018 LSJR IIFR/EIS/EIR, because these improvements would not entail below-ground construction. Likewise, the staging areas and access routes are for the temporary movement and storage of vehicles and material and would not impact groundwater.

Excavation of levee material from the SEWD borrow site would create basins, which would be utilized for groundwater recharge, resulting in a benefit to groundwater supply in the eastern Stockton area.

One of the selection criteria for the mitigation sites was their ability to provide suitable hydrology and topography to support native riparian and wetland habitat without irrigation. Wetland habitat mitigation areas could be graded to support wetland hydrology and associated plants if needed. During plant establishment, any of the mitigation sites could require drilling of a new well or pumping from the river in order to accommodate irrigation needs of young plants. The irrigation would cease after the 3–5-year plant establishment period, and any new well drilled would be closed and sealed.

The California State Water Resources Control Board's GAMA Groundwater Information System shows approximate well locations. There are approximately nine water supply wells within the tract containing TS30L and the mitigation sites under consideration, and few to no wells directly beneath the mitigation site footprints (Figure 4). It is not anticipated that on-site or off-site mitigation options would significantly impact these wells because of the lower irrigation requirements of native vegetation and the irrigation would be limited to the 3–5-year plant establishment period, and drip irrigation would be implemented to minimize water usage. The temporary usage of groundwater, combined with the measures described below in Section 3.4.3, results in less than significant groundwater impacts from the Proposed Action.

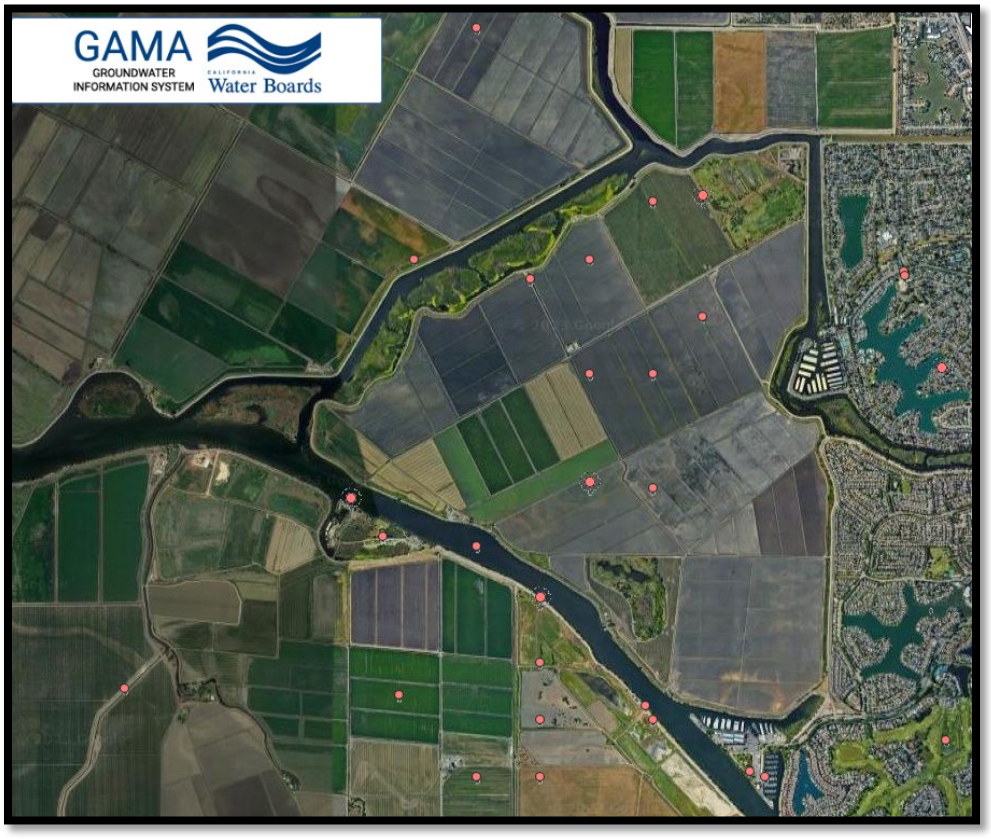


Figure 4. Approximate locations of groundwater wells in the vicinity of TS30L and the potential mitigation sites.

3.4.3 Avoidance, Minimization, and Mitigation Measures

The measures described in Section 5.6.10 of the 2018 LSJR IIFR/EIS/EIR and the measures listed below would be implemented to ensure that effects to groundwater resources would be less than significant.

- All parcels considered for mitigation are located in areas where the topography and hydrology naturally support riparian vegetation.
- Wetland areas would be graded so they support wetland hydrology and associated wetland plants.
- Plantings would be irrigated by drip irrigation to minimize water usage.

3.5 Wetlands and other Waters of the United States

3.5.1 Existing Conditions

The environmental and regulatory framework described in Section 5.7.1 of the 2018 LSJR IIFR/EIS/EIR covering Wetlands and other Waters of the United States is generally applicable to the analysis in this SEA and therefore is not repeated here. Additional site-specific details for segment TS30L are included below.

An aquatic resource delineation was conducted by USACE on March 9, 2021, for the irrigation ditch and the wetlands located between the ditch and the TS30L levee (Figure 5). The delineation measured 2.3 acres of irrigation ditch and 0.6 acres of wetland associated with the ditch. These aquatic resources do not meet the definition of jurisdictional waters of the U.S. under the Clean Water Act according to the latest rule, effective March 20, 2023.

The northern staging area and temporary construction work area west of TS30L (Figure 2) lie in irrigated rice fields and were not included in the original wetland delineation for the TS30L construction footprint. These sites may meet the current definition of jurisdictional waters of the U.S. The on-site mitigation area, described as Mitigation Option 1 in Section 2.2.3, overlays the western portion of the construction work area depicted in Figure 2 and may also meet the definition of jurisdictional waters of the U.S.

Habitat surveys were conducted at each of the three off-site mitigation options in December 2022. The biological community is periodically flooded by nearby waterbodies, such as the irrigation ditches on all three mitigation sites, or has topography and soils that support ponding. These are typically dominated by rooted emergent plants including bulrush (*Schoenoplectus* sp.) and cattail (*Typha* sp.); there are few trees present. All three sites had patches of emergent wetlands associated with agricultural ditches.



Figure 5. Aquatic resources map along TS30L levee

3.5.2 Environmental Effects

No Action Alternative

The No Action Alternative includes the wetland and waters of the U.S. impacts described in Alternative 7a in Section 5.7.4 of the 2018 LSJR IIFR/EIS/EIR, which states that Alternative 7a would result in significant and unavoidable impacts to wetlands and waters of the U.S., even with implementation of mitigation measures. For the Delta Front reaches, which includes TS30L, an estimated four acres of permanent

impacts to wetlands would result from levee reshaping and maintenance of the VFZ. Staging areas and mitigation sites were not analyzed in this document.

Proposed Action

The SEWD borrow site and haul routes would have no effect to wetlands or other waters of the United States in addition to what is described in the 2018 LSJR IIFR/EIS/EIR.

The TS30L levee reshaping would affect 0.6 acres of non-jurisdictional wetlands associated with the 2.3-acre irrigation ditch located west of the levee toe. The irrigation ditch would be reconstructed after construction, and the associated wetlands would be recreated by the construction of one of the on-site or off-site mitigation parcels included in the Proposed Action.

Use of the 9-acre northern staging area would involve ceasing irrigation to a rice field to accommodate material and equipment storage and would not involve grading or permanent modifications. Unless the staging area is chosen as a mitigation area, it would be restored to pre-construction conditions and irrigation and farming of the site are presumed to continue. The temporary construction area west of TS30L would be used for equipment access during construction and would also return to pre-construction conditions, unless this area is chosen for on-site mitigation (described as Mitigation Option 1, Section 2.2.3). Because these uses are temporary and would result in full restoration of the rice fields after construction, impacts to wetlands and other waters of the U.S. would be less than significant.

If Mitigation Option 1 (on-site) is chosen, the staging area and linear corridor west of TS30L would be used for mitigation for impacted riparian and wetland habitat caused by construction. Irrigation of approximately 25 acres of rice fields, a non-natural emergent wetland type, would cease, in that area. Another irrigation ditch would be built at the western boundary of the mitigation site to service the rice fields to the west. The mitigation site would consist of restored habitats sustained by the natural hydrology of the area and by hydrologic influence from the irrigation ditch. The current vegetation growing between the levee and irrigation ditch are sustained by a similar situation. Because this action results in a conversion from a monoculture to a natural mosaic of habitats that support the wooded riparian and native wetland vegetation that existed in the area before conversion to agriculture, impacts of Mitigation Option 1 to wetlands and other waters of the U.S. would be less than significant.

Mitigation Option 2 (off-site) involves three parcels, which would be evaluated for the extent of any Federally protected waters of the U.S. or wetlands. If present, these features would not be negatively impacted by construction of the Proposed Action. Construction of a mitigation site on any of these parcels would result in the enhancement of any aquatic resources present through the restoration of the surrounding land as described above and preservation of the parcel in perpetuity.

3.5.3 Avoidance, Minimization, and Mitigation Measures

The mitigation measures described in Section 5.7.10 of the 2018 LSJR IIFR/EIS/EIR are sufficient to ensure that the impacts of the Proposed Action to Wetlands and Other waters of the U.S. would be less than significant. Additional measures are not required.

3.6 Aesthetic Resources

3.6.1 Existing Conditions

The environmental and regulatory framework described in Section 5.18.1 of the 2018 LSJR IIFR/EIS/EIR covering Aesthetics is generally applicable to the analysis in this SEA and therefore is not repeated here. Additional site-specific details for segment TS30L are included below.

Staging areas are proposed in the southern portion of the segment at Tenmile Slough and the northern portion at Fourteenmile Slough. The southern staging area is on the northwest corner of March Lane and Riverbrook Drive and is covered in non-native herbaceous vegetation, with ornamental trees along the perimeter. The northern staging area is currently occupied by farmland. A housing development is located to the southeast and a marina is located to the north across from Fourteenmile Slough.

The SEWD borrow site is located on farmland east of Stockton; the main SEWD facility borders the site to the south. A levee and canal separate the borrow site from the Garden Acres neighborhood, which is located to the southwest. The remaining land surrounding the borrow site is farmland.

The acreage in Mitigation Option 1 (on-site) is in agricultural use and is a small portion of the total agricultural land in the area. The proposed mitigation areas in Mitigation Option 2 (off-site) consist of parcels located west and within 2 miles of TS30L.

3.6.2 Environmental Effects

No Action Alternative

Section 5.18.4 of the 2018 LSJR IIFR/EIS/EIR states that Alternative 7a would result in significant and unavoidable impacts to aesthetic resources due to waterside vegetation removal, which contributes to scenic vistas and the existing visual character of the site. Section 5.18.10 of the 2018 LSJR IIFR/EIR/EIS stated that USACE would seek opportunities during the design phase to plant onsite vegetation, if a design deviation is received, which would reduce impacts to aesthetics.

Proposed Action

The SEWD borrow site is located on farmland about 400 feet and is across a canal from the nearest housing development. It would be stripped of the upper soil layers in order to access suitable levee material beneath. The topsoil that was removed will be re-used to rebuild the levee upon completion of the Proposed Action. Once the borrow site is no

longer used for levee material, it would serve as a groundwater recharge basin for the Stockton East Water District. Therefore, aesthetic impacts due to excavation of the borrow site would be temporary.

The northern and southern staging areas would be utilized for equipment, parking, and material storage. The southern staging area is located along March Lane and would be visible to cars and pedestrians for the duration of the construction. The northern staging area would be visible to boaters on Fourteenmile Slough and from housing developments to the east and north, though the levees would block some of the views. Visual impacts to the use of the staging areas during construction would be temporary.

The levee improvements under the Proposed Action would result in the removal of the approximately 11.4 acres of riparian shrub- scrub vegetation growing on and between the waterside levee slope and the irrigation ditch to accommodate the widening of the levee. The waterside levee slope would be armored with riprap and a waterside patrol road would be built within the 15-foot VFZ. Because of these design changes, on-site plantings within the VFZ are not being considered under the Proposed Action.

Mitigation Option 1 would result in reestablishment of vegetation in two areas: a portion located along a corridor west of the irrigation ditch, and a portion on the northern stockpile site. Both locations are directly adjacent to the construction impacts. The vegetation plantings, totaling approximately 25 acres, would eventually reach similar size to the existing vegetation.

Mitigation Option 2 would involve establishment of riparian vegetation at alternate locations, resulting in most of the TS30L footprint left bare of woody vegetation. The mitigation sites themselves would change the open vistas of agricultural or other open land, as native vegetation would cover the seasonally barren ground typical of agricultural fields. Aesthetic resources would be improved in these locations due to the establishment of mature large trees, wetland, and shrub-scrub habitats.

The impacts to aesthetics due to Project construction were already disclosed in the 2018 LSJR IIFR/EIR/EIS as significant and unavoidable. The additional impacts under the Proposed Action would be less than significant either because they are either temporary in nature (borrow site and staging areas) or, in the case of Mitigation Option 1, would restore vegetation to the site.

3.6.3 Avoidance, Minimization, and Mitigation Measures

Section 5.18.10 of the 2018 LSJR IIFR/EIR/EIS stated aesthetics impacts due to compliance with the Vegetation EP would be significant and unavoidable. A design deviation was not sought for TS30L due to the need to remove all waterside vegetation to accommodate the widening of the levee and construction of the waterside access road. Any effects of the Proposed Action in addition to those disclosed in the is 2018 LSJR IIFR/EIR/EIS would be less than significant. As an avoidance, minimization, and

mitigation measure to further reduce impacts to aesthetic resources, disturbed land outside of the VFZ would be re-planted once construction is complete.

3.7 Vegetation and Wildlife

3.7.1 Existing Conditions

The environmental and regulatory framework described in Section 5.9 ‘Vegetation’ and Section 5.10 ‘Wildlife’ of the 2018 LSJR IIFR/EIS/EIR is generally applicable to the analysis in this SEA and is not repeated here. Rice fields border Reach TS30L to the west, and urban land lies to the east. An agricultural ditch adjacent to the levee supports riparian shrubs and trees. This vegetation extends up the western levee slope and provides nesting habitat for avian species and supports other wildlife common at the urban-agricultural interface.

Vegetation cover is a general indicator of terrestrial habitat, and the potential impacts to vegetation described provide a measure of impact to wildlife. The Fish and Wildlife Coordination Act, as amended, (16 U.S.C. 661-666(c)) allows the USFWS to assess impacts of proposed projects and make recommendations to reduce those impacts. The 2016 Final Fish and Wildlife Coordination Act Report (CAR) was included in the 2018 LSJR IIFR/EIS/EIR in Addendum B of the Environmental Addenda D. A supplemental CAR was completed in 2022 with the results of a HEP survey led by USFWS to evaluate the quality of the acres of riparian habitat to be impacted at TS30L (Appendix D). Riparian scrub-shrub, riparian forest, and wetland cover types are present at TS30L. The riparian cover types combined consist of 11.4 acres, and there are 0.6 acres of wetland. The 2022 Supplemental CAR designated these cover types with a mitigation goal of no net loss of in-kind habitat value and made recommendations on the amount of mitigation land needed to compensate for the loss of these habitats, depending on the mitigation site location.

Habitat surveys were conducted at each of the three off-site mitigation options in December 2022. Table *2* identifies the biological communities that occur at the sites. The most common communities present include annual grasslands and agricultural land, which together make up nearly 80% of the combined area of the three sites. Annual grasslands are primarily found in Parcel C and along the levee slopes along Sites A and B. This biological community mainly consists of non-native grasses and forbs, such as wild oat (*Avena barbata*), bromes (*Bromus diandrus, B. hordeaceus*), rye grass (*Festuca perennis*), Bermuda grass (*Cynodon dactylon*), yellow-star thistle (*Centaurea solstitialis*), poison hemlock (*Conium maculatum*), etc. The agricultural community includes row crops, dryland farming, orchards, and vineyards, as well as some infrastructure associated with agricultural operations, including rural dirt access roads. Parcel A was planted in olive trees; areas not planted appeared to be regularly sprayed with herbicides and had little to no vegetation. The majority of Parcel B was fallow open fields that appeared to have been previously planted in wheat or row cops, harvested shortly before observation. Invasive non-native plant species occurred in all

plant communities, but most commonly with and adjacent to annual grasslands and ruderal disturbed areas.

Table 2. Biological communities occurring on the mitigation sites

Natural Community	Parcel A, SJR East Site (acres)	Parcel B, SJR West Site (acres)	Parcel C, Fourteenmile Slough Pump Station (acres)
Agriculture	47.93	37.58	0
Annual Grasslands	6.0	8.34	60.30
Developed	0.86	2.06	0
Potential Seasonal Wetland	0	0	0.30
Riparian Woodland	0.75	0	15.80
Riparian Scrub	0	7.79	6.27
Fresh Emergent Wetland	0	2.80	0
Agricultural Ditch	0.85	3.73	1.01
Total	**56.39**	**62.30**	**83.68**

3.7.2 Environmental Effects

No Action Alternative

Section 5.9.4 of the 2018 LSJR IIFR/EIS/EIR estimated that implementation of Alternative 7a would affect 139 acres of riparian trees and shrubs and 10.75 acres of wetlands. Under the descriptions of the levee improvements applicable to TS30L, the 2018 LSJR IIFR/EIS/EIR stated that vegetation would be removed from the levee, as slope reshaping would involve placing material on the landside of the levee, and erosion protection would involve placing riprap on the waterside levee slope. A VFZ would be maintained 15 feet from the landside and waterside levee toes, including the levee slopes, to comply with the USACE EP 1110-2-18, which requires that levees be clear of woody vegetation that might impair levee integrity or maintenance access. However, Section 5.9.4 assumed approximately 25 percent of the waterside vegetation on the lower levee slope and 15-foot waterside easement would remain under a design deviation. If a design deviation was not granted, the VFZ would be seeded with a mixture of native grasses and forbs.

Section 5.10.4 of the 2018 LSJR IIFR/EIS/EIR stated that short-term significant impacts to birds and other wildlife could be experienced in areas adjacent to the construction footprint due to noise, vibration, and dust. Long-term impacts due to vegetation removal were to be avoided by evaluating all levee reaches for suitability for a design deviation. The impact of maintaining the VFZ was deemed significant and unavoidable in the 2018 LSJR IIFR/EIS/EIR because it would eliminate nearly all remaining trees and shrubs throughout the Project footprint in perpetuity.

Proposed Action

The Proposed Action would have short- and long-term impacts to commonly occurring wildlife, including to resident and migratory birds because of the loss of nesting, resting and foraging habitat. This is based upon the removal of vegetation as required for the development of the borrow site, use of the staging areas, construction of levee improvements, compliance with the Vegetation EP, and maintenance of the Operations and Maintenance (O&M) easements. Shorter term impacts could result during the construction and establishment of any mitigation sites.

The 96.4-acre SEWD borrow site lies on agricultural land. A FONSI from the Bureau of Reclamation dated April 11, 2018 states that the borrow site would be utilized by SEWD as a groundwater recharge basin, and that this action “will not significantly impact natural resources”. The haul route from the SEWD borrow site to TS30L utilizes existing roads and would not affect vegetation or wildlife except for tree trimming along a farm road exiting the borrow site. The northern staging area lies on 9 acres of irrigated rice fields, which may be utilized by migratory waterfowl and other wildlife. This parcel would be de-watered for the duration of the anticipated two-year construction. After construction is complete, rice farming would resume, unless the staging area would become a mitigation site.

Reach TS30L is a dryland levee, with the Brookside neighborhood immediately to the east (landside) and several thousand feet of agricultural fields between the levee and the San Joaquin River to the west. Due to real estate constraints, the levee widening under the Proposed Action would shift the levee centerline 20 feet towards the west (waterside), instead of landside as described in the No Action Alternative. Material would be added to the waterside, instead of the landside, in order to accomplish the levee widening. This would result in the removal of all vegetation on the levee slopes and most of the riparian vegetation growing between the waterside levee toe and the irrigation ditch. Approximately 11.4 acres of riparian vegetation and 0.6 acres of wetland would be affected. A design deviation was not sought, as riprap will be installed on the waterside slope (as described in the 2018 LSJR IIFR/EIS/EIR), and an elevated waterside patrol road would be built in the 15-foot waterside easement.

Mitigation Option 1 would offset vegetation and wildlife impacts by creating approximately 25 acres of on-site mitigation. Non-native emergent wetland vegetation would be replaced with a natural mosaic of riparian and wetland habitats, with a mix of native herbaceous vegetation, shrubs and trees capable of supporting higher species diversity. Establishment of a mitigation site at this location would provide habitat linkage between the sloughs to the north and south of Reach TS30L and, according to the USFWS 2022 Supplemental CAR, would require the lowest amount of mitigation land to compensate for the lost habitat.

Mitigation Option 2 would create similar habitat, but at one of the three off-site locations within 3 miles of TS30L. These sites would not function as wildlife corridors between

waterbodies but are located close to the San Joaquin River and White Sough. Parcel A would add to an existing mitigation site, the Pace Preserve, managed by the Center for Natural Lands Management. Due to the distance of these sites from the impacted habitat at TS30L, the USFWS 2022 Supplemental CAR recommends more mitigation acreage is required at these sites to compensate for lost habitat.

In the 2018 LSJR IIFR/EIS/EIR, shrub and tree removal was considered a significant and unavoidable impact because it would eliminate vegetation in the Project footprint in perpetuity. Mitigation Option 1 would make this a temporary impact by allowing for the reestablishment of wildlife habitat immediately adjacent to the TS30L footprint. Once the mitigation site is established, the impact is less than significant. Mitigation Option 2 would not reestablish habitat adjacent to the impact site and would require more acreage to compensate for lost habitat. Either of these options would reduce the Proposed Action's effect on vegetation and wildlife to less than significant.

3.7.3 Avoidance, Minimization, and Mitigation Measures

Section 5.9.10 of the 2018 LSJR IIFR/EIS/EIR discussed avoidance, minimization, remediation and compensation for vegetation and wildlife impacts. While a design deviation was not sought, the remaining measures are applicable to Reach TS30L with the following additions, bringing effects of the Proposed Action to vegetation and wildlife to less than significant:

- Permanent impacts to vegetation and wildlife would be remediated by establishing a mitigation site.
- The Project will comply with the USFWS 2022 Supplemental Coordination Act Report recommendations for compensating for lost habitat.

3.8 Federal Special-Status Species

3.8.1 Existing Conditions

The area surrounding TS30L contains suitable habitat for two federally-listed species (the VELB and the GGS) and one candidate species (the Monarch butterfly). The irrigation ditch adjacent to TS30L does not contain suitable habitat for listed fish species. The environmental and regulatory framework described in Section 5.12 of the 2018 LSJR IIFR/EIS/EIR is generally applicable to the analysis in this SEA; however, in 2017 USFWS published new compensation guidance for VELB: *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle.* This guidance was not addressed in the 2018 LSJR IIFR/EIS/EIR because the consultation with the USFWS was completed in 2016. According to the Framework's decision tree to determine the likelihood of VELB occurrence, the shrubs within the TS30L footprint are located in suitable habitat and are likely occupied.

In addition, the Monarch butterfly became a candidate species in 2020, and therefore was not addressed in the 2016 consultation with USFWS or the 2018 LSJR IIFR/EIS/EIR.

3.8.2 Environmental Effects

No Action Alternative

Valley Elderberry Longhorn Beetle (*Desmocerus californicus*)

Ten elderberry shrubs, the host plant to VELB, are located within the TS30L construction footprint (see Figure 6), growing along the levee slope and near the irrigation ditch. Section 5.12.10.1 of the 2018 LSJR IIFR/EIS/EIR stated that compensation for VELB impacts would be achieved by transplanting elderberry shrubs to a Fourteenmile Slough VELB mitigation site, to be created by the Project just north of TS30L.

Giant Garter Snake (*Tamnophis gigas*)

Suitable habitat for GGS exists adjacent to TS30L due to the presence of irrigated rice fields, an irrigation ditch, wetlands, and upland habitat along the levee. Under the No Action Alternative, levee improvements would temporarily affect aquatic GGS habitat through dewatering and relocation of portions of the irrigation ditch while the construction is occurring. Section 5.12.10.1 of the 2018 LSJR IIFR/EIS/EIR stated that compensation for permanent impacts to aquatic and upland GGS habitat would through the purchase of mitigation bank credits prior to Project construction.

Monarch Butterfly (*Danaus plexippus*)

Adult Monarch butterflies have been reported within two miles of the proposed TS30L site within the last five years (Journey North 2023). The construction of the TS30L levee improvements would result in a loss of habitat due to the removal of vegetation along 5900 feet of the waterside levee slope. The butterfly requires milkweed (*Asclepias* spp.) as its host plant for egg laying and as a larval food source. While several milkweed plants were observed on the site, a sufficient quantity to support the monarch butterfly was not present.

Proposed Action

Valley Elderberry Longhorn Beetle (*Desmocerus californicus*)

No elderberry shrubs will be affected by the development of the SEWD borrow site, the haul routes, or the two staging areas.

The Fourteenmile Slough mitigation area will not be in place prior to TS30L construction. Under the Proposed Action, the ten elderberry shrubs located within the construction footprint would be transplanted to a conservation bank and credits would be purchased to compensate for transplantation impacts. To compensate for loss of

riparian habitat associated with the elderberry shrubs, elderberry plantings would also be incorporated into the riparian habitat established at the chosen mitigation parcel. Elderberry shrubs already exist at mitigation sites A and B; although no shrubs were observed on Parcel C, there is riparian woodland habitat present, which would be supportive of elderberry.



Figure 6. Elderberry shrub locations and riparian vegetation along Reach TS30L

Giant Garter Snake (*Thamnophis gigas*)

The SEWD borrow site does not contain suitable GGS habitat, as it is located over 200 feet east and across a levee from the nearest water source, the Stockton Diverting

Canal. The haul route from the borrow site would utilize canal levee before accessing city streets and appropriate snake avoidance measures would be implemented while this haul route is utilized. Impacts to snake habitat due to utilization of the stockpile sites are considered temporary, as those sites would return to pre-Project conditions after construction is complete.

Permanent impacts to aquatic GGS habitat are anticipated due to the removal of 0.6 acres of wetland associated with the irrigation ditch. The irrigation ditch itself would be temporarily affected during construction of the TS30L improvements through dewatering and equipment operation but would be rebuilt after completion of construction. Impacts to upland GGS habitat would occur during construction through grubbing and widening of the levee, which would affect any burrows the snakes could utilize for refuge. These impacts would be temporary, as riprap would be placed on the levee slope and would provide crevices, which ultimately serve as alternative refugia for the snake.

If Mitigation Option 1 (on-site) is implemented, the proposed mitigation corridor and northern stockpile site would convert approximately 25 acres of rice fields, which could serve as foraging habitat for GGS, to native riparian and wetland habitat to replace the habitat lost by TS30L construction. A new irrigation ditch and farm road would be constructed to the west of the mitigation corridor to serve the remaining rice fields. Under this mitigation option, the riparian and wetland habitat would be reestablished approximately 100 feet to the west of its current location, making permanent impacts to aquatic GGS habitat would be less than significant.

Under Mitigation Option 2, the aquatic GGS habitat permanently affected by TS30L construction would be recreated by establishing wetland habitat at one of the three off-site locations. Due to their distance from TS30L, these sites would require more acreage to compensate for impacts. Parcel A also borders the same rice field as TS30L and surrounds an existing mitigation site, the Pace Preserve. Mitigation at Parcel A would connect the existing riparian, wetland, and upland habitats at the Pace Preserve with the surrounding rice field. Parcels B and C also border rice fields; development of these mitigation sites would establish a natural wetland type surrounded by wooded riparian vegetation adjacent to these existing rice fields. This mitigation option would also result in less than significant impacts to aquatic GGS habitat.

Monarch Butterfly (*Danaus plexippus*)

Under the Proposed Action, the Monarch butterfly would still experience a small amount of habitat loss due to vegetation removal on the levee slope; however, construction of the compensation area would result in a greater amount of superior habitat, since pollinator-specific species would be included in the plantings and the area would not be subject to pesticide drift. Since the loss of habitat would be replaced within one season, the effect is expected to be muted. Therefore, the proposed action is not likely to jeopardize the continued existence of the Monarch butterfly, and effects would be less than significant.

3.8.3 Avoidance, Minimization, and Mitigation Measures

All Avoidance and Minimization Measures and Compensation Measures included in the TS30L Biological Assessment (Appendix F), which are adapted from the 2016 LSJR BO as discussed in Section 5.12.10 of the 2018 LSJR IIFR/EIS/EIR, would be implemented. Any additional measures that may be included in the TS30L BO expected from USFWS in September 2023 would also be incorporated. These guidelines, along with the additional measures below, bring the effects of the Proposed Action to less than significant:

- The ten elderberry shrubs would be transplanted in accordance with the guidelines in Section 5.2 of the 2017 Framework to a USFWS-approved mitigation bank and credits would be purchased to compensate for impacts.
- Wooded riparian habitat would be established at one of four mitigation parcels under consideration; this habitat would include elderberry plantings.
- Permanent impacts to aquatic GGS habitat would be compensated by establishing wetland habitat at the chosen mitigation parcel.

3.9 Socioeconomics and Environmental Justice

3.9.1 Existing Conditions

Environmental justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income. It ensures that there is thoughtful consideration and opportunity for input in developing, implement, and enforcing environmental laws, regulations, and policies so that no group bears a disproportionate burden of environmental harm or risks. In March 2022, the Assistant Secretary of the Army (Civil Works) established a comprehensive EJ policy in the memorandum “Implementation of Environmental Justice and the Justice40 Initiative.” The memorandum directs USACE to listen to partners and stakeholders to understand their needs and problems, identify opportunities to address those challenges, and identify and remove barriers to partnering with communities. Additional guidance was provided by Major General Graham, Deputy Commanding General for Civil and Emergency Operations, in the memorandum “Implementation of the Interim Environmental Justice Strategic Plan” signed in December 2022.

To implement the Justice40 Initiative, agencies must identify communities impacted by EJ concerns. The Justice40 Initiative as well as Executive Order (EO) 14008 and the Council on Environmental Quality (CEQ) identify “disadvantaged communities” as those that are marginalized, underserved, and overburdened by environmental hazards. The Climate and Economic Justice Screening Tool was created under EO 14008 to provide a consistent government-wide method to identify communities with EJ concerns (https://screeningtool.geoplatform.gov/en). Disadvantaged communities are identified by census tracts that meet the thresholds for at lead one category of socioeconomic or environmental burden, or if they are on land within the boundaries of Federally recognized Tribes.

Additional tools are available to provide data for communities that may not be identified in the Climate and Economic Justice Screening Tool. The Environmental Protection Agency's (EPA) EJScreen Tool (https://www.epa.gov/ejscreen) provides additional demographic data that supplements the datasets in the Climate and Economic Justice Screening Tool. Local tools or information may provide additional specificity for a particular situation (e.g., California's CalEnviroScreen Tool, the California Department of Water Resources Disadvantaged Communities Mapping Tool).

3.9.2 Environmental Effects

No Action Alternative

The 2018 LSJR IIFR/EIS/EIR found that Alternative 7a would reduce flood risk to 162,000 residents. Section 5.13.4 of the 2018 LSJR IIFR/EIS/EIR found that the decreased flood risk from the proposed levee improvements would benefit all north and central Stockton and would have a positive impact to socioeconomics in this region. The CEQ's Climate and Economic Justice Screening Tool shows that residential area surrounding land side of the levee for TS30L is not identified as disadvantaged. The Tool shows that the tract on the waterside of the TS30L levee is considered disadvantaged, meeting more than one burden threshold and the associated socioeconomic threshold. Burdens consist of projected flood risk, $PM_{2.5}$ in the air, lack of green space, linguistic isolation, unemployment, low income, and less-than high school education.

Although the CEQ Tool shows several burdens, the census tract used for analysis encompasses a much greater expanse and is not representative of the Proposed Action area, which contains primarily agricultural land and a decommissioned wastewater treatment site. No residences or public areas are present on the Wright-Elmwood Tract. Construction of the Proposed Action would not impact the existing burdens within the census tract.

Overall, effects EJ and socioeconomics from the No-Action Alternative would be largely beneficial by decreasing flood risk to north central Stockton.

Proposed Action

The Proposed Action includes hauling material from the SEWD borrow site east of Stockton. The haul route crosses the Stockton Diverting Canal on the northern edge of the Garden Acres neighborhood but does not cross through the neighborhood itself. From there, the route utilizes Cardinal Ave through an industrial area before accessing state highways and I-5. Material hauling would occur six days per week from 8:00 am to 4:00 pm from February through October 2024. An average of 45 truck trips per day are expected to travel this route for approximately 80 days during the construction season.

The Climate and Economic Justice Screening Tool identifies all roads of the haul route except for W. March Lane as being within disadvantaged communities. However, all of these roads are large thoroughfares and any additional noise and traffic generated from

the haul trucks along these roadways generally would not be detectable to residents. The Garden Acres neighborhood, located across the Stockton Diverting Canal from the borrow site, could potentially experience adverse effects due to its proximity. This area is identified as disadvantaged due to environmental and socioeconomic burden thresholds, including $PM_{2.5}$ in the air, proximity to Risk Management Plan facilities, linguistic isolation, unemployment, low income, and less-than high school education. The haul route utilizes a levee road within 450 feet of the homes along the northeastern portion of the neighborhood until it crosses the Stockton Diverting Canal. After crossing the canal, the route comes within 200 feet of several homes before turning away from the neighborhood along an existing industrial area on Cardinal Avenue. The industrial area contains two freight hauling businesses with a rail line between the businesses and the neighborhood. Due to the haul route's distance from the neighborhood and the existing truck and train noise originating from the freight hauling businesses, impacts from the borrow haul trips would be temporary and less than significant.

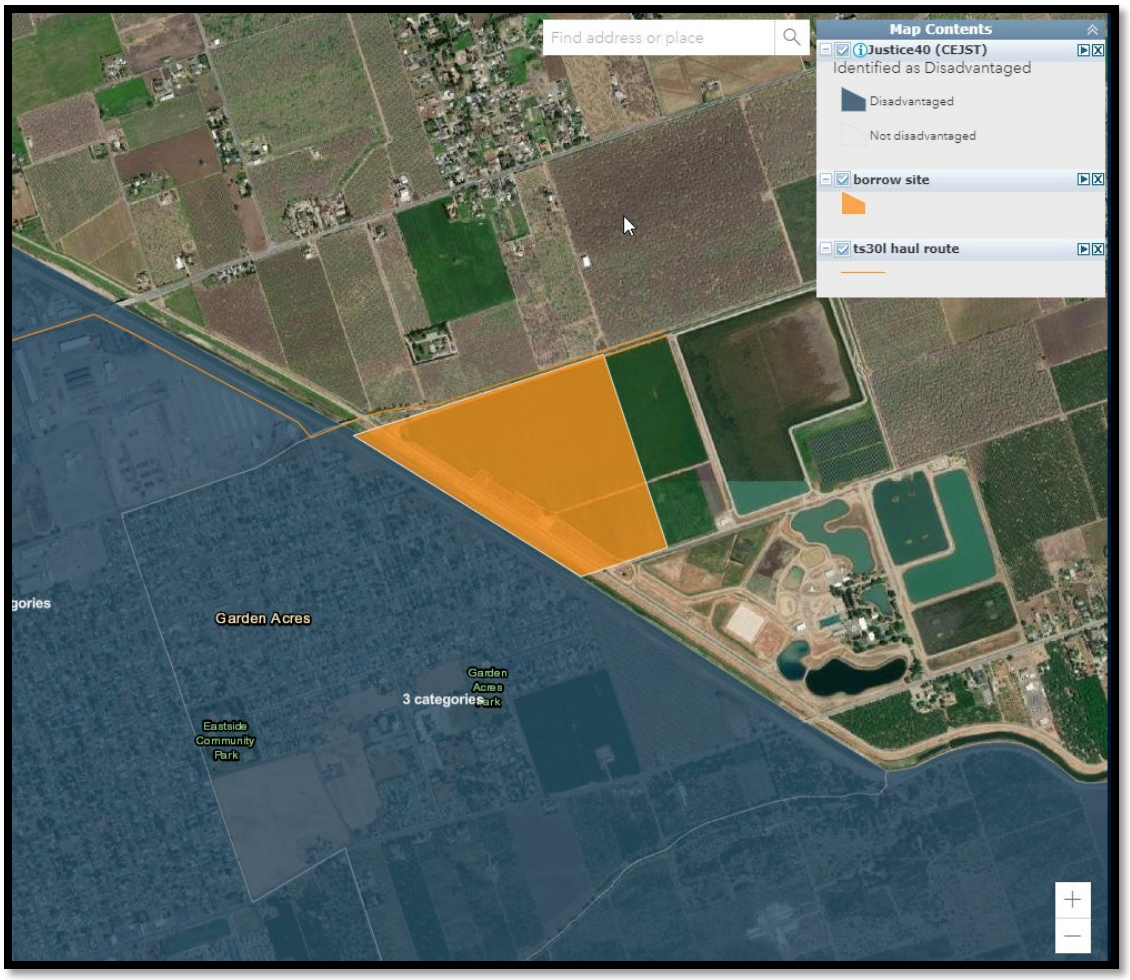


Figure 7. Map of the SEWD borrow site and haul route (orange) adjacent to the Garden Acres neighborhood, which is identified as disadvantaged by the Climate and Economic Justice Screening Tool.

The tract surrounding the potential mitigation sites and stockpile area is in a rural setting that has been identified as disadvantaged by the screening tool (Figure 8). As described above for the *No Action Alternative*, the area is part of a very large tract, and there are no residences near the proposed action area. The Proposed Action would not impact existing burdens within the tract. The Brookside neighborhood, located to the east of TS30L is not identified as disadvantaged. Therefore, impacts from the levee construction, stockpile sites, and development of environmental mitigation sites to Socioeconomics, Population, and Environmental Justice would be less than significant.

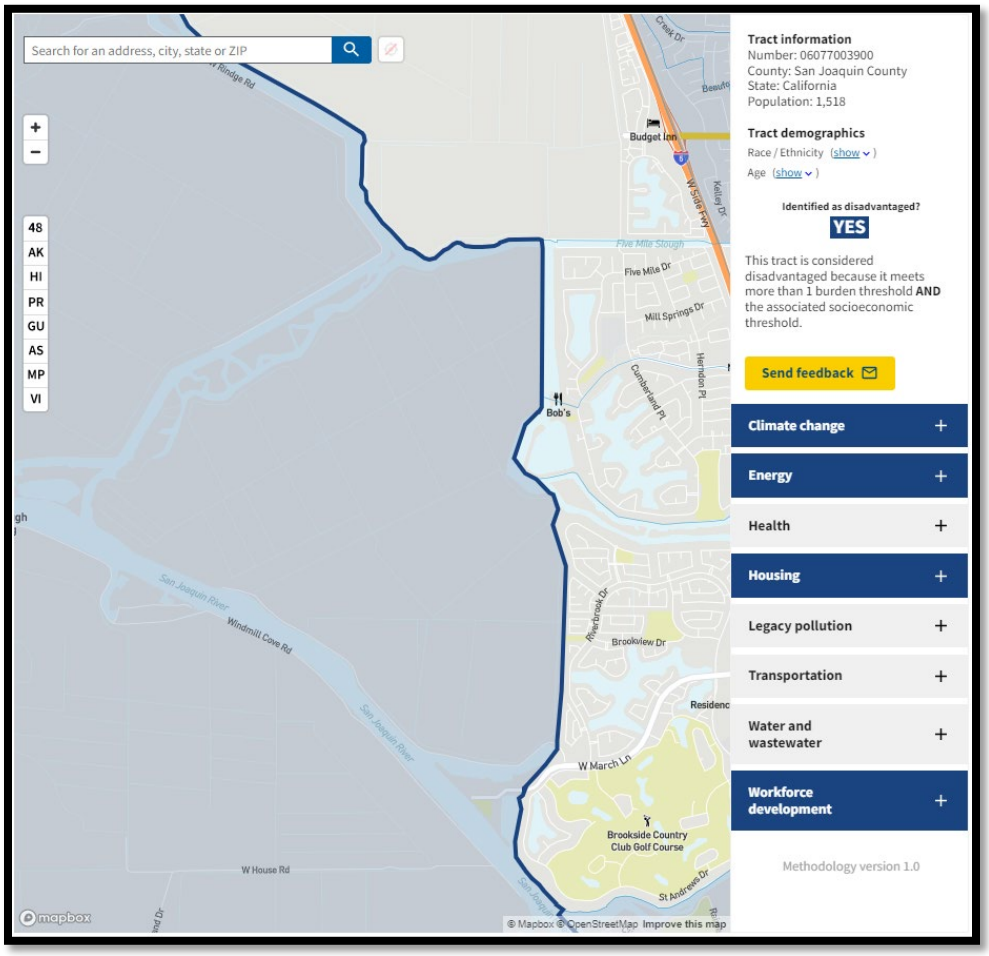


Figure 8. Map of the census tract identified as disadvantaged (shaded) containing the mitigation parcels under consideration for TS30L impacts.

3.9.3 Avoidance, Minimization, and Mitigation Measures

To avoid, minimize, or mitigate impacts to the neighborhood adjacent to the borrow site, the measures discussed in the 2018 LSJR IIFR/EIS/EIR Sections 5.8.10 (air quality), 5.15.10 (transportation), and 5.19.10 (noise) would be implemented, as applicable. In particular, dust control measures would be implemented to minimize air quality impacts due to fugitive dust. Additionally, to minimize impacts to residences, haul trucks must

follow the designated haul route and will not be permitted to drive through the Garden Acres neighborhood.

3.10 Utilities and Public Services

3.10.1 Existing Conditions

The environmental and regulatory framework described in Section 5.16 of the 2018 LSJR IIFR/EIS/EIR is generally applicable to the analysis in this SEA and therefore is not repeated here. The area contains PG&E electric power lines and a guy wire. There is an existing 30-foot-wide easement that runs in parallel to the Tenmile Slough levee protecting a 30-inch only sanitary sewer force main (SSFM) which serves the Brookside community. The City of Stockton plans on installing a future sanitary sewer main that runs parallel to the existing main within the same easement. There is an existing 75-foot-wide easement to PG&E high voltage transmission lines that run north to south across the Tenmile Slough levee.

Existing utilities and associated easements at each of the potential mitigation sites are shown in Figure 9 through Figure 12.

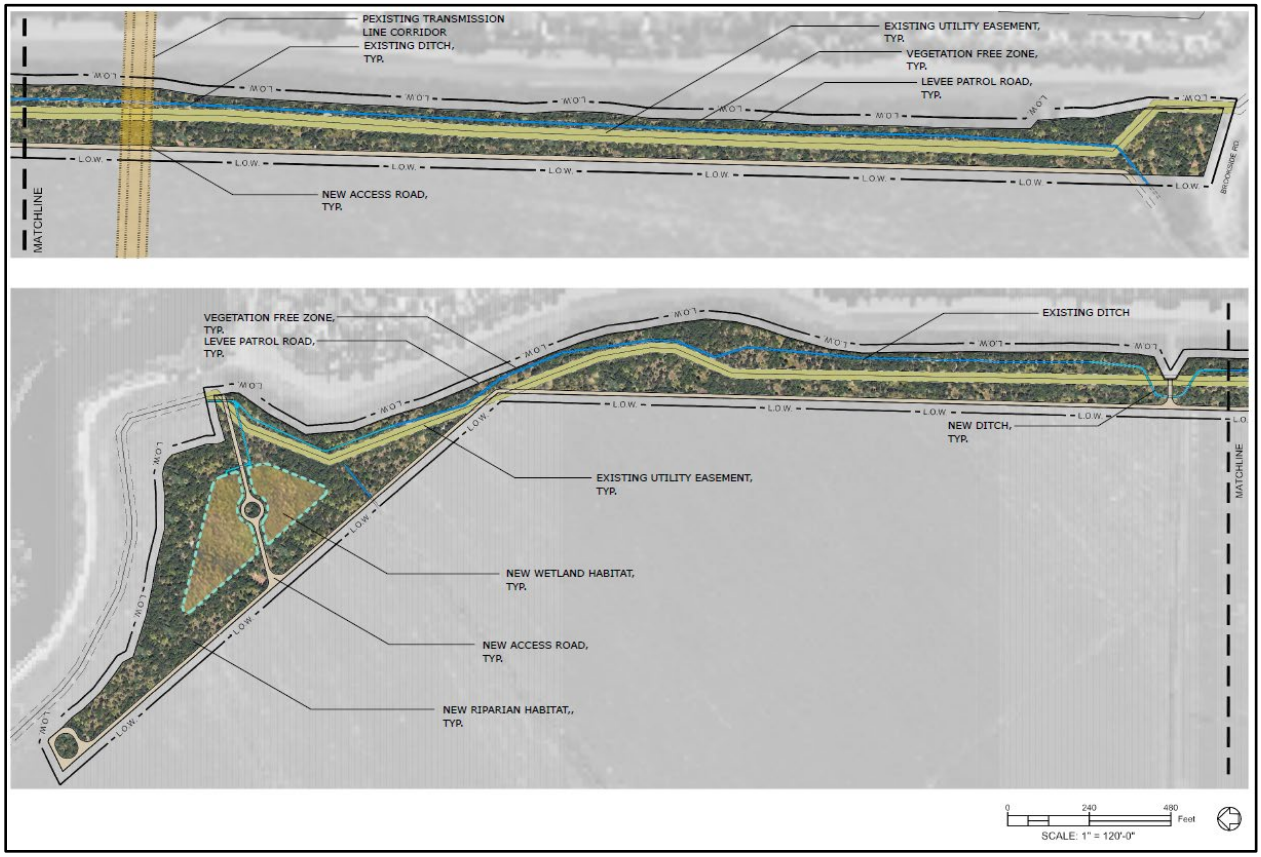


Figure 9. Existing utilities infrastructure and easements in the on-site mitigation footprint

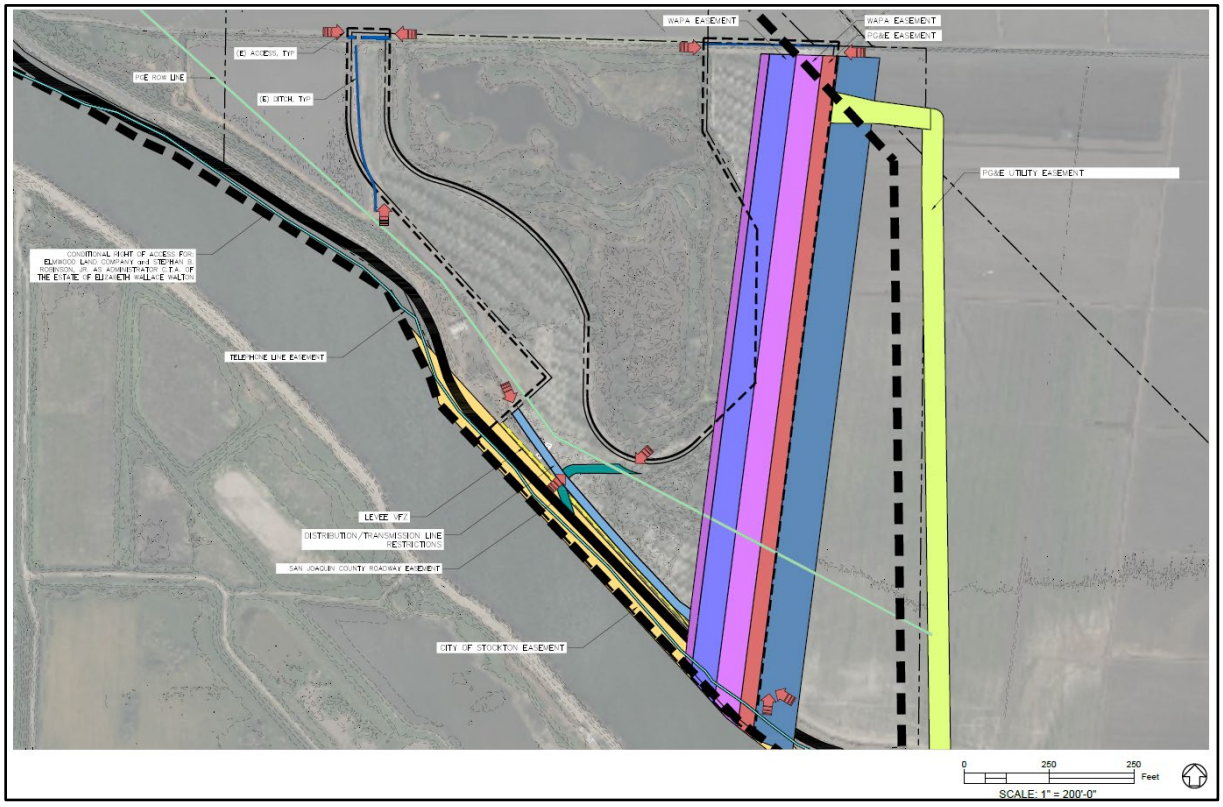


Figure 10. Existing utilities infrastructure and easements at the SJR East Site (Parcel A)

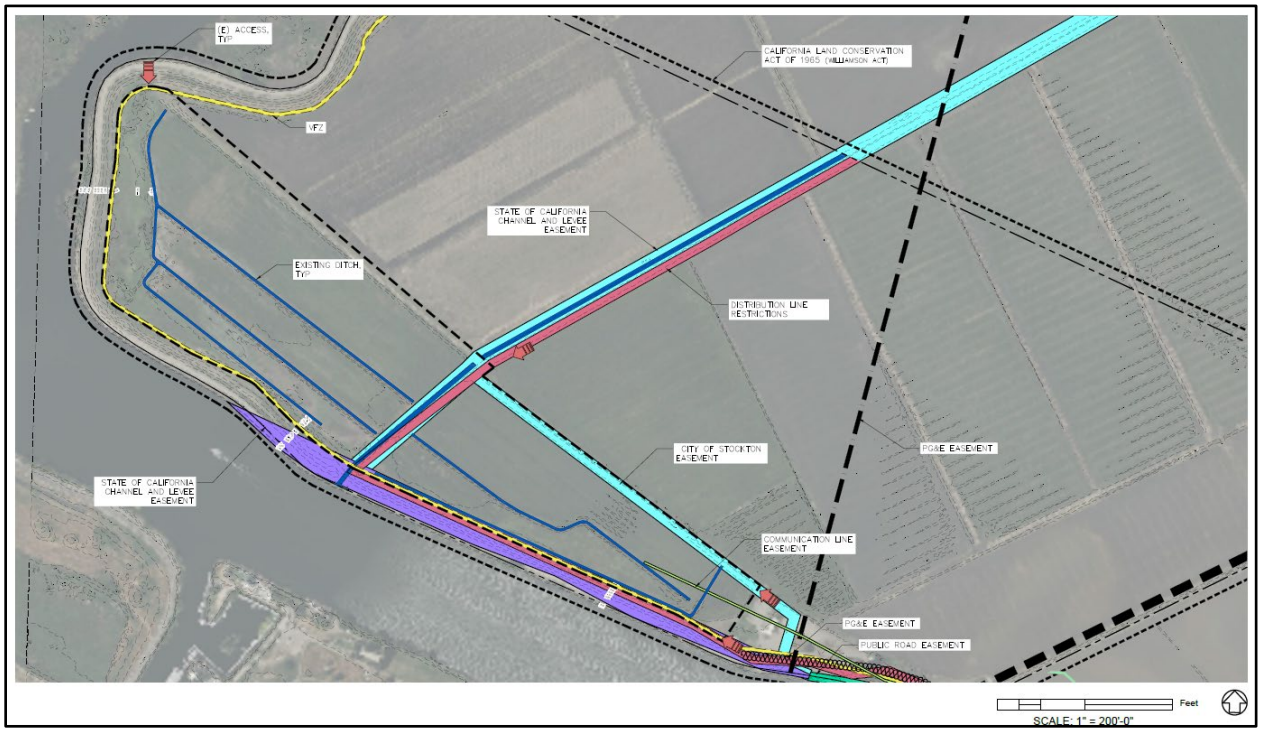


Figure 11. Existing utilities infrastructure and easements at the SJR West Site (Parcel B)

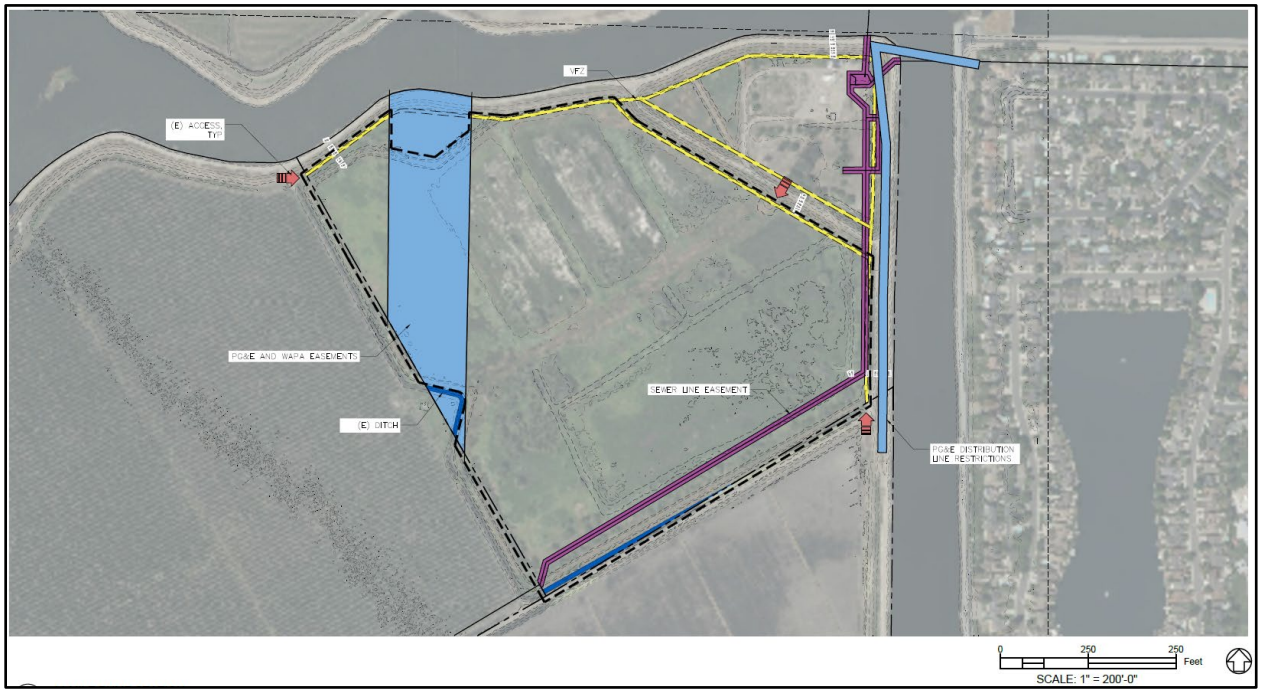


Figure 12. Existing utilities infrastructure and easements at the Fourteenmile Slough Pump Station (Parcel C)

3.10.2 Environmental Effects

No Action Alternative

Section 5.16.4 of the 2018 LSJR IIFR/EIS/EIR stated that construction associated with Alternative 7a, such as grading and excavation, could encroach on multiple types of utility equipment and facilities. Impacts to utilities and public services, such as temporary interruptions in service, would be coordinated with the providers and impacts would be less than significant with mitigation.

Proposed Action

No impacts to utilities and public services are anticipated as a result of developing the SEWD borrow site, use of the haul route, or use of the stockpile sites.

The TS30L construction requires shifting the levee centerline approximately 20-feet towards the waterside (west). This proposed 20-foot shift to the levee configuration would require realignment of the existing waterside irrigation ditch at ten discrete locations to maintain 15-feet from the waterside levee toe. The relocation of the irrigation ditch would not interfere or require movement of the SSFM. The SSFM will be monitored during construction to ensure there is no damage.

Mitigation Option 1 (on-site) would establish an on-site mitigation corridor adjacent to the TS30L levee and would overlay the SSFM. No disruption of the SSFM would occur, as construction of the mitigation site would avoid any excavation near the SSFM. A 30-

foot easement would be maintained free of woody vegetation and access would be maintained for any maintenance vehicles. The properties considered under Mitigation Option 2 (off-site) contain powerlines and utility easements; however, construction of these options would not involve disruption of any utilities. Any existing utility easements would be maintained.

3.10.3 Avoidance, Minimization, and Mitigation Measures

Mitigation measures outlined in Section 5.16.10 of the 2018 LSJR IIFR/EIS/EIR are sufficient to ensure adverse impacts from the Proposed Action remain less than significant. In addition, for the construction of any mitigation site, utility easements would be maintained with compatible vegetation to allow for maintenance vehicle access.

3.11 Land Use

3.11.1 Existing Conditions

The environmental and regulatory framework described in Section 5.14 of the 2018 LSJR IIFR/EIS/EIR is applicable to the analysis in this SEA and therefore is not repeated here. Reach TS30L is on the border of the Stockton city limits but still within the city's sphere of influence, with unincorporated San Joaquin County located to the west. The land immediately to the east of TS30L is designated Low Density Residential under the City's General Plan Map. The land immediately west of the TS30L levee is designated Open Space/Agriculture under the City's General Plan and as Agriculture/General under the San Joaquin County General Plan.

The SEWD borrow site, the northern stockpile site, and the parcels under consideration for mitigation all lie on land designated as prime farmland by the National Resource Conservation Service's (NRCS) Web Soil Survey.

3.11.2 Environmental Effects

No Action Alternative

The land use analysis for Alternative 7a in Section 5.14.3 of the 2018 LSJR IIFR/EIS/EIR determined that the overall Project would not conflict with land use plans, policies, or regulations and would not conflict with master plans, policies, or regulations because the overall affected acreage is small in comparison to the city and county. While locations were not identified at the time, the document stated that staging, stockpile, and haul roads would be developed on agricultural land during Project construction, but impacts would be temporary. The 2018 LSJR IIFR/EIS/EIR estimated the Project would convert 1 acre of farmland along the Calaveras River.

Proposed Action

The 96.4-acre SEWD borrow site lies just east of the city limits and is designated Institutional under the City's General Plan and Agriculture/General under the San

Joaquin County General Plan. It also lies on land designated as prime farmland by the NRCS's Web Soil Survey. The excavation of borrow material will form depressions which would be utilized as a groundwater recharge basin; therefore, the site would not be able to be utilized as farmland once the Proposed Action is constructed. USACE consulted with the NRCS to determine a Land Evaluation and Site Assessment (LESA) score for this parcel, which indicates whether the Farmland Protection Policy Act (FPPA) applies and if an alternate parcel should be considered. The borrow site score did not exceed the threshold for significant prime farmland impacts.

The haul routes would utilize existing roads and no impacts to land use would occur.

The 9-acre northern stockpile site lies in unincorporated San Joaquin County and is designated Open Space/Agriculture under the City's General Plan and as Agriculture/General under the San Joaquin County General Plan. The southern stockpile site is located within the city limits and is part of the right of way for March Lane. Unless used for mitigation, these areas would return to their original uses once the Proposed Action is constructed.

The TS30L levee improvements consist of a cutoff wall construction, levee reshaping, waterside erosion protection, and construction of a waterside patrol road. These improvements will occur on the current levee footprint, though the levee reshaping will cause the footprint to expand 20 feet to the west. This expansion would occur on open land and would not affect adjacent agricultural uses, making the land use impacts due to the levee improvements less than significant.

The parcels under consideration for mitigation all lie on land designated as prime farmland by the NRCS. All parcels are currently farmed except for the Fourteenmile Slough Pump Station site, which formerly contained wastewater treatment ponds. USACE consulted with NRCS to determine LESA scores for each parcel. Due to the abundance of farmland in the area, none of the scores exceeded the threshold for significant impacts to prime farmland; therefore, mitigation for the converted farmland is not required and the Project is in compliance with the FPPA.

3.11.3 Avoidance, Minimization, and Mitigation Measures

Implementation of the TS30L levee improvements and the development of the borrow site and staging areas do not conflict with land use plans, policies, or regulations, and associated effects would be less than significant. Therefore, no mitigation in addition to what is described in Section 5.14.9 of the 2018 LSJR IIFR/EIS/EIR is required.

3.12 Transportation and Circulation

3.12.1 Existing Conditions

The environmental and regulatory framework described in Section 5.15 of the 2018 LSJR IIFR/EIS/EIR is generally applicable to the analysis in this SEA and therefore is not repeated here.

3.12.2 Environmental Effects

No Action Alternative

Section 5.15.4 of the 2018 LSJR IIFR/EIR/EIS states that Alternative 7a would result in minimal, short-term impacts on traffic but would not substantially restrict emergency access. Traffic would increase on local roadways associated with construction trips and may involve hauling materials through residential areas that are not designated truck routes. Additionally, haul routes may occur in the vicinity of schools throughout the Project area. Temporary lane closures associated with levee improvements and with construction staging areas could cause or contribute to temporary increases in traffic levels as traffic slows down on local, collector and arterial streets. Increased traffic congestion on road segments and intersections would temporarily interfere with the use of main roadways for emergency evacuation routes. These impacts were determined to be significant and unavoidable.

Proposed Action

The SEWD borrow site is located approximately nine miles east of the TS30L levee site. Hauling from this site would occur Monday through Saturday between the hours of 8:00 am to 4:00 pm. An average of 45 truck trips per day is anticipated between the borrow site and the construction site. The haul route from the SEWD property would follow a private road on the west side of the property, parallel the Stockton Diverting Canal, cross the canal and utilize Cardinal Ave to SR 26. It would then follow SR 99 until its interchange with SR 4. SR 4 leads to I-5, which would be followed north and west to West March Lane, which leads directly onto the south end of TS30L. This route does not pass by any schools. West March Lane is a six-lane road which runs between two residential neighborhoods. Haul trucks would use one designated lane on March Lane in the eastern and western direction, which would be specified in the traffic control plan. There is an at-grade railroad crossing on Cardinal Avenue, and coordination with Stockton Terminal and Eastern Railroad would occur prior to the start of construction.

Access to and from the staging and stockpile areas for the levee construction would use West March Lane as an access point to the TS30L levee and would then utilize the levee road (Brookside Road) and the parallel agricultural road on the west side of the waterside levee toe. Temporary access routes would be constructed to access the levee crown, which is gated from the public and is not utilized as a public road. The haul routes for other construction materials (e.g., riprap for runoff erosion protection) are based on the location of the material source. All riprap source options are commercial sites within 50 miles of the construction site and all haul routes would use local roads and major state and interstate highways to access West March Lane. Any deviation from the approved routes would be approved by the City of Stockton and the State for the use of off-ramps and on-ramps.

The Proposed Action includes West March Lane as a haul route, which runs through a residential area but not directly adjacent to houses. Because the haul trucks would not

utilize roads within the neighborhoods and would be restricted to a single lane in each direction of March Lane, truck traffic associated with construction of TS30L and the selected mitigation site is not expected to increase congestion in the residential area. The No Action Alternative impacts discussed in the 2018 LSJR IIFR/EIR/EIS regarding lane closures for levee road work, construction traffic near schools, railroad service disruption due to work under railroad crossings, and road closures due to levee work requiring drilling through roadways would not apply to the Proposed Action. Adverse impacts caused by the Proposed Action's site access and haul routes are not expected to exceed those described in the 2018 LSJR IIFR/EIS/EIR.

No significant impacts to transportation and circulation are anticipated due to construction of the mitigation sites. The mitigation sites will not be constructed concurrently with the construction of the TS30L levee.

3.12.3 Avoidance, Minimization, and Mitigation Measures

Mitigation measures outlined in Section 5.15.10 in the 2018 LSJR IIFR/EIS/EIR are sufficient to ensure adverse impacts from the Proposed Action are not greater than those stated in the 2018 LSJR IIFR/EIS/EIR.

3.13 Air Quality and Greenhouse Gas Emissions

3.13.1 Existing Conditions

Air quality management and protection are regulated by Federal, State, and local levels of government. The primary statutes that establish ambient air quality standards and authorities to enforce regulatory attainment are the Federal Clean Air Act (CAA) and California Clean Air Act.

The environmental and regulatory framework described in Section 5.8 of the 2018 LSJR IIFR/EIS/EIR is generally applicable to the analysis in this SEA and therefore is not repeated to the same depth here. The San Joaquin County attainment status of the National Ambient Air Quality Standards (NAAQS) for each of the criteria pollutants is included here for quick reference (Table 3). The applicable *de minimis* thresholds in tons per year (tpy) are listed in the table as well.

Analysis using the Road Construction Emission Model (RCEM) done for the 2018 LSJR IIFR/EIS/EIR was used to evaluate the significance for criteria air pollutants generated by Alternative 7a. Results showed emissions would be below the San Joaquin Valley Air Pollution Control District (SJVAPCD) and Federal conformity thresholds for all pollutants, including greenhouse gas (GHG) emissions, except for oxides of nitrogen (NO_x).

Table 3. San Joaquin County NAAQS attainment status for criteria pollutants

Pollutant	Attainment Status	*De minimis* emission level (tpy)
Ozone (8-hour, 2015)	Non-attainment, extreme	10[1]
$PM_{2.5}$ (2012)	Non-attainment, serious	70[2]
PM_{10} (1987)	Maintenance	100
Sulfur dioxide (2010)	Attainment	n/a
Lead (2008)	Attainment	n/a
Carbon monoxide (1971)	Maintenance (Stockton urbanized area only)	100
Nitrogen dioxide	Attainment	n/a

[1]Ozone emissions include ROGs and oxides of nitrogen (NO_x)
[2]$PM_{2.5}$ emissions include direct emissions, SO_2, NO_x, ROG, and ammonia

Climate Change

Existing conditions summarizing global climate change are adequately discussed in the 2018 LSJR IIFR/EIS/EIR. Locally, the effects of climate change are apparent within the San Joaquin Valley (Fernandez-Bou et al. 2021):

- The annual average maximum temperature in San Joaquin Valley increased in by 1 °F from 1950 to 2020 and is projected to increase by 5 to 8 °F by the end of this century.
- Snowpack in the Sierra Nevada, which serves as an essential water storage for the Valley, is decreasing. Earlier snowmelt will shift peak flows by two to four months by the end of the century, which may reduce water storage.
- Precipitation will likely become more intense during the rainy season, creating longer dry seasons.
- Sea level rise increases flood risk to Delta communities and cities, including Stockton.
- Multi-year climate extremes are becoming more frequent, such as the 2012-2016 drought when thousands of wells dried, decreasing the drinking water quality.

In January 2023, the CEQ released interim guidance regarding the consideration of GHG emissions and climate change in NEPA documents for Federal actions. According to the guidance, when analyzing a proposed action's climate change effects under NEPA, agencies should: (1) quantify the reasonably foreseeable GHG emissions of each alternative; (2) disclose and provide context for the GHG emissions and climate impacts associated with the alternatives, including by monetizing climate damages using estimates of the social cost of GHG (SC-GHG), placing emissions in the context of relevant climate action goals, and providing common equivalents; and (3) analyze reasonable alternatives, including those that would reduce GHG emissions relative to baseline conditions, and identify available mitigation measures to avoid, minimize, or compensate for climate effects.

The impacts of climate change are more pronounced in rural, disadvantaged communities of the San Joaquin Valley than in the rest of the state. Over half of the population of San Joaquin Valley live in disadvantaged communities, and climate change is already disproportionally exacerbating their vulnerabilities, including extremely poor air quality.

3.13.2 Environmental Effects

No Action Alternative

Section 5.8.4 of the 2018 LSJR IIFR/EIR/EIS states that Alternative 7a would be below the San Joaquin Valley Air Pollution Control District's (SJVAPCD) and Federal and State conformity thresholds for all pollutants except NO_x, which can be found in Table 5-9 of the 2018 LSJR IIFR/EIR/EIS. Alternative 7a would generate emissions exceeding the SJVAPCD's CEQA thresholds and Federal conformity thresholds. Additionally, the 2018 LSJR IIFR/EIR/EIS states that construction-related NO_x emissions would likely be reduced due to replacement of older equipment and by flood avoidance. Air pollutant emissions runs higher during the first five years due to greater construction activity. However, with exceedance in NO_x emissions comes a contribution to ozone exceedances in an area designated as an extreme ozone nonattainment area. Consequently, the under Alternative 7a NO_x emissions are significant.

Table 5-9 in the 2018 LSJR IIFR/EIS/EIR describes emissions for all of Alternative 7a; in order to establish a baseline to compare with the Proposed Action, emissions for Reach TS30L are presented here (Table 4), assuming that construction is completed in one season, Tier 4 equipment is required, and dust abatement mitigation is implemented. Estimated values for emissions of regulated pollutants and greenhouse gas emissions were calculated using the RCEM Version 9.0.0. Model inputs and calculations are presented in detail in Appendices B and C.

The 2018 LSJR IIFR/EIS/EIR estimates Project total NOx using 1980s equipment (Tier 0) to exceed the 10 tons per year threshold for five years between 2019-2023, whereas results from mitigated emissions using Tier 4 equipment at TS30L does not exceed 10 tons per year for any year. All regulated pollutants generated are under conformity thresholds established by the SJVAPCD, and all are less than the applicable Federal *de minimis* emission levels (Table 3). Therefore, effects to air quality would be less than significant.

Table 4. Mitigated construction emissions, No Action Alternative

	ROG	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x
No Action Alternative emissions (tpy)	0.73	13.07	1.72	7.28	1.57	0.03
San Joaquin County Thresholds (tpy)	10	100	10	15	15	27

Table 4 presents the mitigated project emissions of criteria pollutants from construction of the No Action Alternative, and GHG emissions are shown in Table 5. For context, the CO_2 emissions produced by the No Action Alternative would be equivalent to the annual CO_2 emissions of 531 passenger vehicles (assuming the average vehicle emits 4.6 tons CO_2 per year, EPA 2022). This is less than 1% of the number of autos and trucks registered in San Joaquin County in 2021 (CA DMV 2023). The SC-GHG for the No Action Alternative was calculated to be $126,372 (IWG 2021). These metrics illustrate that GHG emissions from the No Action Alternative would be relatively minor, and the overall effects to climate change would be less than significant.

Table 5. Estimated GHG emissions from implementation of the No Action Alternative

GHG	Estimated emissions (tpy)
CO_2	2442
CH_4	0.74
N_20	0.04
CO_2e	2472

The No Action Alternative would not result in disproportionate adverse effects to air quality in disadvantaged communities. Although there are no disadvantaged communities immediately surrounding the TS30L action area (except for near the SEWD borrow site), emissions can affect the ambient air quality over a larger area, which would include such communities. However, emissions of such a minor degree would not have a significant adverse effect on the surrounding disadvantaged communities.

Proposed Action

Emissions from the Proposed Action would be generated from the construction of the riparian mitigation site within San Joaquin County. Emissions associated with other elements of the Proposed Action, such as the identified haul route, borrow site, and staging area, are included in the No Action calculations, because even though the details of where these features would be were unknown, they were certainly going to be part of the Project, so they were included in estimating emissions. It is assumed that the updated footprint and the addition of a waterside patrol road would not significantly change the emissions.

In calculating emissions for the construction of the Proposed Action, it was assumed that construction would occur in one calendar year and Tier 4 equipment would be required. Estimated values for emissions of regulated pollutants and greenhouse gas emissions were calculated using the RCEM Version 9.0.0. Model inputs and calculations are presented in detail in Appendices B and C.

Table 6 presents the mitigated emissions of regulated pollutants from construction of the Proposed Action under the assumptions that construction would be completed in a single calendar year, Tier 4 equipment would be required, and dust abatement mitigation is implemented. All regulated pollutants generated by are under conformity thresholds established by the SJVAPCD and the Federal *de minimis* emission levels, even when considered in conjunction with emissions from the No Action Alternative. Thus, effects to air quality would be less than significant.

Table 6. Mitigated construction emissions, Proposed Action

	ROG	**CO**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**SO_x**
Proposed Action Emissions (tpy)	0.06	1.05	0.16	2.21	0.46	0.0
San Joaquin County Thresholds (tpy)	10	100	10	15	15	27

Table 7 presents the emissions of GHG pollutants from construction of the TS30L levee and the riparian mitigation sites construction with the following assumptions: each project will be completed in a single calendar year; Tier 4 equipment is required; dust abatement mitigation is implemented; and construction phases are sequential. The GHG total is estimated as CO_2e or the equivalent quantity of CO_2 based on the higher atmospheric heating efficiency of CH_4 and N_2O compared to CO_2. SJVAPCD does not currently regulate GHG emissions.

The CO_2 emissions produced by the Proposed Action would be equivalent to the annual CO_2 emissions of 45 passenger vehicles, an 8% increase to the No Action Alternative. The SC-GHG for the Proposed Action was calculated to be $10,914 (IWG 2021). These metrics illustrate that GHG emissions from the Proposed Action would be extremely minor, and the overall effects to climate change would be less than significant.

Table 7. Estimated GHG emissions from implementation of the Proposed Action

GHG	Estimated emissions (tpy)
CO_2	209
CH_4	0.05
N_2O	0.01
CO_2e	211

Similar to the No Action Alternative, the Proposed Action would not result in disproportionate adverse effects to air quality in disadvantaged communities.

3.13.3 Avoidance, Minimization, and Mitigation Measures

The mitigation measures outlined in Section 5.8.10 in the 2018 LSJR IIFR/EIS/EIR would be adopted to reduced impacts from the Proposed Action. Those measures, in addition to the measures below, would ensure that Proposed Action would have no significant impacts to air quality and GHG emissions. Note: measures marked with an asterisk (*) would help to reduce the impacts of GHG emissions specifically.

- During construction, the use of off-road equipment that meets or exceeds USEPA or California Air Resource Board (CARB) Tier 4 off-road emission standards would be required. (This requirement is more stringent than the 2018 LSJR IIFR/EIS/EIR, which required the use of Tier 3 equipment.)*
- Maintain properly functioning emission control devices on all vehicles and equipment.*
- During construction, implement all appropriate dust control measures, such as tarps or covers on dirt piles, in a timely and effective manner.
- Periodically water all construction areas having vehicle traffic, including unpaved areas, to reduce generation of dust. Application of water would not be excessive or result in runoff into storm drains.
- Suspend all grading, earth moving, or excavation activities when winds exceed 20 miles per hour.
- Water or cover all material transported offsite to prevent generation of dust.
- Sweep paved streets adjacent to construction sites, as necessary, at the end of each day to remove excessive accumulations of soil or dust.

- Cover all trucks hauling dirt, sand, soil, or other loose material, or maintain at least 2 feet of freeboard (minimum vertical distance between top of the load and top of the trailer) in accordance with the requirements of California Vehicle Code Section 23114. This provision would be enforced by local law enforcement agencies.
- Revegetate or pave areas cleared by construction in a timely manner to control fugitive dust.
- Prior to construction, obtain necessary permit(s) from the San Joaquin Valley Air Pollution Control Board.

3.14 Noise

3.14.1 Existing Conditions

The environmental and regulatory framework described in Sections 5.19 of the 2018 LSJR IIFR/EIS/EIR is generally applicable to the analysis in this SEA and therefore is not repeated here.

In addition to the noise related provisions in the 2018 LSJR IIFR/EIS/EIR, the allowable work hours by the City of Stockton are 8:30 am to 4:30 pm For work outside of these hours, an encroachment permit must be obtained from the City of Stockton.

3.14.2 Environmental Effects

No Action Alternative

Section 5.19.4 of the 2018 LSJR IIFR/EIR/EIS states that Alternative 7a would generate short-term and intermittent noise and vibration at or near sensitive locations along the Project reaches. Individual sensitive receptors would be exposed to construction noise for up to a full construction season. Short term construction-related noises would exceed applicable daytime standards, including those of San Joaquin County and the City of Stockton. In addition, Alternative 7a would introduce construction-related vibration that could exceed the standard for human annoyance for sensitive receptors. Noise- and vibration-reducing practices would reduce the severity of the impacts, but short-term effects would remain significant and unavoidable.

Proposed Action

In general, the noise effects associated with the Proposed Action are sufficiently described in Section 5.19.4 of the 2018 LSJR IIFR/EIS/EIR. Therefore, only impacts unaccounted for in that document are discussed here.

Sensitive receptors surrounding the Proposed Action area (including the potential mitigation sites) could be subjected to construction related noise between the work hours of 7:00 am and 7:00 pm, which falls within the daytime working hours in accordance with the noise ordinances in both the San Joaquin County Code and City of Stockton Municipal Code. However, construction work hours generally allowed by the City of Stockton are 8:30 am to 4:30 pm The Proposed Action would expose sensitive

receptors in the nearby Brookside residential area to noise outside of these hours, however, any effects beyond those disclosed in the 2018 LSJR IIFR/EIS/EIR would be less than significant.

3.14.3 Avoidance, Minimization, and Mitigation Measures

All measures in the 2018 LSJR IIFR/EIS/EIR Section 5.19.10 would be implemented as applicable. In addition, prior to construction, an encroachment permit would be obtained from the City of Stockton for any noise-generating work planned to occur outside of the hours of 8:30 am to 4:30 pm. These measures would ensure that any effects associated with the Proposed Action would be less than significant.

3.15 Cultural Resources

3.15.1 Existing Conditions

The environmental and regulatory framework for Cultural Resources described in Section 5.21 of the 2018 LSJR IIFR/EIS/EIR is applicable to the analysis in this SEA and therefore is not repeated here.

USACE is complying with Section 106 of the National Historic Preservation Act for the LSJRP through implementation of the Programmatic Agreement Between the US Army Corps of Engineers and the California State Historic Preservation Officer Regarding the Lower San Joaquin River Feasibility Study Project, San Joaquin County, California (PA), executed on May 11, 2016, and amended on May 11, 2021. USACE has been utilizing the PA, which is described in the 2018 LSJR IIFR/EIS/EIR, since the PA was executed.

USACE initiated consultation with the California SHPO and the following Native American tribes; Buena Vista Rancheria of Me-Wuk Indians, California Valley Miwok Tribe, The Confederated Villages of Lisjan, Guidiville Indian Rancheria, Ione Band of Miwok Indians, Muwekma Ohlone Indian Tribe of the SF Bay Area, North Valley Yokuts Tribe, Tule River Indian Tribe, Wilton Rancheria and Wuksache Indian Tribe/Eshom Valley Band regarding Reach TS30L in letters dated September 4, 2020. In those letters, USACE delineated the Area of Potential Effects (APE) for Reach TS30L including the staging area and provided documentation of identification and evaluation efforts for Reach TS30L. The haul routes are not included in the APE for Section 106 compliance since they are paved roads and will not be impacted by the Proposed Action. In a letter dated September 28, 2021, the SHPO had no comments on the APE. The SHPO concurred that the Tenmile and Fourteenmile Slough Levees, the only cultural resources identified in the APE, are not eligible for listing in the National Register of Historic Places (NRHP).

In a letter dated November 3, 2021, USACE consulted with the SHPO and interested Native American tribes to revise the APE to include a proposed borrow area for Reach TS30L levee repairs, an actively farmed field between the SEWD percolation pond and Stockton Diverting Canal. During the identification efforts, a previously recorded cultural

resource, a historic-era refuse scatter (SEWD-01), was identified within the APE. No additional cultural resources were identified in the APE. In the same letter, USACE determined that SEWD-01 was ineligible for listing in the NRHP. USACE also proposed a continued finding of no historic properties affected for Reach TS30L. In a letter dated December 1, 2021, the SHPO did not have comments on the APE revision and concurred that SEWD-01 was not eligible for listing in the NRHP. The SHPO also did not object to the continued finding of no historic properties affected for Reach TS30L.

In a letter dated June 7, 2022, USACE consulted with the SHPO and interested Native American tribes to revise the APE to include the Fourteenmile Slough Sanitary Complex (potential off-site mitigation Parcel C), a barge landing area, an access route southwest of Reach TS30L, and a perimeter road of the SEWD in the APE. During the identification efforts, the Wright-Elmwood Tract, a previously unrecorded cultural resource was identified within the APE. A segment of the Southern Pacific Railroad (SPRR), part of the SPRR Oakdale Branch, was also identified within the APE. In the same letter, USACE consulted on a determination that Wright-Elmwood Tract (including SJC Levee 31 & SJC Levee 115), Fourteenmile Slough Sanitary Complex, and the Southern Pacific Railroad Company (SPRR) Oakdale Branch are not eligible for listing on the NRHP. USACE also proposed a continued finding of no historic properties affected for Reach TS30L. In a letter dated July 8, 2022, the SHPO had no comments of the APE revision and concurred with USACE determinations of eligibility for the Wright-Elmwood Tract, Fourteenmile Slough Sanitary Complex, and the SPRR Oakdale Branch. The SHPO also did not object to the finding of no historic properties affected for Reach TS30L.

USACE has revised the APE to include the SJR East (Parcel A) and SJR West (Parcel B) potential habitat mitigation sites. APE consultation letters were sent out to the SHPO and interested Native American tribes on February 6, 2023. In a letter dated March 2, 2023, the SHPO indicated no comments on the revised APE consultation. USACE received an email on February 9, 2023 from the Northern Valley Yokuts stating that the proposed LSJR Project in Stockton has a high potential for inadvertent discoveries of human remains. They recommended that Native American monitors be on site during any ground disturbance. USACE responded to the Northern Valley Yokuts via email on February 23, 2023, thanking them for their comments and letting them know that USACE will reach out to interested Tribes prior to construction of the mitigation sites.

During the identification efforts, five ditches within the Wright-Elmwood Tract were recorded as features, evaluated, and determined not eligible for the NRHP under any criteria. Hurley-Tracy No. 1 Transmission Line, Hurley–Tracy No. 2 Transmission Line, Eight Mile Road-Stagg 230 kV Transmission Line, and Stagg-Tesla 230 kV Transmission Line were all evaluated and determined not eligible for the NRHP under any criteria. In a letter dated March 16, 2023, to the SHPO and interested Native American tribes, USACE proposed a continued finding of No Historic Properties Affected for the Project and requested SHPO concurrence on the determinations of ineligibility. In a letter dated April 11, 2023, the SHPO stated that they would not be able

to respond within the 30 calendar days stipulated by the PA. USACE responded to the SHPO in a letter dated April 18, 2023, stating that the Project's Section 106 compliance is guided by a PA, which outlines timelines and review procedures. According to Stipulation I (Review Procedures and Timeframes) of the PA, "For all documents and deliverables produced in accordance with the stipulations of this Agreement….the SHPO shall have thirty (30) calendar days to respond. Failure of the SHPO, Concurring Parties, and Native American interested parties and Tribes to respond within thirty (30) calendar days of any submittal shall not preclude Corps from moving to the next step in this Agreement." Therefore, USACE does not require a SHPO response and will move forward to construction of the Project. USACE requested that the SHPO discontinue review of the finding of effect and our determinations of ineligibility and that a response is no longer required by the agency under the terms of the PA. The SHPO responded via email on April 18, 2023, stating they will proceed with what was stated in the letter.

3.15.2 Environmental Effects

USACE uses effects determinations arrived at through NHPA Section 106 compliance to assess effects to cultural resources under NEPA and to mitigate for adverse effects under both laws. Any adverse effects to historic properties determined through the Section 106 process would be considered as significant impacts under NEPA if they were to alter, directly or indirectly, the characteristics of a historic property that qualify it for inclusion in the NRHP in a manner that diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association.

No Action Alternative

Alternative 1 - No Action. Under the No Action Alternative, USACE would complete the levee improvements as described in Alternative 7a in Section 5.21.4 of the 2018 LSJR IIFR/EIS/EIR. Based on the results of previous Section 106 consultation with the SHPO, the No Action Alternative would not impact any known historic properties.

Proposed Action

Alternative 2 - Proposed Action. Under the Proposed Action, the levee improvements described in the 2018 LSJR IIFR/EIS/EIR would take place along with the following elements not previously analyzed: borrow site and haul routes, two staging areas, refinements to the levee design, and mitigation for environmental impacts. USACE has completed Section 106 consultation for all of the Proposed Action's elements. The Proposed Action would not impact any known historic properties.

3.15.3 Avoidance, Minimization, and Mitigation Measures

To date, USACE has determined that Proposed Action activities would have no significant impact to cultural resources and no mitigation measures specific to that action are currently contemplated. If adverse effects to any historic properties are found through additional Section 106 consultation, or occur during construction, those effects would be mitigated as stipulated in the PA.

Chapter 4 CUMULATIVE EFFECTS

This EA also considers the effects of cumulative impacts as required in 40 CFR §1508.7 and concurrent actions as required in 40 CFR §1508.25[1]. A cumulative impact, as defined by the CEQ (40 CFR §1508.7) is the "…impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Actions in the region of influence for this Project not already discussed in the 2018 LSJR IIFR/EIS/EIR that could occur during the same time period and have effects, which could combine with effects of the Proposed Action include the Lower San Joaquin River Mossdale Tract and Vicinity Feasibility Study

4.1 Groundwater

The Proposed Action would not prevent the percolation or movement of the underlying groundwater basin and would not use groundwater and there would be no cumulative impact to groundwater supply. The Proposed Action does not include any new subsurface activities that would reach the depth of the underlying water table, so there is no potential to introduce contaminants into groundwater below construction locations. Therefore, the Proposed Action would not contribute to a cumulatively significant impact on groundwater quality.

4.2 Wetlands and Other Waters of the U.S.

Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR identifies cumulative impacts to wetlands and other waters of the U.S. as significant and unavoidable, due to short- and long-term effects on waters of the U.S., including wetlands, as a result of construction and operation of in-water closure structures, placement of fill, and elimination of existing vegetation in the receiving waters. Temporary impacts associated with the fill and relocation of landside toe drains and irrigation ditches would also occur.

Implementation of the Proposed Action would result in the removal of approximately 0.6 acres of wetland habitat. This loss of wetlands would be compensated for through creation of new wetland habitat at a nearby mitigation site either adjacent to the Proposed Action area or at one of Parcels A, B, or C after construction begins. This loss of wetlands, along with the loss attributed to other projects in the area, would contribute to adverse cumulative effects to wetlands and other waters of the U.S., but not above the significant and unavoidable level already discussed in the 2018 LSJR IIFR/EIS/EIR.

4.3 Aesthetic Resources

Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR states that implementation of projects within the study area in the past together with those planned for the future would result

in significant and unavoidable cumulative impacts to aesthetics, primarily related to the loss of visual quality during and after construction. The Proposed Action would contribute to this significant cumulative impact because it would result in permanent loss of large trees and other vegetation along Tenmile Slough. A new mitigation site would be created with habitat that would improve visual quality; however, a long-time period is required for planted vegetation to reach a similar size as the existing vegetation. The adverse cumulative effects to aesthetic resources associated with the Proposed Action would not exceed those significant and unavoidable level described in the 2018 LSJR IIFR/EIS/EIR.

4.4 Vegetation and Wildlife

Cumulative effects to vegetation and wildlife due to the LSJR and other projects are described in Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR. Implementation of avoidance, mitigation, and compensatory mitigation measures in Section 5.9.10 and 5.10.10 would reduce the magnitude of the contribution, but effects as identified would remain significant and unavoidable.

The 2018 LSJR IIFR/EIS/EIR states that 139 acres of riparian habitat and 10.75 acres of wetland habitat would be removed under Alternative 7a; these estimates include the 11.4 acres of riparian and 0.6 acres of wetland habitats that would be removed under the Proposed Action. Therefore, effects from the Proposed Action would not increase the magnitude of the cumulative effects beyond what is described in the 2018 LSJR IIFR/EIS/EIR.

In addition, application of mitigation measures outlined in Section 5.9.10 and Section 5.10.10 of the 2018 LSJR IIFR/EIS/EIR and in Section 3.7.3 of this SEA, including compliance with the recommendations of the USFWS in their 2022 Supplemental CAR for the Proposed Action to the extent feasible and the creation of up to 71 acres of wetland and riparian habitat at a mitigation site would further reduce the magnitude of the Proposed Action’s effects.

4.5 Federal Special Status Species

As discussed in Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR, Alternative 7a would result in considerable contributions to direct and indirect effects on special status species and have a significant and unavoidable cumulative impact. Implementation of the mitigation measures described in Section 5.12.10 of the 2018 LSJR IIFR/EIS/EIR would reduce the impacts, except where there is direct and indirect loss of shaded riverine aquatic (SRA) habitat. The method of mitigation under the Proposed Action has changed (mitigation site construction instead of the purchase of credits) but will provide equivalent reduction to the impacts.

There are two special status species in the Proposed Action area: the VELB and the GGS. The elderberry shrubs within the proposed footprint would be transplanted to an approved conservation bank. To account for the transplant effects, riparian habitat with planted elderberries would be created at the selected mitigation site. This would offset

effects to the VELB and reduce any added cumulative impacts from the proposed action to the VELB to a less than significant level. To minimize effects to GGS, work would be conducted during the GGS's active period so they can move and avoid the construction area. To compensate for the loss of GGS habitat, wetland and upland habitat would be created at the selected mitigation site. This in addition to avoidance and minimization measures would reduce cumulative impacts on GGS to a less than significant level.

4.6 Socioeconomics and Environmental Justice

The LSJR Project would have beneficial cumulative effects to socioeconomics by reducing flood risk to the City of Stockton. The Proposed Action contribute to the beneficial effects, and the overall beneficial cumulative effects.

The Proposed Action could have slight adverse impacts on the Garden Acres neighborhood, a community adjacent to the SEWD borrow site identified as disadvantaged. These impacts would be less than significant, as discussed in Section 3.9.2. The Proposed Action would not create barriers that would divide any established community or disproportionately affect minority or low-income populations, thus would not contribute to adverse cumulative effects to the community when considered with other projects in the area.

4.7 Utilities and Public Services

As stated in Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR, significant cumulative impacts related to the expansion and services from utilities resulting from Alternative 7a and other projects are possible. Implementation of the Proposed Action would not require the use or expansion of local utilities, including water supply. All utilities and utility easements within the proposed footprint, including the mitigation area, would be maintained and protected. The Proposed Action would not contribute to significant cumulative impacts to utilities or public services.

4.8 Land Use

The implementation of the Proposed Action would result in a permanent conversion of a small amount of agricultural land including prime farmland into levees, flood risk management supporting features, and habitat mitigation. However, this small amount of agricultural land does not represent a significant effect to land use. It is a small portion of the available agricultural land on Wright-Elmwood Tract, and the remainder of such land would remain functional for crop production. Construction of the Proposed Action would not contribute to a significant cumulative impact to land use, even when considered with other projects in the area.

4.9 Transportation and Circulation

Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR determines that Alternative 7a would not contribute to significant cumulative impacts on traffic or transportation. The changes to the alternative, analyzed as the Proposed Action, would not change this determination,

as there are no planned projects in the study area surrounding the Proposed Action locations, including TS30L and the SEWD borrow site.

4.10 Air Quality and GHG Emissions

All projects within the SJVAPCD would cumulatively contribute to emissions of criteria pollutants, particularly if they are constructed concurrently, which could have a significant cumulative effect on air quality as described in Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR. Criteria pollutant emissions associated with the Proposed Action are mostly covered in the description of Alternative 7a in the 2018 LSJR IIFR/EIS/EIR, with the exception of the construction of a new mitigation site. However, the construction of a new site would be a minor relative contribution to the No-Action emissions, and the Proposed Action would not contribute significantly to cumulative effects on air quality.

A challenge with GHG emissions and climate change is that no single action is likely to contribute significantly to the climate change process on its own; it is entirely a cumulative progression. It is expected that the primary impacts from concurrent projects would be due to construction activities. On an individual basis, each project would mitigate emissions below the general reporting threshold. If projects are implemented concurrently, it is possible that the combined cumulative effects could be above reporting requirements for GHG emissions. However, with the implementation of mitigation measures, which would be required for each project, it is possible that the effects could be reduced to less than significant. In addition, by implementing flood risk management projects such as the Proposed Action, potential future emissions associated with flood fighting and emergency actions would be reduced. The overall cumulative GHG emissions from these projects are considered to be less than significant.

4.11 Noise

The Proposed Action would contribute to cumulative noise impacts if there are other local projects that would results in temporarily increased levels of ambient noise in the Proposed Action area. None of the projects are in close enough proximity of the proposed TS30L or mitigation construction sites to create a cumulative effect from concurrent construction. If there are any unforeseen projects constructing within audible distance from one another, USACE would coordinate with the other projects to ensure that the Proposed Action would not be constructing at the same time as other, adjacent construction. Therefore, the Proposed Action would not contribute to a significant cumulative impact to noise.

4.12 Cultural Resources

In general, the cumulative impacts to cultural resources would be significant and unavoidable as described in Section 5.23.5 of the 2018 LSJR IIFR/EIS/EIR, due to the amount of earth-disturbing activity associated with construction of the levee

improvements, which, in conjunction with other heavy construction projects, could contribute to the progressive loss of cultural resources. The Proposed Action would not affect known historic or cultural resources; therefore, no contribution to cumulative impacts on cultural resources would occur from the implementation of the Proposed Action.

Chapter 5 COMPLIANCE WITH FEDERAL LAWS AND REGULATIONS

Certain Federal laws and regulations require issuance of permits before project implementation; other laws and regulations require agency consultation but may not require issuance of any authorization or entitlements before project implementation. For each of the laws and regulations addressed in this section, the description indicates either full or partial compliance; if partial compliance is indicated, full compliance will be achieved prior to issuance of a NEPA decision document.

5.1 Clean Air Act, as amended, 42 U.S.C. 7401, et seq.

Air quality regulations were first communicated with the Clean Air Act (CAA). The CAA is intended to protect the Nation's air quality by regulating emissions of air pollutants. The CAA established the NAAQS and delegated enforcement of air pollution control to the states. CARB has been designated as the state agency responsible for regulating air pollution sources at the state level. CARB, in turn, has delegated the responsibility of regulating stationary emission sources to local air pollution control or management districts which, for the Proposed Action is within the SJVAPCD.

The CAA states that all applicable federal and state ambient air quality standards must be maintained during the operation of any emission source. The CAA also delegates to each state the authority to establish air quality rules and regulations. State adopted rules and regulations must be at least as stringent as the mandated federal requirements. In states where the National Ambient Air Quality Standards (NAAQS) are exceeded, the CAA requires preparation of a State Implementation Plan (SIP) that identifies how the state will meet standards within timeframes mandated by the CAA. The U.S. EPA, in conjunction with the U.S. Department of Transportation, established the General Conformity Rule on November 30, 1993. The rule implements the CAA conformity provision, which requires federal agencies to identify, analyze, and quantify emission impacts of an action and mandates that the federal government not engage, support, or provide financial assistance for licensing or permitting, or approve any activity not conforming to an approved CAA implementation plan.

Section 5.8.4 Alternative 7A of the 2018 LSJR IIFR/EIR/EIS states that the No Action Alternative would be below the SJVAPCD and Federal conformity threshold for all pollutants except NO_x.

The Proposed Action area meets NAAQS for criteria pollutants and therefore, no conformity analysis was required. This SEA evaluates air emissions resulting from the Proposed Action and concludes that with mitigation there will be less than a significant impact on air quality.

5.2 Clean Water Act, as amended, 33 U.S.C. 1251, et seq.

The Clean Water Act (CWA) is the primary Federal law that governs and authorizes water quality control activities by the EPA, the lead federal agency responsible for water quality management, and the State. Sections 401 and 404 of the CWA applies to jurisdictional waters of the U.S. and regulate the movement or placement of fill materials and construction activities within these waters.

A jurisdictional delineation of the agricultural ditch and associated wetlands adjacent to TS30L was conducted on March 9, 2021, which found these aquatic resources did not meet the definition of jurisdictional waters of the U.S. under the June 2020 Navigable Waters Protection Rule in effect at the time of the delineation. As of March 20, 2023, a new rule definition waters of the U.S. has come into effect. Under the current rule, the aquatic resources still would not meet the definition of jurisdictional waters of the U.S. The northern staging area and temporary construction work area west of TS30L which lie in irrigated rice fields were not included in the original wetland delineation for the TS30L construction footprint, but may meet the current definition of jurisdictional waters of the U.S.

The Proposed Action includes establishing mitigation sites in areas which may include aquatic resources considered waters of the U.S. and may be subject to Sections 401 and 404 of the CWA. Prior to construction, USACE will prepare a Water Quality Certification and Section 404(b)(1) evaluation for any site which falls under federal CWA jurisdiction.

Prior to construction, the contractor will be required to obtain a Construction General Permit and the preparation of a Stormwater Pollution Prevention Plan (SWPPP) for potential effects related to stormwater discharge. With implementation of these permits, the Proposed Action will be in compliance with the CWA.

5.3 Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. 9601, et seq.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, known as Superfund) was passed to facilitate the cleanup of toxic waste sites. In 1986, the Act was amended by the Superfund Amendment and Reauthorization Act Title III (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of the cleanup, even if the material was dumped illegally when the property was under different ownership. Hazardous material may be present in the vicinity of the Proposed Action, in particular, the potential mitigation site located at the former wastewater ponds at the Fourteenmile Slough pump station (Parcel C). A Phase 1 Environmental Site Assessment was conducted in October 2022, indicating the need for a Phase 2 Assessment, which is tentatively scheduled to occur in May 2023. If the Phase 2 Assessment finds that contaminants exist at the site, it is unlikely that it would be

selected as the mitigation site for TS30L. If the parcel is chosen for mitigation, these lands would require remediation before construction of the site. These conditions, along with those described in Section 5.20.10 of the 2018 LSJR IIFR/EIS/EIR would ensure the Proposed Action remains compliant with CERCLA.

5.4 Endangered Species Act, as amended, 16 U.S.C. 1531, et seq.

Under Section 7(a)(2) of the Endangered Species Act (ESA), federal agencies must consult with USFWS and the National Marine Fisheries Service (NMFS) to ensure that agency actions do not jeopardize the continued existence of any threatened or endangered species or their habitats. BOs were received for the LSJR Project from USFWS and NMFS in June 2016 which concluded that the Project is unlikely to jeopardize the continued existence of federally listed species in the Project area. For TS30L, the species of concern are the VELB and GGS. USACE re-initiated formal consultation with USFWS for the Proposed Action on May 15, 2023 due to changes in the Project that may affect VELB and GGS, particularly relating to compensatory mitigation for the Proposed Action. Under the 2016 consultation, a conservation measure proposed for VELB was a compensatory mitigation site created by a 14-acre levee setback, which would receive the elderberry transplants. However, this levee setback would not be constructed prior to TS30L construction. Additionally, the Project's original compensation strategy was to purchase credits for riparian and wetland habitat. However, since such credits are not available, USACE is instead proposing to construct a mitigation site. These changes were included in the consultation with USFWS, and a BO detailing the Service's determination and any Terms and Conditions is expected in September 2023. All conservation measures and Terms and Conditions resulting from the TS30L consultation will be implemented throughout all phases of the Proposed Action.

5.5 Executive Order 11990, Protection of Wetlands

EO 11990, signed May 24, 1977, directs all Federal agencies to refrain from assisting in or giving financial support to projects that encroach on publicly or privately owned wetlands. It further requires that Federal agencies support a policy to minimize the destruction, loss or degradation of wetlands. Any wetland loss at TS30L will be offset by restoring wetlands at one of four adjacent or nearby parcels, ensuring that wetlands are not lost as a result of the levee improvements. Any existing wetlands at the proposed mitigation parcels would be protected and enhanced by the Proposed Action.

5.6 Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations

EO 12898 directs federal agencies to address disproportionate environmental and human health effects of federal actions on minority and low-income populations. EO 12898 requires that adverse effects on minority or low-income populations be taken into

account during preparation of environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by Federal agencies.

The Proposed Action includes a borrow site located near a residential neighborhood identified as disadvantaged, however the haul route does not go through the neighborhood. The Proposed Action has identified measures to minimize dust and noise impacts resulting from the hauling of material, demonstrating full compliance with EO 12898.

5.7 Executive Order 13112, Invasive Species.

EO 13112, signed February 3, 1999, directs all Federal agencies to prevent and control the introduction of invasive species in a cost-effective and environmentally sound manner. It established the National Invasive Species Council, composed of Federal agencies and departments, and the supporting Invasive Species Advisory Committee, composed of state, local and private entities. The Council's National Invasive Species Management Plan recommends objectives and measures to implement EO 13112, and to prevent he introduction and spread of invasive species (National Invasive Species Council 2008). EO 13112 requires consideration of invasive species in NEPA analysis, including their identification and distribution, their potential effects and measures to prevent or eradicate them. A management plan would be developed and implemented for the construction phase of the Proposed Action and included in the O&M Manual, after which the Project and Proposed Action would be in compliance.

5.8 Farmland Protection Policy Act, 7 USC 4201 et seq.

The purpose of the Farmland Protection Policy Act (FPPA) is to minimize the extent to which federal programs contribute to unnecessary conversion of farmland to nonagricultural uses. While the FPPA does not require the federal agency to modify a project solely to avoid farmland impacts, it does require the agency to examine the effects and consider alternatives to lessen those effects. If an action is to affect agricultural lands, coordination with the U.S. Department of Agriculture, NRCS will occur.

The SEWD borrow site and all parcels under consideration for mitigation lie on land designated as prime farmland. USACE consulted with NRCS to determine LESA scores for each parcel, which indicates whether the FPPA applies and alternate parcels should be considered. None of the scores exceeded the threshold for significant impacts to prime farmland; therefore, mitigation for the converted farmland is not required and the Project and Proposed Action are in compliance with the FPPA.

5.9 Fish and Wildlife Coordination Act, as amended, 16 USC 661, et seq.

The Fish and Wildlife Coordination Act directs the USFWS to provide recommendations to minimize impacts to fish and wildlife resources because of a proposed federal

action's effect on a body of water. The USFWS CAR was prepared in 2016 and included in the Environmental Addendum of the 2018 LSJP IIFR/FEIS/FEIR. A supplemental CAR was prepared in 2022 to provide habitat analysis and recommendations specific to TS30L. The Proposed Action will follow the recommendations provided in the CARs.

5.10 Magnuson-Stevens Fishery Conservation and Management Act, as amended, 16 USC 1801, et seq.

The Magnuson-Stevens Fishery Conservation and Management Act established a management system for national marine and estuarine fishery resources. Essential Fish Habitat (EFH) is defined as "waters and substrate necessary to fish spawning, breeding, feeding or growth to maturity." 16 USC 1802. It states that migratory routes to and from anadromous fish spawning grounds should also be considered EFH. This Act requires Federal agencies to consult with NMFS regarding all action or proposed actions permitted, funded, or undertaken that may adversely affect EFH. The Proposed Action area does not affect any waterways that are defined as EFH.

5.11 Migratory Bird Treaty Act, as amended, 16 USC 703 et seq.

The Migratory Bird Treaty Act (MBTA), as amended, implements treaties and conventions between the United States, Canada, Japan, Mexico, and Russia providing protection for migratory birds as defined in 16 USC 715j. It established hunting seasons and capture limits for game species and protects migratory birds, their occupied nests, and their eggs (16 USC 703; 50 CFR Part 21; 50 CFR Part 10). Permits from USFWS are required for both incidental and direct take.

Migratory birds and their nests are likely to occur within, and adjacent to, the footprint of the proposed action. To ensure that the Proposed Action does not affect migratory birds, vegetation removal would occur during the non-nesting season, and preconstruction surveys would be conducted by a qualified biologist in areas within and adjacent to the construction site. If breeding birds are found in the area, a protective buffer would be delineated and USFWS and California Department of Fish and Wildlife (CDFW) would be consulted for further actions.

5.12 National Environmental Policy Act, as amended, 42 USC 4321 et seq.

NEPA applies to all Federal agencies and requires Federal agencies to provide a detailed statement on proposals for major Federal actions significantly affecting the quality of the human environment. NEPA requires every Federal agency to disclose the environmental effects of its actions for public review purposes and directs the Federal agency to assess alternatives to, and the consequences of, the proposed action. This document supplements the original 2018 LSJR IIFR/EIS/EIR NEPA document, providing additional information to consider the environmental consequences of design

refinements developed since the original 2018 LSJR IIFR/EIS/EIR. This document will be circulated for a 45-day public review. After the public review period, a final document will be prepared that incorporates public comments, as appropriate. Following this review and the issuance of a FONSI, the Project and Proposed Action will be in full compliance with NEPA.

5.13 National Historic Preservation Act, as amended, 54 USC 300101 et seq.

The National Historic Preservation Act (NHPA) is the primary Federal legislation governing the preservation of significant historic properties. Section 106 of the NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties. Undertakings are projects, activities, or programs funded in whole or in part under the direct or indirect jurisdiction of a Federal agency. USACE uses effects determinations arrived at through compliance with Section 106 of the NHPA, to assess effects to cultural resources under NEPA, and to mitigate for adverse effects under both laws.

USACE has consulted and received SHPO concurrence with a finding of No Historic Properties Affected for the activities consisting of the levee repairs, staging areas, the proposed borrow area, and the Fourteenmile Slough Pump Station (Parcel C). USACE completed consultation with the SHPO on a finding of effect related to the SJR East Site (Parcel A) and SJR West Site (Parcel B). USACE determined that the addition of the two sites to the APE would have a continued finding of No Historic Properties Affected for the Project.

5.14 Noise Control Act, as amended, 42 USC 4901, et seq.

Federal action is essential to deal with major noise sources in commerce, control of which require national uniformity of treatment. EPA is directed by Congress to coordinate the programs of all Federal agencies relating to noise research and control. The Noise Control Act requires that Federal agency activities comply with all Federal, State, and local laws and regulation that regulate noise emissions threshold, which were incorporated into the significance thresholds used in the assessment of potential project impacts. The general plans for San Joaquin County, the City of Stockton, and the City of Manteca identify noise emissions thresholds, which were incorporated into the significance threshold used in the assessment of potential Project impacts in the 2018 LSJR IIFR/EIS/EIR (Section 5.19.4).

Construction related noise is not likely to exceed land use compatibly threshold on agricultural lands but could result in intermittent noise impacts to residential uses within 700 feet of construction activities. Truck routes would be properly maintained. No night-time construction between the hours of 10:00 pm and 7:00 am would occur. Development of the proposed mitigation sites would not add additional noise than has already been expected in the 2018 LSJR IIFR/EIS/EIR.

5.15 Noxious Weed Act, as amended, 7 USC 2801, et seq.

The Noxious Weed Act was authorized to control and manage the spread of nonnative plant species that may have adverse effects on agriculture, commerce wildlife resources, or public health. It inhibits the transport, trade or sale of noxious plant species in the U.S. and gave the Secretary of Agriculture authority to determine noxious plant species, and to establish measures to control them. As amended, the Act requires all Federal agencies to establish a management plan to control the spread of noxious plant species in the jurisdiction. A management plan would be developed and implemented for the construction of the Proposed Action and included in the O&M Manual, after which the Proposed Action would be in compliance with this Act.

5.16 Resources Conservation and Recovery Act, as amended, 42 USC 6901 et seq.

The Resources Conservation and Recovery Act enables EPA to administer a regulatory project that extends from the manufacture of hazardous materials to their disposal, thus regulating the generation, transportation, treatment, storage and disposal of hazardous waste at all facilities and sites in the U.S. The LSJR Proposed Action would comply with this Act when transporting or disposing of hazardous material found in the Proposed Action area.

5.17 Uniform Relocation Assistance and Real Property Acquisition Policies Act, as amended, 42 USC 4601 et seq.

The proposed TS30L construction footprint falls within easements and real estate acquisition is not anticipated to construct the levee improvements. Three of the proposed mitigation sites fall on private land and real estate acquisition would be required for on-site mitigation, Parcel A, or Parcel B. Parcel C is located on City of Stockton property and would require a conservation easement. The San Joaquin Area Flood Agency is USACE's partner and is responsible for the Lands, Easements, Rights-of-Way, Relocations, and Disposal (LERRD) processes including any property acquisitions in order to comply with the Act.

5.18 Wild and Scenic Rivers Act, as amended, 16 USC 1271, et seq.

The Proposed Action does not contain any wild or scenic Rivers, therefore the Wild and Scenic Rivers Act is not applicable.

Chapter 6 COORDINATION OF THE SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

This Draft SEA and Draft FONSI will be circulated for public review from May 31 to July 17, 2023. This 45-day period aligns with the public review period of the Draft Supplement Environmental Impact Report as required by CEQA. A public meeting will occur on June 26 in two sessions – one virtual and one in person in the Brookside community. Substantive comments received during the public review period along with USACE's responses will be incorporated into the final SEA as appropriate and will be summarized and included as an appendix to the final report.

Agencies coordinated with during the development of this report include USFWS, NMFS, the SHPO, and EPA.

USACE sent a letter of reinitation to USFWS for Section 7 consultation under the ESA for the TS30L reach on May 15, 2023. A BO is expected from USFWS in September 2023.

USACE has consulted with the California SHPO and the following Native American tribes; Buena Vista Rancheria of Me-Wuk Indians, California Valley Miwok Tribe, The Confederated Villages of Lisjan, Guidiville Indian Rancheria, Ione Band of Miwok Indians, Muwekma Ohlone Indian Tribe of the SF Bay Area, North Valley Yokuts Tribe, Tule River Indian Tribe, Wilton Rancheria and Wuksache Indian Tribe/Eshom Valley Band on the following dates:

- On September 4, 2020 USACE sent a letter delineating the Area of Potential Effects (APE) for Reach TS30L including the staging area and provided documentation of identification and evaluation efforts for Reach TS30L.
- On November 3, 2021, USACE consulted with the SHPO and interested Native American tribes to revise the APE to include the proposed borrow area for Reach TS30L levee repairs. USACE also proposed a continued finding of no historic properties affected for Reach TS30L.
- On June 7, 2022, USACE consulted with the SHPO and interested Native American tribes to revise the APE to include the Fourteenmile Slough Sanitary Complex (potential off-site mitigation Parcel C), a barge landing area, an access route southwest of Reach TS30L, and a perimeter road of the SEWD in the APE. USACE also proposed a continued finding of no historic properties affected for Reach TS30L.
- On February 6, 2023 USACE sent out consultation letters revising the APE to include the SJR East (Parcel A) and SJR West (Parcel B) potential habitat mitigation sites. USACE received an email on February 9, 2023 from the Northern Valley Yokuts stating that the proposed LSJR Project in Stockton has a high potential for inadvertent discoveries of human remains. They recommended

that Native American monitors be on site during any ground disturbance. USACE responded to the Northern Valley Yokuts via email on February 23, 2023, thanking them for their comments and letting them know that USACE will reach out to interested Tribes prior to construction of the mitigation sites. On March 16, 2023, USACE sent letters proposing a continued finding of No Historic Properties Affected for the Project and requesting SHPO concurrence on the determinations of ineligibility for five ditches recorded as features within the Wright-Elmwood Tract.

Chapter 7 FINDINGS

The anticipated environmental effects of the Proposed Action on twelve resource areas were evaluated within this SEA for LSJR Reach TS30L. The analysis indicates that, with implementation of the avoidance, minimization, and mitigation measures described in the 2018 LSJR IIFR/EIS/EIR and the additional measures described in this SEA, the Proposed Action would not cause any new significant impacts beyond those described in the 2018 LSJR IIFR/EIS/EIR. A Draft FONSI of the Proposed Action has been prepared and has been circulated with this SEA.

Chapter 8 REFERENCES

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APPENDIX A – PUBLIC COMMENTS AND RESPONSES

This Draft SEA and Draft FONSI will be circulated for public review from May 31 to July 17, 2023. A public meeting will occur on June 26 in two sessions – one virtual and one in person in the Brookside community. Substantive comments received during the public review period along with USACE's responses will be incorporated into the final SEA as appropriate and will be summarized and included in this Appendix to the final report.

APPENDIX B – AIR QUALITY EMISSIONS FOR CONSTRUCTION OF TS30L

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APPENDIX C – AIR QUALITY EMISSIONS FOR TS30L MITIGATION

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APPENDIX D – AGENCY COORDINATION LETTERS

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APPENDIX E – TS30L SUPPLEMENTAL COORDINATION ACT REPORT

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APPENDIX F – BIOLOGICAL ASSESSMENT AND USFWS BIOLOGICAL OPINION

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Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> TS30L Levee Project

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	2.03	35.03	4.19	50.22	0.22	50.00	10.59	0.19	10.40	0.07	6,497.46	2.05	0.07	6,570.29
Grading/Excavation	6.13	108.98	14.37	50.70	0.70	50.00	11.00	0.60	10.40	0.21	20,367.25	6.19	0.34	20,624.30
Drainage/Utilities/Sub-Grade	2.04	36.26	4.77	50.24	0.24	50.00	10.60	0.20	10.40	0.07	6,766.35	2.05	0.11	6,851.77
Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (pounds/day)	6.13	108.98	14.37	50.70	0.70	50.00	11.00	0.60	10.40	0.21	20,367.25	6.19	0.34	20,624.30
Total (tons/construction project)	0.73	13.07	1.72	7.28	0.08	7.20	1.57	0.07	1.50	0.03	2,441.64	0.74	0.04	2,472.40

Notes:

Project Start Year ->	2024
Project Length (months) ->	12
Total Project Area (acres) ->	55
Maximum Area Disturbed/Day (acres) ->	5
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	2	0	22	0	120	0
Grading/Excavation	111	0	132	0	300	150
Drainage/Utilities/Sub-Grade	22	0	44	0	120	50
Paving	0	0	0	0	0	0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> TS30L Levee Project

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.01	0.21	0.03	0.30	0.00	0.30	0.06	0.00	0.06	0.00	38.98	0.01	0.00	35.76
Grading/Excavation	0.66	11.77	1.55	5.48	0.08	5.40	1.19	0.06	1.12	0.02	2,199.66	0.67	0.04	2,020.71
Drainage/Utilities/Sub-Grade	0.06	1.09	0.14	1.51	0.01	1.50	0.32	0.01	0.31	0.00	202.99	0.06	0.00	186.48
Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (tons/phase)	0.66	11.77	1.55	5.48	0.08	5.40	1.19	0.06	1.12	0.02	2199.66	0.67	0.04	2,020.71
Total (tons/construction project)	0.73	13.07	1.72	7.28	0.08	7.20	1.57	0.07	1.50	0.03	2441.64	0.74	0.04	2,242.95

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Road Construction Emissions Model **Version 9.0.0**
Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a
yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells D10 through D24, E28 through G35, and D38 through D41 for all project types.
Please use "Clear Data Input & User Overrides" button first before changing the Project Type or begin a new project.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	TS30L Levee Project	
Construction Start Year	2024	Enter a Year between 2014 and 2040 (inclusive)
Project Type For 4: Other Linear Project Type, please provide project specific off-road equipment population and vehicle trip data	4	1) New Road Construction : Project to build a roadway from bare ground, which generally requires more site preparation than widening an existing roadway 2) Road Widening : Project to add a new lane to an existing roadway 3) Bridge/Overpass Construction : Project to build an elevated roadway, which generally requires some different equipment than a new roadway, such as a crane 4) Other Linear Project Type: Non-roadway project such as a pipeline, transmission line, or levee construction
Project Construction Time	12.00	months
Working Days per Month	24.00	days (assume 22 if unknown)
Predominant Soil/Site Type: Enter 1, 2, or 3 (for project within "Sacramento County", follow soil type selection instructions in cells E18 to E20 otherwise see instructions provided in cells J18 to J22)	2	1) Sand Gravel : Use for quaternary deposits (Delta/West County) 2) Weathered Rock-Earth : Use for Laguna formation (Jackson Highway area) or the lone formation (Scott Road, Rancho Murieta) 3) Blasted Rock : Use for Salt Springs Slate or Copper Hill Volcanics (Folsom South of Highway 50, Rancho Murieta)
Project Length	1.20	miles
Total Project Area	55.00	acres
Maximum Area Disturbed/Day	5.00	acres
Water Trucks Used?	1	1. Yes 2. No

Please note that the soil type instructions provided in cells E18 to E20 are specific to Sacramento County. Maps available from the California Geologic Survey (see weblink below) can be used to determine soil type outside Sacramento County.

http://www.conservation.ca.gov/cgs/information/geologic_mapping/Pages/googlemaps.aspx#regionalseries

Material Hauling Quantity Input

Material Type	Phase	Haul Truck Capacity (yd^3) (assume 20 if unknown)	Import Volume (yd^3/day)	Export Volume (yd^3/day)
Soil	Grubbing/Land Clearing	20.00		2.00
	Grading/Excavation	20.00	111.00	
	Drainage/Utilities/Sub-Grade	20.00	22.00	
	Paving			
Asphalt	Grubbing/Land Clearing			
	Grading/Excavation			
	Drainage/Utilities/Sub-Grade			
	Paving			

Mitigation Options

On-road Fleet Emissions Mitigation	2010 and Newer On-road Vehicles Fleet	Select "2010 and Newer On-road Vehicles Fleet" option when the on-road heavy-duty truck fleet for the project will be limited to vehicles of model year 2010 or newer
Off-road Equipment Emissions Mitigation	Tier 4 Equipment	Select "20% NOx and 45% Exhaust PM reduction" option if the project will be required to use a lower emitting off-road construction fleet. The SMAQMD Construction Mitigation Calculator can be used to confirm compliance with this mitigation measure (http://www.airquality.org/Businesses/CEQA-Land-Use-Planning/Mitigation). Select "Tier 4 Equipment" option if some or all off-road equipment used for the project meets CARB Tier 4 Standard
Will all off-road equipment be tier 4?	All Tier 4 Equipment	

The remaining sections of this sheet contain areas that require modification when 'Other Project Type' is selected.

Note: The program's estimates of construction period phase length can be overridden in cells D50 through D53, and F50 through F53.

Construction Periods	User Override of Construction Months	Program Calculated Months	User Override of Phase Starting Date	Program Default Phase Starting Date
Grubbing/Land Clearing	0.50	1.20		1/1/2024
Grading/Excavation	9.00	5.40		1/17/2024
Drainage/Utilities/Sub-Grade	2.50	3.60		10/17/2024
Paving	0.00	1.80		1/2/2025
Totals (Months)	12			

Note: Soil Hauling emission default values can be overridden in cells D61 through D64, and F61 through F64.

Soil Hauling Emissions User Input	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing	22.00			1	22.00
Miles/round trip: Grading/Excavation	22.00			6	132.00
Miles/round trip: Drainage/Utilities/Sub-Grade	22.00			2	44.00
Miles/round trip: Paving				0	0.00

2010+ Model Year Mitigation Option Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grading/Excavation (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Drainage/Utilities/Sub-Grade (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.27	0.00	0.27	1,772.62
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.02	0.16	0.01	0.00	0.00	82.14	0.00	0.01	85.99
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.49	0.00	0.00	0.52
Pounds per day - Grading/Excavation	0.01	0.12	0.94	0.03	0.01	0.00	492.84	0.00	0.08	515.94
Tons per const. Period - Grading/Excavation	0.00	0.01	0.10	0.00	0.00	0.00	53.23	0.00	0.01	55.72
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.04	0.31	0.01	0.00	0.00	164.25	0.00	0.03	171.95
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.01	0.00	0.00	0.00	4.93	0.00	0.00	5.16
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.01	0.11	0.00	0.00	0.00	58.65	0.00	0.01	61.40

Note: Asphalt Hauling emission default values can be overridden in cells D91 through D94, and F91 through F94.

Asphalt Hauling Emissions User Input	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing				0	0.00
Miles/round trip: Grading/Excavation				0	0.00
Miles/round trip: Drainage/Utilities/Sub-Grade				0	0.00
Miles/round trip: Paving				0	0.00

2010+ Model Year Mitigation Option Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grading/Excavation (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Drainage/Utilities/Sub-Grade (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.27	0.00	0.27	1,772.62
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Worker commute default values can be overridden in cells D121 through D126.

Worker Commute Emissions User Input	User Override of Worker Commute Default Values	Default Values	Calculated Daily Trips	Calculated Daily VMT
Miles/ one-way trip	10			
One-way trips/day	2			
No. of employees: Grubbing/Land Clearing	6		12	120.00
No. of employees: Grading/Excavation	15		30	300.00
No. of employees: Drainage/Utilities/Sub-Grade	6		12	120.00
No. of employees: Paving			0	0.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.01	0.84	0.06	0.05	0.02	0.00	306.70	0.00	0.01	308.54
Grading/Excavation (grams/mile)	0.01	0.84	0.06	0.05	0.02	0.00	306.70	0.00	0.01	308.54
Drainage/Utilities/Sub-Grade (grams/mile)	0.01	0.84	0.06	0.05	0.02	0.00	306.55	0.00	0.01	308.39
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.98	2.66	0.27	0.00	0.00	0.00	65.99	0.07	0.03	76.61
Grading/Excavation (grams/trip)	0.98	2.66	0.27	0.00	0.00	0.00	65.99	0.07	0.03	76.61
Drainage/Utilities/Sub-Grade (grams/trip)	0.98	2.66	0.27	0.00	0.00	0.00	65.96	0.07	0.03	76.57
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.03	0.29	0.02	0.01	0.01	0.00	82.88	0.00	0.00	83.65
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50
Pounds per day - Grading/Excavation	0.07	0.73	0.06	0.03	0.01	0.00	207.21	0.01	0.01	209.13
Tons per const. Period - Grading/Excavation	0.01	0.08	0.01	0.00	0.00	0.00	22.38	0.00	0.00	22.59
Pounds per day - Drainage/Utilities/Sub-Grade	0.03	0.29	0.02	0.01	0.01	0.00	82.84	0.00	0.00	83.61
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.01	0.00	0.00	0.00	0.00	2.49	0.00	0.00	2.51
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.01	0.09	0.01	0.00	0.00	0.00	25.36	0.00	0.00	25.60

Note: Water Truck default values can be overridden in cells D153 through D156, I153 through I156, and F153 through F156.

Water Truck Emissions	User Override of	Program Estimate of	User Override of Truck	Default Values	Calculated	User Override of	Default Values	Calculated
User Input	Default # Water Trucks	Number of Water Trucks	Round Trips/Vehicle/Day	Round Trips/Vehicle/Day	Trips/day	Miles/Round Trip	Miles/Round Trip	Daily VMT
Grubbing/Land Clearing - Exhaust								0.00
Grading/Excavation - Exhaust	3		10.00			5.00		150.00
Drainage/Utilities/Subgrade	1		10.00			5.00		50.00
Paving								0.00

2010+ Model Year Mitigation Option Emission Rates	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Grading/Excavation (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.55	0.00	0.27	1,772.92
Draining/Utilities/Sub-Grade (grams/mile)	0.03	0.41	3.02	0.11	0.05	0.02	1,693.27	0.00	0.27	1,772.62
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grading/Excavation	0.01	0.13	1.29	0.04	0.02	0.01	560.05	0.00	0.09	586.29
Tons per const. Period - Grading/Excavation	0.00	0.01	0.14	0.00	0.00	0.00	60.49	0.00	0.01	63.32
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.04	0.43	0.01	0.01	0.00	186.65	0.00	0.03	195.40
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.01	0.00	0.00	0.00	5.60	0.00	0.00	5.86
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.02	0.15	0.00	0.00	0.00	66.08	0.00	0.01	69.18

Note: Fugitive dust default values can be overridden in cells D183 through D185.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing			50.00	0.30	10.40	0.06
Fugitive Dust - Grading/Excavation			50.00	5.40	10.40	1.12
Fugitive Dust - Drainage/Utilities/Subgrade			50.00	1.50	10.40	0.31

Values in cells D195 through D228, D246 through D279, D297 through D330, and D348 through D381 are required when 'Other Project Type' is selected.

Off-Road Equipment Emissions

Grubbing/Land Clearing

Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option: Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00			Tier 4	Off-Highway Trucks	1.61	28.02	3.23	0.16	0.15	0.05	5,121.41	1.66	0.05	5,176.54
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equiprr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Tier 4	Rubber Tired Loaders	0.39	6.70	0.77	0.04	0.04	0.01	1,211.03	0.39	0.01	1,224.10
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment

If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing	pounds per day		2.00	34.72	4.01	0.20	0.18	0.07	6,332.44	2.05	0.06	6,400.64
Grubbing/Land Clearing	tons per phase		0.01	0.21	0.02	0.00	0.00	0.00	37.99	0.01	0.00	38.40

Grading/Excavation

Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option: Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Cranes	0.18	3.07	0.35	0.02	0.02	0.01	559.81	0.18	0.01	564.83
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Excavators	0.16	3.92	0.32	0.02	0.01	0.01	500.27	0.16	0.00	505.66
1.00			Tier 4	Forklifts	0.05	1.16	0.09	0.00	0.00	0.00	148.03	0.05	0.00	149.63
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00			Tier 4	Off-Highway Trucks	4.04	70.05	8.08	0.40	0.37	0.13	12,803.52	4.14	0.12	12,941.36
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equiprr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00			Tier 4	Rollers	0.24	5.95	0.48	0.02	0.02	0.01	762.44	0.25	0.01	770.65
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00			Tier 4	Rubber Tired Dozers	0.52	9.06	1.05	0.05	0.05	0.02	1,653.96	0.53	0.01	1,671.78
2.00			Tier 4	Rubber Tired Loaders	0.39	6.70	0.77	0.04	0.04	0.01	1,211.03	0.39	0.01	1,224.10
1.00			Tier 4	Scrapers	0.47	8.08	0.93	0.05	0.04	0.02	1,469.10	0.48	0.01	1,484.93
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment

If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grading/Excavation	pounds per day		6.03	107.99	12.08	0.60	0.56	0.20	19,107.15	6.18	0.17	19,312.94
Grading/Excavation	tons per phase		0.65	11.66	1.30	0.07	0.06	0.02	2,063.57	0.67	0.02	2,085.80

Default Mitigation Option

Drainage/Utilities/Subgrade	Number of Vehicles	Override of	Default		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*	Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Equipment Tier		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Cranes	0.18	3.07	0.35	0.02	0.02	0.01	558.81	0.18	0.01	564.83
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Excavators	0.16	3.92	0.32	0.02	0.01	0.01	500.27	0.16	0.00	505.66
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00			Tier 4	Off-Highway Trucks	1.21	21.01	2.42	0.12	0.11	0.04	3,841.03	1.24	0.03	3,882.38
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equiprr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Rubber Tired Dozers	0.26	4.53	0.52	0.03	0.02	0.01	826.98	0.27	0.01	835.89
1.00			Tier 4	Rubber Tired Loaders	0.19	3.35	0.39	0.02	0.02	0.01	605.52	0.20	0.01	612.05
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment	If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Number of Vehicles	Equipment Tier	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Drainage/Utilities/Sub-Grade		pounds per day	2.00	35.89	4.01	0.20	0.18	0.07	6,332.60	2.05	0.06	6,400.81
	Drainage/Utilities/Sub-Grade		tons per phase	0.06	1.08	0.12	0.01	0.01	0.00	189.98	0.06	0.00	192.02

Paving	Default Number of Vehicles	Override of	Mitigation Option Default		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*	Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Equipment Tier	Type	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equiprr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment	If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Number of Vehicles	Equipment Tier	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Paving		pounds per day	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Paving		tons per phase	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emissions all Phases (tons per construction period) =>				0.72	12.95	1.45	0.07	0.07	0.02	2,291.54	0.74	0.02	2,316.23

Equipment default values for horsepower and hours/day can be overridden in cells D403 through D436 and F403 through F436.

Equipment	User Override of Horsepower	Default Values Horsepower	User Override of Hours/day	Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		78		8
Bore/Drill Rigs		221		8
Cement and Mortar Mixers		9		8
Concrete/Industrial Saws		81		8
Cranes		231		8
Crawler Tractors		212		8
Crushing/Proc. Equipment		85		8
Excavators		158		8
Forklifts		89		8
Generator Sets		84		8
Graders		187		8
Off-Highway Tractors		124		8
Off-Highway Trucks		402		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		168		8
Pavers		130		8
Paving Equipment		132		8
Plate Compactors		8		8
Pressure Washers		13		8
Pumps		84		8
Rollers		80		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		247		8
Rubber Tired Loaders		203		8
Scrapers		367		8
Signal Boards		6		8
Skid Steer Loaders		65		8
Surfacing Equipment		263		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		97		8
Trenchers		78		8
Welders		46		8

END OF DATA ENTRY SHEET

The maximum pounds per day in row 11 is summed over overlapping phases, but the maximum tons per phase in row 34 is not summed over overlapping phases.

Road Construction Emissions Model, Version 9.0.0

Daily Emission Estimates for -> LSJR Mitigation Project

Project Phases (Pounds)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	Total PM10 (lbs/day)	Exhaust PM10 (lbs/day)	Fugitive Dust PM10 (lbs/day)	Total PM2.5 (lbs/day)	Exhaust PM2.5 (lbs/day)	Fugitive Dust PM2.5 (lbs/day)	SOx (lbs/day)	CO2 (lbs/day)	CH4 (lbs/day)	N2O (lbs/day)	CO2e (lbs/day)
Grubbing/Land Clearing	0.74	12.96	2.29	50.17	0.17	50.00	10.50	0.10	10.40	0.03	2,953.60	0.68	0.09	2,996.70
Grading/Excavation	1.37	25.74	3.96	50.24	0.24	50.00	10.57	0.17	10.40	0.05	5,078.86	1.33	0.13	5,149.39
Drainage/Utilities/Sub-Grade	1.24	23.99	3.53	50.19	0.19	50.00	10.54	0.14	10.40	0.05	4,488.21	1.22	0.11	4,552.93
Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (pounds/day)	3.34	62.69	9.78	150.60	0.60	150.00	31.61	0.41	31.20	0.13	12,520.67	3.23	0.33	12,699.01
Total (tons/construction project)	0.06	1.05	0.16	2.21	0.01	2.20	0.46	0.01	0.46	0.00	208.53	0.05	0.01	211.45

Notes:

Project Start Year ->	2025
Project Length (months) ->	4
Total Project Area (acres) ->	154
Maximum Area Disturbed/Day (acres) ->	5
Water Truck Used? ->	Yes

	Total Material Imported/Exported Volume (yd^3/day)		Daily VMT (miles/day)			
Phase	Soil	Asphalt	Soil Hauling	Asphalt Hauling	Worker Commute	Water Truck
Grubbing/Land Clearing	0	0	0	0	780	100
Grading/Excavation	194	0	34	0	780	100
Drainage/Utilities/Sub-Grade	2	0	30	0	360	100
Paving	0	0	0	0	0	0

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

Total Emission Estimates by Phase for -> LSJR Mitigation Project

Project Phases (Tons for all except CO2e. Metric tonnes for CO2e)	ROG (tons/phase)	CO (tons/phase)	NOx (tons/phase)	Total PM10 (tons/phase)	Exhaust PM10 (tons/phase)	Fugitive Dust PM10 (tons/phase)	Total PM2.5 (tons/phase)	Exhaust PM2.5 (tons/phase)	Fugitive Dust PM2.5 (tons/phase)	SOx (tons/phase)	CO2 (tons/phase)	CH4 (tons/phase)	N2O (tons/phase)	CO2e (MT/phase)
Grubbing/Land Clearing	0.00	0.07	0.01	0.28	0.00	0.28	0.06	0.00	0.06	0.00	16.24	0.00	0.00	14.95
Grading/Excavation	0.05	0.85	0.13	1.66	0.01	1.65	0.35	0.01	0.34	0.00	167.60	0.04	0.00	154.16
Drainage/Utilities/Sub-Grade	0.01	0.13	0.02	0.28	0.00	0.28	0.06	0.00	0.06	0.00	24.69	0.01	0.00	22.72
Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum (tons/phase)	0.05	0.85	0.13	1.66	0.01	1.65	0.35	0.01	0.34	0.00	167.60	0.04	0.00	154.16
Total (tons/construction project)	0.06	1.05	0.16	2.21	0.01	2.20	0.46	0.01	0.46	0.00	208.53	0.05	0.01	191.83

PM10 and PM2.5 estimates assume 50% control of fugitive dust from watering and associated dust control measures if a minimum number of water trucks are specified.

Total PM10 emissions shown in column F are the sum of exhaust and fugitive dust emissions shown in columns G and H. Total PM2.5 emissions shown in Column I are the sum of exhaust and fugitive dust emissions shown in columns J and K.

CO2e emissions are estimated by multiplying mass emissions for each GHG by its global warming potential (GWP), 1 , 25 and 298 for CO2, CH4 and N2O, respectively. Total CO2e is then estimated by summing CO2e estimates over all GHGs.

The CO2e emissions are reported as metric tons per phase.

Road Construction Emissions Model **Version 9.0.0**
Data Entry Worksheet

Note: Required data input sections have a yellow background.
Optional data input sections have a blue background. Only areas with a
yellow or blue background can be modified. Program defaults have a white background.
The user is required to enter information in cells D10 through D24, E28 through G35, and D38 through D41 for all project types.
Please use "Clear Data Input & User Overrides" button first before changing the Project Type or begin a new project.

To begin a new project, click this button to clear data previously entered. This button will only work if you opted not to disable macros when loading this spreadsheet.

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Input Type

Project Name	LSJR Mitigation Project	
Construction Start Year	2025	Enter a Year between 2014 and 2040 (inclusive)
Project Type For 4: Other Linear Project Type, please provide project specific off-road equipment population and vehicle trip data	4	1) New Road Construction : Project to build a roadway from bare ground, which generally requires more site preparation than widening an existing roadway 2) Road Widening : Project to add a new lane to an existing roadway 3) Bridge/Overpass Construction : Project to build an elevated roadway, which generally requires some different equipment than a new roadway, such as a crane 4) Other Linear Project Type: Non-roadway project such as a pipeline, transmission line, or levee construction
Project Construction Time	4.00	months
Working Days per Month	22.00	days (assume 22 if unknown)
Predominant Soil/Site Type: Enter 1, 2, or 3 (for project within "Sacramento County", follow soil type selection instructions in cells E18 to E20 otherwise see instructions provided in cells J18 to J22)	1	1) Sand Gravel : Use for quaternary deposits (Delta/West County) 2) Weathered Rock-Earth : Use for Laguna formation (Jackson Highway area) or the lone formation (Scott Road, Rancho Murieta) 3) Blasted Rock : Use for Salt Springs Slate or Copper Hill Volcanics (Folsom South of Highway 50, Rancho Murieta)
Project Length	0.50	miles
Total Project Area	154.00	acres
Maximum Area Disturbed/Day	5.00	acres
Water Trucks Used?	1	1. Yes 2. No

Please note that the soil type instructions provided in cells E18 to E20 are specific to Sacramento County. Maps available from the California Geologic Survey (see weblink below) can be used to determine soil type outside Sacramento County.

http://www.conservation.ca.gov/cgs/information/geologic_mapping/Pages/googlemaps.aspx#regionalseries

Material Hauling Quantity Input

Material Type	Phase	Haul Truck Capacity (yd^3) (assume 20 if unknown)	Import Volume (yd^3/day)	Export Volume (yd^3/day)
Soil	Grubbing/Land Clearing	12.00		
	Grading/Excavation	12.00	98.00	96.00
	Drainage/Utilities/Sub-Grade	12.00	2.00	
	Paving			
Asphalt	Grubbing/Land Clearing			
	Grading/Excavation			
	Drainage/Utilities/Sub-Grade			
	Paving			

Mitigation Options

On-road Fleet Emissions Mitigation	2010 and Newer On-road Vehicles Fleet	Select "2010 and Newer On-road Vehicles Fleet" option when the on-road heavy-duty truck fleet for the project will be limited to vehicles of model year 2010 or newer
Off-road Equipment Emissions Mitigation	Tier 4 Equipment	Select "20% NOx and 45% Exhaust PM reduction" option if the project will be required to use a lower emitting off-road construction fleet. The SMAQMD Construction Mitigation Calculator can be used to confirm compliance with this mitigation measure (http://www.airquality.org/Businesses/CEQA-Land-Use-Planning/Mitigation).
Will all off-road equipment be tier 4?	All Tier 4 Equipment	Select "Tier 4 Equipment" option if some or all off-road equipment used for the project meets CARB Tier 4 Standard

The remaining sections of this sheet contain areas that require modification when 'Other Project Type' is selected.

Note: The program's estimates of construction period phase length can be overridden in cells D50 through D53, and F50 through F53.

Construction Periods	User Override of Construction Months	Program Calculated Months	User Override of Phase Starting Date	Program Default Phase Starting Date
Grubbing/Land Clearing	0.50	0.40	4/1/2025	1/1/2025
Grading/Excavation	3.00	1.60	4/16/2025	1/17/2025
Drainage/Utilities/Sub-Grade	0.50	1.40	7/16/2025	4/19/2025
Paving	0.00	0.60	8/5/2025	5/5/2025
Totals (Months)	4			

Note: Soil Hauling emission default values can be overridden in cells D61 through D64, and F61 through F64.

Soil Hauling Emissions User Input	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing	2.00			0	0.00
Miles/round trip: Grading/Excavation	2.00			17	34.00
Miles/round trip: Drainage/Utilities/Sub-Grade	30.00			1	30.00
Miles/round trip: Paving				0	0.00

2010+ Model Year Mitigation Option Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Grading/Excavation (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Drainage/Utilities/Sub-Grade (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hauling Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grading/Excavation	0.00	0.03	0.40	0.01	0.00	0.00	125.39	0.00	0.02	131.27
Tons per const. Period - Grading/Excavation	0.00	0.00	0.01	0.00	0.00	0.00	4.14	0.00	0.00	4.33
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.03	0.21	0.01	0.00	0.00	110.64	0.00	0.02	115.83
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	0.64
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.00	0.01	0.00	0.00	0.00	4.75	0.00	0.00	4.97

Note: Asphalt Hauling emission default values can be overridden in cells D91 through D94, and F91 through F94.

Asphalt Hauling Emissions User Input	User Override of Miles/Round Trip	Program Estimate of Miles/Round Trip	User Override of Truck Round Trips/Day	Default Values Round Trips/Day	Calculated Daily VMT
Miles/round trip: Grubbing/Land Clearing				0	0.00
Miles/round trip: Grading/Excavation				0	0.00
Miles/round trip: Drainage/Utilities/Sub-Grade				0	0.00
Miles/round trip: Paving				0	0.00

2010+ Model Year Mitigation Option Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Grading/Excavation (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Drainage/Utilities/Sub-Grade (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drainage/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Grading/Excavation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Worker commute default values can be overridden in cells D121 through D126.

Worker Commute Emissions User Input	User Override of Worker Commute Default Values	Default Values	Calculated Daily Trips	Calculated Daily VMT
Miles/ one-way trip	30			
One-way trips/day	2			
No. of employees: Grubbing/Land Clearing	13		26	780.00
No. of employees: Grading/Excavation	13		26	780.00
No. of employees: Drainage/Utilities/Sub-Grade	6		12	360.00
No. of employees: Paving			0	0.00

Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.01	0.78	0.06	0.05	0.02	0.00	295.84	0.00	0.01	297.52
Grading/Excavation (grams/mile)	0.01	0.78	0.06	0.05	0.02	0.00	295.84	0.00	0.01	297.52
Drainage/Utilities/Sub-Grade (grams/mile)	0.01	0.78	0.06	0.05	0.02	0.00	295.84	0.00	0.01	297.52
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.93	2.56	0.25	0.00	0.00	0.00	63.73	0.06	0.03	73.77
Grading/Excavation (grams/trip)	0.93	2.56	0.25	0.00	0.00	0.00	63.73	0.06	0.03	73.77
Drainage/Utilities/Sub-Grade (grams/trip)	0.93	2.56	0.25	0.00	0.00	0.00	63.73	0.06	0.03	73.77
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.07	1.48	0.11	0.08	0.03	0.01	512.38	0.01	0.01	515.85
Tons per const. Period - Grubbing/Land Clearing	0.00	0.01	0.00	0.00	0.00	0.00	2.82	0.00	0.00	2.84
Pounds per day - Grading/Excavation	0.07	1.48	0.11	0.08	0.03	0.01	512.38	0.01	0.01	515.85
Tons per const. Period - Grading/Excavation	0.00	0.05	0.00	0.00	0.00	0.00	16.91	0.00	0.00	17.02
Pounds per day - Drainage/Utilities/Sub-Grade	0.03	0.68	0.05	0.04	0.02	0.00	236.48	0.00	0.01	238.08
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	0.00	1.31
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.06	0.00	0.00	0.00	0.00	21.03	0.00	0.00	21.17

Note: Water Truck default values can be overridden in cells D153 through D156, I153 through I156, and F153 through F156.

Water Truck Emissions User Input	User Override of Default # Water Trucks	Program Estimate of Number of Water Trucks	User Override of Truck Round Trips/Vehicle/Day	Default Values Round Trips/Vehicle/Day	Calculated Trips/day	User Override of Miles/Round Trip	Default Values Miles/Round Trip	Calculated Daily VMT
Grubbing/Land Clearing - Exhaust	1		20.00			5.00		100.00
Grading/Excavation - Exhaust	1		20.00			5.00		100.00
Drainage/Utilities/Subgrade	1		20.00			5.00		100.00
Paving								0.00

2010+ Model Year Mitigation Option Emission Rates	ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Grubbing/Land Clearing (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Grading/Excavation (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Draining/Utilities/Sub-Grade (grams/mile)	0.03	0.41	3.06	0.11	0.05	0.02	1,672.88	0.00	0.26	1,751.28
Paving (grams/mile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grubbing/Land Clearing (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grading/Excavation (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Draining/Utilities/Sub-Grade (grams/trip)	0.00	0.00	4.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving (grams/trip)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emissions	**ROG**	**CO**	**NOx**	**PM10**	**PM2.5**	**SOx**	**CO2**	**CH4**	**N2O**	**CO2e**
Pounds per day - Grubbing/Land Clearing	0.01	0.09	0.87	0.02	0.01	0.00	368.81	0.00	0.06	386.09
Tons per const. Period - Grubbing/Land Clearing	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	0.00	2.12
Pounds per day - Grading/Excavation	0.01	0.09	0.87	0.02	0.01	0.00	368.81	0.00	0.06	386.09
Tons per const. Period - Grading/Excavation	0.00	0.00	0.03	0.00	0.00	0.00	12.17	0.00	0.00	12.74
Pounds per day - Drainage/Utilities/Sub-Grade	0.01	0.09	0.87	0.02	0.01	0.00	368.81	0.00	0.06	386.09
Tons per const. Period - Drainage/Utilities/Sub-Grade	0.00	0.00	0.00	0.00	0.00	0.00	2.03	0.00	0.00	2.12
Pounds per day - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tons per const. Period - Paving	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons per construction project	0.00	0.00	0.04	0.00	0.00	0.00	16.23	0.00	0.00	16.99

Note: Fugitive dust default values can be overridden in cells D183 through D185.

Fugitive Dust	User Override of Max Acreage Disturbed/Day	Default Maximum Acreage/Day	PM10 pounds/day	PM10 tons/per period	PM2.5 pounds/day	PM2.5 tons/per period
Fugitive Dust - Grubbing/Land Clearing			50.00	0.28	10.40	0.06
Fugitive Dust - Grading/Excavation			50.00	1.65	10.40	0.34
Fugitive Dust - Drainage/Utilities/Subgrade			50.00	0.28	10.40	0.06

Values in cells D195 through D228, D246 through D279, D297 through D330, and D348 through D381 are required when 'Other Project Type' is selected.

Off-Road Equipment Emissions

Grubbing/Land Clearing

Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option: Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.50			Tier 4	Off-Highway Trucks	0.20	3.50	0.40	0.02	0.02	0.01	639.84	0.21	0.01	646.73
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equiprr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Rubber Tired Dozers	0.26	4.53	0.52	0.03	0.02	0.01	826.96	0.27	0.01	835.87
1.00			Tier 4	Rubber Tired Loaders	0.19	3.35	0.39	0.02	0.02	0.01	605.62	0.20	0.01	612.16
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment

If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Grubbing/Land Clearing	pounds per day	0.66	11.38	1.31	0.07	0.06	0.02	2,072.42	0.67	0.02	2,094.76
Grubbing/Land Clearing	tons per phase	0.00	0.06	0.01	0.00	0.00	0.00	11.40	0.00	0.00	11.52

Grading/Excavation

Override of Default Number of Vehicles	Default Number of Vehicles *Program-estimate*	Mitigation Option: Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier	Type	ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Excavators	0.16	3.92	0.32	0.02	0.01	0.01	500.34	0.16	0.00	505.73
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Off-Highway Trucks	0.40	7.00	0.81	0.04	0.04	0.01	1,279.68	0.41	0.01	1,293.45
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equiprr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Rollers	0.08	1.98	0.16	0.01	0.01	0.00	254.06	0.08	0.00	256.80
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Rubber Tired Dozers	0.26	4.53	0.52	0.03	0.02	0.01	826.96	0.27	0.01	835.87
2.00			Tier 4	Rubber Tired Loaders	0.39	6.70	0.77	0.04	0.04	0.01	1,211.24	0.39	0.01	1,224.32
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment

If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab

Number of Vehicles	Equipment Tier	Type		ROG pounds/day	CO pounds/day	NOx pounds/day	PM10 pounds/day	PM2.5 pounds/day	SOx pounds/day	CO2 pounds/day	CH4 pounds/day	N2O pounds/day	CO2e pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Grading/Excavation	pounds per day	1.29	24.14	2.58	0.13	0.12	0.04	4,072.28	1.32	0.04	4,116.18
Grading/Excavation	tons per phase	0.04	0.80	0.09	0.00	0.00	0.00	134.39	0.04	0.00	135.83

Default Mitigation Option

Drainage/Utilities/Subgrade	Number of Vehicles	Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Default Equipment Tier		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*				pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Excavators	0.16	3.92	0.32	0.02	0.01	0.01	500.34	0.16	0.00	505.73
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Off-Highway Trucks	0.40	7.00	0.81	0.04	0.04	0.01	1,279.68	0.41	0.01	1,293.45
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Other Material Handling Equiprr	0.18	4.39	0.36	0.02	0.02	0.01	559.68	0.18	0.01	565.71
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00			Tier 4	Rubber Tired Dozers	0.26	4.53	0.52	0.03	0.02	0.01	826.96	0.27	0.01	835.87
1.00			Tier 4	Rubber Tired Loaders	0.19	3.35	0.39	0.02	0.02	0.01	605.62	0.20	0.01	612.16
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment	If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Number of Vehicles	Equipment Tier	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Drainage/Utilities/Sub-Grade	pounds per day		1.19	23.19	2.39	0.12	0.11	0.04	3,772.28	1.22	0.03	3,812.93
Drainage/Utilities/Sub-Grade	tons per phase		0.01	0.13	0.01	0.00	0.00	0.00	20.75	0.01	0.00	20.97

Paving	Default Number of Vehicles	Override of Default Equipment Tier (applicable only when "Tier 4 Mitigation" Option Selected)	Mitigation Option Default Equipment Tier		ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Override of Default Number of Vehicles	*Program-estimate*				pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
			Tier 4	Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Air Compressors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Bore/Drill Rigs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cement and Mortar Mixers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Concrete/Industrial Saws	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crawler Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Crushing/Proc. Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Excavators	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Graders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Tractors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Off-Highway Trucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Construction Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other General Industrial Equipn	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Other Material Handling Equiprr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pavers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Paving Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pressure Washers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rollers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rough Terrain Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rubber Tired Dozers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Rubber Tired Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Scrapers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Signal Boards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Skid Steer Loaders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Surfacing Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Sweepers/Scrubbers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Tractors/Loaders/Backhoes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Trenchers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
			Tier 4	Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

User-Defined Off-road Equipment	If non-default vehicles are used, please provide information in 'Non-default Off-road Equipment' tab			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Number of Vehicles	Equipment Tier	Type		pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day	pounds/day
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	N/A		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

			ROG	CO	NOx	PM10	PM2.5	SOx	CO2	CH4	N2O	CO2e
Paving	pounds per day		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving	tons per phase		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Emissions all Phases (tons per construction period) =>			0.05	0.99	0.11	0.01	0.00	0.00	166.53	0.05	0.00	168.33

Equipment default values for horsepower and hours/day can be overridden in cells D403 through D436 and F403 through F436.

Equipment	User Override of Horsepower	Default Values Horsepower	User Override of Hours/day	Default Values Hours/day
Aerial Lifts		63		8
Air Compressors		78		8
Bore/Drill Rigs		221		8
Cement and Mortar Mixers		9		8
Concrete/Industrial Saws		81		8
Cranes		231		8
Crawler Tractors		212		8
Crushing/Proc. Equipment		85		8
Excavators		158		8
Forklifts		89		8
Generator Sets		84		8
Graders		187		8
Off-Highway Tractors		124		8
Off-Highway Trucks		402		8
Other Construction Equipment		172		8
Other General Industrial Equipment		88		8
Other Material Handling Equipment		168		8
Pavers		130		8
Paving Equipment		132		8
Plate Compactors		8		8
Pressure Washers		13		8
Pumps		84		8
Rollers		80		8
Rough Terrain Forklifts		100		8
Rubber Tired Dozers		247		8
Rubber Tired Loaders		203		8
Scrapers		367		8
Signal Boards		6		8
Skid Steer Loaders		65		8
Surfacing Equipment		263		8
Sweepers/Scrubbers		64		8
Tractors/Loaders/Backhoes		97		8
Trenchers		78		8
Welders		46		8

END OF DATA ENTRY SHEET

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

May 15, 2023

Environmental Resources Branch (CESPK-PDR)

Mr. Donald Ratcliff
Field Supervisor
Attn: Kim Squires, Section 7 Division Manager
San Francisco Bay-Delta Fish and Wildlife Office
U. S. Fish and Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4718

Dear Mr. Ratcliff:

The U.S. Army Corps of Engineers (USACE) is requesting reinitiation of formal consultation under Section 7(a) of the Endangered Species Act (16 U.S.C. 1536[a]) for levee improvements on the TS-30L reach of the Lower San Joaquin River (LSJR) Project, San Joaquin County, California. This action is covered under the Lower San Joaquin River Feasibility Study Recommended Plan (LSJRFS) Biological Opinion (BO) (08ESMF00-2015-F-0206) issued by the U. S. Fish and Wildlife Service on June 13, 2016.

The LSJR Project is a cooperative flood risk management effort by the USACE with its non-Federal sponsors (NFS) – the San Joaquin Area Flood Control Agency (SJAFCA) and the Central Valley Flood Protection Board (CVFPB), represented by California Department of Water Resources (DWR). The overall purpose of the LSJR Project is to decrease flood risk by achieving a 200-year level of protection to north and central Stockton. This letter and the enclosed Supplemental Biological Assessment (SBA) summarize the project features and potential effects to Federally listed species that occur in the TS-30L project area. Details of the final design for TS-30L were unknown at the time of the original 2016 BO.

The LSJR Project was authorized for construction in America's Water Infrastructure Act of 2018 (P.L. 115-270), which expedited the completion of the feasibility study and allowed the study to proceed directly to the preconstruction engineering and design phase of the project, as described in Section 1322(b)(2)(F) of the Water Resources Development Act of 2016 (130 Stat. 1707).

USACE is requesting reinitiation for two reasons: (1) Compensation measures in the 2016 BO for the Valley Elderberry Longhorn Beetle (VELB) direct that transplants and compensatory seedlings of elderberry occur within the Fourteen Mile Slough setback area, or to an approved conservation bank; otherwise, USACE will coordinate the use of a new

site through reinitiation of formal consultation; and (2) where removal of vegetation is not otherwise required for construction of the project features, conservation measures for all species direct that USACE evaluate the suitability of the levees for a vegetation variance (now called a design deviation). If that evaluation is not completed or a deviation is not approved, then USACE would reinitiate consultation. While the original design contemplated removal of vegetation on the land and waterside slopes to accommodate project features, inclusion of an armored patrol road within the waterside easement, and associated vegetation removal was not analyzed in the original consultation.

The ESA-listed or candidate species that may be affected by the proposed action are Giant garter snake(*Thamnophis gigas*), Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), and Monarch Butterfly (*Danaus plexippus*).

We request the USFWS review the above information and provide an amended BO within 135 days of the receipt of this letter. If you need any additional information or have questions regarding this action, please contact Ms. Lorena Guerrero, Environmental Manager, at (916) 557-7134 or by e-mail: Lorena.G.Guerrero@usace.army.mil. Thank you for your attention to this matter.

Sincerely,

HARPER.MARSHALL.KEVIN.1536114358

Digitally signed by HARPER.MARSHALL.KEVIN.1536114358
Date: 2023.05.15 16:53:09 -07'00'

Kevin Harper
Chief, Environmental Resources Branch
Planning Division

Enclosures

cc: (w/encl)
Zach Kearns, California Department of Fish and Wildlife, *zachary.kearns@wildlife.ca.gov*
Lyla Pirkola, National Marine Fisheries Service, *lyla.pirkola@noaa.gov*

cc: (w/o encl)
Chris Elias, SJAFCA, *chris.elias@stocktonca.gov*
Larry Ito, DWR, *larry.ito@water.ca.gov*

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

Environmental Resources Branch

Subject: Continuing National Historic Preservation Act (NHPA) Section 106 Compliance for the Lower San Joaquin River Project – Reach TS30L (COE120921B).

Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Dear Ms. Polanco:

The U.S. Army Corps of Engineers (Corps), Sacramento District, is writing to continue Section 106 consultation on the Lower San Joaquin River Project (Project) – Reach TS30L in Stockton, California. The Project was authorized under the Corps Section 905(b) Analysis [in accordance with the Water Resources Development Act (WRDA) 1986, Public Law (PL) 99-662] dated September 23, 2004. The Section 905(b) Analysis was approved by the Commander, Corps South Pacific Division on June 10, 2005. The Section 905(b) Analysis was prepared in response to House Report 105-190, which accompanied the Energy and Water Development Appropriations Act of 1998 (PL 105-62). Its purpose was to determine the level of Federal interest in providing increased flood protection that is adaptable to future physical and environmental conditions and then implement any necessary flood protection improvements in the study areas.

The Corps is complying with Section 106 of the National Historic Preservation Act (NHPA) for the Project through the implementation of a Programmatic Agreement (PA) regarding the Project executed on May 11, 2016. Pursuant to Stipulation V of the PA, we are now consulting on the Area of Potential Effects (APE) and sharing inventory results for the proposed Reach TS30L, and requesting concurrence in our determination of eligibility for the Tenmile Slough Levee.

The Corps is currently preparing the design for levee improvements to remediate seepage at select locations within the TS30L reach of the Tenmile Slough Levee, located within Tenmile Slough in Stockton, California. Because the design for levee improvements is in progress, the Corps may adjust the APE as the design is refined. Proposed repairs for this reach include a cutoff wall along the centerline of the levee. Potential staging areas thus far are located within or immediately adjacent to the levee prism, and access routes include existing dirt and paved roads. Borrow location(s) are being identified for this reach and will be added to the APE as they are identified. Therefore, the current APE for identification and evaluation of historic properties includes the entire length of the TS30L Reach and a buffer of 300 meters on either side of the centerline of the levee, as well as all known access and staging routes, as required by Stipulation III of the PA. The APE (Enclosure 1) encompasses all identified construction and staging areas for the proposed TS30L Reach, a total of approximately 160 acres.

The Corps sent letters to Native American tribes identified in the PA as invited Concurring Parties, as well as those identified in a list for the area provided by the Native American Heritage Commission on November 8, 2019. The Corps invited comments on geotechnical explorations for the Reach TS30L. No responses were received. In March 2020, the Corps sent documentation of historic property identification efforts for Reach TS30L. One response was received from Wilton Rancheria on April 20, 2020, via e-mail, requesting the lead California Environmental Quality Act (CEQA) agency as well as any records searches or reports completed for the project. Corps Senior Archaeologist Jessica Tudor Elliott responded via e-mail the same day notifying Wilton Rancheria that the lead CEQA agency is the San Joaquin Area Flood Control Agency, and providing previously completed documentation for the Project via secure file transfer. Mrs. Tudor Elliott followed up via email and telephone on May 4, 2020, and on May 29, 2020, and no responses were received.

Further historic property identification efforts for Reach TS30L are documented in the attached Memorandum for Record (Enclosure 2). The Tenmile Slough Levee and Fourteenmile Slough Levee are the only potential historic properties identified within the APE for Reach TS30L. The Corps has determined that the Tenmile Slough Levee and Fourteenmile Slough Levee are not eligible for listing in the National Register of Historic Places (NRHP). Further discussion of this determination can be found in Enclosure 2.

In future correspondence, the Corps will initiate renewal of the PA for the Lower San Joaquin River Project, which is set to expire in May 2021. We will provide a proposed amendment, pursuant to Stipulation XVIII.A, to extend the duration of the PA for an additional five years, beginning on the date of expiration of the current document.

At this time, we are seeking your comments on our APE designation for the proposed Reach TS30L pursuant to Stipulation V of the PA and requesting concurrence in our determinations of eligibility for the Tenmile Slough Levee and Fourteenmile Slough Levee. Correspondence may be sent to Attn: Jessica Tudor Elliott, Senior Archaeologist, U.S. Army Corps of Engineers, CESPK-PDR-C, 1325 J Street, Sacramento, CA 95814. If you are able, please send your response to Mrs. Tudor Elliott by email at Jessica.L.TudorElliott@usace.army.mil. Mrs. Tudor Elliott can also be reached by telephone at (916) 557-7133. Please refer to the Lower San Joaquin River Project in all future correspondence concerning this project.

Sincerely,

ARTHO.DANIEL.FRANCIS.1254218576

Digitally signed by ARTHO.DANIEL.FRANCIS.1254218576
Date: 2020.09.04 14:53:31 -07'00'

Daniel F. Artho
Acting Chief, Environmental Resources Branch

Enclosures

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

November 3, 2021

Environmental Resources Branch

SUBJECT: Continuing Consultation for National Historic Preservation Act Section 106 Compliance for the Lower San Joaquin River Project (COE120921B) – Reach TS30L.

Ms. Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Dear Ms. Polanco:

The US Army Corps of Engineers, Sacramento District (USACE) is continuing consultation on the Lower San Joaquin River Project in Stockton, California. USACE completed the feasibility study and construction of the Lower San Joaquin River Project (LSJRP) was authorized by the Water Infrastructure Improvements for the Nation Act of 2016 (Public Law 114-322) Title I, Subtitle C, Section 1322(b)(2)(F) and the America's Water Infrastructure Act of 2018 (Public Law 115-270), Title I, Subtitle D, Section 1401(2)1. The purpose of the current phase, Reach TS30L, is to bring the Tenmile Slough Levee into compliance with Federal and State safety and engineering standards. Reach TS30L is on the northwest side of Stockton, California.

USACE is complying with Section 106 of the National Historic Preservation Act for the LSJRP through implementation of the *Programmatic Agreement Between the US Army Corps of Engineers and the California State Historic Preservation Officer Regarding the Lower San Joaquin River Feasibility Study Project, San Joaquin County, California* (PA), signed by USACE and the California State Historic Preservation Officer (SHPO) on May 11, 2016, and renewed on May 11, 2021. USACE previously consulted with your office and interested Native American tribes regarding Reach TS30L in letters dated September 4, 2020, pursuant to Stipulation V of the PA. In those letters, USACE delineated the Area of Potential Effects for Reach TS30L (APE) and provided documentation of identification and evaluation efforts for Reach TS30L. USACE received your comments in a letter dated September 28, 2021. You had no comments on the APE. You concurred that the Tenmile and Fourteenmile Slough Levees, the only cultural resources identified in the APE, are not eligible for listing in the National Register of Historic Places. USACE received responses from the United Auburn Indian Community, voicing no concerns, and the Northern Valley Yokuts Tribe, requesting

further project information. USACE provided the requested information on November 5, 2020 and have not received a response.

Pursuant to Stipulations III and V of the PA, we are now consulting on a revision to the APE and associated inventory and evaluation. We are requesting your agreement that the refuse scatter SEWD-01 is not eligible for listing on the National Register of Historic Places and, pursuant to Stipulation VI of the PA, requesting your agreement with our finding of *No Historic Properties Affected* (800.4[d][1]) for Reach TS30L.

All construction, staging, and access routes for Reach TS30L are contained in the previously defined APE. In this consultation, we are adding the proposed borrow area for Reach TS30L levee repairs, an actively farmed field between the Stockton East Water District (SEWD) percolation pond and Stockton Diversion Canal. It is approximately 122 acres (Enclosure 1). The vertical APE is up to 17 feet below surface. Ingress will be from Cardinal Avenue using SEWD's northern access road and gate.

The proposed borrow area for Reach TS30L was subject to consultation by the US Bureau of Reclamation, Mid-Pacific Regional Office (BOR) in 2017 for a separate undertaking. Native American tribes did not identify any properties of cultural or religious significance in or near the area. A records search through the Central California Information Center returned no previously recorded resources within the proposed borrow area or access route. Intensive pedestrian survey of the proposed borrow area (but not the proposed access route) was conducted by qualified personnel (Enclosure 2). BOR identified two historic-era refuse scatters – SEWD-01 and SEWD-02 – and nine isolates and ultimately consulted on the eligibility of SEWD-02 (not eligible) but not SEWD-01. BOR found *No Historic Properties Affected,* with SHPO concurrence (BUR_2017_1017_001).

USACE conducted a sacred lands file search with the Native American Heritage Commission on June 7, 2021, for the proposed borrow area for Reach TS30L and sent letters to all potentially interested tribes on July 28, 2021, providing the revised Reach TS30L APE. USACE also described BOR's prior consultation and requested input regarding any nearby sites of religious or cultural importance. Follow-up calls were made September 16, 2021. No tribe has expressed concern to this point. Consultation continues and USACE will consider any future tribal input.

USACE archaeologist Andrew Ugan conducted an intensive pedestrian survey of the borrow site access route on August 27, 2021. Dr. Ugan identified no additional cultural resources and established that BOR's records search, survey, and findings regarding the borrow area remain valid. USACE has determined SEWD-01 ineligible for listing on the National Register of Historic Places. Documentation of inventory and consultation efforts and a buried site sensitivity analysis are provided in Enclosure 2.

There are no known historic properties within the APE, and USACE finds *No Historic Properties Affected* for Reach TS30L, pursuant to Stipulation VI of the PA. In accordance with the stipulations of the PA, USACE is now seeking your comments regarding the addition of the SEWD borrow area to the APE and the adequacy of inventory efforts. USACE is also seeking your agreement with our determination that SEWD-01 is *ineligible* for listing on the National Register of Historic Places and with our finding of effect for Reach TS30L. USACE is also providing the enclosed documents to interested tribes for comment at this time. In the event of a post-review discovery, USACE would comply with 36 CFR § 800.13(b), pursuant to Stipulation VI of the PA.

USACE respectfully requests your response within 30 days. Pursuant to Stipulation I of the PA, failure to respond within 30 days will not preclude USACE from moving forward with the project. Correspondence may be sent to Attn: Tatum Clinton-Selin, Historian, US Army Corps of Engineers, CESPK-PDR-C, 1325 J Street, Sacramento, CA 95814. Ms. Clinton-Selin can be reached by telephone at (916) 557-7283 or by email at Caitlin.C.Clinton-Selin@usace.army.mil. Please cc USACE archaeologist Dr. Andrew Ugan on email correspondence at Andrew.S.Ugan@usace.army.mil. Dr. Ugan can be reached by telephone at (916) 557-5136.

Sincerely,

Daniel F. Artho Date: 2021.11.02 11:03:02 -07'00'

Daniel F. Artho
Deputy Chief, Planning Division

Enclosures

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

June 07, 2022

Environmental Resources Branch

SUBJECT: Continuing Consultation for National Historic Preservation Act Section 106 Compliance for the Lower San Joaquin River Project (COE120921B) – Reach TS30L.

Ms. Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Dear Ms. Polanco:

The US Army Corps of Engineers, Sacramento District (USACE) is continuing consultation on the Lower San Joaquin River Project (LSJRP) in Stockton, California. Construction of the LSJRP was authorized by the Water Infrastructure Improvements for the Nation Act of 2016 (Public Law 114-322) Title I, Subtitle C, Section 1322(b)(2)(F) and the America's Water Infrastructure Act of 2018 (Public Law 115-270), Title I, Subtitle D, Section 1401(2)1. USACE is complying with Section 106 of the National Historic Preservation Act for the LSJRP through implementation of the *Programmatic Agreement Between the US Army Corps of Engineers and the California State Historic Preservation Officer Regarding the Lower San Joaquin River Feasibility Study Project, San Joaquin County, California* (PA), executed on May 11, 2016, and renewed on May 11, 2021. The purpose of the current phase, Reach TS30L, is to bring the Tenmile Slough Levee into compliance with Federal and State safety and engineering standards. Reach TS30L is on the northwest side of Stockton, California.

USACE previously consulted with your office and interested Native American tribes regarding the Area of Potential Effects (APE), identification and evaluation, and USACE's finding of *No Historic Properties Affected* (36 CFR § 800.4[d][1]) for Reach TS30L pursuant to Stipulation V of the PA (Identification and Evaluation before Historic Properties Management Plan Approval) in letters dated September 4, 2020, and November 1, 2021. USACE received responses from the United Auburn Indian Community (UAIC) and the North Valley Yokuts Tribe (NVYT) in October and November 2020, respectively. UAIC and NVYT had no specific concerns about the project.

In letters dated September 28, 2020, and December 1, 2021, you concurred that the Tenmile and Fourteenmile Slough Levees and resources SEWD-1, ISO-1, ISO-7, and ISO-8 are not eligible for listing in the National Register of Historic Places (NRHP). You did not object to our finding of *No Historic Properties Affected* for Reach TS30L.

Pursuant to Stipulations III and V of the PA (Area of Potential Effects and Identification and Evaluation before Historic Properties Management Plan Approval), we are now consulting on a revision to the APE, associated inventory and evaluation, and a continued finding of *No Historic Properties Affected* for Reach TS30L. In this consultation, we are adding to the APE the Fourteenmile Slough Sanitary Complex (a potential mitigation site), a barge landing area and access route southwest of Reach TS30L, and a perimeter road of the Stockton East Water District (SEWD) (Enclosure, Figure 2). The horizontal extent of the APE expansion is approximately 145 acres. The vertical extent of disturbance within the additions to the APE is two feet.

On November 5, 2021, USACE conducted a California Historic Resources Inventory System records search at the Central California Information Center for areas being added to the APE. Further information regarding the records search is in the enclosure. The search indicated that a segment of one previously recorded resource, the Southern Pacific Railroad (SPRR, P-39-000002), is within the APE addition. In letters dated March 28, 2022, USACE contacted all potentially interested tribes regarding the proposed APE expansion. To date, USACE has received no responses.

USACE Archaeologist Andrew Ugan and USACE Historian Tatum Clinton-Selin conducted an intensive pedestrian survey of the Fourteenmile Slough Sanitary Complex APE addition on March 4, 2021. The Fourteenmile Slough Sanitary Complex is more than 50 years old, and thus is a potential historic property. Dr. Ugan conducted an intensive pedestrian survey of the proposed barge landing area and access route and the SEWD Borrow Area perimeter road on August 27, 2021. Dr. Ugan identified one previously unrecorded cultural resource: the Wright-Elmwood Tract. Dr. Ugan also identified a segment of the SPRR (P-39-000002). The segment of P-39-000002 within the APE addition is part of the SPRR Oakdale Branch.

USACE has determined that the Wright-Elmwood Tract, the Fourteenmile Slough Sanitary Complex, and the SPRR Oakdale Branch are ineligible for listing on the NRHP. Documentation to support our determinations, as well as California Department of Parks and Recreation 523 forms, are provided in the enclosure. We are requesting your agreement that the Wright-Elmwood Tract, Fourteenmile Slough Sanitary Complex, and SPRR Oakdale Branch are not eligible for listing on the NRHP.

Given the results of inventory, evaluation, and consultation, there are no known historic properties within the APE. Pursuant to Stipulation VI of the PA (Assessment of Effects), we are requesting your agreement with our continued finding of *No Historic Properties Affected* for Reach TS30L. USACE is also providing the enclosure to interested tribes at this time and will consider any tribal input. In the event of a post-review discovery, USACE would comply with 36 CFR § 800.13(b), pursuant to Stipulation IX of the PA (Discovery of Unknown Potential Historic Properties).

USACE respectfully requests your response within 30 days. Pursuant to Stipulation I of the PA (Review Procedures and Timeframes), failure to respond within 30 days will not preclude USACE from moving forward with the project. Please direct your response to Tatum Clinton-Selin by email at Caitlin.C.Clinton-Selin@usace.army.mil. Ms. Clinton-Selin can also be reached by telephone at (916) 557-7283 or by postal service (not preferred) at Attn: Tatum Clinton-Selin, Historian, U.S. Army Corps of Engineers, CESPK-PDR-C, 1325 J Street, CA 95814. Please cc USACE Archaeologist Dr. Andrew Ugan on email correspondence at Andrew.S.Ugan@usace.army.mil. Dr. Ugan can be reached by telephone at (916) 557-5136.

Sincerely,

HARPER.MARSHALL.KEVIN.1536114358

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Date: 2022.06.07 13:36:40 -07'00'

Marshall K. Harper
Chief, Environmental Resources Branch

Enclosure

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

February 2, 2023

Environmental Resources Branch

SUBJECT: Continuing Consultation under Section 106 of the National Historic Preservation Act regarding a Revision to the Area of Potential Effects for Reach TS30L of the Lower San Joaquin River Project (COE120921B)

Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Dear Ms. Polanco:

The US Army Corps of Engineers, Sacramento District (USACE) is continuing consultation regarding the Lower San Joaquin River Project (LSJRP) in Stockton, California. Construction of the LSJRP was authorized by the Water Infrastructure Improvements for the Nation Act of 2016 (Public Law 114-322) Title I, Subtitle C, Section 1322(b)(2)(F) and the America's Water Infrastructure Act of 2018 (Public Law 115-270), Title I, Subtitle D, Section 1401(2)1. USACE is complying with Section 106 of the National Historic Preservation Act for the LSJRP through implementation of the Programmatic Agreement between the US Army Corps of Engineers and the California State Historic Preservation Officer Regarding the Lower San Joaquin River Feasibility Study Project, San Joaquin County, California (PA), executed on May 11, 2016, and amended on May 11, 2021.

Pursuant to Stipulations III.C (Area of Potential Effects [APE]) of the PA, USACE is requesting your comments on the delineation of the revised APE for Reach TS30L (Enclosure 1). The purpose of the current phase, Reach TS30L, is to bring the Tenmile Slough Levee into compliance with Federal and State safety and engineering standards. Reach TS30L is on the northwest side of Stockton, California. USACE is revising the Reach TS30L APE to include the Kumar and Solari properties to be used as habitat mitigation sites (HMS). This letter will describe the activities proposed for both HMS. The Kumar property is approximately 50 acres in size and is currently being used as an olive orchard. The Solari property is approximately 53 acres in size and has been used for growing rice and row crops in the past. Both sites are located just west of the original TS30L APE.

The proposed activities at both HMS would consist of changing the topography to support wetland and riparian habitats. Throughout the sites, the surface elevation would be lowered between1.5 feet (ft) to 3 ft to allow for riparian and wetland habitats. The

depth of the APE for both HMS is a maximum of 3 ft. The height of the APE is approximately 20 ft, to account for temporary construction trailers, lighting, fencing and passage of heavy machinery during construction. USACE's rationale for using the APE for the proposed HMS is that, at the current point of the design phase for Reach TS30L, all known construction activities for the HMS are contained within these locations. As the design progresses, it is possible that additional HMS construction activities will be introduced that fall outside of, or entail additional ground disturbance within, the currently proposed APE. If this is the case, USACE will consult on the revision to the APE in accordance with Stipulation III of the PA.

At this time, USACE requests your comments on the proposed APE. Please provide your comments within 30 days of receiving this letter. Comments or questions may be sent to Robert Gudiño, Archaeologist, U.S. Army Corps of Engineers, Sacramento District, 1325 J Street, Sacramento, California 95814-2922; by phone at (916) 557-5104; or by email at: Robert.Gudino@usace.army.mil.

Sincerely,

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Geneva Kraus
Chief, Cultural, Recreational, and Social Assessment Section

Enclosure

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay-Delta Fish and Wildlife Office
650 Capitol Mall, Suite 8-300
Sacramento, California 95814

In Reply Refer to:
2022-0043398

Ms. Alicia Kirchner
Chief, Planning Division
Sacramento District
U. S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814

Subject: Supplemental Fish and Wildlife Coordination Act Report for the Lower San Joaquin River Feasibility Study - Segment TS_30_L Habitat Evaluation Procedures

Dear Ms. Kirchner:

Per our Scope of Work for FY 2022, please find enclosed the subject report.

If you have any questions, please contact Steven Schoenberg of my staff at (916) 930-5672, or by email at Steven_Schoenberg@fws.gov.

Sincerely,

Daniel Welsh
Deputy Field Supervisor

Enclosure

cc:
Dave Fluetsch, Corps of Engineers, Sacramento, CA
Lorena Guerrero, Corps of Engineers, Sacramento, CA
Howard Brown, National Marine Fisheries Service, Sacramento, CA
Jeff Drongesen, Region II, California Department of Fish and Wildlife, Sacramento, CA
Jim Starr, Region III, California Department of Fish and Wildlife, Stockton, CA
Ruth Darling, Department of Water Resources, Sacramento, CA
Juan Niera, San Joaquin Area Flood Control Agency, Stockton, CA
Chris Elias, San Joaquin Area Flood Control Agency, Stockton, CA

SUPPLEMENTAL FISH AND WILDLIFE COORDINATION ACT REPORT FOR THE LOWER SAN JOAQUIN RIVER FEASIBILITY STUDY: SEGMENT TS_30_L HABITAT EVALUATION PROCEDURES

PREPARED BY:

Steven Schoenberg, Senior Fish and Wildlife Biologist
U.S. Fish and Wildlife Service
Watershed Planning Division
San Francisco Bay-Delta Fish and Wildlife Office
Sacramento, California

PREPARED FOR:

U.S. Army Corps of Engineers
Sacramento District
Sacramento, California

November 2022

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INTRODUCTION

This report is a supplement to the Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act (FWCA) detailed report (hereafter, "2016 FWCA") on the U.S. Army Corps of Engineers (Corps) Lower San Joaquin River Feasibility Study (LSJRFS) (FWS 2016). The purpose of this supplemental report is to present the results of a habitat evaluation of one reach segment within that study known as TS_30_L. We also provide preliminary recommendations for the siting of mitigation for the impacts of construction of that reach.

BACKGROUND AND COORDINATION HISTORY

The preferred alternative for the proposed project (alternative 7a) involves some 24 miles of levee improvements, of which TS_30_L is part, and two tidal gates in an overall effort to protect greater Stockton from flood events. The 2016 FWCA did not include a formal habitat evaluation of any of the project elements because of limited information, and funding and schedule constraints within the Corps' "SMART" planning guidance (Corps 2015a). Therefore, we were limited to a Corps-provided desktop analysis using aerial images and their estimates of impact, and our own observations during several hours of site visits to the project element locations. The 2015 draft Integrated Feasibility Report/Final Environmental Impact Statement/Report (FS/FEIS/R) stated that a full mitigation plan, including field surveys and habitat evaluations as appropriate, would be done during the Pre-construction Engineering and Design (PED) phase (Corps 2015b).

The Corps issued a final FS/FEIS/R for the project in 2018 (Corps 2018). There are significant differences from the project as described in the final environmental document (Corps 2018). The 2018 FS/FEIS/R states that mitigation bank credits would be obtained to offset impacts of the project; however, such credits are not currently nor foreseeably available. In response to our 2016 FWCA, the Corps also committed in its 2018 FS/FEIS/R to evaluate other on and near impact site opportunities for mitigation, including some we had identified (FWS 2016). The project elements that would incorporate mitigation for impacts included one setback levee, within Fourteenmile Slough, which would incorporate mitigation in the forms of some riparian and Shaded Riverine Aquatic (SRA, a type of riparian cover adjacent to water) cover types, and was also intended to accept elderberry transplants (host plant for the federally listed Valley Elderberry Longhorn Beetle, or VELB) from other parts of the project. However, constructing other reaches like TS_30_L in advance of the Fourteenmile Slough element creates the additional need to develop mitigation elsewhere.

The Feasibility Study entered the PED phase around October 2019 and the Service was funded in late 2020 to resume FWCA coordination activities. The Corps had selected the segment TS_30_L as the first construction element, a 5,900 foot long stretch of levee bordered at the south by March Lane and to the north by the Fourteenmile Slough levee near White Slough. In environmental documents and our 2016 FWCA report, this segment is one of several in the Delta Front work element, which includes Shima Tract, Fivemile, Tenmile, and Fourteenmile Slough, with "TS" referring to the Tenmile Slough levee. The work at TS_30_L originally involved the installation of cutoff walls, slope reshaping, and application of west facing rock protection.

Project refinements to TS_30_L have since been identified which would likely increase impact beyond the estimates in the environmental documents, including a 20-foot westward levee prism shift which is needed to allow room for a patrol road to inspect the land (east) side of the levee. This would extend water side work (rock revetment, patrol road, levee reconstruction), in most sections, all the way to the irrigation ditch (the westward extent of the natural habitat). Additionally, at the time of the 2018 FS/FEIS/R, there was consideration of applying for a variance which would permit some vegetation on the lower slopes of levees. During PED, however, the Corps determined it would not seek a vegetation variance, but might consider a design deviation based on risk assessment which could permit some vegetation growth. Whether or not a design deviation is approved, nearly all vegetation within the impact footprint area would be removed initially due to earthwork.

A more detailed site visit to the TS_30_L impact area was conducted in March 2021. Among the more notable observations was the apparent high wildlife use by songbirds and raptors, elderberry bushes, and mixture of habitat elements (trees, snags, shrubs, herbaceous areas, native trees, exotics). Persistence of the habitat appeared to be a consequence of both proximity to an irrigation drainage ditch, and apparent low maintenance at least on the lower levee slope. Several potential areas for mitigation were discussed and/or looked at briefly in early 2021 as well.

We provided a site visit report in March 2021 with our findings and, after further review of the project history, we also provided a May 2021 guidance memo with our preliminary recommendations for mitigation and imminent construction as it pertains to TS_30_L. In brief, we concluded no path forward to 2021 construction because of unresolved matters of project impacts without mitigation agreed and in place prior to project impacts, unevaluated changes to the project, elderberry impacts which required reconsultation, and the need to evaluate on/near site mitigation options. Our primary recommendation, if the Corps intended to proceed with TS_30_L construction in the near term, was to plan a mitigation area in a corridor adjacent to the affected habitat.

Beginning late August 2021, the Service participated in a number of calls with the Corps related to the sequencing of the project, various mitigation locations and ratios, and technical assistance under the Endangered Species Act (ESA) regarding federally listed species. The Corps planned to proceed with the project beginning with vegetation removal in early 2022 in advance of other construction. To quantify the baseline habitat value of the impacted areas before these anticipated impacts, the Corps communicated to the Service the need to conduct a habitat evaluation of the impact area of TS_30_L. That habitat evaluation, based on field work conducted in December 2021, is the focus of this supplemental report. At the time of the writing of this report, vegetation has not been impacted because the project has not yet begun. On July 26, 2022, the Service attended a site visit to view additional potential mitigation sites. To better assist the Corps' mitigation planning, this report also includes an initial evaluation and prioritization of these mitigation sites based on our observations and best professional opinion.

HABITAT EVALUATION PROCEDURES

Habitat Evaluation Procedures, or "HEP", is an accounting methodology developed by the Service and other agencies to quantify habitat value of a particular area of habitat to selected wildlife species or communities associated with that habitat (FWS 1980a, 1980b, 1981). It is based on models which calculate an index value between 0.0 and 1.0, the Habitat Suitability Index (HSI), that is used to weight habitat area. HSI models consist of a set of habitat variables which are measured or estimated (usually denoted V1, V2... etc.) that are considered important life requisites to the particular wildlife species or community. These variables, or Vs, are converted to Suitability Indices (SIs) using graphical relationships or best-fit word descriptions provided in the model that assign an index value to a measured or assumed variable quantity. The SIs are then combined using equations to obtain the HSI. A series of HSIs are estimated for several points in time in the future (called Target Years, or TYs), over the life of the project; these sets of HSIs for the target years are commonly referred to as "futures". For these futures, the HSI is multiplied by the habitat area to obtain habitat units, which are summed and averaged over the life of the project (Average Annualized Habitat Units, or AAHUs). This routine can be applied to both an impacted project site and a proposed mitigation site. AAHUs are used as the metric to compare habitat values of the future without the project to the future with the project.

APPLICATION AND LIMITATIONS

HEP is a tool that can be useful in assessing the need and adequacy of mitigation for impacts of an action but it has limits and assumptions. AAHUs for a mitigation site can be compared to that of an impact site to estimate the area of mitigation necessary to provide at least the same habitat value. HEP does not normally include and therefore does not evaluate habitat values within a landscape context: corridor values that permit the movement of wildlife across a landscape, the distribution and rarity of habitat across a region, actual use by wildlife, or the interaction between habitats, agriculture or urban components. It is often a coarse evaluation, subject to error in the measurements themselves and variation in the way wildlife resources use habitat in different regions of the Country. HEP is also not used for listed species. Instead, mitigation for effects on listed species is determined separately during ESA consultation, often using guidance documents and similar treatment as in other consultations for the individual species. Listed species guidance can vary, and may involve the use of standardized mitigation ratios and other factors.

MODEL SELECTION

The process of model selection for this HEP study involved preliminary assessment of the habitat during a site visit, a review of available models, and communication with a HEP team that included Service and Corps staff. Models were selected that we considered to best represent the values of the affected habitat and mitigation, and the majority of the habitat components. A site visit was first conducted on March 9, 2021. Vegetation had just started to leaf out, however, the general habitat characteristics could be observed. There was a mix of woody vegetation dominated by dense shrub species, particularly willows, blackberry, and buttonbush, together with some larger and taller willows, other taller trees such as oaks and some non-natives (walnuts, pecan) and patches of rose and elderberry. Snags (larger dead limbs or entire dead

trees) were evident throughout the site. The woody vegetation was interspersed with tall herbaceous plants, especially thistle. Wetland patches were also seen in association with what appeared to be an agricultural drainage ditch at or slightly beyond the toe of slope, which was maintained on the west side and had water (or evidence of recent water). At this time, and in subsequent visits to the site, a variety of avian wildlife were noted such as hummingbirds, sparrows, mockingbirds, raptors, quail, and others. The habitat mix varied over the length of TS_30_L, with areas dominated by shrubs, trees, or herbaceous plants, depending on exact location.

On the basis of these initial observations, we reviewed available models and selected a suite of five HEP models that would complement one another and best represent the values provided by the existing habitat. These included published models, modifications to published models, and in-house unpublished models locally developed and applied to evaluations of other Corps projects. A HEP "package", consisting of the models, summary of methods, and basic rationale, was provided to the Corps prior to field sampling. The Corps noted prior to field sampling, per their current guidance, that unpublished and modified models would need to undergo a certification process, which involves review by the Corps' Engineering Research and Development Center (ERDC) and communication with Service staff. However, given the field conditions (late fall), the Service and Corps mutually agreed to proceed and complete field sampling, in advance of completion of the certification process. The Service responded to all ERDC requests for documentation and justification of models used to the extent these were available. The Corps notified the Service that certification was forthcoming, and to proceed at least for use in this specific application (HEP evaluation of TS_30_L) (August 4, 2022, email from David Fluetsch, Sacramento District). The selected models and rationales are as follows:

Yellow Warbler (Schroeder 1982): The preferred habitat of this species is a deciduous riparian assemblage of hydrophytic species such as willows and cottonwoods. It is a summer resident in similar habitat in the Central Valley of California. This model emphasizes the lower and middle canopy and the habitat preference of this species for hydrophytic shrubs. The Service developed and validated this model for use throughout this species' range; however, the original model is derived from early work in the eastern United States which acknowledged forest use as occasional only. That original model had three variables, all associated with shrubs and/or lower canopy (percent deciduous crown cover, average shrub height, and percent hydrophytic shrubs). We used a modification of this published model that we had also applied to other local Corps Federal projects since 1998. This modification added a fourth variable for tall trees, consistent with forage beats by this species in the West ranging up to 40 feet above the ground, presence of trees in portions of the project area, and expected effect of the project on this combination of tall trees with a shrub understory. During the Corps' certification process, we researched and responded to Corps questions to justify this modification, noting that partial use of the higher canopy by this species had been well documented in the West.

Riparian Songbird Guild (Roberts et al. 1986): This is an unpublished model originally developed for application to forested or scrub-shrub wetlands in Humboldt Bay, and was the original model used to evaluate riparian forest habitat in the 1999 and 2009 HEPs of the Corps' Napa Creek project (FWS 2009). It is intended to apply to a relatively broad range of bird species (mostly in the order Passeriformes, but also associated species in the order Piciformes)

that use plants, snags or associated insects for food, or use the plants and snags for nesting. Variables include shrub and tree cover, tree height, canopy layering category, snags, and overall woody cover. The variables focus on somewhat shorter canopy elements. This model has the smallest snag dimension (4 inches) of the three models with snag variables used for TS_30_L. This was deemed appropriate because of the presence of woodpeckers and birds at TS_30_L, and the small snags present that would be impacted by the project.

Riparian Forest Cover Type (DeHaven 2001): This unpublished model was developed by the Service's Sacramento Fish and Wildlife Office originally for Corps bank protection actions along the lower Sacramento River, and was later modified for use in the Corps' Llagas Creek project. It is a generalist model, intended to quantify values to a range of bird and mammals that could utilize this habitat. It combines vegetation parameters such as height, closure, stand width, understory, and species number, and has discounting factors for non-native dominance and distance from water. This model is sensitive to structural diversity of habitats and narrowing of corridors by project actions. It was considered appropriate for TS_30_L in light of the combination and variation in tree and shrub cover, and stand width, at this location.

Downy Woodpecker (Schroeder 1983): The species' habitat covered by this published model associates primarily with older soft wood riparian species like willow and cottonwood in lowland stream bottoms. Older trees are not common in TS_30_L, but are present and considered a significant component which would be affected by the project. The variables are snags (6 inch minimum; required for value) and basal area at breast height, the latter of which can only be coarsely estimated in thick young stands such as TS_30_L. Nevertheless, this model was included in this HEP analysis because it reflected the values, albeit limited, of this older vegetation component, the presence of snags at TS_30_L, and the observation of cavity dwellers such as woodpeckers and owls at this site.

Hairy Woodpecker (Souza 1987): The habitat represented by this published model is also older, larger, trees in a variety of forest types and densities. Measurements include mean tree diameter at breast height (used in two suitability indices), canopy cover, and snag count. It has an even larger snag dimension criterion (10 inches) than other models in this HEP study. It was included for the HEP at TS_30_L as an alternative to the Downy Woodpecker model. This model emphasizes larger trees and snags, but without an absolute requirement for snags to yield value in a plot. Larger trees and snags were present, but infrequent and patchy, at this location.

STUDY ACTIVITIES

The HEP evaluation for TS_30_L involved the following sequence of activities:

a) *Field Sampling*: Sampling was conducted on December 2, 3, 7, and 8, 2021. The Service author of this report was present on all days (Steven Schoenberg, Senior Biologist), and was assisted by one or two Corps staff each day (Savannah Fahning, Jessica Agajan, Steve McLemore, Miranda Doutch, or Dave Fluetsch). Conditions were considered fair due to some leaf drop and shedding of terminal branches, but acceptable for the purposes of the study. The suboptimal field conditions mean that there is some potential underestimate of features such as woody vegetation height and cover that could result in an underestimate of baseline value, but

not to a major degree. The measurement requirements for the selected models included both transect and plot based parameters.

The plot size and extent of effort for each parameter was tailored by the Service staff's best judgement to complete the sampling in a reasonable time, given the size of the site, the need to assess 20 variables in the five models, limited remaining season due to ongoing leaf and branch shedding, and short days at the time of the field work. The TS_30_L site is also typified by the presence of a dense, often thorned, lower shrub layer, and patchy dense woody stems. The limited time available to meet these study needs and difficulty moving within a site with these characteristics necessitated a coarse, visual estimation of some variables. Detailed measurement protocols for each variable are provided in Appendix A, TAB: Models.

Taking these factors into consideration, a plot length of 300 feet was selected, which could be sampled within study time constraints while still capturing the variation in habitat suitability over the length of the site. Two perpendicular transects were set up in each plot. Transect position within a plot was decided by selecting two single digits from a random number table (1-9), which were each multiplied by a tenth of the total plot length to determine the locations of the perpendicular transects. After a plot and its transects were set up, a waypoint location of the beginning (south end) of each plot was recorded on a GPS device. When all sampling was completed, the spatial data for the plot boundaries were downloaded from the GPS device using the software Garmin Basecamp, and converted to a shapefile (Appendix D, Plate 1). Three photographs were taken on each plot, one facing north from the beginning of each plot, and west across each of the two perpendicular transects. Measurements were recorded on paper data sheets, one per plot (Appendix C). All raw data were entered into a multitab Excel spreadsheet file, designed to convert the data into SIs and HSIs for each model (Appendix A). In a few rare instances of missing data, all noted in Appendix C, either reference photos and/or similar data from other models were used to develop a best estimate of values for those variables.

b) *Data Reduction*: Measurements from the two transects for each plot were averaged to obtain plot specific values for the transect-based measurements and, with the values for the other full plot measurements, were used to obtain a single plot-specific variable for each SI and then, using the model equations, plot specific HSIs for each model. These plot-specific HSIs were averaged to determine a reach-wide HSI for each model. This manner of calculation, with plot-specific HSIs used to obtain a reach-wide average, is typical in HEP studies. Some test calculations were done by assigning a single, reach-wide average SI for snag density and basal area to each of the plots, to see if variation between plots in these particular variables might bias the reach-wide HSI. However, these test calculations showed that the reach-wide average HSI would be the same with either calculation routine (Appendix A, TAB: HSIdatacalcs, lines: 224-225, 282), so this alternative routine was not used, and is not discussed further in this report.

c) *Futures*: Initial, solely HEP-based, estimates of mitigation needs were made by developing mitigation site futures and calculating and comparing changes in habitat value (AAHUs) for the Corps-determined 13.88 acre impact footprint and a hypothetical 10 acre (ac) restoration site (Appendix A, TAB: futures). The ratio of losses at the impact site to gains at the restoration site, adjusted by area, is the theoretical mitigation ratio. As noted in the general assumptions

described below, for the purposes of this exercise, we assume that restoration at the mitigation site, including planting, is complete by the time of first project impact.

Two future comparisons were done. In the first, we varied habitat development. Two future scenarios were developed to describe the range of potential mitigation ratios and areas: a "best case" scenario with the fastest development and higher optimum ranges reflective of high management and success; and a "worst case" scenario, which has a more moderate rate of habitat development and maxima. This "worst case" scenario is not unsuccessful, but takes into consideration the possibility of less than fully optimal habitat for certain model parameters. Such limits on habitat potential may reflect constraints created by variability in weather and water availability, unforeseen disturbances like fire and disease, site-specific limitations such as power line easements, natural variation in parameters, and/or reduced long term management.

In the second comparison, we varied mitigation start. We compared mitigation that was started 10 years prior to impact, with mitigation concurrent with impact, for the worst case scenario only (see RESULTS, below).

d) *Mitigation Site Qualitative Evaluation*: Based on site visit observations, and our best professional opinion, we analyzed six identified locations in terms of other habitat value characteristics not reflected in the selected HEP models (distance from impact, corridor value, utility easements, buffer value, adjacent land use, floodplain/connectivity to delta waters, benefits to special-status species, unit size, etc.). Together with the futures estimate of mitigation site habitat value from the HEP, this qualitative evaluation was used to prioritize the sites and propose a recommended mitigation ratio for each location.

c) *Documentation*: Documentation of study activities is provided within the Appendices of this report (Excel spreadsheet, data forms, models, plates) and/or, as appropriate, is maintained in electronic files at the Service's field office (Excel spreadsheet; shapefile of plot boundaries; reference photographs; email communications).

ASSUMPTIONS

The following assumptions apply to the analysis and findings in this report:

-The impact site at TS_30_L, about 13.88 ac, can be adequately assessed as a single cover-type consisting of a mosaic of patches of scrub, herbaceous, scrub and tree cover in varied proportions, wetland, and ditch cover.

-All vegetation will be initially removed within this 13.88 ac project footprint.

-For the purposes of assessing without-project habitat value, we assume that the baseline measurements in this HEP are representative of the future, which is explicit in the calculations as shown by a constant HSI for the life of the project, without the project.

-The life of project is 50 years, equivalent to the period of economic analysis, and the period of analysis is 51 years, equal to the life of project plus construction, assumed to be one year.

-There is an inherent, unknown, level of error due to simplification of the measurement techniques for many of the variables, such as rough visual estimates of cover proportions (see Appendix A for details). Nevertheless, the measurements are assumed to be of adequate accuracy to represent existing habitat values of the site and hence, determine the losses and mitigation need associated with project implementation.

-There is also an inherent, unknown, level of error due to simplification of the calculation procedure, which uses the average HSI across plots and the overall impact area (13.88 ac), to calculate habitat value. Again, although higher precision is possible with a stratified sample across patch subtypes, and much greater effort, the simplified procedure is assumed adequate to represent existing habitat values and losses with project implementation.

-For the purpose of the simplified analysis of futures, below, we assume that mitigation site construction is completed at Target Year 1, the time of impact. Impact in this situation is the clearing of vegetation in TS_30_L, which would occur in the winter preceding construction-related earth-moving later that same year. In habitat restoration, earthwork is done before planting. Accordingly, the results discussed below for concurrent mitigation would apply only to a situation where restoration is complete (i.e., including planting), by the time of first impact.

RESULTS

Results are expressed in habitat value changes, in AAHUs, calculated for the five models at the impact site and a theoretical 10 ac site under best and worse case future scenarios (Table 1).

Table 1: Habitat Values for TS_30_L HEP study. Impact is loss of December 2021 baseline. Mitigation is for a conceptual 10 ac site started concurrent with construction, under best and worst case future habitat scenarios. See text and Appendix A for details.

	Habitat Value change, AAHUs			area to offset AAHU loss, ac		"mitigation ratio"	
future habitat scenario:		best	worst	best	worst	best	worse
	Impact	mitigation	mitigation				
Model:	TS_30_L	10ac	10ac				
Yell. Warbler	-8.8	8.8	5.9	9.9	14.9	0.72	1.08
Rip. Songbird	-8.8	5.7	3.0	15.5	29.3	1.12	2.11
Rip. Forest CT	-10.0	8.9	5.4	11.3	18.8	0.81	1.35
Downy Wood.	-3.2	2.1	1.4	14.8	22.2	1.07	1.60
Hairy Wood.	-0.9	4.1	0.9	2.1	9.2	0.15	0.88

Comparison of the losses at the impact site to the gains at the theoretical mitigation site is used to determine the mitigation need in terms of acres and the mitigation ratio. In such an analysis, it is customary for the Service to apply to its recommendation the result from the model that shows the greatest ratio. This practice ensures that in-kind values for other models with lower ratios would be at least fully compensated. For TS_30_L under the stated assumptions, and assuming a reasonable worst-case future scenario for mitigation, full compensation for loss of habitat values for all models would be achieved by a ratio (impact site: mitigation site) of about 2.11:1. This would require a riparian mitigation area of 29.3 ac to offset the habitat value impacts to the 13.88 ac at TS_30_L. As we explain below (Analysis), this result is not a precise prescription for our mitigation recommendation due to factors beyond the scope of the models.

We also conducted a futures analysis to compare mitigation scenarios (worst case only) where the mitigation was assumed initiated 10 years before impact (Table 2). This was intended to illustrate the mitigation value in excess of that needed for TS_30_L, which could be used to offset a future impact (APPENDIX A, TAB: futureexcess). For purposes of this exercise, we assume that the impact is the same as TS_30_L, although another reach would likely have a different baseline and area. Over a 51 year period of analysis of that scenario, an earlier mitigation start lowered the mitigation ratio. The greatest difference is for the Hairy Woodpecker model (ratio of 0.49 compared to 0.88, above) which is attributed to the longer period of snag presence. The minimum effect, for the Riparian Songbird Guild model, is slight (ratio of 2.05 compared to 2.11, above). Taken together, the results indicate that the recommended mitigation ratio with advance mitigation (or remaining excess used for future impacts) remains about 2:1.

Table 2: Habitat Values for TS_30_L HEP study. Impact is loss of December 2021 baseline. Mitigation is for a conceptual 10 ac site started either concurrent with construction or 10 years before construction ("10 yr", below), under worst case futures scenario. See text and Appendix A for details.

	Habitat Value change, AAHUs			area to offset AAHU loss, ac		"mitigation ratio"	
start scenario:		concurrent	10 yr	concurrent	10 yr	concurrent	10 yr
site:	Impact	Mitigation	Mitigation				
Model:	TS_30_L	10ac	10ac				
Yell. Warbler	-8.8	5.9	6.7	14.9	13.1	1.08	0.94
Rip. Songbird	-8.8	3.0	3.1	29.3	28.4	2.11	2.05
Rip. Forest CT	-10.0	5.4	5.7	18.8	17.7	1.35	1.28
Downy Wood.	-3.2	1.4	1.5	22.2	20.8	1.60	1.50
Hairy Wood.	-0.9	0.9	1.3	9.2	6.8	0.88	0.49

ANALYSIS

Here, we consider differences between the impact site and alternative mitigation locations (Appendix D, Plates 2-3). This analysis involves other factors not inherent in HEP which, together with the HEP results, are used to develop recommendation for siting priority and site-

specific mitigation ratios for impacts at TS_30_L. Unless noted otherwise, the sites are privately owned. These mitigation locations are:

- Adjacent Corridor: This would be immediately west of TS_30_L, about 80-100 feet wide and roughly the length of TS_30_L. This would make it about 25 ac, corresponding to the parcel in which it is located. There is a force sewer main and associated easement running the full north-south length of the parcel and another shorter easement where high power lines cross. As with TS_30_L, adjacent land use is residential to the east and rice agriculture within this site and to the west.
- Manteca: This site is located 18 miles south of TS_30_L, about a half mile southwest of the intersection of South McKinley Street and Pink Muhly Lane. About 150 ac, it is currently in agriculture (gourd such as squash or pumpkin). It is surrounded by levees, and part of the site is close to Walthall Slough, a perennial waterway which has some natural oak woodland, riparian, and wetland vegetation.
- Van Buskirk Park: This site is about 5 miles south of TS_30_L along the right (north) bank of French Camp Slough. It is a recently decommissioned golf course with redevelopment pending, on land deeded to the City of Stockton for the purpose of community recreation. Currently, the site has been cleared of most woody vegetation, although some scrub has regrown in former water features. The mitigation concept is to include a component of habitat restoration of some of the 152 ac in redevelopment of the site in a way that would be consistent with that purpose. Improvement of the levee at this site is another component of the LSJRFS, although it could be set back or modified to provide tidal influence and additional benefit.
- Kumar Property: This site is a horseshoe-shaped area of 50 ac, currently with young olive trees, that surrounds another 40-50 ac mitigation site managed by the Center for Natural Lands Management known as the Pace Preserve. This mitigation site has a mosaic of trees, shrubs, and wetlands. High-power lines run through the site. It is several miles west of TS_30_L. The idea at this site would be to remove the olive trees and perform habitat restoration. Vegetation may be limited under the power lines.
- Solari Property: This 50 ac site is fallowed, former farmland with a few shrubs. It is also a few miles west of TS_30_L. It appears bordered by hay fields. It is perhaps 100 yards or so from the San Joaquin River, which is leveed. There are no visible power lines or other known utilities.
- Pump Station: This 113 ac site is a mile or so north of TS_30_L at the corner of 14 Mile and White Sloughs. An actual pump station takes up a small portion of the site, and another portion of the site was used at one time as sewage ponds. Several high-voltage lines and associated towers run through the site. Most of the site is fallow herbaceous weeds, and some scrub. The concept for this site would be to restore riparian (with shorter habitat types or wetland under power lines). It may be possible to modify the levee alignment to allow tidal exchange.

PRELIMINARY MITIGATION RECOMMENDATIONS

The recommendations in this report are to be considered preliminary due to the limited information about the mitigation sites. These recommendations are based on the Service's best professional opinion on resource considerations only, such as habitat quality, fish and wildlife

resource needs - including those of listed species, and landscape factors. Other factors such as real estate acquisition, cost, and implementation schedule are beyond our purview and are not discussed. As originally described in our FWCA report for the LSJRFS, repeated below, we use similarity in location and habitat type to prioritize mitigation options (Service 2016, p. 28):

> "In order of decreasing preference, the Service's preference for type and location of mitigation action for this project would be: (1) avoidance of impact, such as through changes in design or design approach; (2) minimization of impact, by similar means; (3) compensation on-site, as in the same location of the impact; (4) compensation near-site, and in-kind, as in very close proximity to the impact site on the same waterway, and of the same or similar habitat type, or, if an alternative habitat type, one which will benefit the affected fish and wildlife resources; (5) off-site compensation, also in-kind; and (6) off-site compensation, out-of-kind, meaning a moderately or completely different habitat type, but preferably, a cover type which is as or more desirable than that being affected. Existing conservation banks, due to their siting and other factors, would be considered of relatively low priority in this scheme."

Following this scheme as a guide, the Service's first preference of the location for mitigation of TS_30_L impacts is Adjacent Corridor. This is closest to the impact site and would replace several functions not achievable with other options. This is the only option which would provide, as well as enhance, a direct corridor for wildlife movement between habitat at Tenmile Slough/Bulkley Cove and Fourteenmile Slough. Habitat in Adjacent Corridor would replace the buffer between the Brookside residential community and adjacent rice agriculture currently provided by habitat in the TS_30_L footprint. Disturbance of a portion of the site, with relocation of the drainage ditch, is already necessary for the construction of TS_30_L, so the additional work for restoration would be modest. In the long term, lateral groundwater movement due to proximity to the drainage ditch would presumably support the restoration. During the design high water event, riparian vegetation here might provide an increment of wave attenuation that could enhance flood protection. The sewer main and easement location, depth, and associated vegetation restrictions, would need to be assessed for consistency with restoration. If tall unmowed (or infrequently mowed) herbaceous vegetation were allowed in this easement, this might replace the value of the herbaceous/woody mixture of the current habitat at TS_30_L.

In general, habitat quality increases with unit size and width, which are limited in Adjacent Corridor by the narrow width of the allowed woodland. However, we noted that the TS_30_L impact site is also narrow and experiences apparently high wildlife use. Raptors seen on tall snags during the March 2021 site visit may be foraging in plowed fields near the site at that time of year, or in the herbaceous grassland patches within the site. Site specific factors not explicit in the HEP models which may attract wildlife to this site include the patch combination of dense shrub, herbaceous, and tree cover, nearby semi-perennial water, semi-perennial water of the drainage ditch, associated wetlands, aspect (west facing), or other factors. The Service would recommend mitigation similar to the HEP-derived 2.11:1 ratio (mitigation area:impact area) for the Adjacent Corridor, due to its similarity in landscape functions, very close proximity to the impact site, and potential to integrate restoration work with project construction.

The Kumar, Solari, and Pump Station sites are similar in their next nearest proximity to the impact site, and have a mixture of advantages and disadvantages on first impression. Both the Kumar and Pump Station sites have significant powerline easements that would likely limit habitat restoration underneath them in those areas. The Solari property has no such easements, but it is a smaller unit size. The Pump Station has the potential for contaminants in minor areas which would require at least assessment and possibly cleanup. All are more or less isolated sites which do not act as a corridor, although all are in the general proximity of the San Joaquin River or White Slough, which are potential wildlife corridors. The Service would recommend a slightly higher mitigation ratio for these sites, on the order of 2.5:1. Because one or more of these sites have a higher near term certainty of implementation than the others, and their proximity to the impact site, they are considered second preference to Adjacent Corridor.

Van Buskirk is more distant from the impact site, but has additional potential because it is close to a section of French Camp Slough near its confluence with the San Joaquin River, and also across the slough from the French Camp Mitigation Bank. This levee is heavily rocked and planned currently to be improved (raised, slurry wall) in place under the LSJRFS, but it could be set back or modified to provide a tidal connection. This would allow for water side vegetation (both wetlands and SRA cover) habitat at the land-water interface. Mitigation in the form of waterside vegetation and tidal connection would provide habitat values to the Delta and associated aquatic community. Although tidal habitats are not impacted by TS_30_L in particular, there are expected impacts to Delta tidal waters in other elements of the LSJRFS that do affect SRA cover and shallow water habitat generally. Actual habitat restoration area at Van Buskirk is likely to be partial due to other site uses, but still significant (~50-70 ac). If Van Buskirk were to be ready and available as mitigation for TS_30_L, the Service would recommend a lower mitigation ratio on the order of 2.0-2.5:1, with the lowest ratio associated with a setback design. However, due to distance from the impact site and lower certainty of near term implementation, it is considered third priority.

Manteca is the farthest from TS_30_L but it also is the largest in size of actual restorable habitat (150+ ac). It is far enough south that it is in the range of the listed riparian brush rabbit, which has been successfully propagated and introduced elsewhere on the west side of the San Joaquin River. Adequate water appears to be available through the existing agricultural infrastructure. This site, about a mile east of the San Joaquin River, would add to other habitat on Walthall Slough and the vicinity. Nevertheless, mitigating for impacts of TS_30_L, and likely other impacts within the LSJRFS so far away would have the adverse effect of consolidation (i.e., the formation of habitat voids by concentrating mitigation at one location, to offset impacts to widely distributed habitat). Here, mitigation would be at the south end of the LSJRFS, at the expense of impacted fragments and channel-associated riparian all to the north. Additionally, this particular site is also identified for habitat restoration under the Mossdale Tract Urban Flood Risk Reduction project (Mossdale UFRR) as an enhancement action. Although the Mossdale UFRR is in earlier planning and subject to change, the Service would need to further scrutinize the matter of changing the intent of enhancement to using it as mitigation for TS_30_L. Should Manteca ultimately be selected and ready for TS_30_L, the Service would recommend a higher mitigation ratio of at least 3:1. For these reasons, the Manteca site is considered fourth priority.

GENERAL RECOMMENDATIONS

1. Sequence: To ensure that the amount (area) of habitat is not reduced and, consistent with our general guidance, we recommend that mitigation be fully constructed and planted prior to the time of first impact. That is, if vegetation clearing and any associated elderberry transplantation for TS_30_L were done during the winter season to minimize impacts, the mitigation for those impacts should already be in place by the time of clearing.

2. Overall Mitigation Strategy: An overall strategy is recommended to incentivize early implementation and provide a mechanism for accounting impacts and mitigation. Because most sites are larger than needed for TS_30_L, any excess that is generated could potentially be used to offset impacts of future reaches of the LSJRFS. Mitigation ratios for future impacts will depend on the baseline habitat affected, the time that the excess mitigation has been in place, additional HEP study, and further coordination with the Corps expected as part of their development of an overall mitigation strategy.

3. Objectives: The Service will seek to achieve both (a) no net loss of in-kind habitat value, the resource category goal stated in Service (2016) as well as (b) no net loss of in-kind habitat area, for Resource Category 2 habitats. No net loss of area is justified when, as in this project area with its combined development for urban and agricultural uses, the habitat types are already rare and limited. This includes wetlands and riparian cover-types.

4. Mitigation Ratio: The recommended mitigation ratio will depend on the site, but should in no case be less than 2:1 on an area basis.

5. Listed Species compensation: To the extent possible, mitigation should include components of compensation for listed species, such as elderberry bushes for VELB, wetlands for giant garter snake, and habitats adjacent to tidal waters such as SRA cover and shallow water habitat for listed fishes.

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APPENDIX A: Excel Spreadsheet for HEP of TS_30_L

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	THIS IS THE "Models" TAB															
2																
3	This Excel Spreadsheet has seven TABS and calculates habitat value for the HEP sampling done at TS_30_L in December 2021												last edited 11/2/2022			
4	This first TAB starts includes a description of the seven TABs in this excel spreadsheet, and describes the models used															
5	Sampling dates: December 2, 3, 7, and 8, 2021															
6																
7																
8	TABS	Models: describes the variables, curves, and methods used														
9		HSIdatacalc: includes raw data from field datasheets, plot values for variables (V), associated suitability indicices (SI), and HSI														
10			also includes rough calculation of sampled area (all habitat area), and average HSIs which are used in futures													
11		Tree Hts:	includes raw data from field datasheets, plot averages in meters and feet, SI calculations for V1(rfct) and V3(rsg) variables models													
12		Species: includes list of species seen in each plot, as noted on field datasheets														
13		BasalArea: includes all direct measurements and estimations in field for basal area for each plot, and total calculations														
14		Futures: desktop exercise to assess mitigation area need; best professional opinion of best case and worst case scenario														
15			developed futures for each model; compared loss to existing; based on concurrent mitigation													
16		FuturesExcess: this tab is a scenario in which mitigation is set to begin at 10 years old at time of project impact														
17																
18		CAUTION: futures are best case, preliminary/subject to review/revision, actual habitat value may vary with mitigation timing, actual performance,														
19			as well as other factors not reflected in HEP models (e.g., adjacency to water/ag, connectivity, location/position on landscape, etc.)													
20																
21	Models chosen based on general characteristics, dominated by shrub/understory vegetation, some larger willows, a few larger trees															
22	snags suspected; high bird use noted in March 2021 site visit (raptors, songbirds, woodpeckers, hummingbirds, others);															
23	proximity to ag fields, water via ag drainage ditch, and separation from human activity (levee, restricted access) enhances wildlife use															
24																
25	1. modified Yellow Warbler (Schroeder 1982) - FWS "bluebook" model; derived from earlier Morse studies;															
26	V1- percent deciduous shrub crown cover, total as measured on two transects in each plot. Optimal at 60-80% cover															
27	note: herbaceous, including tall stiff herbaceous, are not included as shrub, that is, it is woody only; frequently estimated to nearest 5 or 10 feet.															
28	V2 - average height of deciduous shrub canopy, in meters; average of shrubs along or nearest to two transects. Optimal at 2+ meters.															
29	V3 - % deciduous shrub canopy cover composed of hydrophytic shrubs, ft cover along two transects converted to %. Min SI = 0.1; Max SI at 100% cover															
30	V4 - % cover of tall trees (> 30 feet tall), measured as the canopy greater than 30 feet over two transects in each plot															
31	Note: V4 is a modification, an added variable first developed by local sponsor in a 1988 HEP for the upper Guadalupe River															
32	The 1988 version had a minimum of zero for 0% tall trees, optimum of 1.0 from 50-75% tall trees, and decline to 0.75 at 100% tall trees															
33	This original modification was further modified in the 1998, USFWS HEP, to have a minimum value of 0.5 at 0% tall trees.															
34	This further modified model, with 4 variables was again used in the 2009 Reach 12 HEP on the Guadalupe River															
35	Use of tall trees, for occasional forage beats, or nest protection from cowbird parasitism, is consistent with yellow warbler observations															
36	since Morse and the 1982 Schroeder model, and is particularly applicable to yellow warbler populations in the western USA															
37																
38	HSI (yellow warbler modified) = (siV1 x siV2 x siV3 x V4)^1/2															
39																

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
40	2. Riparian Songbird Guild (Roberts 1986)															
41	V1 - % shrub cover: by transect intercept method (feet cover of woody vegetation 1-3 m tall along transect/total transect length * 100)															
42	V2 - % tree cover: by transect intercept method (feet cover of woody vegetation > 3m tall along transect/total transect length * 100)															
43	V3 - average height of overstory trees: A minimum of 3 overstory trees were selected within each 300 x ~100 ft plot, and measured using a clinometer															
44	In some instances, a clear line of sight to the treetop and tape could not be established, so these trees were estimated visually															
45	note: clinometer and visual estimates are noted in the data sheets with "c" or "v"; clinometer estimates are in feet calculated from the slope angle															
46	percentage multiplied by ground distance, however, these angles and distances are not recorded, only the height in feet															
47	V4 - Canopy Layering Category: 1-none (SI=0); 2-shrubs only (SI=.25); 3=tall shrubs only (SI=.5); 4=trees only (SI=.75); 5=multiple layers (SI=1)															
48	V5 - number of snags > 4 inches per acre: snags were identified for the entire plot, roughly 1/14 acre															
49	assuming 300 ft X 100 ft wide plots (3000 sq ft), the suitability index is maximized by 1 snag observed in a plot															
50	dead limbs of trees were counted as snags if at least breast height (4.5 feet) above the ground.															
51	V6 - Percent of site in woody vegetation; this was measured directly by all woody vegetation over a transect ("feet woody" on data sheets)															
52	note: herbaceous, including tall stiff herbaceous, are not included as shrub, that is, it is woody only; frequently estimated to nearest 5 or 10 feet.															
53																
54	HSI = {[(V1+ V2 + (2 X V3)/4)X V4]^0.5 + V5}*V6/2															
55																
56	3. Riparian Forest Cover type (USFWS. 2001. Sacramento Fish and Wildlife Office in-house model)															
57	V1 - Average tree height, in feet; optimal at 60 feet and greater; same data as rip. songbird guild V3, converted to feet, different SI curve															
58	V2 - Average canopy width of riparian trees, measured as intersection along transect across riparian zone. min SI = 0.2 at 30 or less ft; opt SI = 1 at 70+ ft.															
59	field estimate by taking total transect length, and subtracting tape-measured outer herbaceous, if any.															
60	V3 - Tree Canopy Closure, measured as percent of tree cover over transect; optimal at 60-80%; SI=0.8 at 100%, SI=0.0 at 0%															
61	Note: 5M criterion (16.5 ft) for trees, so may not be same as rip. songbird guild variables V2 (tree cover, 3M+) or V6 (all woody cover, which includes shrubs)															
62	Rationale is that low shrubs (1-3 M) are not considered "canopy", nor "tree"; notation made on all data sheets that rip. songbird guild V2 is to be used.															
63	V4 - number of tree or shrub species; optimal at 4+ species; minimum value of 0.6 for 1 species															
64	V5 - Average Understory Vegetative Density in %, this calculated from the feet of interception of vegetation at planes at 2, 6, and 14 feet, estimated at each transect															
65	Note: One such overall estimate at each transect, then average of transects within a plot															
66	A (non-native adjustment factor): If tree canopy dominated by non-natives, HSI is reduced by 40%, so A=.6; if native-dominated tree canopy, A = 1.0															
67	B (separation from surface water): If riparian edge begins further than 20' from water, reduce by 1/3, so B=2/3; otherwise B =1.0 (not applied in this study)															
68																
69	HSI (riparian forest cover type) = A*B*(((siV1 * siV3 * siV4)^1/3 + (siV2 * siV5)^.5)/2)															
70																
71	4. Hairy Woodpecker (Sousa 1987)															
72	Note: model applicability states a minimum of 4 ha (~11 acres) of habitat and 40 M width, marginal for TS_30_L, but other forested habitat is present south.															
73	Note: variables V1-3 measured with Biltmore stick															
74	V1	snags>25cm/acre		optimized at 2+/acre; due to rarity of this size snag, and use in nesting, average of all plots is applied for this variable (total ~1.4 ac)												
75	V2	nest component; SI=0 at >8", 1.0 at 16+"; mean dbh of overstory tree; overstory trees in each plot as could be reasonably estimated;														
76	V3	cover component; SI=.5<6", 1.0>10"; mean dbh of overstory tree; plot specific as with V2														
77	V4	% tree canopy cover; from trees 6+M, above songbird guild/RFCT models; coarse estimate (nearest 5-10% or feet recorded)														
78																

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
79	HSI = (V1 +.75V2) X (V3 X V4)															
80																
81	5. Downy Woodpecker (USFWS. 1983. FWS/OBS-82/10.38)															
82	V1 - Basal area; at 4.5' height, optimal (SI=1) from 10-20 sq M/hectare (2.71 ac), SI=0 at 0 basal area; SI=.5 at 30+sq M.															
83	Note: alternative method to cruz-all needed for this study due to obscured visibility from shrubs, did stem count/diameter coarse estimate of basal area of entire plot															
84	V2 - density of snags > 6" in diameter, per acre; optimal at 5+ snags/acre															
85		optimized at 5+/acre; due to use in nesting, average of all plots is applied for this variable (total ~1.4 ac for 21 plots)														
86	Note: a constant snag density is used (all plots) with a plot-specific basal area															
87																
88	HSI (downy woodpecker) = the mininum SI of V1 and V2															

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	THIS IS THE "HSIdatacalc" TAB															
2	Yellow Warbler Modified															
3	note: for V3, essentially all deciduous shrub canopy cover is by hydrophytic species, thus V3 = 1.0 unless specified otherwise															
4	Plot	1		2		3		4		5		6		7		
5	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
6	length	65	100	100	100	120	100	100	100	100	100	100	100	100	100	
7	feet dsc	18	79	72	82	60	100	50	90	90	100	70	90	90	90	
8	V1trans	0.28	0.79	0.72	0.82	0.5	1	0.5	0.9	0.9	1	0.7	0.9	0.9	0.9	
9	V1avg	0.59		0.77		0.73		0.70		0.95		0.80		0.90		
10	SI(V1)avg	0.98		1.00		1.00		1.00		0.70		1.00		0.80		
11	V2	2		2		2		1.6	2	1.88	1.92	1.45	1.5	1.79		
12	V2avg	2		2		2		1.8		1.9		1.475		1.79		
13	SI(V2)	1.00		1.00		1.00		0.80		0.94		0.73		0.90		
14	V3	1.00		1.00		1.00		1.00		1.00		1.00		1.00		
15	SI(V3)	1.00		1.00		1.00		1.00		1.00		1.00		1.00		
16	V4	0	0	0	0	0.6	0.1	0.6	0.1	0.3	0.3	0	0.3	0	0.2	
17	V4avg	0		0		0.35		0.35		0.3		0.15		0.1		
18	SI(V4)	0.5		0.5		1		1		0.8		0.5		0.5		
19																
20	HSI-ywmod	0.70		0.71		1.00		0.89		0.73		0.60		0.60		
21	HSI-yworig	0.99		1.00		1.00		0.89		0.81		0.85		0.85		
22																
23	Plot	8		9		10		11		12		13		14		
24	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
25	length	100	100	60	50	100	100	100	100	100	100	100	100	100	100	
26	feet dsc	85	100	60	50	60	100	90	100	95	75	80	80	77	74	
27	V1trans	0.85	1	1	1	0.6	1	0.9	1	0.95	0.75	0.8	0.8	0.77	0.74	
28	V1avg	0.93		1.00		0.80		0.95		0.85		0.80		0.76		
29	SI(V1)avg	0.75		0.60		1.00		0.70		0.90		1.00		1.00		
30	V2	1.76	1.88	1.6	2	2	1.8	1.6	2	2	2	1.1	2	1.65	1.22	
31	V2avg	1.82		1.8		1.9		1.8		2		1.55		1.435		
32	SI(V2)	0.88		0.80		1.00		0.80		1.00		0.55		0.83		
33	V3trans	1.00	1.00	1.00	1.00	1.00	1.00	0.40	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
34	V3avg	1.00		1.00		1.00		0.70		1.00	1.00	1.00		1.00		
35	SI(V3)avg	1.00		1.00		1.00		0.73		1.00		1.00		1.00		
36	V4	0	0	0	0	0	0.1	0.2	0	0.2	0	0	0	0.2	0	
37	V4avg	0		0		0.05		0.1		0.1		0		0.1		
38	SI(V4)	0.5		0.5		0.5		0.7		0.7		0.5		0.7		
39																
40	HSI-ywmod	0.57		0.49		0.71		0.53		0.79		0.52		0.76		
41	HSI-yworig	0.81		0.69		1.00		0.64		0.95		0.74		0.91		
42																
43	Plot	15		16		17		18		19		20		21		

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
44	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
45	length	100	100	150	120	100	100	80	75	100	90	80	80	80	80	
46	feet dsc	50	50	135	90	50	85	60	30	30	0	45	60	75	60	
47	V1	0.50	0.5	0.9	0.75	0.5	0.85	0.75	0.4	0.3	0	0.5625	0.75	0.9375	0.75	
48	V1avg	0.50		0.83		0.68		0.58		0.16		0.66		0.84		
49	SI(V1)avg	0.83		0.93		1.00		0.97		0.26		1.00		0.91		
50	V2	0.5	0.81	2	1.466667	1.75	1.647059	2	2	1.25	0	2	1.8	2	1.75	
51	V2avg	0.655		1.733333		1.698529		2		0.625		1.9		1.875		
52	SI(V2)	0.25		1.00		0.88		1.00		0.63		1.00		1.00		
53	V3	1.00	1.00	1.00	1.00	1.00	1.00	0.40	1.00	1.00	0.00	1.00	1.00	1.00	0.69	
54	V3avg	1.00		1.00		1.00		0.70		0.50	0.10	1.00		0.84		
55	SI(V3)avg	1.00		1.00		1.00		0.73		0.55		1.00		0.86		
56	V4	0	0	0	0.1	0	0	0	0.533333	0	0	0	0	0	0.2	
57	V4avg	0		0.05		0		0.266667		0		0		0.1		
58	SI(V4)	0.5		0.5		0.5		0.5		0.5		0.5		0.5		
59																
60	HSI-ywmod	0.32		0.68		0.66		0.59		0.21		0.71		0.63		
61	HSI-yworig	0.46		0.97		0.94		0.84		0.30		1.00		0.89		
62																
63	Riparian Songbird Guild															
64	note: for variables V1 and V2, these are considered non overlapping, as "trees" being >3M only generally have lower limbs that go 1-3M as well															
65	note: this non-overlapping assumption may modestly underestimate foliage SIs and overall HSI but is deemed appropriate for this site															
66	note: V4 is the maximum, not the average, of both transects, considering that multiple layers anywhere in a plot applies															
67	Plot	1		2		3		4		5		6		7		
68	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
69	length	65	100	100	100	120	100	100	100	100	100	100	100	100	100	
70	ftshrub<3m	18	79	77	82	60	100	50	90	90	100	40	45	30	30	
71	V1	27.69230769	79	77	82	50	100	50	90	90	100	40	45	30	30	
72	V1avg	53.34615385		79.5		75		70		95		42.5		30		
73	SI(V1)avg	1.00		1.00		1.00		1.00		0.63		0.81		0.50		
74	fttree>3m	12	70	77	82	80	80	20	70	80	80	50	55	70	60	
75	V2	18.46153846	70	77	82	66.66667	80	20	70	80	80	50	55	70	60	
76	V2avg	44.23		79.5		73.33333		45		80		52.5		65		
77	SI(V2)avg	0.21		1		1		0.25		1		1		1		
78	V3	7.66		7.10		10.8966		13.716		8.5344		9.492343		5.7912		
79	SI(V3)	1		1		1		1		1		1		0.95824		
80	V4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	
81	V4max	5.00		5.00		5.00		5.00		5.00		5.00		5.00		
82	SI(V4)max	1		1		1		1		1		1		1		
83	snags>4"	1		3		1		4		0		1		6		
84	V5	1.76		4.356		1.32		5.808		0		1.452		8.712		
85	SI(V5)	0.59		1.00		0.44		1.00		0.00		0.48		1.00		
86	allwoodyft	18.00	79	77.00	82	120.00	90	70.00	90	90.00	100	70.00	90	90.00	90	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
87	V6%allwoody	27.69	79.00	77.00	82.00	100.00	90.00	70.00	90.00	90.00	100.00	70.00	90.00	90.00	90.00	
88	V6avg	53.35		79.50		95.00		80.00		95.00		80.00		90.00		
89	SI(V6)avg	0.51		0.78		0.95		0.79		0.95		0.79		0.89		
90																
91	HSI-rsg	0.38		0.78		0.68		0.75		0.45		0.58		0.86		
92																
93	Plot	8		9		10		11		12		13		14		
94	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
95	length	100	100	60	50	100	100	100	100	100	100	100	100	100	100	
96	ftshrub<3m	40	25	60	0	30	60	40	100	65	40	80	80	32	40	
97	V1	40	25	100	0	30	60	40	100	65	40	80	80	32	40	
98	V1avg	32.5		50		45		70		52.5		80		36		
99	SI(V1)avg	0.56		1.00		0.88		1.00		1.00		1.00		0.65		
100	fttree>3m	60	75	0	40	70	40	40	0	30	30	5	5	45	30	
101	V2	60	75	0	80	70	40	40	0	30	30	5	5	45	30	
102	V2avg	67.50		40		55		20		30		5		37.5		
103	SI(V2)avg	1.00		0.75		1.00		0.25		0.50		0.00		0.69		
104	V3	8.26		7.62		6.096		8.382		6.477		7.112		6.2992		
105	SI(V3)	1		1		1		1		1		1		1		
106	V4	5		5		5	5	5	5	5	5	5	5	5		
107	V4max	5.00		5.00		5.00		5.00		5.00		5.00		5.00		
108	SI(V4)max	1		1		1		1		1		1		1		
109	snags>4"	2		0		1		3		4		4		3		
110	V5	2.904		0		1.452		4.356		5.808		5.808		4.356		
111	SI(V5)	0.97		0.00		0.48		1.00		1.00		1.00		1.00		
112	allwoodyft	85	100	60	50	100	100	100	100	100	75	85	85			
113	V6%allwoody	85	100	100	100	100	100	100	100	100	75	85	85	77	74	
114	V6avg	92.50		100.00		100.00		100.00		87.50		85.00		75.50		
115	SI(V6)avg	0.92		1.00		1.00		1.00		0.87		0.84		0.74		
116																
117	HSI-rsg	0.88		0.48		0.73		0.95		0.84		0.79		0.71		
118																
119	Plot	15		16		17		18		19		20		21		TEST
120	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
121	length	100	100	150	120	100	100	80	75	100	90	80	80	80	80	
122	ftshrub<3m	40	30	10	60	35	85	40	29	30	0	20	40	30	20	
123	V1	40	30	6.666667	50	35	85	50	38.66667	30	0	25	50	37.5	25	
124	V1avg	35		28.33333		60		44.33333		15		37.5		31.25		
125	SI(V1)avg	0.63		0.46		1.00		0.86		0.13		0.69		0.53		1
126	fttree>3m	0	20	130	30	10	30	20	50	0	0	25	20	45	55	
127	V2	0	20	86.66667	25	10	30	25	66.66667	0	0	31.25	25	56.25	68.75	
128	V2avg	10.00		55.83333		20		45.83333		0		28.125		62.5		
129	SI(V2)avg	0.00		1.00		0.25		0.90		0.00		0.45		1.00		1

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
130	V3	8.26		7.18		7.3152		9.0424		5.588		8.1788		6.94944		
131	SI(V3)	1		1		1		1		0.9176		1		1		1
132	V4	1	5	5	5	5	5	5	5	2	1	5	5	5	5	
133	V4max	5.00		5.00		5.00		5.00		2.00		5.00		5.00		
134	SI(V4)max	1		1		1		1		0.25		1		1		1
135	snags>4"	4		2		1		2		4		1		1		
136	V5	5.808		2.151111		1.452		3.747097		6.113684		1.815		1.815		
137	SI(V5)	1.00		0.72		0.48		1.00		1.00		0.61		0.61		1
138	allwoodyft	50	50	135	90	50	85	60	65	30	0	45	60	75	75	
139	V6%allwoody	50	50	90	75	50	85	75	87	30	0	56	75	94	94	
140	V6avg	50.00		82.50		67.50		80.83		15.00		65.63		93.75		
141	SI(V6)avg	0.47		0.82		0.66		0.80		0.11		0.64		0.93		1
142																
143	HSI-rsg	0.43		0.67		0.46		0.79		0.07		0.48		0.72		1.00
144																
145	Riparian Forest Cover Type															
146	note: V1 is in feet; V2 is feet over transect; V3 is % estimate over transect; V5 is % visual estimate over transect, at 3 planes, averaged, recorded on datasheet (entered here)															
147	Plot	1		2		3		4		5		6		7		
148	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
149	length	65	100	100	100	120	100	100	100	100	100	100	100	100	100	
150	V1treehtft	21		23		21		27		24		24		30		
151	SI(V1-RFCT)	0.35		0.39		0.34		0.45		0.39		0.40		0.49		
152	V2ripwdthft	20	80	77	82	120	100	100	90	90	100	85	90	90	90	
153	V2avg	50		79.5		110		95		95		87.5		90		
154	SI(V2-RFCT)	0.6		1		1		1		1		1		1		
155	V3canopy%	0	20	20	0	80	50	20	70	80	80	5	50	60	40	
156	V3avg	10		10		65		45		80		27.5		50		
157	SI(V3-RFCT)	0.2		0.2		1		0.9		1		0.55		1		
158	V4#spp	4		3		4		5		4		4		5		
159	SI(V4-RFCT)	1		0.9		1		1		1		1		1		
160	V5undstry	5	55	60	70	50	85	40	75	90	90	60	75	80	55	
161	V5avg	30		65		67.5		57.5		90		67.5		67.5		
162	SI(V5-RFCT)	1.00		0.94		0.91		1.00		0.63		0.91		0.91		
163	Nnadjfctr	1		1		1		1		1		1		1		
164																
165	HSI-RFCT	0.59		0.69		0.83		0.87		0.76		0.78		0.87		
166																
167	Plot	8		9		10		11		12		13		14		
168	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
169	length	100	100	60	50	100	100	100	100	100	100	100	100	100	100	
170	V1treehtft	23.5		25		20		27.5		21.25		23.33333		20.66667		
171	SI(V1-RFCT)	0.39		0.42		0.33		0.46		0.35		0.39		0.34		
172	V2ripwdthft	85	100	60	50	100	100	100	100	100	100	100	100	100	100	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
173	V2avg	92.5		55		100		100		100		100		100		
174	SI(V2-RFCT)	1		0.7		1		1		1		1		1		
175	V3canopy%	50	30	0	25	90	30	40	0	20	30	5	0	40	30	
176	V3avg	40		12.5		60		20		25		2.5		35		
177	SI(V3-RFCT)	0.8		0.25		1		0.4		0.5		0.05		0.7		
178	V4#spp	5		4		5		3		4		5		7		
179	SI(V4-RFCT)	1		1		1		0.9		1		1		1		
180	V5undstry	70	70	50	80	90	80	60	60	60	70	35	35	55	30	
181	V5avg	70		65		85		60		65		35		42.5		
182	SI(V5-RFCT)	0.88		0.94		0.69		1.00		0.94		1.00		1.00		
183	Nnadjfctr	1		1		1		1		1		1		1		
184																
185	HSI-RFCT	0.81		0.64		0.76		0.77		0.76		0.63		0.81		
186																
187	Plot	15		16		17		18		19		20		21		
188	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
189	length	100	100	150	120	100	100	80	75	100	90	80	80	80	80	
190	V1treehtft	27		24		24		30		18		27		23		
191	SI(V1-RFCT)	0.45		0.39		0.40		0.49		0.31		0.45		0.38		
192	V2ripwdthft	90	60	135	90	65	75	60	70	50	0	45	60	75	80	
193	V2avg	75		112.5		70		65		25		52.5		77.5		
194	SI(V2-RFCT)	1		1		1		0.9		0.2		0.65		1		
195	V3canopy%	0	0	135	90	5	35	20	65	0	0	20	10	50	62.5	
196	V3avg	0		112.5		20		42.5		0		15		56.25		
197	SI(V3-RFCT)	0		0.59375		0.4		0.85		0		0.3		1		
198	V4#spp	7		6		2		5		6		6		6		
199	SI(V4-RFCT)	1		1		0.8		1		1		1		1		
200	V5undstry	15	30	85	40	30	65	40	40	25	0	45	50	75	50	
201	V5avg	22.5		62.5		47.5		40		12.5		47.5		62.5		
202	SI(V5-RFCT)	0.80		0.97		1.00		1.00		0.53		1.00		0.97		
203	Nnadjfctr	1		1		1		1		1		1		1		
204																
205	HSI-RFCT	0.45		0.80		0.72		0.86		0.37		0.72		0.85		
206																
207	Downy Woodpecker															
208	see BasalArea TAB of this spreadsheet for V1, SI(V1-dw) calculations															
209	Plot:	1	2	3	4	5	6	7	8	9	10					
210	SI(V1-dw)	0.27	1.00	0.99	0.50	0.50	0.80	0.19	0.05	0.16	1.00					
211	plot 10"snag	1	3	1	2	0	1	6	0	0	1					
212	V2-snag/ac	1.5	4.4	1.5	2.9	0.0	1.5	8.7	0.0	0.0	1.5					
213	SI(V2-dw)	0.29	0.87	0.29	0.58	0.00	0.29	1.00	0.00	0.00	0.29					
214	HSI-dw	0.27	0.87	0.29	0.50	0.00	0.29	0.19	0.00	0.00	0.29					
215																

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
216	Plot:	11	12	13	14	15	16	17	18	19	20	21				
217	SI(V1-dw)	0.20	0.74	0.71	0.16	0.34	0.59	0.77	0.30	0.14	0.78	0.71				
218	plot 10"snag	3	3	0	2	2	1	0	1	1	0	0				
219	V2-snag/ac	4.4	4.4	0.0	2.9	2.9	1.5	0.0	1.5	1.5	0.0	0.0				
220	SI(V2-dw)	0.87	0.87	0.00	0.58	0.58	0.29	0.00	0.29	0.29	0.00	0.00				
221	HSI-dw	0.20	0.74	0.00	0.16	0.34	0.29	0.00	0.29	0.14	0.00	0.00				
222																
223	Test calculation (average snag density)			1.16			Test calculation (average basal area)				38.14					
224	associated snag SI(V1-dw)			0.23			associated BA SI(V2-dw)				0.87					
225	Test calculation, HSI-dw from average snag and BA				0.23											
226	Test calculation, HSI-dw as average HSI across plots				0.23											
227																
228	Hairy Woodpecker															
229	see BasalArea TAB of this spreadsheet for V1-hw (DbH of overstory trees) calculations															
230	Plot:	1	2	3	4	5	6	7	8	9	10					
231	trans1length	65	100	120	100	100	100	100	100	60	100					
232	trans2length	100	100	100	100	100	100	100	100	50	100					
233	plot10"snag	1	2	0	0	0	0	3	0	0	0					
234	V1-snag/ac	1.5	2.9	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0					
235	SI(V1-hw)	0.29	0.58	0.00	0.00	0.00	0.00	0.87	0.00	0.00	0.00					
236	meandbhov	8.8	1.0	13.8	8.8	4.7	6.5	12.5	6.0	1.3	12.5					
237	SI(V2-hw)	0.11	0.00	0.83	0.11	0.00	0.00	0.65	0.00	0.00	0.65					
238	SIN	0.37	0.58	0.63	0.09	0.00	0.00	1.36	0.00	0.00	0.48					
239	Testcalc SINavgsng	0.26	0.18	0.80	0.27	0.18	0.18	0.66	0.18	0.18	0.66					
240	SI(V3-hw)	0.86	0.50	1.00	0.87	0.50	0.57	1.00	0.51	0.50	1.00					
241	cancovtree1	10	20	80	20	60	0	60	50	0	15					
242	cancovtree2	25	20	20	50	70	30	30	25	25	25					
243	cancovtree%total	21	20	45	35	65	15	45	38	23	20					
244	SI(V4-hw)	0.09	0.07	0.44	0.29	0.71	0.00	0.43	0.32	0.11	0.07					
245	SIC	0.08	0.04	0.44	0.25	0.36	0.00	0.43	0.16	0.06	0.07					
246	HSI(hw)	0.03	0.02	0.27	0.02	0.00	0.00	0.58	0.00	0.00	0.03					
247	testcalc HSIavgsng	0.02	0.01	0.35	0.07	0.06	0.00	0.28	0.03	0.01	0.05					
248																
249	Test calculation: average snag density =			0.90												
250	Test calculation: average SI(V1-hw)=			0.18												
251	using avg snagSI															
252																
253	Plot:	11	12	13	14	15	16	17	18	19	20	21				
254	trans1length	100	100	100	100	100	150	100	80	100	80	80				
255	trans2length	100	100	100	100	100	120	100	75	90	80	80				
256	plot10"snag	3	2	0	0	1	1	0	0	0	0	0				
257	V1-snag/ac	4.4	2.9	0.0	0.0	1.5	1.5	0.0	0.0	0.0	0.0	0.0				
258	SI(V1-hw)	0.87	0.58	0.00	0.00	0.29	0.29	0.00	0.00	0.00	0.00	0.00				

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
259	meandbhov	5.0	12.5	14.0	7.7	12.5	25.0	12.3	17.0	5.7	17.9	10.6				
260	SI(V2-hw)	0.00	0.65	0.86	0.00	0.65	1.00	0.62	1.00	0.00	1.00	0.37				
261	SIN	0.87	1.07	0.65	0.00	0.78	1.04	0.46	0.75	0.00	0.75	0.28				
262	Testcalc SINavgsng	0.18	0.66	0.83	0.18	0.66	0.93	0.64	0.93	0.18	0.93	0.46				
263	SI(V3-hw)	0.50	1.00	1.00	0.72	1.00	1.00	1.00	1.00	0.50	1.00	1.00				
264	cancovtree1	30	20	0	30	0	10	0	15	0	0	10				
265	cancovtree2	0	20	0	20	10	20	25	40	0	5	40				
266	cancovtree%total	15	20	0	25	5	11	13	35	0	3	31				
267	SI(V4-hw)	0.00	0.07	0.00	0.14	0.00	0.00	0.00	0.29	0.00	0.00	0.23				
268	SIC	0.00	0.07	0.00	0.10	0.00	0.00	0.00	0.29	0.00	0.00	0.23				
269	HSI(hw)	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.06				
270	testcalc HSIavgsng	0.00	0.05	0.00	0.02	0.00	0.00	0.00	0.27	0.00	0.00	0.11				
271																
272	Test calculation (average snag density)			0.90												
273	associated snag SI(V1-hw)			0.18												
274																
275	Summary of HEP:	HSImean	HSImax	HSImin												
276	Model															
277	YellowWarblerMod	0.64	1.00	0.21												
278	YellowWarblerOrig	0.83	1.00	0.30												
279	RipSongbirdGuild	0.64	0.95	0.07												
280	RipForestCovertyp	0.73	0.87	0.37												
281	DownyWoodpckr	0.23	0.87	0.00												
282	HairyWoodpckr	0.06	0.58	0.00												
283	Hwtestcalcavgsnag	0.06	0.35	0.00												
284																
285	Area estimate (rough, average width X 300 ft, summed)															
286	Plot	1		2		3		4		5		6		7		
287	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
288	length	65	100	100	100	120	100	100	100	100	100	100	100	100	100	
289	area, acres	0.57		0.69		0.76		0.69		0.69		0.69		0.69		
290	Plot	8		9		10		11		12		13		14		
291	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
292	length	100	100	60	50	100	100	100	100	100	100	100	100	100	100	
293	area, acres	0.69		0.38		0.69		0.69		0.69		0.69		0.69		
294	Plot	15		16		17		18		19		20		21		
295	transect	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
296	length	100	100	150	120	100	100	80	75	100	90	80	80	80	80	
297	area, acres	0.69		0.93		0.69		0.53		0.65		0.55		0.55		

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	THIS IS THE "TreeHts" TAB												
2	Tree height calculation for Riparian Songbird model, variable V3; Riparian Forest Cover Type model variable V1												
3	for December 2021 HEP of Lower San Joaquin River Feasibility Study, Reach TS_30_L												
4	note: method identifier c, refers to clinometer, calculated in field; v means visual estimate by eye												
5	note: some numbers represent "synthetic" values to reflect visual estimates recorded on data sheets and verified by photos												
6	Data sheet:		1	2	3	4	5	6	7	8	9	10	11
7			14	55	30	55	29	53	10	20	25	18	30
8			60	16	47	35	30	25	10	21	25	22	25
9			20	16	25		25	26	10	30			30
10			22	18	41			27	40	25			25
11			20	18				28	30	20			
12			20	20				29	18	25			
13			20	20				30	15				
14	Ht feet (V1 RFCT)		25.1	23.3	35.8	45.0	28.0	31.1	19.0	23.5	25.0	20.0	27.5
15	Ht meters (V3 RSG)		7.7	7.1	10.9	13.7	8.5	9.5	5.8	7.2	7.6	6.1	8.4
16													
17	Data sheet:		12	13	14	15	16	17	18	19	20	21	
18			33	38	25	25	15	30	45	21	18	20	
19			20	25	25	25	12	35	25	14	22	18	
20			20	14	20	30	35	20	25	15	48	35	
21			20	20	20	22	22	20	40	20	28	20	
22			20	30	20	22	40	44	25	13	25		
23			20			12	25	20		18			
24			25			55		20		20			
25						40		20		25			
26						25		20					
27								20					
28								20					
29								25					
30								25					
31													
32	Ht feet (V1 RFCT)		21.3	23.3	20.7	27.1	23.6	24.0	29.7	18.3	26.8	22.8	
33	Ht meters (V3 RSG)		6.5	7.1	6.3	8.3	7.2	7.3	9.0	5.6	8.2	6.9	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	THIS IS THE "Species" TAB														
2	This TAB records the species observed in each plot:														
3	Plot:	1		2		3		4		5		6		7	
4		BB		BB		BB		BB		BB		BB		buttonwillow	
5		ash		willow		willow		red willow		red willow		willow		BB	
6		willow		buttonwillow		buttonwillow		silver willow		silver willow		elderberry		red willow	
7		unk. compd leaf				walnut		buttonwillow		buttonwillow		silver willow		unid hanging seed	
8								walnut						green unid Fig?	
9															
10	Plot:	8		9		10		11		12		13		14	
11		buttonwillow		buttonwillow		BB		california rose		buttonwillow		buttonwillow		BB	
12		red willow		red willow		buttonwillow		willow		BB		hackberry		silver willow	
13		silver willow		compnd leaf unid		unid willow		BB		red willow		silver willow		red willow	
14		BB		red oak seedling		red willow				valley oak		red willow		unid	
15		Fig				elderberry						unk brownfuzzybush		compnd leaf unid	
16						unid near top								unk brownfuzzybush	
17														buttonwillow	
18															
19	Plot:	15		16		17		18		19		20		21	
20		red willow		silver willow		buttonwillow		willow		valley oak		willow1		pecan	
21		BB		live oak		silver willow		buttonwillow		willow		willow2		valley oak	
22		buttonwillow		buttonwillow				valley oak		2nd willow spp		BB		willow	
23		2nd willow spp		BB				BB		unid treewithgalls		pecan		BB	
24		cork oak		coyote bush				2nd willow spp		fig		live oak		unid hanging seed	
25		black locust		walnut						live oak		valley oak		live oak	
26		walnut								BB					

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	THIS IS THE "BasalArea" TAB															
2	Note: Basal Area was determined from DbH measurements of larger trees, plus estimates of stem number X approximate DbH of dense stems															
3	this calculation can be seen in the cells for rows "BA ft/ac", recorded exactly as noted in field on data sheets.															
4	Note: overstory trees shown in bold															
5	Note: plots 2, 4, and 5, were not done by stem count due to extremely high willow density, in these plots, estimated 3 or 6 inches															
6		per square yard (9 sq ft), and applied that density to the shrub portion of the plot, that is 300 ft x shrub cover in V1-yellow warbler model														
7		to get an estimate of basal area in feet, per acre														
8	Note: missing data/not measured in plot 10, so assumed 3"/yard X 50 ft shrub cover average / 9 ft per yard x (30,000 plot size/43,560 sq ft per acre)															
9		estimate based on field photos 196, 197, 198														
10	Note: some plots (2,4,5) where average stem densities per square meter were included, yielded very large basal areas, and may be overestimates															
11	NOTE: 4/15/22 - SOME BASAL AREAS ARE MISRECORDED AS SUM OF DIAMETERS, THESE INDIVIDUAL DIAMETERS MUST BE CONVERTED TO AREAS BEFORE SUMMING															
12	NOTE: 4/27/22 - ALL BASAL AREAS CHECKED, RECALCULATED, RESUME EDITING 6/24/22															
13	Plot:	1	2	3	3-BA sq ft	4	5	6	7	8	9	10				
14		**9**	8000	**26**	**3.687008**	**30**	**4**	**20**	**10**	**6**	**8**	**15**				
15		**10**		**16**	**1.396263**	**7**	**4**	**6**	**15**	**6**	**20**	**10**				
16		**10**		**16**	**1.396263**	**4**	**6**	**6**		**6**	**10**					
17		**6**		**16**	**1.396263**	**4**		**6**		**6**	**10**					
18				**14**	**1.069014**	**6**		**6**		**6**	**8**					
19				**4**	**0.087266**	**6**		**6**		**6**						
20				**4**	**0.087266**	**8**		**6**		**6**						
21				**11**	**0.659953**	**7**		**6**								
22				**15**	**1.227185**	**6**		48								
23				**16**	**1.396263**	**10**										
24				60												
25						14000	16000				40					
26					12.40275											
27	Basal Area estimation notes for plots 1-10:															
28	Note: all square inches linear converted to square feet by dividing by 144															
29	plot 1: estimate wooded northern half of site is 8" per 100 sq ft, or 960" (80') BA, site area is ~.57 ac (300*(65+100/2)															
30		1/2 of site is 150 x 80 feet wide = 12,000 sq ft so if 8" per 100 feet, that is 960" BA (or 960/144= 6.7 sq ft) in whole plot.										BA per ac = 6.7/.57=11.7'				
31	plot 2: note estimate wooded area, 80% of site (24,000 sq ft, 2667 sq yds) has 3"(3/144 = .0208') BA per yard, or 667 sq ft BA; 43560/30000*55.5=80.5'/ac BA															
32	plot 3: data sheets recorded 10 tree diameters, and "2x20 - 2x40" notation, meaning 2" X 20 to 40 willow shrubs, and "est, several feet/10th acre"															
33		Total for trees only is 12.4 ft sq; but if est, above is for willows, that is 3 ft/tenth acre is 30 sq feet/ac BA; overall guess 43.4/ac BA														
34	plot 4: data sheet notes "likely high, 6" per sq M", which is 0.0417sq ft; assuming 80% (average of "all woody", RSG V6) reduces this to 0.033 ft BA per 9 sq ft															
35		.033 ft/sq M ~.033 ft/9 sq ft; expanding to an acre 0.033/9*43560 sq ft/ac = 161.5'/ac BA														
36	plot 5: data sheet notes " est thick willow stems 6" per sq M + trees. Likely high [BA]." This would calculate out to at least plot 4, or more; 161.5' ac BA															
37																
38	plot 6: data notes "15 willows x 6" = 90 sq in trees alone + willows; dense willows 1/3 site 6+"/sqM"; 20" willow, willow 6-8 stems 6"															
39		species	diameter	BA	assumption											

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
40		willow	6	1.374447	7 stems this size											
41		willow	20	2.181662												
42		thicket		20.83333	((100x45/9)x 6)/144 =			20.83333								
43		total BA in plot		24.38944		total per acre		35.41347								
44		(300 x45/9)/3x 6/144=46.3 sq ft BA in 30,000 sq ft site. 46.3*43560/30000=67.2/ac BA														
45	plot 7: data notes "4-6"/10 sq M for 1/2 site; 0"/sq M [for other 1/2?]";															
46		data note calculation, assume "10 sq M" is 90sqft, not 900.														
47		so overall is 2"/sqM; 2"/144=.014'; .014/9*43560=67.8'/ac BA														
48		overall average of "4-6" and zero, is 2.5", (5+0)/2														
49		estimate calculation of BA per sq ft, therefore, is (2.5/144)/90						0.000193								
50		the BA for 1 acre is the above per foot x 43560						8.402778								
51		this was one of the few sites with a cruz-all estimate, 2 x 5 BAF, or 10'/ac BA														
52		select the lower of the two estimates for the HEP														
53	plot 8: notes say "not possible ~1 x 5?", in likely reference to a cruz-all measurement; the seven, 6" trees are 28" BA each or 196" total															
54		169"/144=1.36 sq ft in the plot. 1.36*43560/30000=1.98'/ac BA														
55	plot 9:	notes indicate 10, 4" stems; thats pi x 2 squared,x 10, or 125.6 inches or 0.872' BA in plot (125.6/144); 0.872*43560/30000=1.27/ac BA														
56		individual trees measured additionally														
57		species	diameter	BA	assumption											
58		ash	8	0.349066												
59		buttonW	20	2.181662	multiple stems of same species											
60			10	0.545415												
61			10	0.545415												
62			8	0.349066												
63		total BA in plot		3.970624		total per acre		5.765346	plus 1.27 above =		7.035346					
64	plot 10: "missing data", post field photo interp: min 2" dia/yd=(~3" BA) per yard x 50' wooded x 300' long /144 sq in per ft)/9 ft per yd *43560/30000 = 50.4'/ac BA															
65	Plot:	1	2	3	4	5	6	7	8	9	10					
66	meanDbH	8.8	1.0	13.8	8.8	4.7	6.5	12.5	6.0	1.3	12.5					
67	BA ft/ac	11.7	80.5	43.4	161.5	161.5	35.4	8.4	2.0	7.0	50.4					
68	SI(V1-dw)	0.27	1.00	0.99	0.50	0.50	0.80	0.19	0.05	0.16	1.00					
69																
70	Plot:	11	12	13	14	15	16	17	18	19	20	21				
71		**6**	**14**	**10**	**4**	**16**	**16**	**8**	**14**	**6**	**11**	**15**				
72		**6**	**13**	**9**	**18**	**8**	**29**	**8**	**12**	**5**	**18**	**10**				
73		**4**	**32**	**12**	**6**	**13**	**30**	**8**	**18**	**6**	**34**	**8**				
74		**3**	**4**	**8**	**6**	**8**		**20**	**16**		**22**	**11**				
75		**3**	**4**	**10**	**6**	**7**		**12**	**25**		**28**	**21**				
76		**8**	**8**	**15**	**6**	**23**		**6**			**26**	**11**				
77				**30**				**24**			**22**	**9**				
78				**18**							**6**	**9**				

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
79											**6**	**9**				
80											**6**	**8**				
81												**8**				
82												**8**				
83	meanDbH	5.0	12.5	14.0	7.7	12.5	25.0	12.3	17.0	5.7	17.9	10.6				
84	BA ft/ac	8.6	32.7	31.1	6.9	15.0	26.1	33.9	13.1	6.2	34.2	31.1				
85	SI(V1-dw)	0.20	0.74	0.71	0.16	0.34	0.59	0.77	0.30	0.14	0.78	0.71				
86	Basal Area estimation notes for plots 11-21:															
87	plot 11: notes for this plot have a list of species and diameters, and a guess of "10-20" for 1/3 plot", likely in reference to sum of diameters															
88		photos show a foreground of rose, with sufficiently separated trees in the background to conclude the stem/diameter counts are accurate														
89		species	diameter	BA	assumption											
90		walnut	8	0.349066	individual											
91		buttonW	10	0.545415	individual											
92		buttonW	5	0.545415	20 inch sum of diameters recorded, guess 5 inches, 4 stems											
93		hollyoak	6	0.19635	individual											
94		willow	10	1.090831	individual											
95		willow	8	1.047198	25 inch sum of diameters recorded, guess 8 inches, 3 stems											
96		willow	4	0.698132	30 inch sum of diameters recorded for bush, guess 4 inches, 8 stems											
97		elderberry	8	0.349066	individual											
98		elderberry	3	0.147262	individual, overstory measurement says "4,3,3" so guess 3 inches, 3 stems											
99		3-4 willow	5	0.545415	20 inch sum of diameters recorded, "3-4 willows, 20' total", guess 5 inches 4 stems											
100		2 willows	5	0.409062	recorded "2 more willows, 15" total", guess 5 inches, 3 stems											
101		total BA in plot		5.923211		total per acre		8.600503								
102	plot 12: notes for this plot have a list of diameters, or diameter classes and numbers of stems, by species.															
103		species	diameter	BA	assumption											
104		willow	14	1.069014												
105		willow	13	0.921752												
106		willow	32	5.585054												
107		willow	4	0.087266												
108		willow	20	8.726646	4 of these											
109		willow	20	2.181662	1 of these											
110		willow	5	0.545415	4 of these											
111		buttonW	20	2.181662	1 of these											
112		buttonW	15	1.227185	1 of these											
113		total BA in plot		22.52566		total per acre		32.70725								
114	plot 13:	species	diameter	BA	assumption											
115		buttonW	6	0.19635	5 of these											
116		hackberry	18	1.767146												
117		willow	20	2.181662												

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
118		buttonW	6	0.785398	4 of these											
119		hackberry	9.5	0.984475	2, actually 2 stems 10 and 9"											
120		buttonW	12	1.570796	24", assume 2 12"											
121		buttonW	24	1.668971	24" assume 15 and 9"											
122		willow	45	12.27185	30 and 15"											
123		total BA in plot		21.42664		total per acre		31.11149								
124	plot 14:	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														
125		buttonW	4	0.349066	4 of these											
126		buttonW	8	0.785398	3 of these, 20" total, 8" x2, 4"x1											
127		willow		0.19635	2,4, and 4"; 10" total											
128		willow	15	1.227185	individual											
129		willow	18	1.767146	individual											
130		thicket	2	0.261799	25" total dia recorded; assume 12, 2 inch stems											
131		fuzzytree	6	0.19635	individual											
132		total BA in plot		4.783293		total per acre		6.945341								
133	plot 15	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														
134		species	diameter	BA	assumption											
135		corkoak	16	1.396263												
136		willow	8	0.370882	8 and 2" stems											
137		willows	1	0.1309	24x1" stems											
138		buttonW	6	0.19635												
139		willow	20	2.181662												
140		redberry	18	1.767146												
141		willows	1	0.163625	30x1" stems											
142		walnut	13	2.405282	13 and 12" stems											
143		locust	7	0.267254												
144		unid	23	2.885247												
145		total BA in plot		11.76461		total per acre		17.08221								
146	plot 16	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														
147		willow	16	1.396263												
148		willow	29	4.586943	recorded "28-30" willow"; assume 29											
149		willow	30	4.908739	recorded "28-32" willow"; assume 30											
150		willow	1	1.041667	100's of 1" stems; assume 1.5" BA per stem											
151		buttonW	8	0.349066												
152		walnut	20	2.181662												
153		walnut	18	1.767146												
154		walnut	18	1.767146												
155		total BA in plot		17.99863		total per acre		26.13401								
156	plot 17	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
157		species	diameter	BA	assumption											
158		willow	30	14.72622	3, 9" stems											
159		willow	2	1.636246	thicket, assume 25, 2 inch stems											
160		willow	8	0.349066												
161		liveoak	20	2.181662												
162		willow	1	0.327249	thicket, assume 20, 1 inch stems											
163		buttonW	24	3.141593												
164		buttonW	18	0.981748	12, 6 inch stems total 18 dia											
165		total BA in plot		23.34378		total per acre		33.89517								
166	plot 18	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														
167		species	diameter	BA	assumption											
168		willow	2	0.392699	thicket, 35" total , 18, 2 inch stems											
169		buttonW	14	1.069014	each stem in two bushes measured individually											
170			12	0.785398												
171			8	0.349066												
172			16	1.396263												
173		buttonW	5	0.136354												
174			3	0.049087												
175			3	0.049087												
176			3	0.049087												
177			8	0.349066												
178		valloak	25	3.408846												
179		willow	2	0.327249	thicket, 30" total , 15, 2 inch stems											
180		willow	5	0.681769	small bush, 25" dbh total, assume 5 stems 5"											
181		total BA in plot		9.042987		total per acre		13.13042								
182	plot 19	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														
183		species	diameter	BA	assumption											
184		willow	5	0.818123	"large thicket"; 30", assume six, 5 inch stems											
185		willow	2	0.283616	thicket; 25", assume 13, 2 inch stems											
186		valloak	3	0.049087	individual stems on two trees measured											
187			6	0.19635												
188			4	0.087266												
189		valloak	6	0.19635	individual											
190		willow	1	0.109083	thicket; 20"; smaller stature, assume 20, 1" stems											
191			1	0.109083	thicket; 20"; smaller stature, assume 20, 1" stems											
192			1	0.109083	thicket; 20"; smaller stature, assume 20, 1" stems											
193			1	0.109083	thicket; 20"; smaller stature, assume 20, 1" stems											
194		fig	20	2.181662	individual											
195		total BA in plot		4.248786		total per acre		6.169237								

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
196	plot 20	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														
197		species	diameter	BA	assumption											
198		pecan	11	0.659953												
199		willow	18	1.767146	very large willow with many individually measured stems											
200			34	6.305002												
201			22	2.63981												
202			28	4.276057												
203			26	3.687008												
204			22	2.63981												
205		valloak	6	0.19635												
206		liveoak	6	0.19635												
207		pecan	12	0.785398												
208		willow	1	0.218166	thicket; 40"; assume 40, 1" stems											
209		willow	1	0.163625	thicket; 30"; assume 30, 1" stems											
210		total BA in plot		23.53467		total per acre		34.17235								
211	plot 21	notes - reconstructed/estimated stems from basal area and overstory dbh lists as best possible														
212		species	diameter	BA	assumption											
213		valloak	15	1.227185	individual											
214		pecan	10	0.545415	two stems, measured individually											
215			8	0.349066												
216		unid	6	1.178097	6, 6" stems											
217		corkoak	21	2.405282												
218		corkoak	11	0.659953												
219		pecan	5	0.136354												
220		unid	4	1.570796	18 stems											
221		willow	8	2.792527	large stems, 60" , estimate 8, 8" stems											
222		total BA in plot		10.86467		total per acre		31.13587								

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	THIS IS THE "Futures" TAB																				
2	This TAB estimates best case futures in mitigation site, that could be theoretically used to estimate mitigation ratio.																				
3	Assume a site, such as agriculture, which has no value/woody currently.																				
4																					
5	Warbler Model - Best Case Scenario										Warbler Model - Worse Case Scenario										
6	V1-shrub cover: estimate this would be optimized (60-80%) in 5 years; with lots of planting/watering										V1-shrub cover: maxes out at 40% due to water variability/dieoff after year 5										
7	V2-shrub height: estimate it would take 5 years to get to 2M tall average, with watering, ideal site										V2-shrub height: 1.2 M max due to alot of herbaceous										
8	V3-percent deciduous shrub cover: presume this would be 100%, determined by planting pallette										V3- percent deciduous shrub cover: same as best case										
9	V4-percent tall tree cover, optimized at 50-75%, is 30 feet tall, estimate 15 years										V4- percent tall tree cover, takes longer due to variable water, 40% maximum										
10																					
11		TY0	TY1	TY5	TY15	TY25	TY51					TY0	TY1	TY5	TY15	TY25	TY51				
12	V1	0	0.1	0.6	0.8	0.8	0.8				V1	0	0.1	0.6	0.5	0.5	0.5				
13	V2	0	0.1	2	2	2	2				V2	0	0.1	0.6	1.2	1.2	1.2				
14	V3	0	1	1	1	1	1				V3	0	1	1	1	1	1				
15	V4	0	0	0	0.3	0.5	0.75				V4	0	0	0	0.3	0.4	0.4				
16																					
17	SI(V1)	0.00	0.17	1.00	1.00	1.00	1.00				SI(V1)	0.00	0.17	1.00	0.83	0.83	0.83				
18	SI(V2)	0	0.05	1	1	1	1				SI(V2)	0	0.05	0.3	0.6	0.6	0.6				
19	SI(V3)	0.1	1	1	1	1	1				SI(V3)	0.1	1	1	1	1	1				
20	SI(V4)	0.5	0.5	0.5	0.8	1	1				SI(V4)	0.5	0.5	0.5	0.8	0.9	0.9				
21	HSI-ywm	0.00	0.06	0.71	0.89	1.00	1.00				HSI-ywm	0.00	0.06	0.39	0.63	0.67	0.67				
22																					
23	TY	0	1	5	15	25	51				TY	0	1	5	15	25	51				
24	HSIw/o	0.00	0.00	0.00	0.00	0.00	0.00				HSIw/o	0.00	0.00	0.00	0.00	0.00	0.00				
25	HSI w/	0.00	0.06	0.71	0.89	1.00	1.00				HSI w/	0.00	0.06	0.39	0.63	0.67	0.67				
26	area w/o	10	10	10	10	10	10				area w/o	10	10	10	10	10	10				
27	area w/	10	10	10	10	10	10				area w/	10	10	10	10	10	10				
28	HUs w/o		0	0	0	0	0				HUs w/o		0	0	0	0	0				
29	HUs w/		0.322749	15.43313	80.0767	94.72136	260				HUs w/		0.322749	9.036961	50.98769	65.1638	174.4133				
30	AAHUs without						0				AAHUs without						0				
31	AAHUs with						8.834391				AAHUs with						5.880873				
32	change due to project						8.834391				change due to project (mitigation gain)						5.880873				
33																					
34	TY	0	1	5	15	25	51														
35	HSIw/o	0.64	0.64	0.64	0.64	0.64	0.64														
36	HSI w/	0.64	0.00	0.00	0.00	0.00	0.00														
37	area w/o	13.88	13.88	13.88	13.88	13.88	13.88														
38	area w/	13.88	13.88	13.88	13.88	13.88	13.88														
39	HUs w/o		8.867974	35.4719	88.67974	88.67974	230.5673														
40	HUs w/		4.433987	0	0	0	0														
41	AAHUs without						8.867974														
42	AAHUs with						0.086941														
43	change due to project (project impact loss)						-8.78103														
44									Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres												
45	I set the area of the mitigation site at 10 acres; so this suggests the habitat value								Best case scenario: CR =	0.71611											
46	is compensated roughly at a ratio of slightly less than 1:1 with perfect mitigation								Worst case scenario: CR =	1.075757											
47																					
48					compensation area best case:			9.94													
49																					
50					compensation area worst case:			14.93151													
51																					
52	Riparian Songbird Model - best case scenario										Riparian Songbird Model - worst case scenario										

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
53	V1- % shrub cover, 1-3M;optimal 50-75%; this will take 10 years to achieve										V1 - takes 14 years, maxes out at 50%										
54	V2- % tree cover, 3+M; optimal 50-75%; takes about 15 years										V2 - takes 15 years, maxes out at 40%										
55	V3- ht of trees, optimal 6+M; takes about 10 years, with watering										V3 - takes 14 years to reach 6+M										
56	V4- layering category; 1-none, 2-low shrub, 3-tall shrubs, 4- trees only, 5- multiple layers; TY1 low only (.3); TY5-51 - multiple (1.0)													V4 - not all "5", some "2","3","4"; max SI .7							
57	V5- snags 4"+ ; optimal at 3+/ac; none for TY0-14; then optimal TY15-51										V5 - not optimal throughout; max average is 1.2 snags/ac										
58	V6- % of site as woody riparian; TY1-5%; TY5-30%; TY10-50%; TY15to51-75%										V6 - lower, max is 60%										
59																					
60	TY	0	1	5	10	14	15	51			TY	0	1	5	10	14	15	51			
61	V1	0	10	30	50	50	60	75			V1	0	10	30	40	50	50	50			
62	V2	0	0	0	30	30	50	75			V2	0	0	0	30	40	40	40			
63	V3	0	1	3	6	6	6	6			V3	0	1	3	5	6	6	6			
64	V4	1	2	3	5	5	5	5			V4	1	2	3	(assume SI of 0.7, mix of categories 2-5)						
65	V5	0	0	0	0	0	3	3			V5	0	0	0	0	0	1.2	1.2			
66	V6	0	5	30	50	75	75	75			V6	0	5	30	50	60	60	60			
67																					
68	SI(V1)	0	0	0.5	1	1	1	1			SI(V1)	0	0	0.5	0.75	1	1	1			
69	SI(V2)	0	0	0	0.5	0.5	1	1			SI(V2)	0	0	0	0.5	0.75	0.75	0.75			
70	SI(V3)	0	0	0.4	1	1	1	1			SI(V3)	0	0	0.4	0.8	1	1	1			
71	SI(V4)	0	0.3	0.5	1	1	1	1			SI(V4)	0	0.3	0.5	0.7	0.7	0.7	0.7			
72	SI(V5)	0.00	0.00	0.00	0.00	0.00	1.00	1.00			SI(V5)	0.00	0.00	0.00	0.00	0.00	0.40	0.40			
73	SI(V6)	0.00	0.00	0.26	0.47	0.74	0.74	0.74			SI(V6)	0.00	0.00	0.26	0.47	0.58	0.58	0.58			
74	HSI-rsg	0.00	0.00	0.06	0.22	0.34	0.74	0.74			HSI-rsg	0.00	0.00	0.06	0.18	0.26	0.37	0.37			
75																					
76	TY	0	1	51																	
77	HSIw/o	0.64	0.64	0.64																	
78	HSI w/	0.64	0	0.00																	
79	area w/o	13.88	13.88	13.88																	
80	area w/	13.88	13.88	13.88																	
81	HUs w/o		8.9	445.5																	
82	HUs w/		4.5	0.0																	
83	AAHUs without			8.9																	
84	AAHUs with			0.1																	
85	change due to project			-8.8																	
86																					
87	TY	0	1	5	10	14	15	51			TY	0	1	5	10	14	15	51			
88	HSIw/o	0	0	0	0	0	0	0			HSIw/o	0	0	0	0	0	0	0			
89	HSI w/	0.00	0.00	0.06	0.22	0.34	0.74	0.74			HSI w/	0.00	0.00	0.06	0.18	0.26	0.37	0.37			
90	area w/o	10	10	10	10	10	10	10			area w/o	10	10	10	10	10	10	10			
91	area w/	10	10	10	10	10	10	10			area w/	10	10	10	10	10	10	10			
92	HUs w/o		0	0	0	0	0	0			HUs w/o		0	0	0	0	0	0			
93	HUs w/		0.00	1.25	7.10	11.32	5.41	265.26			HUs w/		0.00	1.25	6.12	8.78	3.15	134.16			
94	AAHUs without							0.00			AAHUs without							0.00			
95	AAHUs with							5.69			AAHUs with							3.01			
96	change due to project							5.69			change due to project							3.01			
97																					
98	In this case it would take more than 10 acres to compensate the losses of value										Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres										
99	to riparian songbird guild; the estimated compensation area would be:							15.50			Best case scenario: CR =		1.11646								
100	which is somewhat more than 1:1 with perfect mitigation										Worst case scenario: CR =		2.112309								
101	with "worst case" futures; the estimated compensation area would be:							29.31885													
102																					
103	Riparian Forest Cover Type - Best Case Scenario										Riparian Forest Cover Type - Worst Case Scenario										
104																					

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
105	V1 - tree height; optimum 60+ feet; takes about 20 years to get this									V1 - tree height; optimum 60+ feet; max avg of 40 feet after 20 years											
106	V2 - stand width; optimum assumed if 70+ feet wide site									V2 - stand width; optimum assumed if 70+ feet wide site, same as best case											
107	V3-tree canopy closure; optimum 50-80%, may barely get there in 20 years									V3-tree canopy closure; optimum 50-80%, scenario max is 40%											
108	V4- # species; assume can be optimally planted at 4+ species, all survive									V4- # species; 3 of 4 planted species survives											
109	V5 - average understory density; optimal 30-60% this will evolve over time									V5 - average understory density; overshoots optimum after year 20											
110	TY5=20%; TY10-51 - optimal (i.e., 30-60%)									* - discount overall HSI by 1/3 per model assumes most not adjacent to water											
111																					
112	TY	0	1	5	10	15	20	51		TY	0	1	5	10	15	20	51				
113	V1	0	3	15	25	35	60	75		V1	0	3	15	25	30	40	40				
114	V2	0	70	70	70	70	70	70		V2	0	70	70	70	70	70	70				
115	V3	0	0	10	30	40	50	60		V3	0	0	10	30	35	40	40				
116	V4	0	4	4	4	4	4	4		V4	0	4	4	3	3	3	3				
117	V5	0	0	20	30	50	60	60		V5	0	0	20	25	50	70	70				
118																					
119	SI(V1)	0.00	0.05	0.25	0.42	0.58	1.00	1.00		SI(V1)	0.00	0.05	0.25	0.42	0.50	0.67	0.67				
120	SI(V2)	0.2	1	1	1	1	1	1		SI(V2)	0.2	1	1	1	1	1	1				
121	SI(V3)	0	0	0.2	0.6	0.8	1	1		SI(V3)	0	0	0.2	0.6	0.7	0.8	0.8				
122	SI(V4)	0	1	1	1	1	1	1		SI(V4)	0	1	1	1	1	1	1				
123	SI(V5)	0.20	0.20	0.73	1.00	1.00	1.00	1.00		SI(V5)	0.20	0.20	0.73	0.87	1.00	0.88	0.88				
124	HSI-rfct	0.10	0.22	0.61	0.81	0.89	1.00	1.00		HSI-rfct*	0.07	0.15	0.41	0.52	0.57	0.59	0.59				
125																					
126	TY	0	1	51																	
127	HSIw/o	0.73	0.73	0.73																	
128	HSI w/	0.73	0	0																	
129	area w/o	13.88	13.88	13.88																	
130	area w/	13.88	13.88	13.88																	
131	HUs w/o		10.1	507.4																	
132	HUs w/		5.1	0.0																	
133	AAHUs without			10.1																	
134	AAHUs with			0.1																	
135	change due to project			-10.0																	
136																					
137	TY	0	1	5	10	15	20	51		TY	0	1	5	10	15	20	51				
138	HSIw/o	0	0	0	0	0	0	0		HSIw/o	0	0	0	0	0	0	0				
139	HSI w/	0.10	0.22	0.61	0.81	0.89	1.00	1.00		HSI w/	0.07	0.15	0.41	0.52	0.57	0.59	0.59				
140	area w/o	10	10	10	10	10	10	10		area w/o	10	10	10	10	10	10	10				
141	area w/	10	10	10	10	10	10	10		area w/	10	10	10	10	10	10	10				
142	HUs w/o		0	0	0	0	0	0		HUs w/o		0	0	0	0	0	0				
143	HUs w/		1.62	16.72	35.68	42.57	47.20	310.00		HUs w/		1.08	11.20	23.33	27.35	28.90	181.36				
144	AAHUs without							0.00		AAHUs without							0.00				
145	AAHUs with							8.90		AAHUs with							5.36				
146	change due to project							8.90		change due to project							5.36				
147																					
148	In this case it would take more than 10 acres to compensate the losses of value									Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres											
149	to riparian forest covertype; the estimated compensation area would be:							11.29		Best case scenario: CR =			0.813662								
150	which is somewhat more than 1:1 with perfect mitigation									Worst case scenario: CR =			1.351352								
151	with "worst case" futures; the estimated compensation area would be:							18.75677													
152																					
153	Downy Woodpecker model - Best Case Scenario									Downy Woodpecker model - Worst Case Scenario											
154	V1- Basal Area, this will take awhile to maximize (44'/acre); guess is at least 20 years, remains optimal through TY51									V1 = less, slower, basal area, site heterogeneity, limits max SI to 0.7											
155	V2- 6+" snags, these take longer than 4" snags; guess 20 years for this exercise; will max out at 1.5 snags/ac									V2 = snags slightly less abundant at year 20, 1.0 snags/ac											
156																					

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
157																					
158	TY	0	1	5	10	19	20	51		TY	0	1	5	10	19	20	51				
159	V1	0	5	10	20	40	44	90		V1	0	5	10	20	24	25	31				
160	V2	0	0	0	0	0	1.5	1.5		V2	0	0	0	0	0	1	1				
161																					
162	SI(V1)	0.00	0.11	0.23	0.45	0.91	1.00	0.97		SI(V1)	0.00	0.11	0.23	0.45	0.55	0.57	0.70				
163	SI(V2)	0.00	0.00	0.00	0.00	0.00	0.30	0.30		SI(V2)	0.00	0.00	0.00	0.00	0.00	0.20	0.20				
164	HSI-dw	0.00	0.00	0.00	0.00	0.00	0.30	0.30		HSI-dw	0.00	0.00	0.00	0.00	0.00	0.20	0.20				
165																					
166	TY	0	1	51																	
167	HSIw/o	0.23	0.23	0.23																	
168	HSI w/	0.23	0	0.00																	
169	area w/o	13.88	13.88	13.88																	
170	area w/	13.88	13.88	13.88																	
171	HUs w/o		3.2	160.5																	
172	HUs w/		1.6	0.0																	
173	AAHUs without			3.2																	
174	AAHUs with			0.0																	
175	change due to project			-3.2																	
176																					
177	TY	0	1	5	10	14	15	51		TY	0	1	5	10	14	15	51				
178	HSIw/o	0	0	0	0	0	0	0		HSIw/o	0	0	0	0	0	0	0				
179	HSI w/	0.00	0.00	0.00	0.00	0.00	0.30	0.30		HSI w/	0.00	0.00	0.00	0.00	0.00	0.20	0.20				
180	area w/o	10	10	10	10	10	10	10		area w/o	10	10	10	10	10	10	10				
181	area w/	10	10	10	10	10	10	10		area w/	10	10	10	10	10	10	10				
182	HUs w/o		0	0	0	0	0	0		HUs w/o		0	0	0	0	0	0				
183	HUs w/		0.00	0.00	0.00	0.00	1.50	108.00		HUs w/		0.00	0.00	0.00	0.00	1.00	72.00				
184	AAHUs without							0.00		AAHUs without							0.00				
185	AAHUs with							2.15		AAHUs with							1.43				
186	change due to project							2.15		change due to project							1.43				
187																					
188	Best case it would take more than 10 acres to compensate the losses of value									Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres											
189	to downy woodpecker; the estimated compensation area would be:							14.81		Best case scenario: CR =	1.066869										
190	which is more than 1:1 with perfect mitigation									Worst case scenario: CR =	1.600304										
191	Note: this assumes higher snag density (1.5/ac) than seen natural (1.08)									Note: lower overall snag densities possible where easements restrict woody plantings/height											
192	which could occur if larger trees were set as goal; may be unrealistic																				
193	with "worst case" futures; the estimated compensation area would be:							22.21222													
194																					
195	Hairy Woodpecker - best case scenario									Hairy Woodpecker - worst case scenario (shrub emphasis, encroachments, cover/dbh more limited)											
196	V1 - snags >10"; optimum at 2+/acre; begin to form at year 20									V1 - snags >10"; optimum at 1/acre; begin to form at year 30											
197	V2 - mean dbh, nesting, has value at 8+ inches (year 15), opt at 15+" (year 25)									V2 - mean dbh, nesting, has value at 8+ inches (year 15), opt at 10+" due to encroachment limits (year 20)											
198	V3 - mean dbh, cover, min value SI .5, then increases with dbh 6 to 12" (years 10 to 20); max 15 (year 25+)									V3 - mean dbh, cover, min value SI .5, then increases with dbh 6 to 10" (years 10 to 20)											
199	V4 - % canopy cover, begins to have value >15%,then increases with cover to 55% (years 5 to 25), max 60% (yr 51)									V4 - % canopy cover, begins to have value >15%,then increases with cover to 40% (years 5 to 25)											
200																					
201	TY	0	1	5	10	15	19	20	25	51		TY	0	1	5	10	15	25	29	30	51
202	V1	0	0	0	0	0	0	1	2	2		V1	0	0	0	0	0	0	0	1	1
203	V2	0	1	3	6	8	9	12	15	15		V2	0	1	3	6	8	9	10	10	10
204	V3	0	1	3	6	8	9	12	15	15		V3	0	1	3	6	8	9	10	10	10
205	V4	0	0	0	30	40	48	50	55	60		V4	0	0	0	30	35	40	40	40	40
206																					
207	SI(V1)	0	0	0	0	0	0	0.2	0.4	0.4		SI(V1)	0	0	0	0	0	0	0	0.2	0.2
208	SI(V2)	0.00	0.00	0.00	0.00	0.00	0.14	0.57	1.00	1.00		SI(V2)	0.00	0.00	0.00	0.00	0.00	0.14	0.29	0.29	0.29

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
209	SI(V3)	0.50	0.50	0.50	0.51	0.77	0.89	1.00	1.00	1.00		SI(V3)	0.50	0.50	0.50	0.51	0.77	0.89	1.00	1.00	1.00
210	SI(V4)	0.00	0.00	0.00	0.21	0.36	0.47	0.50	0.57	0.64		SI(V4)	0.00	0.00	0.00	0.21	0.29	0.36	0.36	0.36	0.36
211	HSI(hw)	0.00	0.00	0.00	0.00	0.00	0.05	0.32	0.66	0.74		HSI(hw)	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.15	0.15
212																					
213	TY	0	1	51																	
214	HSIw/o	0.06	0.06	0.06																	
215	HSI w/	0.06	0	0																	
216	area w/o	13.88	13.88	13.88																	
217	area w/	13.88	13.88	13.88																	
218	HUs w/o		0.9	43.6																	
219	HUs w/		0.4	0.0																	
220	AAHUs without			0.9																	
221	AAHUs with			0.0																	
222	change due to project			-0.9																	
223																					
224	TY	0	1	5	10	15	19	20	25	51		TY	0	1	5	10	15	29	30	25	51
225	HSIw/o	0	0	0		0	0	0	0	0		HSIw/o	0	0	0	0	0	0	0	0	0
226	HSI w/	0.00	0.00	0.00	0.00	0.00	0.05	0.32	0.66	0.74		HSI w/	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.15	0.15
227	area w/o	10	10	10	10	10	10	10	10	10		area w/o	10	10	10	10	10	10	10	10	10
228	area w/	10	10	10	10	10	10	10	10	10		area w/	10	10	10	10	10	10	10	10	10
229	HUs w/o		0	0	0	0	0	0	0	0		HUs w/o		0	0	0	0	0	0	0	0
230	HUs w/		0.00	0.00	0.00	0.00	0.91	1.80	24.32	181.54		HUs w/		0.00	0.00	0.00	0.00	2.41	0.56	-5.63	38.58
231	AAHUs without									0.00		AAHUs without									0.00
232	AAHUs with									4.09		AAHUs with									0.70
233	change due to project									4.09		change due to project									0.70
234																					
235	Best case it would take far less than 10 acres to compensate the losses of value											Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres									
236	to hairy woodpecker; the estimated compensation area would be:							2.11				Best case scenario: CR =			0.152019						
237	which is less than 1:1 with perfect mitigation											Worst case scenario: CR =			0.882875						
238	Note: this assumes higher snag density (1.5/ac) than seen natural (1.08)											Note: lower overall snag densities possible where easements restrict woody plantings/height									
239	which could occur if larger trees were set as goal; may be unrealistic											Also less than 1:1 with lower futures, although HSI (0.15 after yr 25) much better than baseline (0.06)									
240	With "worst case" futures; the estimated compensation area would be:							12.2543													
241																					
242	Summary Table of Futures-based compensation area and ratio for best/worse case scenarios																				
243					mitigation need		mitigation ratio														
244	scenario		best	worst	best	worst	best	worse													
245		project	mitigation	mitigation																	
246		loss	gain, 10ac	gain, 10ac																	
247	MODEL	AAHUs	AAHUs	AAHUs																	
248	mWarblr	-8.8	8.8	5.9	9.9	14.9	0.72	1.08													
249	RSG	-8.8	5.7	3.0	15.5	29.3	1.12	2.11													
250	RFCT	-10.0	8.9	5.4	11.3	18.8	0.81	1.35													
251	DW	-3.2	2.1	1.4	14.8	22.2	1.07	1.60													
252	HW	-0.9	4.1	0.7	2.1	12.3	0.15	0.88													

	A	B	C	D	E	F	G	H	I	J	K	L
1	THIS IS THE "FuturesExcess" TAB											
2	In this TAB: a simplified future test is done, in which the starting point of the mitigation site is advanced by 10 years											
3	This scenario informs how excess mitigation might apply to a future project phase, or if mitigation is started before impact.											
4	For the purpose of this exercise, it is assumed the impact site is similar to TS_30_L in baseline value and impact											
5	The 10 year advance is done by creating a TY0 and 1 which has the same as the TY10 (or next higher TY) in the "Futures" Tab.											
6	NOTE:	ONLY using the worse case scenario for mitigation sites, however, in this future test										
7												
8	10 YEAR HEADSTART WORST CASE SHOWN BELOW											
9	NOTE: proofed 10/31/22											
10	THESE ARE THE RELEVANT COLUMNS											
11	TO SHOW VALUE OF MITIGATION "LEFT OVER" OR STARTED EARLY.											
12												
13	WARBLER MODEL											
14	Warbler Model - Worse Case Scenario											
15	V1-shrub cover: maxes out at 40% due to water variability/dieoff after year 5											
16	V2-shrub height: 1.2 M max due to alot of herbaceous											
17	V3- percent deciduous shrub cover: same as best case											
18	V4- percent tall tree cover, takes longer due to variable water, 40% maximum											
19												
20		TY0	TY1	TY5	TY15	TY25	TY51					
21	V1	0.5	0.5	0.5	0.5	0.5	0.5					
22	V2	1.2	1.2	1.2	1.2	1.2	1.2					
23	V3	1	1	1	1	1	1					
24	V4	0.3	0.4	0.4	0.4	0.4	0.4					
25												
26	SI(V1)	0.83	0.83	0.83	0.83	0.83	0.83					
27	SI(V2)	0.6	0.6	0.6	0.6	0.6	0.6					
28	SI(V3)	1	1	1	1	1	1					
29	SI(V4)	0.8	0.9	0.9	0.9	0.9	0.9					
30	HSI-ywm	0.63	0.67	0.67	0.67	0.67	0.67					
31												
32	TY	0	1	5	15	25	51					
33	HSIw/o	0.00	0.00	0.00	0.00	0.00	0.00					
34	HSI w/	0.63	0.67	0.67	0.67	0.67	0.67					
35	area w/o	10	10	10	10	10	10					
36	area w/	10	10	10	10	10	10					
37	HUs w/o		0	0	0	0	0					
38	HUs w/		6.51638	26.83282	67.08204	67.08204	174.4133					
39	AAHUs without						0					
40	AAHUs with						6.704443					
41	change due to project (mitigation gain)						6.704443					
42												
43	TY	0	1	5	15	25	51					
44	HSIw/o	0.64	0.64	0.64	0.64	0.64	0.64					
45	HSI w/	0.64	0.00	0.00	0.00	0.00	0.00					
46	area w/o	13.88	13.88	13.88	13.88	13.88	13.88					
47	area w/	13.88	13.88	13.88	13.88	13.88	13.88					
48	HUs w/o		8.867974	35.4719	88.67974	88.67974	230.5673					
49	HUs w/		4.433987	0	0	0	0					
50	AAHUs without						8.867974					
51	AAHUs with						0.086941					
52	change due to project (project impact loss)						-8.78103					
53	Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres											
54												
55	worst case scenario, future with mitigation started 10 years prior to impact: CR =									**0.943612**		
56	Compare with worst case scenario, future with mitigation started same time of impact: CR=									1.075757		
57												

	A	B	C	D	E	F	G	H	I	J	K	L
58	compensation area worst case, mitigation started 10 yrs before impact:							13.09733				
59	compensation area worst case, mitigation started same time as impact:							14.93151				
60												
61	RIPARIAN SONGBIRD MODEL											
62	Riparian Songbird Model - worst case scenario											
63	V1 - takes 14 years, maxes out at 50%											
64	V2 - takes 15 years, maxes out at 40%											
65	V3 - takes 14 years to reach 6+M											
66				V4 - not all "5", some "2","3","4"; max SI .7								
67	V5 - not optimal throughout; max average is 1.2 snags/ac											
68	V6 - lower, max is 60%											
69												
70	TY	10	10	10	10	14	15	51				
71	V1	40	40	40	40	50	50	50				
72	V2	30	30	30	30	40	40	40				
73	V3	5	5	5	5	6	6	6				
74	V4	3	3	3	(assume SI of 0.7, mix of categories 2-5)							
75	V5	0	0	0	0	0	1.2	1.2				
76	V6	30	30	30	50	60	60	60				
77												
78	SI(V1)	0.75	0.75	0.75	0.75	1	1	1				
79	SI(V2)	0.5	0.5	0.5	0.5	0.75	0.75	0.75				
80	SI(V3)	0.8	0.8	0.8	0.8	1	1	1				
81	SI(V4)	0.7	0.7	0.7	0.7	0.7	0.7	0.7				
82	SI(V5)	0.00	0.00	0.00	0.00	0.00	0.40	0.40				
83	SI(V6)	0.26	0.26	0.26	0.47	0.58	0.58	0.58				
84	HSI-rsg	0.10	0.10	0.10	0.18	0.26	0.37	0.37				
85												
86	TY	0	1	51								
87	HSIw/o	0.64	0.64	0.64								
88	HSI w/	0.64	0	0.00								
89	area w/o	13.88	13.88	13.88								
90	area w/	13.88	13.88	13.88								
91	HUs w/o		8.9	445.5								
92	HUs w/		4.5	0.0								
93	AAHUs without			8.9								
94	AAHUs with			0.1								
95	change due to project			-8.8								
96												
97	TY	0	1	5	10	14	15	51				
98	HSIw/o	0	0	0	0	0	0	0				
99	HSI w/	0.10	0.10	0.10	0.18	0.26	0.37	0.37				
100	area w/o	10	10	10	10	10	10	10				
101	area w/	10	10	10	10	10	10	10				
102	HUs w/o		0	0	0	0	0	0				
103	HUs w/		1.01	4.05	7.09	8.78	3.15	134.16				
104	AAHUs without							0.00				
105	AAHUs with							3.10				
106	change due to project							3.10				
107												
108	Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres											
109												
110		worst case scenario, future with mitigation started 10 years prior to impact: CR =								**2.048404**		
111	Compare with worst case scenario, future with mitigation started same time of impact: CR=									**2.112309**		
112												
113	compensation area worst case, mitigation started 10 yrs before impact:							28.43185				
114	compensation area worst case, mitigation started same time as impact:							29.31885				

	A	B	C	D	E	F	G	H	I	J	K	L
115	Note: slightly lower than mitigation concurrent, 10 yr headstart makes little difference											
116												
117	RIPARIAN FOREST COVER TYPE MODEL											
118	Riparian Forest Cover Type - Worst Case Scenario											
119												
120	V1 - tree height; optimum 60+ feet; max avg of 40 feet after 20 years											
121	V2 - stand width; optimum assumed if 70+ feet wide site, same as best case											
122	V3-tree canopy closure; optimum 50-80%, scenario max is 40%											
123	V4- # species; 3 of 4 planted species survives											
124	V5 - average understory density; overshoots optimum after year 20											
125	* - discount overall HSI by 1/3 per model assumes most not adjacent to water											
126												
127	TY	0	1	5	10	15	20	51				
128	V1	25	25	25	25	30	40	40				
129	V2	70	70	70	70	70	70	70				
130	V3	30	30	30	30	35	40	40				
131	V4	3	3	3	3	3	3	3				
132	V5	25	25	25	25	50	70	70				
133												
134	SI(V1)	0.42	0.42	0.42	0.42	0.50	0.67	0.67				
135	SI(V2)	1	1	1	1	1	1	1				
136	SI(V3)	0.6	0.6	0.6	0.6	0.7	0.8	0.8				
137	SI(V4)	0	1	1	1	1	1	1				
138	SI(V5)	0.87	0.87	0.87	0.87	1.00	0.88	0.88				
139	HSI-rfct*	0.31	0.52	0.52	0.52	0.57	0.59	0.59				
140												
141	TY	0	1	51								
142	HSIw/o	0.73	0.73	0.73								
143	HSI w/	0.73	0	0								
144	area w/o	13.88	13.88	13.88								
145	area w/	13.88	13.88	13.88								
146	HUs w/o		10.1	507.4								
147	HUs w/		5.1	0.0								
148	AAHUs without			10.1								
149	AAHUs with			0.1								
150	change due to project			-10.0								
151												
152	TY	0	1	5	10	15	20	51				
153	HSIw/o	0	0	0	0	0	0	0				
154	HSI w/	0.31	0.52	0.52	0.52	0.57	0.59	0.59				
155	area w/o	10	10	10	10	10	10	10				
156	area w/	10	10	10	10	10	10	10				
157	HUs w/o		0	0	0	0	0	0				
158	HUs w/		4.17	20.92	26.15	27.35	28.90	181.36				
159	AAHUs without							0.00				
160	AAHUs with							5.66				
161	change due to project							5.66				
162												
163	Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres											
164												
165		worst case scenario, future with mitigation started 10 years prior to impact: CR =								**1.278279**		
166	Compare with worst case scenario, future with mitigation started same time of impact: CR=									**1.351352**		
167	compensation area worst case, mitigation started 10 yrs before impact:							17.74252				
168	compensation area worst case, mitigation started same time as impact:							18.75677				
169	Note: Again, a 10 year headstart on mitigation slightly lowers worst case CR											
170												
171	DOWNY WOODPECKER MODEL											

	A	B	C	D	E	F	G	H	I	J	K	L
172			Downy Woodpecker model - Worst Case Scenario									
173			V1 = less, slower, basal area, site heterogeneity, limits max SI to 0.7									
174			V2 = snags slightly less abundant at year 10, 1.0 snags/ac									
175												
176	Note: for the 10 year headstart, shifted TY10 to TY0, and TY20 to TY10 and higher											
177	TY	0	1	5	9	10	20	51				
178	V1	0	20	20	24	25	25	31				
179	V2	0	0	0	0	1	1	1				
180												
181	SI(V1)	0.00	0.45	0.45	0.55	0.57	0.57	0.70				
182	SI(V2)	0.00	0.00	0.00	0.00	0.20	0.20	0.20				
183	HSI-dw	0.00	0.00	0.00	0.00	0.20	0.20	0.20				
184												
185	TY	0	1	51								
186	HSIw/o	0.23	0.23	0.23								
187	HSI w/	0.23	0	0.00								
188	area w/o	13.88	13.88	13.88								
189	area w/	13.88	13.88	13.88								
190	HUs w/o		3.2	160.5								
191	HUs w/		1.6	0.0								
192	AAHUs without			3.2								
193	AAHUs with			0.0								
194	change due to project			-3.2								
195												
196	TY	0	1	5	10	14	15	51				
197	HSIw/o	0	0	0	0	0	0	0				
198	HSI w/	0.00	0.00	0.00	0.00	0.20	0.20	0.20				
199	area w/o	10	10	10	10	10	10	10				
200	area w/	10	10	10	10	10	10	10				
201	HUs w/o		0	0	0	0	0	0				
202	HUs w/		0.00	0.00	0.00	4.00	2.00	72.00				
203	AAHUs without							0.00				
204	AAHUs with							1.53				
205	change due to project							1.53				
206												
207	Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres											
208												
209		worst case scenario, future with mitigation started 10 years prior to impact: CR =								**1.49772**		
210	Compare with worst case scenario, future with mitigation started same time of impact: CR=									**1.600304**		
211	Note: lower overall snag densities possible where easements restrict woody plantings/height											
212	Note: again, slightly lower CR with 10 year headstart on mitigation site											
213	compensation area worst case, mitigation started 10 yrs before impact:							20.78836				
214	compensation area worst case, mitigation started same time as impact:							22.21222				
215												
216	HAIRY WOODPECKER MODEL											
217	Hairy Woodpecker - worst case scenario (shrub emphasis, encroachments, cover/dbh more limited)											
218	V1 - snags >10"; optimum at 1/acre; begin to form at year 20											
219	V2 - mean dbh, nesting, has value at 8+ inches (year 5), opt at 10+" due to encroachment limits (year 10)											
220	V3 - mean dbh, cover, min value SI .5, then increases with dbh 6 to 10" (years 0 to 10)											
221	V4 - % canopy cover, begins to have value >15%,then increases with cover to 40% (years 0 to 15)											
222												
223	TY	0	1	5	10	15	19	20	25	51		
224	V1	0	0	0	1	1	1	1	1	1		
225	V2	0	1	8	10	10	10	10	10	10		
226	V3	6	6	8	10	10	10	10	10	10		
227	V4	30	30	35	40	40	40	40	40	40		
228												

	A	B	C	D	E	F	G	H	I	J	K	L
229	SI(V1)	0	0	0	0.2	0.2	0.2	0.2	0.2	0.2		
230	SI(V2)	0.00	0.00	0.00	0.29	0.29	0.29	0.29	0.29	0.29		
231	SI(V3)	0.51	0.51	0.77	1.00	1.00	1.00	1.00	1.00	1.00		
232	SI(V4)	0.21	0.21	0.29	0.36	0.36	0.36	0.36	0.36	0.36		
233	HSI(hw)	0.00	0.00	0.00	0.15	0.15	0.15	0.15	0.15	0.15		
234												
235	TY	0	1	51								
236	HSIw/o	0.06	0.06	0.06								
237	HSI w/	0.06	0	0								
238	area w/o	13.88	13.88	13.88								
239	area w/	13.88	13.88	13.88								
240	HUs w/o		0.9	43.6								
241	HUs w/		0.4	0.0								
242	AAHUs without			0.9								
243	AAHUs with			0.0								
244	change due to project			-0.9								
245												
246	TY	0	1	5	10	15	19	20	25	51		
247	HSIw/o	0	0	0	0	0	0	0	0	0		
248	HSI w/	0.00	0.00	0.00	0.15	0.15	0.15	0.15	0.15	0.15		
249	area w/o	10	10	10	10	10	10	10	10	10		
250	area w/	10	10	10	10	10	10	10	10	10		
251	HUs w/o		0	0	0	0	0	0	0	0		
252	HUs w/		0.00	0.00	3.71	7.42	5.94	1.48	7.42	38.58		
253	AAHUs without									0.00		
254	AAHUs with									1.27		
255	change due to project									1.27		
256												
257	Compensation Ratio estimate: CR = loss at impact site/gain at mitigation site X 10/13.88 acres											
258												
259		worst case scenario, future with mitigation started 10 years prior to impact: CR =								**0.49115**		
260	Compare with worst case scenario, future with mitigation started same time of impact: CR=									**0.882875**		
261	Note: lower overall snag densities possible where easements restrict woody plantings/height											
262	Also less than 1:1 with lower futures, although HSI (0.15 after yr 19) much better than baseline (0.06)											
263	compensation area worst case, mitigation started 10 yrs before impact:							6.817155				
264	compensation area worst case, mitigation started same time as impact:							12.2543				
265	NOTE: Above boldface value shows significant reduction compared to without 10 years											
266												
267	Summary Table of Futures-based compensation area and ratio for worst case scenario, 10 year advance mitigation											
268				hab value		comp		mitigation ratios				
269				10 yr adv		area		this TAB	from prior TAB			
270	scenario			worst		worst		worst	mitigation starts same			
271		project		mitigation		10 yr adv		10y adv	year as impact			
272		loss		gain, 10ac								
273	MODEL	AAHUs		AAHUs				COMPARE THESE				
274	mWarblr	-8.8		**6.7**		**13.1**		**0.94**	1.08			
275	RSG	-8.8		**3.1**		**28.4**		**2.05**	2.11			
276	RFCT	-10.0		**5.7**		**17.7**		**1.28**	1.35			
277	DW	-3.2		**1.5**		**20.8**		**1.50**	1.60			
278	HW	-0.9		**1.3**		**6.8**		**0.49**	0.88			
279												
280	Note: in the columns A-H, above left, the boldfaced values show the effect of the 10 year headstart											
281	If mitigation area were "left over" from a larger than needed site for TS_30_L, the compensation											
282	for a next reach exactly the same as TS_30_L, would be slightly less, due to greater AAHUs											
283	gained per 10 acres of mitigation site, which would be 10 years ahead and of higher value											
284	It isn't a huge difference, however, and the highest ratio of all models still rounds to 2:1											

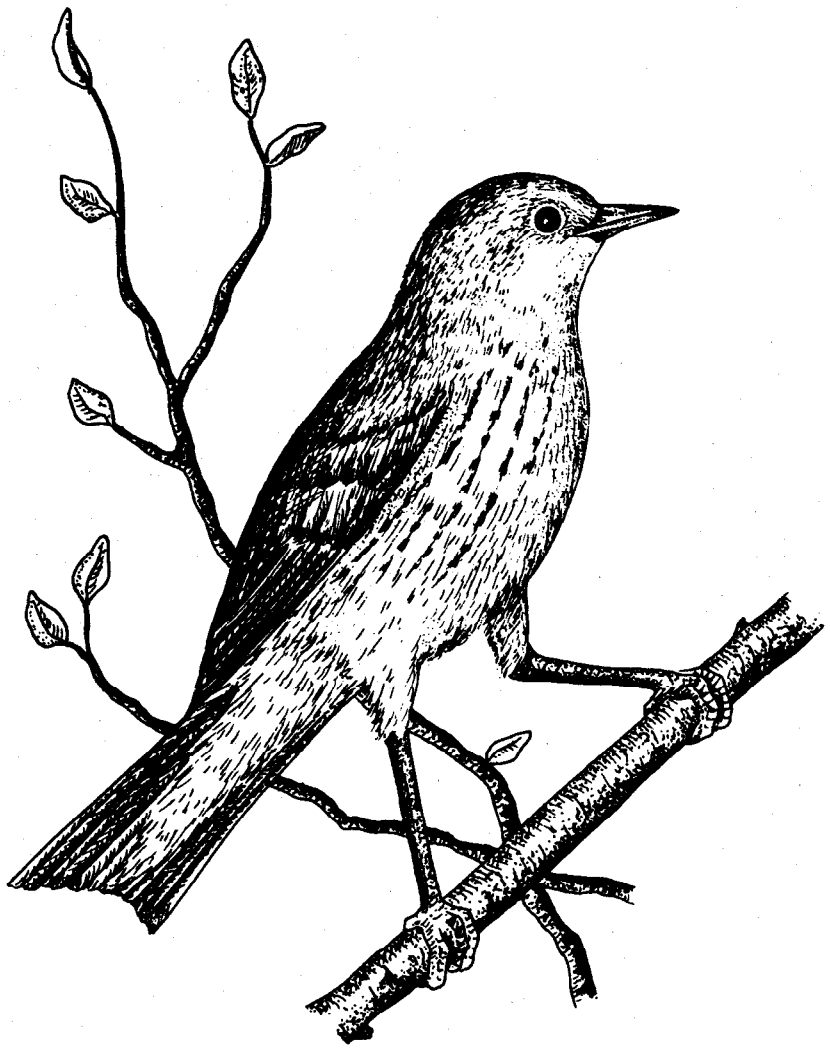
APPENDIX B: Models

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Division of Ecological Services

FWS/OBS-82/10.27
JULY 1982

HABITAT SUITABILITY INDEX MODELS: YELLOW WARBLER



Fish and Wildlife Service

U.S. Department of the Interior

The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems. The mission of the program is as follows:

- To strengthen the Fish and Wildlife Service in its role as a primary source of information on national fish and wildlife resources, particularly in respect to environmental impact assessment.
- To gather, analyze, and present information that will aid decisionmakers in the identification and resolution of problems associated with major changes in land and water use.
- To provide better ecological information and evaluation for Department of the Interior development programs, such as those relating to energy development.

Information developed by the Biological Services Program is intended for use in the planning and decisionmaking process to prevent or minimize the impact of development on fish and wildlife. Research activities and technical assistance services are based on an analysis of the issues, a determination of the decisionmakers involved and their information needs, and an evaluation of the state of the art to identify information gaps and to determine priorities. This is a strategy that will ensure that the products produced and disseminated are timely and useful.

Projects have been initiated in the following areas: coal extraction and conversion; power plants; geothermal, mineral and oil shale development; water resource analysis, including stream alterations and western water allocation; coastal ecosystems and Outer Continental Shelf development; and systems inventory, including National Wetland Inventory, habitat classification and analysis, and information transfer.

The Biological Services Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams, which provide the Program's central scientific and technical expertise and arrange for contracting biological services studies with states, universities, consulting firms, and others; Regional Staffs, who provide a link to problems at the operating level; and staffs at certain Fish and Wildlife Service research facilities, who conduct in-house research studies.

This model is designed to be used by the Division of Ecological Services in conjunction with the Habitat Evaluation Procedures.

FWS/OBS-82/10.27
July 1982

HABITAT SUITABILITY INDEX MODELS: YELLOW WARBLER

by

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PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series (FWS/OBS-82/10), which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information Section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. The habitat use information provides the foundation for HSI models that follow. In addition, this same information may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents a habitat model and information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The application information includes descriptions of the geographic ranges and seasonal application of the model, its current verification status, and a listing of model variables with recommended measurement techniques for each variable.

In essence, the model presented herein is a hypothesis of species-habitat relationships and not a statement of proven cause and effect relationships. Results of model performance tests, when available, are referenced. However, models that have demonstrated reliability in specific situations may prove unreliable in others. For this reason, feedback is encouraged from users of this model concerning improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning. Please send suggestions to:

Habitat Evaluation Procedures Group
Western Energy and Land Use Team
U.S. Fish and Wildlife Service
2625 Redwing Road
Ft. Collins, CO 80526

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YELLOW WARBLER (Dendroica petechia)

HABITAT USE INFORMATION

General

The yellow warbler (Dendroica petechia) is a breeding bird throughout the entire United States, with the exception of parts of the Southeast (Robbins et al. 1966). Preferred habitats are wet areas with abundant shrubs or small trees (Bent 1953). Yellow warblers inhabit hedgerows, thickets, marshes, swamp edges (Starling 1978), aspen (Populus spp.) groves, and willow (Salix spp.) swamps (Salt 1957), as well as residential areas (Morse 1966).

Food

More than 90% of the food of yellow warblers is insects (Bent 1953), taken in proportion to their availability (Busby and Sealy 1979). Foraging in Maine occurred primarily on small limbs in deciduous foliage (Morse 1973).

Water

Dietary water requirements were not mentioned in the literature. Yellow warblers prefer wet habitats (Bent 1953; Morse 1966; Stauffer and Best 1980).

Cover

Cover needs of the yellow warbler are assumed to be the same as reproduction habitat needs and are discussed in the following section.

Reproduction

Preferred foraging and nesting habitats in the Northeast are wet areas, partially covered by willows and alders (Alnus spp.), ranging in height from 1.5 to 4 m (5 to 13.3 ft) (Morse 1966). It is unusual to find yellow warblers in extensive forests (Hebard 1961) with closed canopies (Morse 1966). Yellow warblers in small islands of mixed coniferous-deciduous growth in Maine utilized deciduous foliage far more frequently than would be expected by chance alone (Morse 1973). Coniferous areas were mostly avoided and areas of low deciduous growth preferred.

Nests are generally placed 0.9 to 2.4 m (3 to 8 ft) above the ground, and nest heights rarely exceed 9.1 to 12.2 m (30 to 40 ft) (Bent 1953). Plants

used for nesting include willows, alders, and other hydrophytic shrubs and trees (Bent 1953), including box-elders (Acer negundo) and cottonwoods (Populus spp.) (Schrantz 1943). In Iowa, dense thickets were frequently occupied by yellow warblers while open thickets with widely spaced shrubs rarely contained nests (Kendeigh 1941).

Males frequently sing from exposed song perches (Kendeigh 1941; Ficken and Ficken 1965), although yellow warblers will nest in areas without elevated perches (Morse 1966).

A number of Breeding Bird Census reports (Van Velzen 1981) were summarized to determine nesting habitat needs of the yellow warbler, and a clear pattern of habitat preferences emerged. Yellow warblers nested in less than 5% of census areas comprised of extensive upland forested cover types (deciduous or coniferous) across the entire country. Approximately two-thirds of all census areas with deciduous shrub-dominated cover types were utilized, while shrub wetland types received 100% use. Wetlands dominated by shrubs had the highest average breeding densities of all cover types [2.04 males per ha (2.5 acre)]. Approximately two-thirds of the census areas comprised of forested draws and riparian forests of the western United States were used, but average densities were low [0.5 males per ha (2.5 acre)].

Interspersion

Yellow warblers in Iowa have been reported to prefer edge habitats (Kendeigh 1941; Stauffer and Best 1980). Territory size has been reported as 0.16 ha (0.4 acre) (Kendeigh 1941) and 0.15 ha (0.37 acre) (Kammeraad 1964).

Special Considerations

The yellow warbler has been on the Audubon Society's Blue List of declining birds for 9 of the last 10 years (Tate 1981).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model has been developed for application within the breeding range of the yellow warbler.

Season. This model was developed to evaluate the breeding season habitat needs of the yellow warbler.

Cover types. This model was developed to evaluate habitat in the dominant cover types used by the yellow warbler: Deciduous Shrubland (DS) and Deciduous Scrub/Shrub Wetland (DSW) (terminology follows that of U.S. Fish and Wildlife Service 1981). Yellow warblers only occasionally utilize forested habitats and reported population densities in forests are low. The habitat requirements in forested habitats are not well documented in the literature. For these reasons, this model does not consider forested cover types.

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before an area will be occupied by a species. Information on the minimum habitat area for the yellow warbler was not located in the literature. Based on reported territory sizes, it is assumed that at least 0.15 ha (0.37 acre) of suitable habitat must be available for the yellow warbler to occupy an area. If less than this amount is present, the HSI is assumed to be 0.0.

Verification level. Previous drafts of the yellow warbler habitat model were reviewed by Douglass H. Morse and specific comments were incorporated into the current model (Morse, pers. comm.).

Model Description

Overview. This model considers the quality of the reproduction (nesting) habitat needs of the yellow warbler to determine overall habitat suitability. Food, cover, and water requirements are assumed to be met by nesting needs.

The relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler is illustrated in Figure 1.

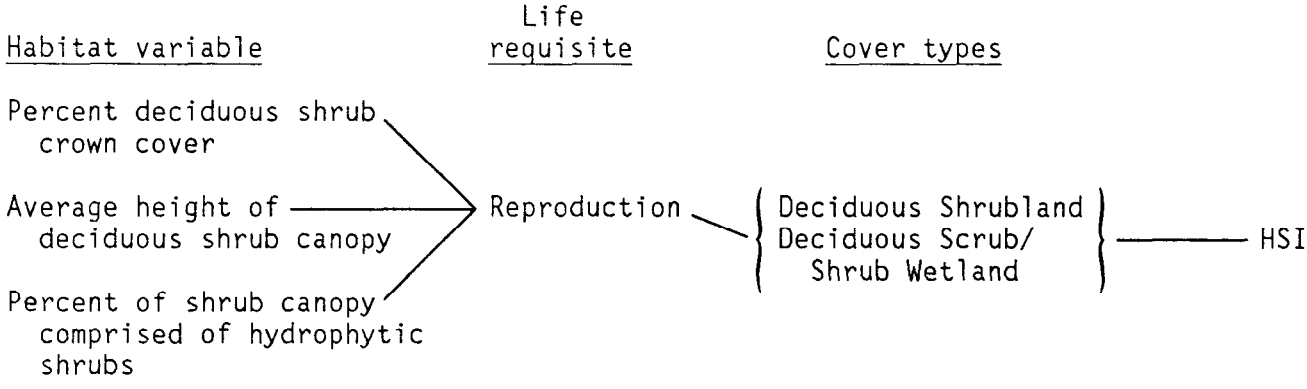


Figure 1. Relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler.

The following sections provide a written documentation of the logic and assumptions used to interpret the habitat information for the yellow warbler and to explain and justify the variables and equations that are used in the HSI model. Specifically, these sections cover the following: (1) identification of variables that will be used in the model; (2) definition and justification of the suitability levels of each variable; and (3) description of the assumed relationship between variables.

Reproduction component. Optimal nesting habitat for the yellow warbler is provided in wet areas with dense, moderately tall stands of hydrophytic deciduous shrubs. Upland shrub habitats on dry sites will provide only marginal suitability.

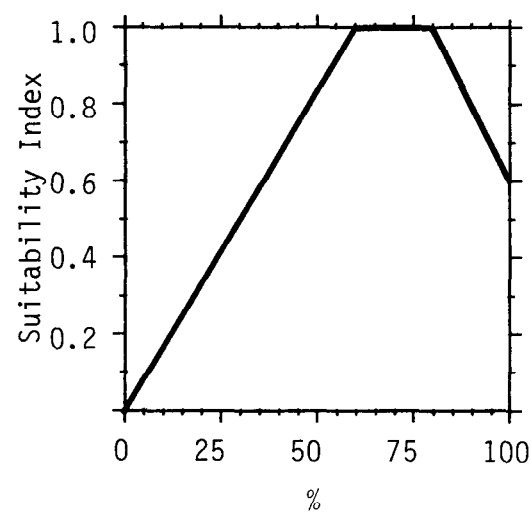
It is assumed that optimal habitats contain 100% hydrophytic deciduous shrubs and that habitats with no hydrophytic shrubs will provide marginal suitability. Shrub densities between 60 and 80% crown cover are assumed to be optimal. As shrub densities approach zero cover, suitability also approaches zero. Totally closed shrub canopies are assumed to be of only moderate suitability, due to the probable restrictions on movement of the warblers in those conditions. Shrub heights of 2 m (6.6 ft) or greater are assumed to be optimal, and suitability will decrease as heights decrease to zero.

Each of these habitat variables exert a major influence in determining overall habitat quality for the yellow warbler. A habitat must contain optimal levels of all variables to have maximum suitability. Low values of any one variable may be partially offset by higher values of the remaining variables. Habitats with low values for two or more variables will provide low overall suitability levels.

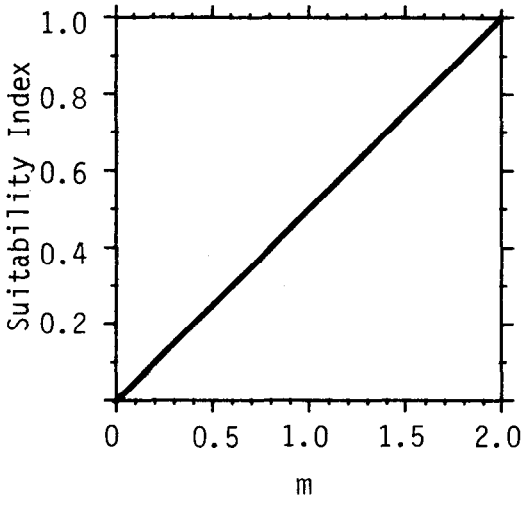
Model Relationships

Suitability Index (SI) graphs for habitat variables. This section contains suitability index graphs that illustrate the habitat relationships described in the previous section.

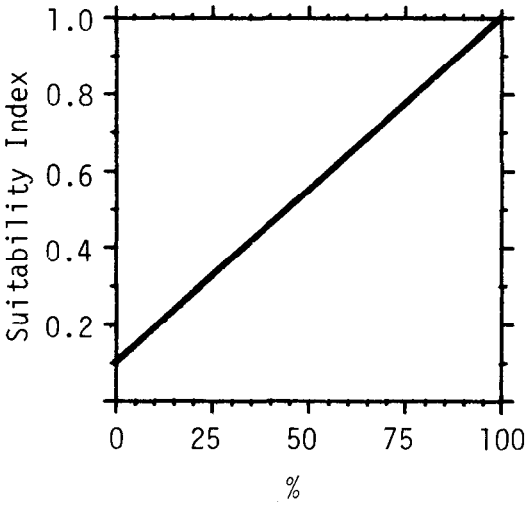
Cover type	Variable	
DS,DSW	V_1	Percent deciduous shrub crown cover.



DS,DSW	V_2	Average height of deciduous shrub canopy.



DS,DSW	V_3	Percent of deciduous shrub canopy comprised of hydrophytic shrubs.



Equations. In order to obtain life requisite values for the yellow warbler, the SI values for appropriate variables must be combined with the use of equations. A discussion and explanation of the assumed relationship between variables was included under Model Description, and the specific equation in this model was chosen to mimic these perceived biological relationships as closely as possible. The suggested equation for obtaining a reproduction value is presented below.

Life requisite	Cover type	Equation
Reproduction	DS,DSW	$(V_1 \times V_2 \times V_3)^{1/2}$

HSI determination. The HSI value for the yellow warbler is equal to the reproduction value.

Application of the Model

Definitions of variables and suggested field measurement techniques (Hays et al. 1981) are provided in Figure 2.

Variable (definition)		Cover types	Suggested technique
V_1	Percent deciduous shrub crown cover (the percent of the ground that is shaded by a vertical projection of the canopies of woody deciduous vegetation which are less than 5 m (16.5 ft) in height).	DS,DSW	Line intercept
V_2	Average height of deciduous shrub canopy (the average height from the ground surface to the top of those shrubs which comprise the uppermost shrub canopy).	DW,DSW	Graduated rod
V_3	Percent of deciduous shrub canopy comprised of hydrophytic shrubs (the relative percent of the amount of hydrophytic shrubs compared to all shrubs, based on canopy cover).	DS,DSW	Line intercept

Figure 2. Definitions of variables and suggested measurement techniques.

SOURCES OF OTHER MODELS

No other habitat models for the yellow warbler were located.

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16. Abstract (Limit: 200 words)

Habitat preferences of the yellow warbler (Dendroica petechia) are described in this publication. It is one of a series of Habitat Suitability Index (HSI) models and was developed through an analysis of available information on the species-habitat requirements of the species. Habitat use information is presented in a review of the literature, followed by the development of an HSI model, designed for use in impact assessment and habitat management activities.

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Mathematical models
Wildlife
Habits

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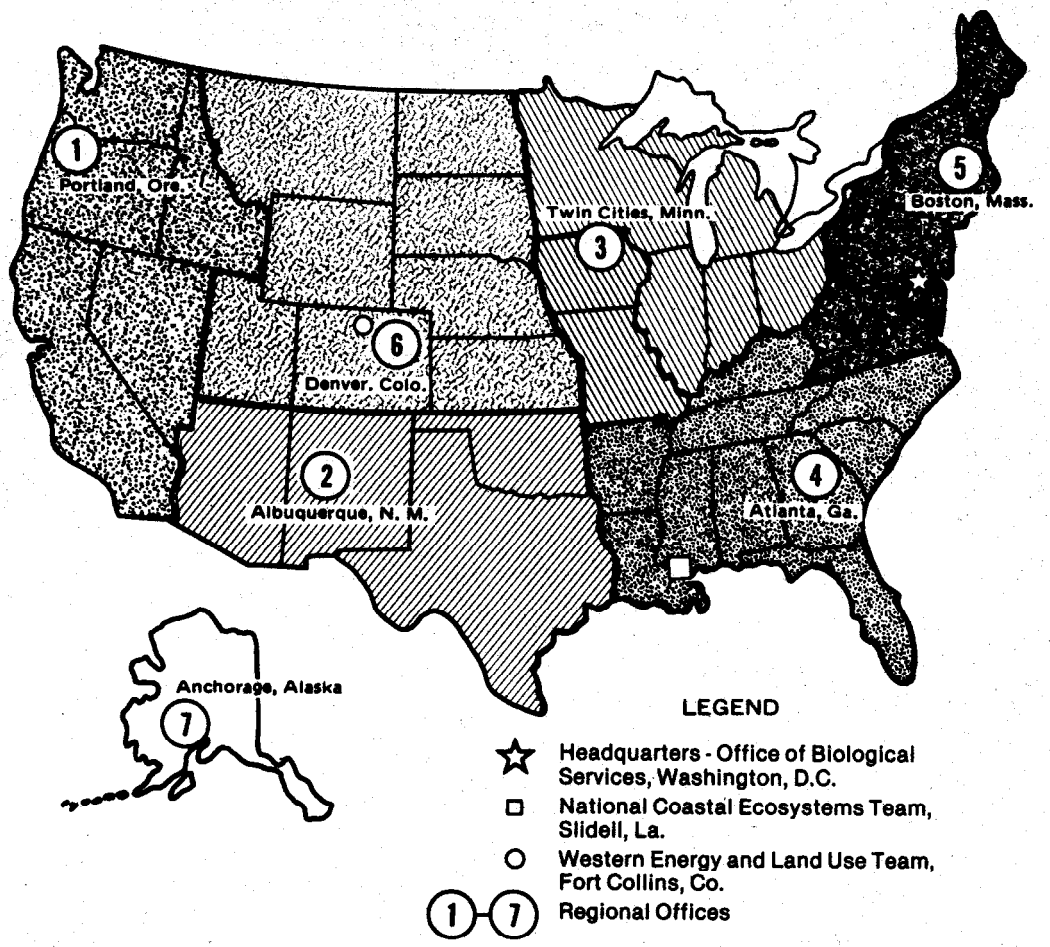
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HABITAT SUITABILITY INDEX MODEL

RIPARIAN SONGBIRD GUILD

HUMBOLDT BAY, CALIFORNIA

Prepared for:

California State Coastal Conservancy
County of Humboldt, Department of Public Works
Humboldt Bay Working Group

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INTRODUCTION

This is a habitat suitability index model for songbird species that use forested or scrub-shrub wetlands (Cowardin *et al.* 1979) in the Humboldt Bay watershed in northern California; these wetlands are defined further below. The model can be used in determining existing habitat values, and in projecting habitat values at sites restored as wetlands. In addition, the model can be used to determine mitigation requirements for developments proposed to be sited in wetlands.

The model may be useful in determining habitat suitability in other wetland areas along the Pacific coast. Such application will require that users examine the model in order to determine whether local use necessitates model modification.

The model is based upon a review and synthesis of existing information, derived from the scientific literature, unpublished research reports available from Humboldt State University, comments from local biologists, and the author's personal observations. It is an hypothesis of species/habitat relationships, and is not a statement of proven cause and effect. It represents suspected relationships between habitat factors and the carrying capacity of the habitat for species in the guild. The model is scaled to produce a Habitat Suitability Index (HSI) value between 0.0 (unsuitable habitat) and 1.0 (optimally suitable habitat). Further discussion of HSI models may be obtained from part 103 of the Ecological Services Manual (see references).

This model has not been reviewed by species experts. The model has been reviewed by individuals familiar with HSI modelling, and modified according to their comments. The model has not been tested in the field.

The model is based on the perception that songbird species of riparian or swamp wetlands in the Humboldt Bay watershed form a guild in the sense used by Root (1967), Holmes *et al.* (1979), and Verner (1984). Further discussion of

this use of the guild concept will be provided separately. This use of the term does not correspond to that advanced by Short (1983, 1984; Short and Burnham 1982).

Riparian habitat is used by a number of bird species, from a variety of avian families. This model is restricted to species that use the plants within this habitat directly for food, either through consumption of plant materials or through consumption of invertebrates that consume the plants, and that also nest (or potentially nest) within the habitat type. Most such species are members of the avian order Passeriformes. This model also addresses habitat needs of species in the order Piciformes (woodpeckers), at least two of which may be encountered foraging with passerines during the winter.

LIFE HISTORY OVERVIEW

Bird species potentially covered by this model include resident (i.e., remaining in the watershed all year), breeding visitor (here from spring through early fall), and winter visitor (here from fall through early spring) species. Examples of the three groups include: (i) resident - Chestnut-backed Chickadee (scientific names of all species are included in Attachment A), Downy Woodpecker, and Winter Wren; (ii) breeding visitor - Wilson's Warbler, Swainson's Thrush, and Tree Swallow; and (iii) winter visitor - Ruby-crowned Kinglet, Yellow-rumped Warbler, and Fox Sparrow. Additional species (such as the American Robin) are present all year, but probably are represented by different individuals in the winter and breeding seasons.

A vast quantity of ornithological and ecological literature exists covering the use of riparian wetlands by passerine and other birds; it is inappropriate to cite or synopsize it all here, but interested readers may wish to review Stevens *et al.* (1977), Hehnke and Stone (1979), Gaines (1980), Swift *et al.* (1984), and a number of papers in Warner and Hendrix (1984). There are currently two Master's thesis projects underway at Humboldt State University that include investigations of use of riparian and/or swamp habitats by songbirds in the Humboldt Bay area; one has resulted in interim reports that are useful in this analysis (Kelly 1983).

The specific habitat requirements of the species in this guild are rather varied. It is not the purpose of the model to address the conditions that would make riparian habitat more or less desirable for the individual species. The ecological backgrounds of the species are also varied; some species are almost completely "insectivorous" (consumers of arthropods), while some are primarily seed-eaters, and yet others consume both arthropods and seeds, as well as other plant material (see Martin *et al* 1951).

In order to address this variability, attention must be restricted to common elements in the ecology of the species. James (1971) demonstrated a "niche gestalt" for each of a number of passerine species. This interpretation is commonly adopted by ornithologists, and a number of "guild"

studies (e.g., Holmes et al. 1979) utilize the concept of habitat conformation as a major element in defining guild membership. That approach is used in this model.

The bird species covered here are generally associated with deciduous tree and shrub species. It appears that the annual burst of production in the spring provides food for arthropods that compose the primary diet of most species, or food for the birds themselves. There is a general recognition that the diversity of bird species in an area generally is correlated with the vertical and horizontal foliage distribution (MacArthur and MacArthur 1961, Roth 1976, Holmes et al. 1979, Niemi and Hanowski 1984, Swift et al. 1984, and many others). Greater diversity in foliage distribution thus generally leads to greater bird species diversity. This correlation essentially ignores the actual relationship between productivity and reproductive success that presumably underlies the evolution of the habitat preferences.

It has been noted (e.g., Sturman 1968) that one of the species in this guild that is present in this watershed (the Chestnut-backed Chickadee) may respond to the presence or abundance of coniferous tree species. Observations in this region, and in other parts of California in which this species occurs, indicate that the chickadee does in fact use deciduous vegetation regularly. However, inclusion of conifers in riparian wetlands in the vicinity of Humboldt Bay has been recognized as the natural condition in these wetlands prior to settlement by European man (see Ray et al. 1984). For the purposes of this model, no differentiation will be made between deciduous and coniferous vegetation.

The distribution of foliage provides nesting substrate for the birds (each according to the appropriate niche gestalt). Some species in the guild are primary or secondary cavity nesters (secondary = using holes made by primary excavators). Cavity nesters generally use dead wood, rather than nesting in live trees. Thus, the presence of snags or other dead substrate is an important element for some species in the guild (see Schroeder 1982b, 1982c).

HABITAT REQUIREMENTS

This model addresses life requisites of food and foraging, reproduction (nesting), and cover. It is assumed that water is not limiting for any species, and no explicit element for water is included in this model. Food and foraging substrate are considered to be provided by woody vegetation. Shrubs are considered to be live woody stems up to 3 meters (10 feet) tall. Live woody stems greater than 3 m tall are considered to be trees. This model will not differentiate between single and multiple tree canopy layers, with possibly higher habitat values because of the presence of additional layers, primarily for logistical reasons.

Stem diameter is not considered for foraging purposes, although it is clear that scansorial (trunk- and limb-foraging) birds will experience greater

habitat value as basal area increases (e.g., see Schroeder 1982c).

Similarly, cover is considered to be provided by vegetation; separate variables to differentiate between foraging and cover substrates are not included in the model.

Reproduction substrate is provided for these species by the plants that also provide cover and foraging substrate. The volume of space that potentially offers nesting sites increases proportionally with the total volume of plant leaf area. A further consideration for nesting substrate is the availability of snags of suitable size, to accommodate cavity nesters.

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability. This model was developed to address habitat needs within the Humboldt Bay watershed. The model is also expected to apply to coastal wetlands elsewhere on California's northern coast, although the full range of geographical applicability is not defined. The model may be applicable (with suitable modifications) to other coastal and noncoastal wetland areas in California and Oregon; many northwestern California wetlands are more similar to those of Oregon than to wetlands farther south in California. There is no intended seasonal applicability, inasmuch as the habitats covered by the model are used by different members of the guild in all four seasons.

Wetlands included in the habitats that could be evaluated by this model are: (i) riparian woodlands along streamcourses that enter the bay; (ii) swamps dominated by willows (*Salix* spp.), alders (*Alnus oregona*), and waxmyrtles (*Myrica californica*), most of which occur in saturated or poorly drained soils; and (iii) similar wetlands with emergent woody vegetation. Cowardin *et al.* (1979) note that scrub-shrub and forested wetlands are restricted to "palustrine" and "estuarine" wetlands; in Humboldt Bay, only palustrine wetlands include these habitats. Readers should review Cowardin *et al.* (1979) for additional information regarding classification of wetlands, and examples of wetland habitats.

One variable used in the model (number six, below) requires information that may be obtained from maps or aerial photographs. All other variables require field sampling. Model users are expected to exercise adequate rigor in sampling and analysis, so that statistical validity is ensured. Although there is no mandatory season for sampling, it is recommended that sampling be conducted when tree and shrub canopies are in leaf.

The model is intended to be applied to habitat areas that may not be entirely one cover type (i.e., a site may contain emergent wetland as well as woody vegetation). This formulation accommodates changes in wetland area through time, as would be expected in wetland restoration or enhancement projects; suitability is related to the fraction of the area presenting appropriate habitat conditions. A functionally similar (but not exactly

identical) model would result if the sixth variable were omitted and the model applied only to ripa[illegible] wetlands. As noted below, the model includes a "minimum area" assumption, a requirement that the model only be applied to habitat areas with at least 20 square meters of riparian vegetation.

Description of the Model. This model is based upon the two basic habitat parameters noted above, the presence and volume of foliage and the presence of suitable snags. The model uses several variables to account for foliage characteristics. This is considered appropriate, in view of the presumed importance of foliage in providing foraging area, cover, and nesting substrate for most of the species in this guild. The model includes one variable covering snag availability. It also includes a variable scaling the suitability of an evaluation site according to the fraction of the site that has appropriate vegetation.

The first and second variables relate suitability to the percent of canopy closure in two vegetational layers. Canopy closure is directly related to canopy foliage volume (see, for example, Hays et al. 1981). Each variable relates to foliage volume in two horizontal dimensions within a specific "layer" of the habitat (see next section). Site suitability increases with foliage volume, until there is enough foliage to begin shading lower layers, thus reducing ecological productivity in those layers. It is to be expected, therefore, that intermediate values for canopy closure provide optimal habitat. The third variable scales foliage volume in the vertical dimension.

The first and second variables are expressed as canopy cover, which is the percentage of the ground surface covered by a vertically downward projection of aerial foliage. While some ecological studies express cover in terms of specific layers or of total numbers of foliage layers, this model will use cover in the botanical sense as just defined.

The assumption that intermediate cover values are optimal follows from the use of ground-level vegetation by species that should be evaluated by this model. Complete canopy closure generally leads to a loss of live ground cover. Ground cover vegetation is not measured by this model; however, incomplete canopy cover in the shrub and tree layers is anticipated to lead to appropriate live plants at ground level.

All of the above variables are scaled by the fourth variable to reflect the overall canopy "layering" within the vegetation. Habitat value increases as the amount of layering increases (see next section for details).

The fifth variable in this model is a measure of the density of snags of minimally acceptable size for cavity nesters. Site suitability increases with snag density until optimal conditions are reached. This may not address site suitability adequately for some habitat conditions, as both more snags and larger snags may improve a site for some bird species. However, it is believed that the variable incorporated into this model addresses the needs of the small passerine and woodpecker species primarily covered by this model.

The sixth variable scales the habitat value in direct proportion to the fraction of the site that provides the other variables. If there is no woody riparian vegetation, the site [illegible]. It is presumed that a vegetation patch must have a minimum area of approximately 20 square meters (about 215 square feet) to provide habitat utility.

Suitability Index (SI) Graphs for Model Variables. Following in Figure 1 are graphic representations of presumed relationships between habitat variables and habitat suitability. The SI values are read directly from the graph (1.0 = optimal suitability; 0.0 = no suitability) for each variable. The rationale for developing each graph is presented below.

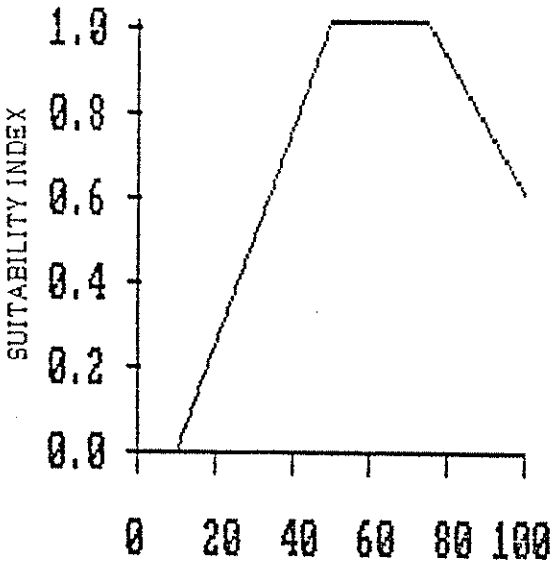
Variable 1: DSCCP - Percent shrub (1 - 3 meter tall) canopy cover. The model assumes that foliage must be present before the habitat is suitable at all. This variable is structured to reflect habitat utility when the foliage in the shrub canopy covers at least 10 percent of the ground surface (see previous section). Suitability increases to an optimum when 50% - 75% of the site has shrub canopy cover. These cover levels provide relatively dense foliage within the shrub layer, while allowing some light to pass through to the ground level.

As the canopy closes, lower light levels at the ground surface restrict vegetation growth. It appears that there will be a tradeoff between increased suitability for species that use the shrub canopy and decreased suitability for species that use the forest floor. The SI value is assumed to decrease to 0.6 at 100% canopy closure. This value greater than one-half should reflect the contribution to habitat of the foliage volume in three dimensions above the ground, as contrasted with the two dimensions at ground level. It should be noted that this variable is modified from Schroeder (1982a).

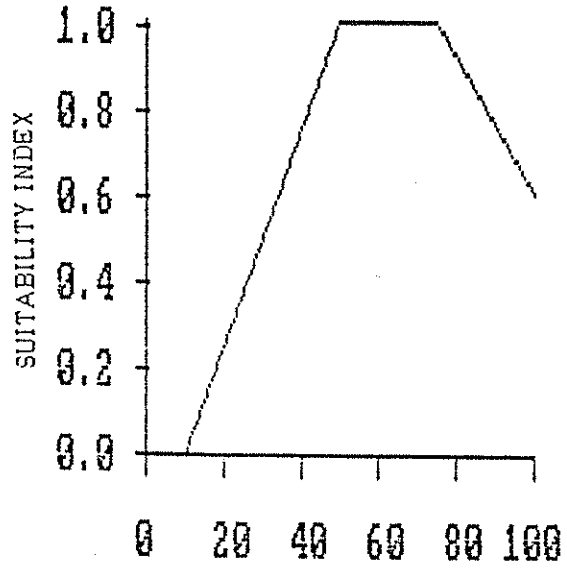
Variable 2: CC3MP - Percent tree (greater than 3 meter tall) canopy cover. This variable is similar to variable 1. At least 10% of the site's ground surface must lie under tree canopy for any suitability to exist. Suitability increases to optimum levels at 50% to 75% cover, then decreases to intermediate values as canopy cover approaches 100% (for identical reasoning).

This variable does not differentiate the canopy into lower and higher levels, as the expected use of the model is within riparian or swamp habitats near Humboldt Bay, where canopy heights rarely exceed 6 m and one canopy layer. Were the model to be applied to other riparian forests, where canopy heights can reach 10 m, and where there may be more than one distinct tree canopy layer, it would be appropriate to restructure this variable (or the entire model) to reflect the additional layering. This variable is modified from Schroeder (1982b).

Variable 3: NAHOT - Average height of overstory trees (in meters). This variable reflects the vertical dimension of the foliage; habitat utility should increase with the value of the variable. As with other variables in the model, a threshold exists; vegetation must be at least 1 m tall before it provides habitat value. The SI increases with canopy height until the height

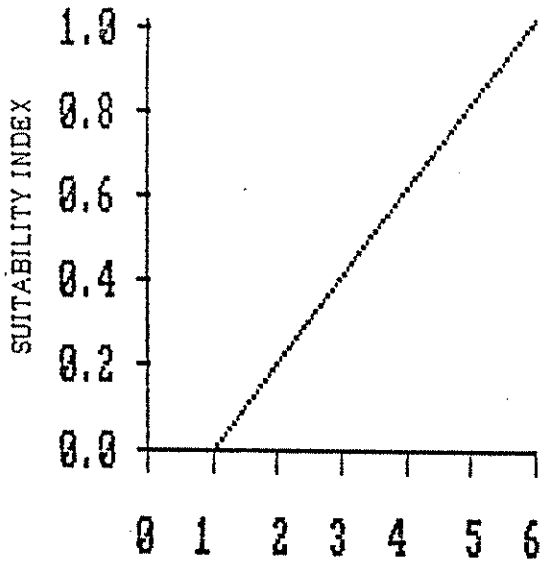


Percent Shrub (1 - 3 m Tall) Canopy Cover



Percent Tree (> 3 m tall) Canopy Cover

FIGURE 1A - SUITABILITY INDEX GRAPHS



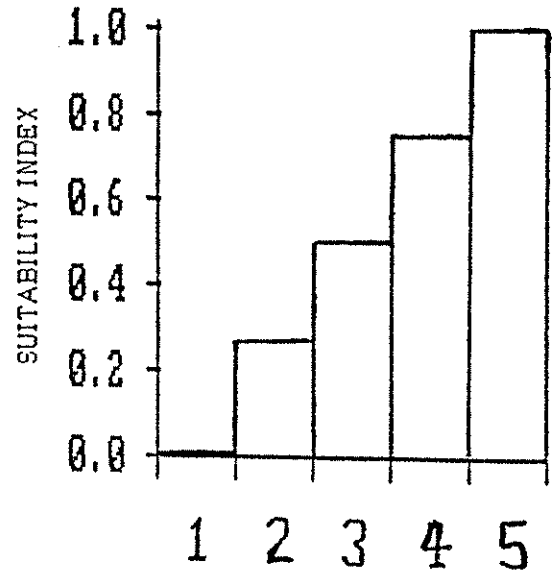


FIGURE 1B - SUITABILITY INDEX GRAPHS

reaches 6 m (20 feet). Willows and other trees in Humboldt Bay riparian habitats seldom exceed this height, and it thus represents an approximate maximum value. This variable is modified from Schroeder (1982b).

Variable 4: CNLAY - Canopy layering categories (1, 2, 3, 4, or 5). This variable requires an input scalar value from the user, depending upon the general conformation of the habitat. The scalar values and the associated SI values are shown in Figure 1: Category 1 - no woody vegetation; Category 2 - low shrubs, less than a meter tall; Category 3 - tall shrubs, 1 to 3 m tall; Category 4 - trees, more than 3 m tall but without woody understory; and Category 5 - multiple layers of woody vegetation, with both trees and shrubs present.

This variable is used in the model to scale vertical habitat heterogeneity. Greater value follows from more diverse habitat. Alternate measures of this variable are available (e.g., MacArthur and MacArthur 1961), but this formulation is more direct and is easier to measure.

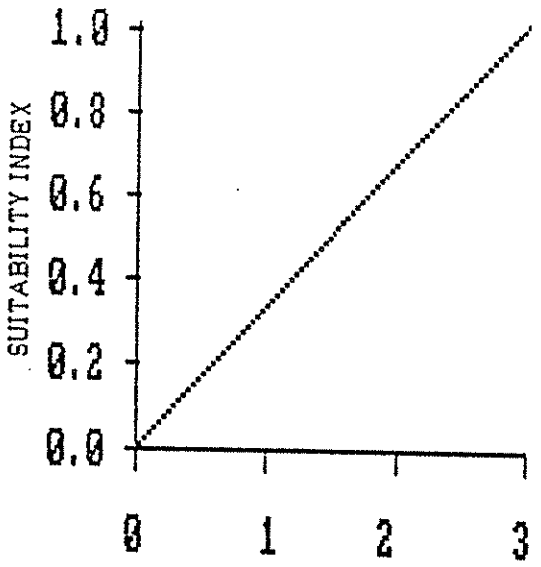
Variable 5: DSNAG10 - Number of snags greater than 10 cm diameter at breast height (dbh) per 0.4 hectare (greater than 4 inches dbh per acre). Since several members of this guild require cavities, the suitability of a site increases with the density of snags of appropriate size. This variable produces a linear increase in suitability if any snags at least 10 cm in diameter are present, reaching an optimum when three or more are present per acre.

Were this model to be applied to more diverse riparian habitats than Humboldt Bay, this variable should be modified to require larger snags for optimum suitability. Small trees and snags are adequate for small bird species, but do not serve for large birds, or for mammals and other potential cavity users. This variable is modified from Schroeder (1982b, 1982c); the optimum level of 3 snags per acre is a compromise from the two previous models.

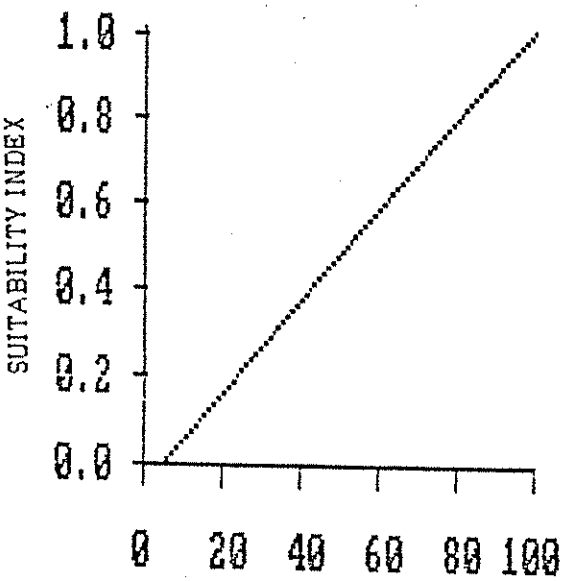
Variable 6: APWRV - Percent of the site in woody riparian vegetation. This variable scales the habitat suitability of a site according to the fraction that provides appropriate vegetation. From a threshold value at 5% of the site, the value increases linearly to optimality when 100% of the site provides riparian vegetation. As noted above, a presumed threshold size of 20 square meters of woody vegetation is required for this variable to be applicable.

HSI Determination. The riparian songbird guild model is shown in Figure 2; a printout of the electronic version of the model is included in Attachment B.

The overall suitability of a riparian or swamp wetland for the species in Attachment 1 is evaluated by this model in terms of the distribution of foliage, by the presence and number of snags, and by the fraction of the evaluation site containing such vegetation. Variables 1 through 4 in the model address vegetation, and the remaining parameters are addressed by

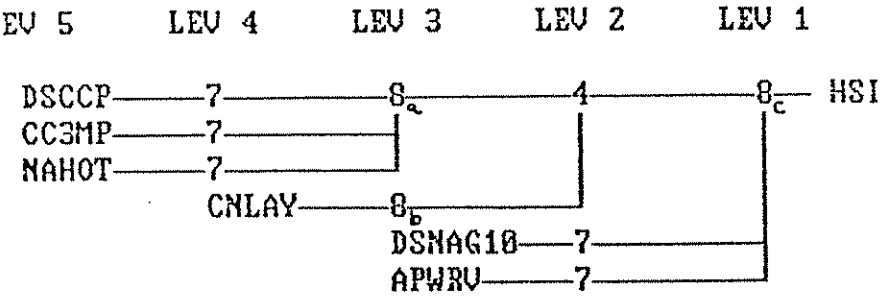


Number of Snags > 10 cm DBH per 0.4 ha (> 4 inches DBH per acre)



Percent of Site in Woody Riparian Vegetation

FIGURE 1C - SUITABILITY INDEX GRAPHS



TREE DIAGRAM FOR THE RIPARIAN SONGBIRD GUILD MODEL

DOCUMENTATION

1. Values of input variables are entered according to variable definitions and Table 1.

2. Function code "4" is a geometric mean; e.g., $Y = (X_1 * X_2)^{\frac{1}{2}}$.

3. Function code "7" is a graph; see Figure 1. Output from graph is a value $0.0 \leq Y \leq 1.0$.

4. Function code "8" is a user-specified function. Input values (left side of function code in figure) are numbered 1, 2, etc., from top down.

   Equations are: 8_a: $Y = (X_1 + X_2 + 2.0*X_3)/4.0$.

   8_b: see Figure 1b.

   8_c: $HSI = ((X_1 + X_2)/2.0) * X_3$.

FIGURE 2 - MODEL TREE DIAGRAM AND DOCUMENTATION

variables 5 and 6 respectively.

Variables 1, 2, and 3 are combined in the model to reflect the volume of foliage present. The first two variables reflect horizontal foliage distributions, and the third the vertical distribution. Foliage in the shrub and tree canopy layers of the relatively low thickets in the watershed is assumed to be continuous, and the values for the two variables are deemed to be compensatory; a single value reflecting horizontal foliage dimensions is achieved by averaging the two variables.

The vertical dimension is incorporated into this model as part of the averaging calculation, to reflect the compensation between "layers." This variable is weighted at twice the value of the former variables, however, so that suitability calculations emphasize the vertical foliage distribution. Half of the output from the user-specified function thus relates to horizontal, and half to vertical, foliage distribution (see Fugure 2).

The intermediate suitability index value provided by the calculation above is modified in the model by the suitability index derived from the canopy layering present. The model combines the foliage variables via a geometric mean function. This is used to reflect the partial compensation between foliage volume and layering criteria, and the increased departure from optimum conditions when either of the factors is much less than optimum. The output from this computation thus emphasizes any departure from optimum foliage distribution conditions.

The habitat suitability index (HSI) is computed in the model with a user specified function. The function calculates the arithmetic mean of the foliage and snag variable values. This is appropriate when the variables are fully compensatory, so that high values of one offset low values of the other. This appears reasonable in this case; good foraging area might not provide many snags for nesting (or vice versa), but the favorability of the site for foraging still maintains a relatively high utility for the habitat. The function also reduces the index value according to the fraction of the site that is not in appropriate vegetation.

In general terms, the HSI value is determined approximately half by foliage value and half by snag value. About a quarter of the value relates to canopy layering, and a quarter to the combination of cover values and total canopy height.

FIELD USE OF THE MODELS - SAMPLING

Suggested sampling techniques for the variables in the riparian songbird guild HSI model are indicated in Table 1. Readers should consult Hays *et al.* (1981) for specific discussion of sampling techniques useful in determining habitat suitability. Other sampling techniques may be substituted if equivalent results are produced.

Table 1. Suggested measurement techniques for variables in the riparian songbird guild model.

Variable	Suggested Measurement Technique
DSCCP: percent shrub (1-3 m tall) canopy cover.	Establish a baseline transect through the habitat area. At regular intervals, establish sample transects perpendicular to the baseline. Using a random sampling procedure (such as random numbers to determine distances along transects), establish sample plots at least 1 square meter in area. Estimate percentage shrub canopy cover (the area on the ground surface covered by aerial foliage of woody-stemmed plants 1 to 3 meters tall) to the nearest 5% interval. Recommended: sample at least 20 points. Compute average coverage for all samples.
CC3MP: percent tree (>3 m tall) canopy cover.	Establish a baseline transect as above, with sampling transects perpendicular to baseline. Sample as for DSCCP, except that percentage cover should be estimated for trees (woody plants >3 m tall). Recommended: sample at least 20 points. Compute average coverage for all samples.
NAHOT: average height (m) of overstory trees.	Use sample points identified for CC3MP. Obtain a single measurement of tree canopy height for each point. Measure canopy height as the tallest (highest) vegetation in the quadrat sampled. Compute average of all sampled values. [Note: if there are no trees (plants >3 m tall), measure the canopy height of shrubs.]
CNLAY: canopy layering category (1, 2, 3, 4, or 5).	For each sample point for DSCCP and CC3MP, record the presence or absence of trees, shrubs (as defined above), and woody stems <1 m tall. When sampling is complete, inspect these records. Assign an ordinal value (1, 2, 3, 4, or 5) according to these records, considering all data together. [Note: this variable is intended to involve the user's judgement about the entire site. The value assigned should be biologically justifiable.]
DSNAG10: number of snags >10 cm diameter at breast height (dbh) per 0.4 ha (>4 inches dbh per acre).	For each sample point for DSCCP and CC3MP, record the number of snags in the quadrat meeting this screening criterion (>10 cm dbh). Compute the total number of snags observed and the total area sampled. Convert to 0.4 ha (acre) density value.
APWRV: percent of the site in woody riparian vegetation.	Using aerial photo or map of entire evaluation area, compute total area. Also compute area covered by woody "riparian" vegetation. Divide latter area by total and multiply by 100. Alternatively, lay out a grid of points over entire evaluation area; ensure that grid covers the entire study area, but exclude all areas outside study boundary. Tally the number of grid points falling in appropriate vegetation, divide by the total number of grid points, and multiply by 100.

OTHER MODELS

The U.S. Fish & Wildlife Service has published HSI models for the Yellow Warbler (Schroeder 1982a), the Black-capped Chickadee (Schroeder 1982b), and the Downy Woodpecker (Schroeder 1982c). The third species is resident in the Humboldt Bay watershed, and the first uses habitats here during migration. The Chestnut-backed Chickadee uses habitats somewhat like those used by the Black-capped Chickadee (see above and Sturman 1968). The three published models were reviewed in preparing this model, and portions were incorporated. The author is not aware of other published or unpublished HSI models for species in this guild, or of models in any stage of development for the guild as a whole.

ACKNOWLEDGEMENTS

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ATTACHMENT A

The following species are expected to derive habitat utility from the riparian or "swamp" habitat type covered by this model. This is considered a minimum list; other species not recorded here also should benefit. Listing order is taxonomic, and does not imply importance, abundance, or degree of benefit. The list is based upon references cited in the model.

Taxonomic Name	Common Name
Picoides pubescens	Downy Woodpecker
Picoides villosus	Hairy Woodpecker
Empidonax difficilis	Western Flycatcher
Tachycineta bicolor	Tree Swallow
Parus rufescens	Chestnut-backed Chickadee
Troglodytes troglodytes	Winter Wren
Turdus migratorius	American Robin
Ixoreus naevius	Varied Thrush
Catharus guttatus	Hermit Thrush
Catharus ustulatus	Swainson's Thrush
Regulus calendula	Ruby-crowned Kinglet
Vermivora celata	Orange-crowned Warbler
Dendroica petechia	Yellow Warbler
Dendroica coronata	Yellow-rumped Warbler
Wilsonia pusilla	Wilson's Warbler
Carduelis tristis	American Goldfinch
Passerella iliaca	Fox Sparrow
Melospiza melodia	Song Sparrow

ATTACHMENT B

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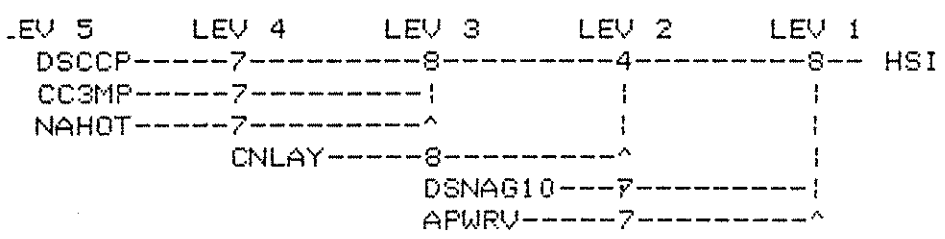
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10DEL NAME: RIPARIAN SONGBIRD GUILD AUTHOR DRAFT 04-15-1986

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J.S. Dept. Int. Fish. Wildl. Serv. FWS/OBS-82/10.27. 7 pp.

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See written version for further references.



DSCCP Percent shrub (1-3m tall) canopy cover.
CC3MP Percent tree (>3m high) canopy cover.
NAHOT AVERAGE HEIGHT OF OVERSTORY TREES (M)
CNLAY Canopy layering categories (1,2,3,4, or 5) - see model documentation.
DSNAG10 Number of snags >10cm dbh per 0.4 ha (>4 in dbh per acre).
APWRV Percent of site in woody riparian vegetation.

GRAPH FUNCTION AT LEVEL 4 . POSITION 1
Title: DSCCP

X=	Y=
0.000	0.000
10.000	0.000
50.000	1.000
75.000	1.000
100.000	0.600
110.000	0.600

GRAPH FUNCTION AT LEVEL 4 . POSITION 2
Title: CC3MP

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10.000	0.000
50.000	1.000
75.000	1.000
100.000	0.600
110.000	0.600

odel: RIPARIAN SONGBIRD GUILD (continued)

```
RAPH FUNCTION AT LEVEL 4 , POSITION 3
 Title:  HOT
   X=       0.000     Y=       0.000
            1.000               0.000
            6.000               1.000
            7.000               1.000

SER-SPECIFIED FUNCTION AT LEVEL 3 , POSITION 1
SUB = (X(1)+X(2)+2.*X(3))/4.

SER-SPECIFIED FUNCTION AT LEVEL 3 , POSITION 2
F X(1)<>1 AND X(1)<>2 AND X(1)<>3 AND X(1)<>4 AND X(1)<>5 THEN PRINT:PRINT"***
ERROR IN INPUT***":PRINT"VALUE FOR CNLAY MUST BE 1, 2, 3, 4, OR 5.":PRINT"PRESS
ANY KEY TO RETURN TO DATA MODIFICATION MENU  -  "::Z$ = INPUT$(1):GOTO 9010
F X(1) = 1 THEN USUB = 0
F X(1) = 2 THEN USUB = .25
F X(1) = 3 THEN USUB = .5
F X(1) = 4 THEN USUB = .75
F X(1) = 5 THEN USUB = 1.

RAPH FUNCTION AT LEVEL 2 , POSITION 2
 Title:  SNAG10
   X=       0.000     Y=       0.000
            3.000               1.000
            4.000               1.000

RAPH FUNCTION AT LEVEL 2 , POSITION 3
 Title:  PWRV
   X=       0.000     Y=       0.000
            5.000               0.000
          100.000               1.000
          110.000               1.000

ISER-SPECIFIED FUNCTION AT LEVEL 1 , POSITION 1
ISUB = ((X(1)+X(2))/2.)*X(3)
```

FILE COP

COMMUNITY-BASED
HABITAT SUITABILITY INDEX MODEL
FOR THE RIPARIAN FOREST COVER-TYPE
ALONG LLAGAS CREEK

Adapted from a model used by the HEP team evaluating impacts of proposed riprap bank protection along the lower Sacramento River

As Revised
September 2001

BACKGROUND: The cover-type model described here is for Riparian Forest Cover. This cover-type is defined as a stand of woody vegetation composed of primarily trees greater than 20-feet-tall. The Riparian Forest cover-type model identifies and quantifies characteristics of this cover type which are important to a wide array of wildlife. The model does not attempt to portray exactly the needs of any one species, but rather it broadly portrays the needs of many species or species groups of riparian zones along Llagas Creek.

For example, many birds, including nesting raptors such as red-tailed hawks and re-shouldered hawks require tall trees, and thus tree height, with taller trees being more favorable, has been included as a key model variable. Also, many songbirds, such as the northern oriole and least Bell's vireo, require relatively dense canopies, thus canopy closure, with greater closure providing greater value, is included as a model variable. Similarly, riparian water birds such as herons an egrets have specific needs relating to canopy closure, width of stand, and density of vegetative understory, so these needs have been met as much as possible with the appropriate model variables.

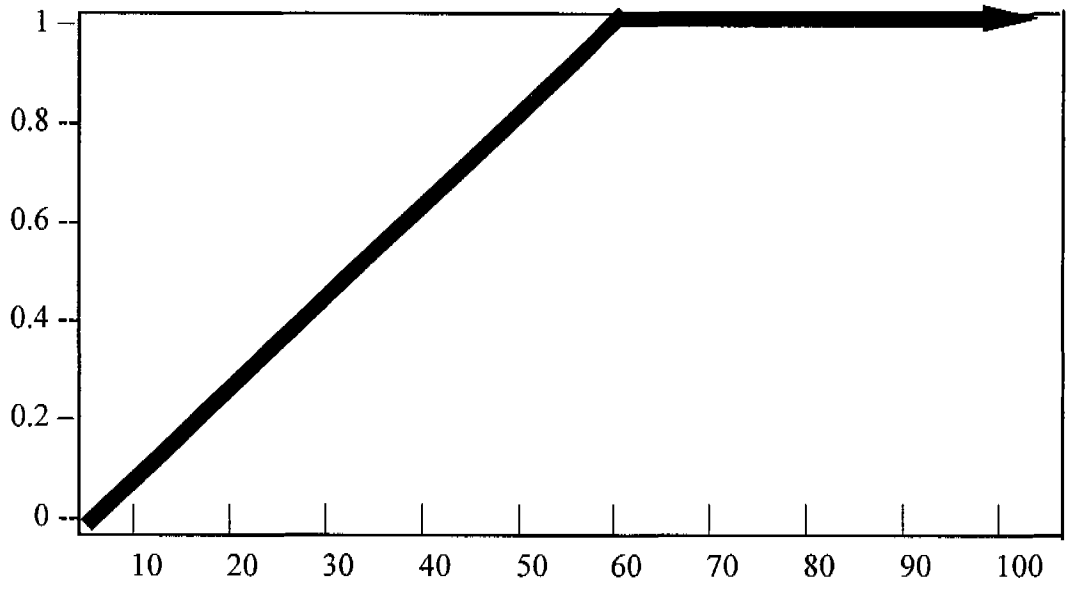
The single Habitat Suitability Index (HSI) value which is derived using the Riparian Forest cover-type model is therefore, not an exact measure of the habitat value of any single wildlife species. Instead, the HSI indicates the overall, broad quality of the cover-type to a broad array of the most important species which inhabit the creek's riparian zone. As such, the use of this single HSI value in the HEP process is assumed to provide the same results (i.e., estimates of relative impacts and compensation needs) as if the HEP were completed using a number of individual wildlife species models. Past comparisons using actual HSI data collected from Riparian Forest Cover along the Sacramento River suggest the validity of this assumption.

AREA OF APPLICABILITY: Riparian Forest Cover along Llagas Creek, a tributary of the Pajaro River.

VARIABLE

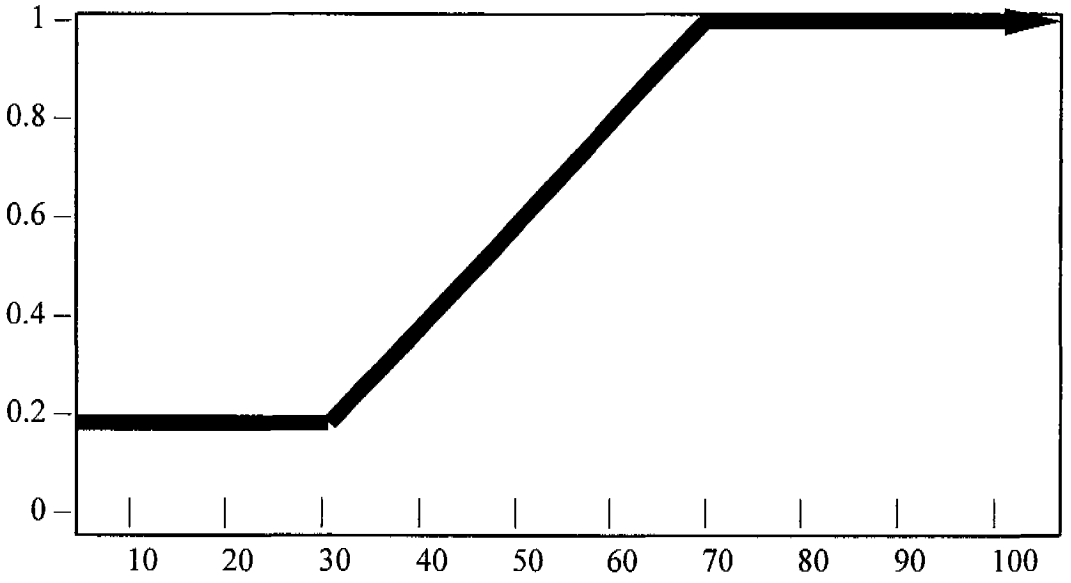
V_1 – Average tree height.
V_2 – Average canopy width of the stand.
V_3 – Tree canopy closure.
V_4 – Number of tree or shrub species.
V_5 – Understory vegetative density.

V_1 – Average tree height. Suitability Index (SI) determination. Assumptions: For most wildlife species of concern, the taller the trees, the better the habitat value. Nesting raptors in particular require relatively tall trees. A tree height, on average, of about 60 feet or greater is optimum.



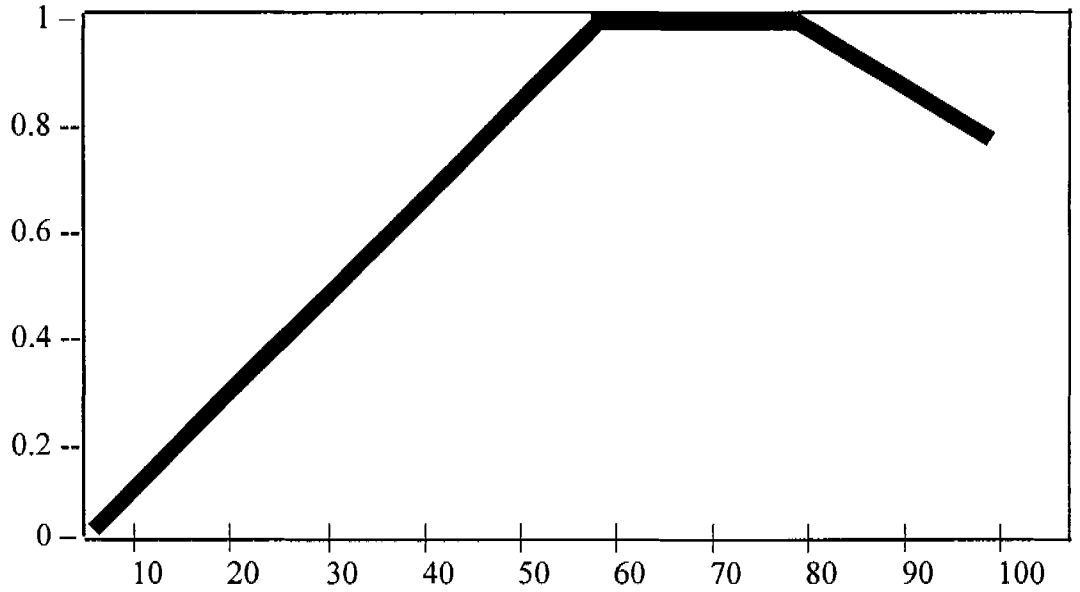
V_1 – Average Tree Height (Ft.)

V_2 – Average canopy width of the stand. Suitability Index (SI) determination. Assumptions: Generally, the wider the stand, the better the values for most key fish and wildlife. Stands less than 30-feet-wide have relatively low values; stands over 70 feet in width are best.



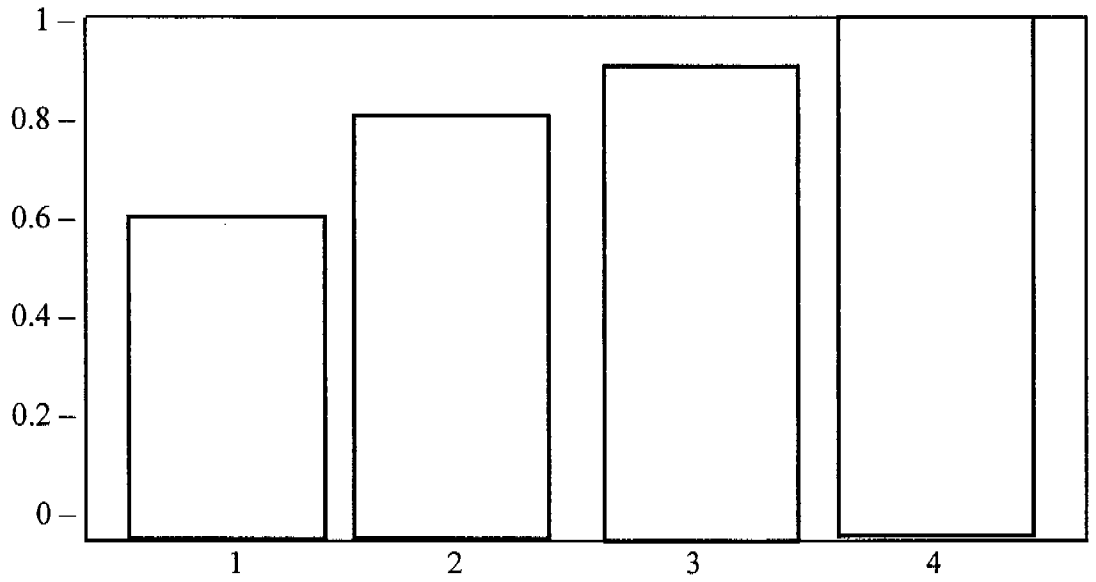
V_2 – Average Canopy Width of the Stand (Ft.)

V_3 – Tree canopy closure. Suitability Index (SI) determination. Assumptions: In general, the greater the forest density, as determined by percent of canopy closure, the greater the values of the forest. However, if the stand becomes too dense, habitat values frequently decline. The optimal condition is with percent canopy closure of 50 to 80 percent.



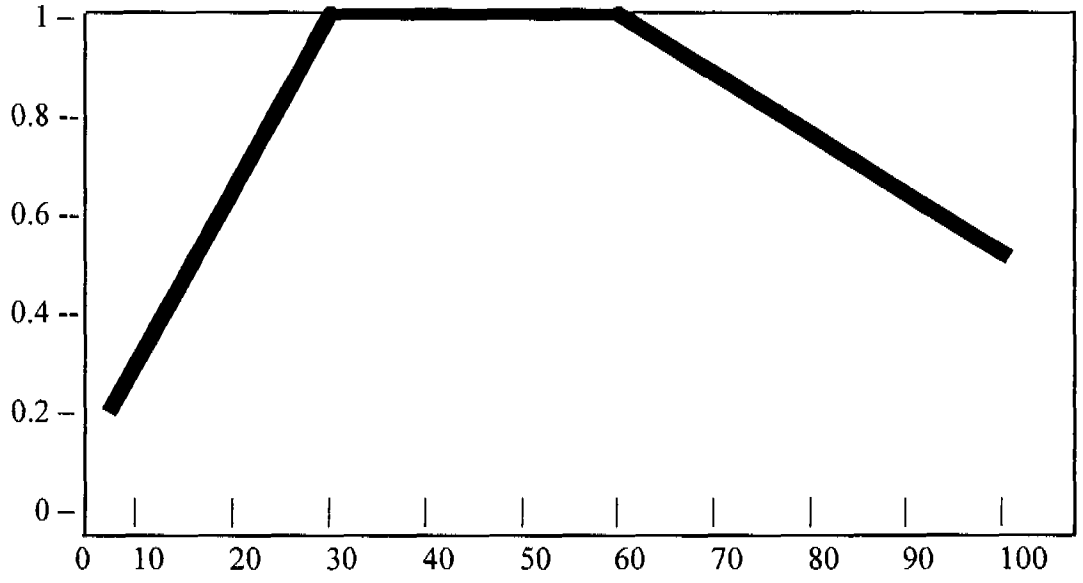
V_3 – Tree canopy closure (%)

V_4 – Number of tree or shrub species. Suitability Index (SI) determination. Assumptions: Habitat diversity improves carrying capacity. Generally, the more tree or shrub species present, the more diverse th forest, and the greater the values to fish and wildlife. The optimal condition is when the forest is composed of at least four species of trees.



V_4 – Number of Tree or Shrub Species

V_5 – Understory vegetative density. Suitability Index (SI) determination. Assumptions: The best Riparian Forest habitat occurs when both overstory and understory canopies are relatively dense. the understory should generally have a moderate density of vegetation at various elevations. By estimating the understory of the forest for the horizontal planes at 2, 6, and 14 feet above ground, and then averaging these three figures (i.e., the three estimates of percent vegetative cover), a good index of overall understory density can be derived.



V_5 – Average Understory Vegetative Density (%)
(At 2. 6. and 14 Feet Above Ground)

HABITAT SUITABILITY INDEX (HSI): Average canopy width and understory density are believed to be slightly more important variables than the other three variables. The five variables are thus combined as follows:

$$HSI = \frac{(V_1 \times V_3 \times V_4)^{1/3} + (V_2 \times V_5)^{1/2}}{2}$$

Variables are generally measured or estimated during periods of maximum vegetative leaf-out.

The calculated HSI is reduced by 40% when the majority of the tree canopy closure is from non-native species such as eucalyptus. In addition, this adjusted (or if not adjusted) HSI is further reduced by 33% if the edge of the riparian forest occurrence begins 20 feet or more away from the edge of the streambed, since riparian forest in close association with the stream has highest values.

FWS/OBS-82/10.38
APRIL 1983

HABITAT SUITABILITY INDEX MODELS: DOWNY WOODPECKER



Fish and Wildlife Service
U.S. Department of the Interior

This model is designed to be used by the Division of Ecological Services in conjunction with the Habitat Evaluation Procedures.

FWS/OBS-82/10.38
April 1983

HABITAT SUITABILITY INDEX MODELS: DOWNY WOODPECKER

by

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This report should be cited as:

Schroeder, R. L. 1982. Habitat suitability index models: Downy woodpecker. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.38. 10 pp.

PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series (FWS/OBS-82/10), which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information Section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. The habitat use information provides the foundation for HSI models that follow. In addition, this same information may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents a habitat model and information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The application information includes descriptions of the geographic ranges and seasonal application of the model, its current verification status, and a listing of model variables with recommended measurement techniques for each variable.

In essence, the model presented herein is a hypothesis of species-habitat relationships and not a statement of proven cause and effect relationships. Results of model performance tests, when available, are referenced. However, models that have demonstrated reliability in specific situations may prove unreliable in others. For this reason, feedback is encouraged from users of this model concerning improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning. Please send suggestions to:

Habitat Evaluation Procedures Group
Western Energy and Land Use Team
U.S. Fish and Wildlife Service
2627 Redwing Road
Ft. Collins, CO 80526

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ACKNOWLEDGMENTS

We gratefully acknowledge Richard Conner and Lawrence Kilham for their review of this habitat model. Funds for the development of this model were provided by the U.S. Fish and Wildlife Service Regional Office in Portland. Publication costs of this model were partially paid for by the U.S. Army Corps of Engineers. The cover of this document was illustrated by Jennifer Shoemaker. Word processing was provided by Carolyn Gulzow and Dora Ibarra.

DOWNY WOODPECKER (Picoides pubescens)

HABITAT USE INFORMATION

General

Downy woodpeckers (Picoides pubescens) inhabit nearly all of North America where trees are found (Bent 1939). They are rare or absent in arid desert habitats and most common in open woodlands.

Food

The downy woodpecker is primarily an insectivore; 76% of the diet is animal foods, and the remainder is vegetable food (Beal 1911). Beetles, ants, and caterpillars are the major animal foods, and vegetable foods include fruits, seeds, and mast. Downy woodpeckers feed by digging into the bark with the bill, by gleaning along the bark surface, and, infrequently, by flycatching (Jackson 1970).

Downy woodpeckers in Illinois foraged more in the lower height zones of trees than in the tree canopies and foraged more often on live limbs than on dead limbs (Williams 1975). Similarly, downy woodpeckers in Virginia foraged primarily on live wood in pole age and mature forests (Conner 1980). Downy woodpeckers in New York spent 60% of their foraging time in elms (Ulmus spp.) (Kisiel 1972). They foraged most frequently on twigs 2.5 cm (1 inch) or less in diameter, and drilling was the foraging technique used most often. Downy woodpeckers are not strong excavators and do not excavate deeply to reach concentrated food sources, such as carpenter ants (Camponotus spp.) (Conner 1981).

Downy woodpeckers in Virginia foraged in the breeding season in habitats with a mean basal area of 11.3 m^2/ha (49.2 ft^2/acre). Habitats used for foraging during the postbreeding and winter seasons had significantly higher mean basal areas of 21.4 m^2/ha (93.2 ft^2/acre) and 17.2 m^2/ha (74.9 ft^2/acre), respectively. Downy woodpeckers in New Hampshire fed heavily in stands of paper birch (Betula papyrifera) that were infected with a coccid (Xylococchus betulae) (Kilham 1970). The most attractive birches for foraging were those that were crooked or leaning, contained broken branches in their crown, and had defects, such as cankers, old wounds, broken branch stubs, and sapsucker drill holes. Downy woodpeckers invaded an area in Colorado in high numbers during the winter months in response to a severe outbreak of the pine bark beetle (Dendroctonus ponderosae) (Crockett and Hansley 1978). This outbreak of beetles had not resulted in increased breeding densities of the woodpeckers at the time of the study.

Downy woodpeckers foraged more on tree surfaces during summer than in winter (Conner 1979). They increased the amount of time spent in subcambial excavation in winter months, probably in response to the seasonal availability and location of insect prey. Downy woodpeckers appear to broaden all aspects of their foraging behavior in the winter in order to find adequate amounts of food (Conner 1981).

Downy woodpeckers in Ontario extracted gall fly (Eurosta solidaginis) larvae from goldenrod (Solidago canadensis) galls growing near forest edges (Schlichter 1978). Corn stubble fields supported small winter populations of downy woodpeckers in Illinois (Graber et al. 1977).

Water

Information on the water requirements of the downy woodpecker was not located in the literature.

Cover

The cover requirements of the downy woodpecker are similar to their reproductive requirements, which are discussed in the following section.

Reproduction

The downy woodpecker is a primary cavity nester that prefers soft snags for nest sites (Evans and Conner 1979). These woodpeckers nest in both coniferous and deciduous forest stands in the Northwest. Nests in Virginia were common in both edge situations and in dense forests far from openings (Conner and Adkisson 1977). Downy woodpeckers in Oregon occur primarily in deciduous stands of aspen (Populus tremuloides) or riparian cottonwood (Populus spp.) (Thomas et al. 1979). The highest nesting and winter densities in Illinois were in virgin or old lowland forests (Graber et al. 1977).

Downy woodpeckers in Virginia preferred to nest in areas with high stem density, but with lower basal area and lower canopy heights than areas used by the other woodpeckers studied (Conner and Adkisson 1977). They preferred sparsely stocked forests commonly found along ridges (Conner et al. 1975). Preferred nest stands had an average basal area of 10.1 m^2/ha (44 ft^2/acre), 361.8 stems greater than 4 cm (1.6 inches) diameter/ha (894/acre), and canopy heights of 16.3 m (53.5 ft) (Conner and Adkisson 1976). Downy woodpeckers in Tennessee were frequently seen feeding in the understory and apparently selected habitats with an abundance of understory vegetation (Anderson and Shugart 1974).

Downy woodpeckers excavate their own cavity in a branch or stub 2.4 to 15.3 m (8 to 50 ft) above ground, generally in dead or dying wood (Bent 1939). There was a positive correlation between downy woodpecker densities and the number of dead trees in Illinois (Graber et al. 1977). Downy woodpeckers rarely excavate in oaks (Quercus spp.) or hickories (Carya spp.) with living cambium present at the nest site (Conner 1978). They apparently require both sap rot, to soften the outer part of trees, and heart rot, to soften the

interior, when hardwoods, and possibly pines, are used for nesting. Downy woodpeckers in Virginia nested mainly in dead snags with advanced stages of fungal heart rot (Conner and Adkisson 1976).

Downy woodpeckers "search image" of an optimal nest site is a live tree with a broken off dead top (Kilham 1974). Suitable nest trees are in short supply in most areas and appear to be a limiting factor in New Hampshire. Downies in Montana appeared to prefer small trees, possibly to avoid the difficulty of excavating through the thick sapwood of large trees (McClelland et al. 1979). The average dbh of nest trees (n = 3) in Montana was 25 cm (10 inches). All 11 nests in an Ontario study were in dead aspen, and the average dbh of four of these nest trees was 26.2 cm (10.3 inches) (Lawrence 1966). Fourteen of 19 nest trees in Virginia were dead, the average dbh of nest trees was 31.8 cm (12.4 inches), and nest trees averaged 8.3 m (27.2 ft) in height (Conner et al. 1975).

Thomas et al. (1979) estimated that downy woodpeckers in Oregon require 7.4 snags, 15.2 cm (6 inches) or more dbh, per ha (3 snags/acre). This estimate is based on a territory size of 4 ha (10 acres), a need for two cavities per year per pair, and the presence of 1 useable snag with a cavity for each 16 snags without a cavity. Evans and Conner (1979) estimated that downies in the Northeast require 9.9 snags, 15 to 25 cm (6 to 10 inches) dbh, per ha (4 snags/acre). Their estimate is based on a territory size of 4 ha (10 acres), a need for four cavity trees per year per pair, and a need for 10 snags for each cavity tree used in order to account for unuseable snags, a reserve of snags, feeding habitat, and a supply of snags for secondary users. Conner (pers. comm.) recommended 12.4 snags/ha (5 snags/acre) for optimal downy woodpecker habitat.

Interspersion

Downy woodpeckers occupy different size territories at different times of the year (Kilham 1974). Fall and winter territories consist of small, defined areas with favorable food supplies and the area near roost holes. Breeding season territories consist of an area as large as 10 to 15 ha (24.7 to 37.1 acres) used to search out nest stubs, and a smaller area around the nest stub itself. Breeding territories of downies in Illinois ranged from 0.5 to 1.2 ha (1.3 to 3.1 acres) (Calef 1953 cited by Graber et al. 1977). Male and female downy woodpeckers retain about the same breeding season territory from year to year, while their larger overall range has more flexible borders (Lawrence 1966).

Downy woodpeckers occupy all portions of their North American breeding range during the winter (Plaza 1978). There is, however, a slight, local southward migration in many areas.

Special Considerations

Conner and Crawford (1974) reported that logging debris in regenerating stands (1-year old) following clear cutting were heavily used by downy woodpeckers as foraging substrate. Timber harvest operations that leave snags and

trees with heart rot standing during regeneration cuts and subsequent thinnings will help maintain maximum densities of downy woodpeckers (Conner et al. 1975). Foraging habitat for the downy woodpecker in Virginia would probably be provided by timber rotations of 60 to 80 years (Conner 1980).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model was developed for the entire range of the downy woodpecker.

Season. This model was developed to evaluate the year-round habitat needs of the downy woodpecker.

Cover types. This model was developed to evaluate habitat in Deciduous Forest (DF), Evergreen Forest (EF), Deciduous Forested Wetland (DFW), and Evergreen Forested Wetland (EFW) areas (terminology follows that of U.S. Fish and Wildlife Service 1981).

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before a species will live and reproduce in an area. Specific information on minimum habitat areas for downy woodpeckers was not found in the literature. However, based on reported territory and range sizes, it is assumed that a minimum of 4 ha (10 acres) of potentially useable habitat must exist or the HSI will equal zero.

Verification level. Previous drafts of this model were reviewed by Richard Conner and Lawrence Kilham and their comments were incorporated into the current draft (Conner, pers. comm.; Kilham, pers. comm.).

Model Description

Overview. This model considers the ability of the habitat to meet the food and reproductive needs of the downy woodpecker as an indication of overall habitat suitability. Cover needs are assumed to be met by food and reproductive requirements and water is assumed not to be limiting. The food component of this model assesses food quality through measurements of vegetative conditions. The reproductive component of this model assesses the abundance of suitable snags. The relationship between habitat variables, life requisites, cover types, and the HSI for the downy woodpecker is illustrated in Figure 1.

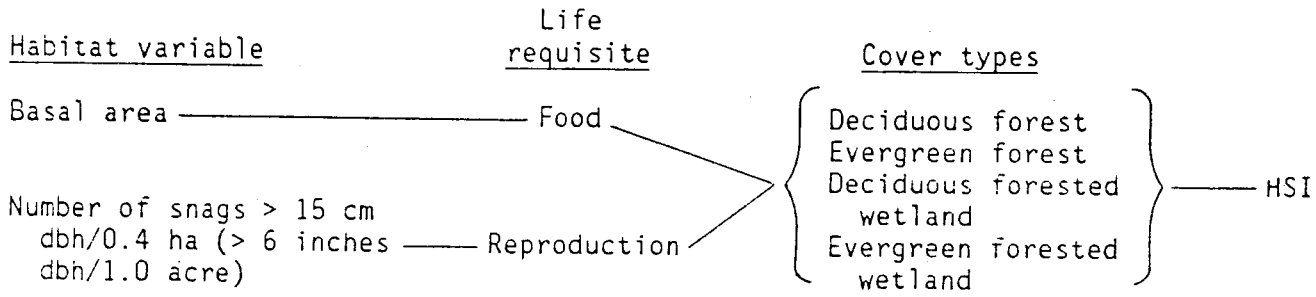


Figure 1. Relationships of habitat variables, life requisites, and cover types in the downy woodpecker model.

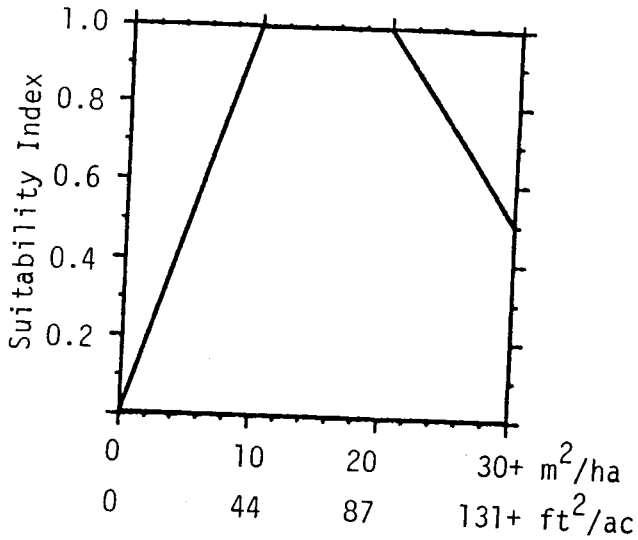
The following sections provide a written documentation of the logic and assumptions used to interpret the habitat information for the downy woodpecker in order to explain the variables and equations that are used in the HSI model. Specifically, these sections cover the following: (1) identification of variables used in the model; (2) definition and justification of the suitability levels of each variable; and (3) description of the assumed relationship between variables.

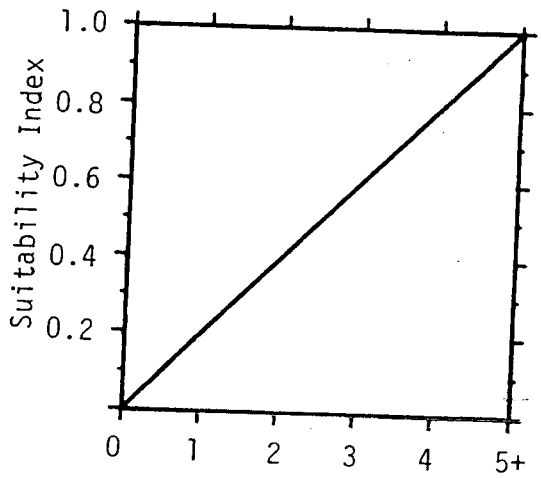
Food component. Food for the downy woodpecker consists of insects found on trees in forested habitats. Downy woodpeckers occupy a wide variety of forested habitats from virgin bottomlands to sparsely stocked stands along ridges. The highest downy woodpecker densities were most often reported in the more open stands with lower basal areas, but it is assumed that all forested habitats have some food value for downies. Optimal conditions are assumed to occur in stands with basal areas between 10 and 20 m^2/ha (43.6 and 87.2 ft^2/acre), and suitabilities will decrease to zero as basal area approaches zero. Stands with basal areas greater than 30 m^2/ha (130.8 ft^2/acre) are assumed to have moderate value for downy woodpeckers.

Reproduction component. Downy woodpeckers nest in cavities in either totally or partially dead small trees. They require snags greater than 15 cm (6 inches) dbh for nest sites. Optimal habitats are assumed to contain 5 or more snags greater than 15 cm dbh/0.4 ha (6 inches dbh/1.0 acre), and habitats without such snags have no suitability.

Model Relationships

Suitability Index (SI) graphs for habitat variables. This section contains suitability index graphs that illustrate the habitat relationships described in the previous section.

Cover type	Variable		Suitability graph
EF,DF, EFW,DFW	V_1	Basal area.	

EF,DF, EFW,DFW	V_2	Number of snags > 15 cm dbh/0.4 ha (> 6 inches dbh/ 1.0 acre).	

Life requisite values. The life requisite values for the downy woodpecker are presented below.

Life requisite	Cover type	Life requisite value
Food	EF,DF,EFW,DFW	V_1
Reproduction	EF,DF,EFW,DFW	V_2

HSI determination. The HSI for the downy woodpecker is equal to the lowest life requisite value.

Application of the Model

Definitions of variables and suggested field measurement techniques (Hays et al. 1981) are provided in Figure 2.

Variable (definition)		Cover types	Suggested technique
V_1	Basal area [the area of exposed stems of woody vegetation if cut horizontally at 1.4 m (4.5 ft) height, in m^2/ha (ft^2/acre)].	EF,DF,EFW,DFW	Bitterlich method
V_2	Number of snags > 15 cm (6 inches) dbh/0.4 ha (1.0 acre) [the number of standing dead trees or partly dead trees, greater than 15 cm (6 inches) diameter at breast height (1.4 m/4.5 ft), that are at least 1.8 m (6 ft) tall. Trees in which at least 50% of the branches have fallen, or are present but no longer bear foliage, are to be considered snags].	EF,DF,EFW,DFW	Quadrat

Figure 2. Definitions of variables and suggested measurement techniques.

SOURCES OF OTHER MODELS

Conner and Adkisson (1976) have developed a discriminant function model for the downy woodpecker that can be used to separate habitats that possibly provide nesting habitat from those that do not provide nesting habitat. The model assesses basal area, number of stems, and canopy height of trees.

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A review and synthesis of existing information was used to develop a habitat model for the downy woodpecker (Picoides pubescens). The model is scaled to produce an index of habitat suitability between 0 (unsuitable habitat) and 1 (optimally suitable habitat) for areas of the continental United States. Habitat suitability indexes are designed for use with Habitat Evaluation Procedures previously developed by the U.S. Fish and Wildlife Service.

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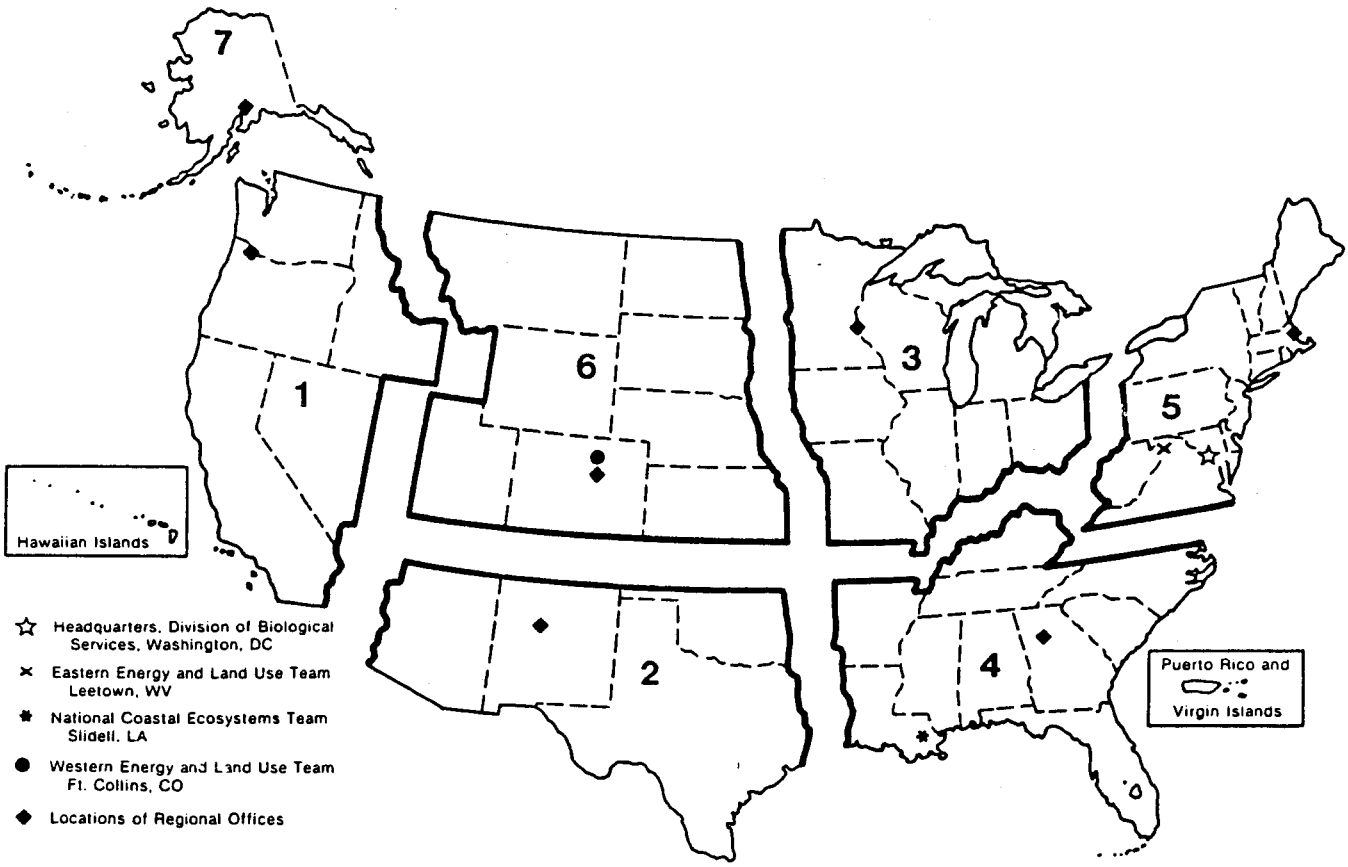
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Picoides pubescens
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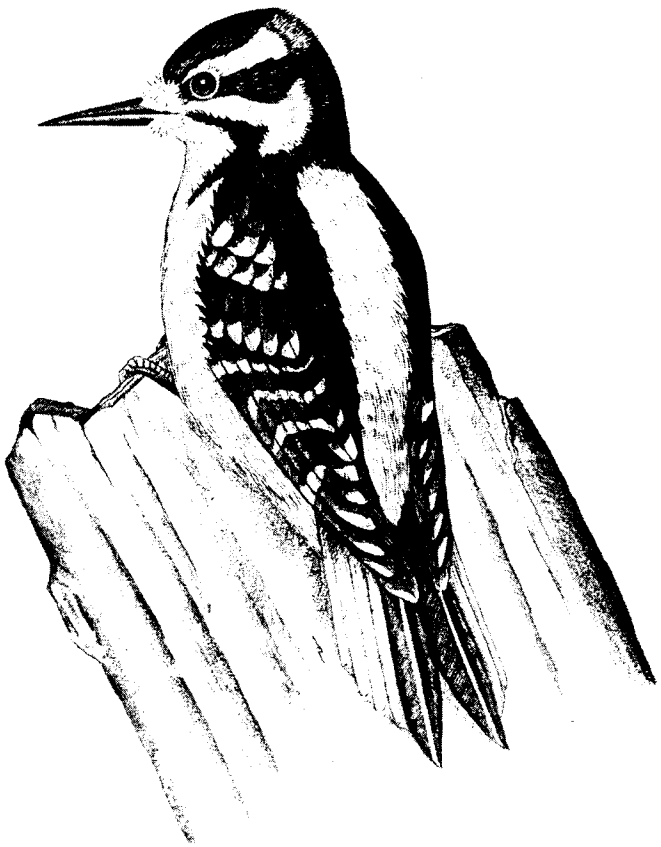
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BIOLOGICAL REPORT 82(10.146)
SEPTEMBER 1987

HABITAT SUITABILITY INDEX MODELS: HAIRY WOODPECKER



Fish and Wildlife Service

U.S. Department of the Interior

MODEL EVALUATION FORM

Habitat models are designed for a wide variety of planning applications where habitat information is an important consideration in the decision process. However, it is impossible to develop a model that performs equally well in all situations. Assistance from users and researchers is an important part of the model improvement process. Each model is published individually to facilitate updating and reprinting as new information becomes available. User feedback on model performance will assist in improving habitat models for future applications. Please complete this form following application or review of the model. Feel free to include additional information that may be of use to either a model developer or model user. We also would appreciate information on model testing, modification, and application, as well as copies of modified models or test results. Please return this form to:

Habitat Evaluation Procedures Group
U.S. Fish and Wildlife Service
2627 Redwing Road, Creekside One
Fort Collins, CO 80526-2899

Thank you for your assistance.

Species _____ Geographic Location _____

Habitat or Cover Type(s) _____

Type of Application: Impact Analysis ____ Management Action Analysis _____
Baseline _____ Other _____

Variables Measured or Evaluated _____
_____
_____
_____

Was the species information useful and accurate? Yes ____ No ____

If not, what corrections or improvements are needed?_____
_____
_____
_____

Were the variables and curves clearly defined and useful? Yes ____ No ____

If not, how were or could they be improved? _____

_____

_____

_____

Were the techniques suggested for collection of field data:

Appropriate? Yes ____ No ____

Clearly defined? Yes ____ No ____

Easily applied? Yes ____ No ____

If not, what other data collection techniques are needed? _____

_____

_____

_____

Were the model equations logical? Yes ____ No ____

Appropriate? Yes ____ No ____

How were or could they be improved? _____

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_____

Other suggestions for modification or improvement (attach curves, equations, graphs, or other appropriate information) _____

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Additional references or information that should be included in the model:

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Model Evaluator or Reviewer _____ Date _____

Agency _____

Address _____

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Telephone Number Comm: _____ FTS _____

Biological Report 82(10.146)
September 1987

HABITAT SUITABILITY INDEX MODELS: HAIRY WOODPECKER

by

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PREFACE

This document is part of the Habitat Suitability Index (HSI) model series [Biological Report 82(10)], which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. This information provides the foundation for the HSI model and may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model section documents the habitat model and includes information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The HSI Model section includes information about the geographic range and seasonal application of the model, its current verification status, and a list of the model variables with recommended measurement techniques for each variable.

The model is a formalized synthesis of biological and habitat information published in the scientific literature and may include unpublished information reflecting the opinions of identified experts. Habitat information about wildlife species frequently is represented by scattered data sets collected during different seasons and years and from different sites throughout the range of a species. The model presents this broad data base in a formal, logical, and simplified manner. The assumptions necessary for organizing and synthesizing the species-habitat information into the model are discussed. The model should be regarded as a hypothesis of species-habitat relationships and not as a statement of proven cause and effect relationships. The model may have merit in planning wildlife habitat research studies about a species, as well as in providing an estimate of the relative suitability of habitat for that species. User feedback concerning model improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning are encouraged. Please send suggestions to:

Resource Evaluation and Modeling Section
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National Ecology Center
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Ft. Collins, CO 80526-2899

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A field validation of an earlier version of the HSI model for the hairy woodpecker was conducted under the direction of Ms. L. Jean O'Neil, U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS. The field validation was based on habitat evaluation by the following individuals:

Dr. F.J. Alsop, III, East Tennessee State University, Johnson City

Dr. C.E. Bock, University of Colorado, Boulder

Dr. R.N. Conner, U.S. Forest Service, Nacogdoches, TX

Dr. J.A. Jackson, Box Z, Mississippi State, MS

Dr. F.C. James, Florida State University, Tallahassee

Dr. B.J. Schardien Jackson, Mississippi State, MS

Mr. J. Teaford and Dr. T. Roberts, Waterways Experiment Station, and Dr. J. Wakeley, Pennsylvania State University, assisted in the study design, data collection, data analysis, and model modification. The field validation resulted in several improvements in the model. The efforts of all of those involved in the field validation are very much appreciated.

Earlier drafts of the model were reviewed by Dr. R.N. Conner and Dr. C.E. Bock. Their review comments led to significant improvements in the model and are appreciated.

Word processing of this document was provided by C. Gulzow, D. Ibarra, P. Gillis, and E. Barstow. The cover was illustrated by J. Shoemaker.

HAIRY WOODPECKER (Picoides villosus)

HABITAT USE INFORMATION

General

The hairy woodpecker (Picoides villosus) breeds and winters throughout most of North America (American Ornithologists' Union 1983). The species is a primary cavity nester in "deciduous or coniferous forest, well-wooded towns and parks, and open situations with scattered trees ..." (American Ornithologists' Union 1983:391).

Food

Animal matter, such as beetle larvae (Coleoptera), ants (Hymenoptera), caterpillars (Lepidoptera), and adult beetles, accounted for 78% of the hairy woodpecker's annual diet, based on 382 stomachs collected throughout North America (Beal 1911). The diet is supplemented by fruit and mast (Beal 1911; Hardin and Evans 1977). Hairy woodpeckers forage extensively for seeds in winter (Jackman 1975); in Colorado, they foraged extensively during the non-reproductive season on the seeds of ponderosa pine (Pinus ponderosa) (Stallcup 1966). Hairy woodpeckers may concentrate in areas of insect outbreaks in response to the increased food source (Koplin 1967; Massey and Wygant 1973). The hairy woodpecker was considered to be a primary predator of the Southern pine beetle (Dendroctonus frontalis) in east Texas (Kroll and Fleet 1979).

Hairy woodpeckers are considered opportunistic foragers (Raphael and White 1984); they forage on a variety of substrates, including tree trunks, stumps, exposed roots (Lawrence 1966), snags, downed logs, the ground (Mannan et al. 1980), and logging debris in recent clearcuts (Conner and Crawford 1974). In California, hairy woodpeckers foraged on snags 51% of the time and on live trees 47% of the time (Raphael and White 1984). During winter, hairy woodpeckers in Virginia foraged most often on dead trees or dead parts of live trees (Conner 1980). Hairy woodpeckers in New York exhibited a sexual difference in the selection of winter foraging sites; males foraged on dead trees significantly more often than females, and females foraged significantly more often on live trees (Kisiel 1972). Both sexes used a variety of tree species for foraging sites. A variety of tree species was also used for foraging by hairy woodpeckers in Sierra Nevada forests (Raphael and White 1984). Snags used for foraging in Douglas-fir (Pseudotsuga menziesii) forests in Oregon averaged 61 cm dbh and ranged from 13 to 173 cm dbh (Mannan 1977). The average foraging height of hairy woodpeckers in Iowa was 8.8±1.55 m, and the average diameter of limbs used for foraging was 6.52±1.04 cm (Gamboa and Brown 1976). Hairy woodpeckers in New York typically foraged on limbs 5 to 10 cm in diameter (Kisiel 1972).

Hairy woodpeckers in southwestern Virginia foraged in "... habitats with relatively dense vegetation near the ground" (Conner 1980:121) in comparison to foraging habitat selected by other species of woodpeckers, especially the downy woodpecker (P. pubescens).

Water

No specific information on water requirements of the hairy woodpecker was found in the literature.

Cover

Hairy woodpeckers inhabit a wide variety of forest cover types. For example, they inhabit Douglas-fir forests (Mannan et al. 1980), ponderosa pine forests (Diem and Zeveloff 1980), pinyon-juniper (Pinus edulis - Juniperus spp.) woodlands (Balda and Masters 1980), eastern deciduous forests (Conner et al. 1975), and riparian communities (Stauffer and Best 1980). Winter population densities of hairy woodpeckers in Illinois were positively correlated with the number of trees >56 cm dbh and with a diversity of genera and species of large trees (Graber et al. 1977). Hairy woodpeckers in Oregon use the shrub/sapling (8 to 15 yr) and second-growth (16 to 40 yr) stages of Douglas-fir forests, but they do not nest in these younger stages (Meslow and Wight 1975). Jackman (1975) stated that hairy woodpeckers inhabit second-growth, partially thinned, and other altered forest types; however, hairy woodpeckers were reported more frequently (95% of 40 breeding bird censuses) in mature undisturbed habitats in the northern hardwoods region than in disturbed and successional habitats (43% of 30 censuses) (Noon et al. 1979).

Hairy woodpeckers use tree cavities for roosting and winter cover, as well as for nesting and rearing young (Thomas et al. 1979), and they will excavate new cavities in the fall to be used for roosting (Jackman 1975).

Reproduction

The hairy woodpecker is a primary cavity nester that is able to adapt to a wide variety of habitats (Kilham 1968). In the Pacific Northwest, hairy woodpeckers require standing dead trees and live trees with rotted heartwood (Jackman 1975). Similarly, hairy woodpeckers in Virginia exhibited a definite preference for trees with heartrot (Conner et al. 1975; Conner et al. 1976). Thomas et al. (1979), however, listed the hairy woodpecker as a species that usually excavates in sound wood. Runde and Capen (1987) found that the amount of sound wood varied widely (based on a visual estimate) in live trees used for nesting by hairy woodpeckers; 11 of 21 nests were in live trees. A possible exception to the apparently general use of live or dead trees for nest sites is that hairy woodpeckers do not nest in Engelmann spruce (Picea engelmannii) forests in the Pacific Northwest (Jackman 1975). Haapanen (1965 cited by Smith 1980:264) found that "of all the woodpeckers found in spruce-fir forests, apparently only the Northern 3-toed Woodpecker [Picoides tridactylus] is capable of making holes in the dense wood of living spruce trees." R.N. Conner (U.S. Forest Service, Nacogdoches, TX; letter dated February 19, 1986) suggests, however, that Engelmann spruce and other North American spruces

are relatively soft-wooded trees (compared to oaks) that can be easily excavated by some species of woodpeckers. He suggests that the lack of use may be due to the absence of heartwood decay or to resin produced by spruce rather than to the density of the spruce wood. Whatever the reason for the observed lack of use, Conner believes that insufficient data exist to categorically classify live spruces as unsuitable for excavation by hairy woodpeckers.

Preferred nesting areas of hairy woodpeckers in east Tennessee were characterized by a large number of trees >23 cm dbh and associated high canopy biomass (Anderson and Shugart 1974). Hairy woodpeckers in Virginia apparently preferred areas with high stem density, but nested in areas with a wide range of basal areas, canopy heights, stem densities, and distances from cleared areas (Conner and Adkisson 1977). In northwestern Washington, hairy woodpecker nests were found in a variety of successional stages, though most were in, or at the edge of, old-growth forests (Zarnowitz and Manuwal 1985). Hairy woodpeckers in Washington are found in open rather than dense stands of timber (Larrison and Sonnenberg 1968), and in California's Sierra Nevada they prefer forests of low to moderate canopy closure (<70%) (Verner 1980). Both understocked and fully stocked stands in Virginia were suitable nesting areas as long as decayed trees were present (Conner et al. 1975). Hairy woodpeckers have even been reported nesting in the grass-forb stage of mixed coniferous forest regeneration by using stumps <1.5 m tall (Verner 1980).

Hairy woodpeckers require trees with a minimum dbh of 25 cm and a minimum height of 4.6 m for nesting (Thomas et al. 1979). Raphael and White (1984:24) found that "...diameter was the tree characteristic most closely correlated with nesting use" for 17 cavity-nesting birds. Conner and Adkisson (1976) found that canopy height had a greater influence on distinguishing between "possible nesting habitat" and "not nesting habitat" than did either basal area or stem density. In Vermont, no significant difference in mean tree height was detected between nest trees and adjacent non-nest trees (Runde and Capen 1987). Diameter at breast height (dbh) and diameter at nest height (dnh) were significantly greater for nest trees than non-nest trees ($\bar{x}$ dbh:27.1±1.3 cm vs. 23.9±0.7 cm, $P<0.05$; $\bar{x}$ dnh:22.4±1.1 cm vs. 13.2±9.6 cm, $P<0.01$). The probable optimum diameter range for hairy woodpecker nest trees is 25 to 35 cm dbh, and the probable optimum height range for nest trees is 6 to 12 m (Evans and Conner 1979). In Douglas-fir forests, however, hairy woodpeckers nest in older second-growth (41 to 120 yr) and mature (120+ yr) forests (Meslow and Wight 1975); these age classes are presumably taller than the optimum range suggested by Evans and Conner (1979). The average height of eight trees used for nesting in a Colorado aspen forest was 18 m, and ranged from about 11 to 21.3 m (Scott et al. 1980). Ten trees used for nesting in Virginia averaged 13.0 m tall and ranged from 4 to 26.5 m (Conner et al. 1975). The diameter of the tree at the cavity level in these 10 trees averaged 25.2 cm and ranged from 20 to 46 cm. In California, 19 nest trees averaged 13.7 m tall with an average diameter at the cavity level of 36.3±2.09 cm (Raphael and White 1984). Table 1 summarizes tree condition, nest heights, and nest tree diameter from several studies.

Table 1. Characteristics of nest sites selected by hairy woodpeckers in several study areas.

Source	Number of nests (n)	Tree condition Dead	Tree condition Live	Average nest height (range)	Average nest tree dbh (range)
Lawrence (1966) (NH)	11 (n=7 for dbh)	1	10	10.5 m (4.5-14 m) 34.9 ft (15-45 ft)	28 cm (25.4-34.8 cm) 11.1 inches (10-13.7 inches)
Conner et al. (1975) (VA)	10	5	5[a]	8.8 m (2.4-19.8 m) 28.9 ft (7.9-65 ft)	40.6 cm (20-64 cm) 16 inches (7.9-25.2 inches)
Jackman (1975) (OR)	33	?	?	7.6 m (5-10 m) 24.9 ft (16.4-32.8 ft)	?
Graber et al. (1977) (IL)	17	6	11[b]	4.6-10.7 m 15-35 ft	?
Mannan (1977) (OR)	7	?	?	18.2 m (7.9-41.8 m) 59.4 ft (25.9-137.1 ft)	92 cm (48-172 cm) 36.2 inches (18.9-67.8 inches)
Scott et al. (1980) (CO)	8	2	6	10 m (6.7-15.2 m) 33 ft (22-50 ft)	38 cm (25.4-58.4 cm) 15 inches (10-23 inches)
Raphael and White (1984) (CA)	19	16	3[c]	4.9±0.69 m 16.1±2.26 ft	43.8 cm 17.2 inches
Zarnowitz and Manuwal (1985) (WA)	16	16[d]	-	13±12 m 42.6±39.4 ft	41±13 cm 16.1±5.1 inches
Runde and Capen (1987) (VT)	21	10	11[e]	17.5±1.2 m 57.4±3.9 ft	27.1±1.3 cm 10.7±0.5 inches

[a] Four of the five nests in live trees were located in dead portions of the trees; the fifth was located in a totally live oak tree with a decayed heartwood (Conner, unpubl.).

[b] About one-half of these nests were located in dead portions of the trees.

[c] Located in dead portions of live trees.

[d] All nests located in broken-top trees.

[e] All 11 cavities were drilled through live wood.

Hairy woodpeckers will excavate in both hard and soft snags (Evans and Conner 1979); however, hairy woodpecker breeding densities were significantly positively correlated ($P \leq 0.01$) with soft snags in Iowa riparian forests (Stauffer and Best 1980). The hairy woodpecker was categorized as a soft snag excavator in Sierra Nevada forests (Raphael and White 1984). Evans and Conner (1979) estimated that 200 snags were necessary in order to support the maximum population of hairy woodpeckers on 40 ha of forest. Their estimate was based on a minimum annual need of four cavities per pair, and an assumption that only 10% of the available snags would be suitable for use. Snag density requirements decreased in direct proportion to the percentage of maximum population desired; e.g., 160 snags are required to support 80% of the maximum population, and 100 snags would support 50% of the maximum population. A similar estimate for the Blue Mountains of Oregon and Washington was that 180 snags/40 ha are necessary to support maximum populations of hairy woodpeckers (Thomas et al. 1979). Raphael and White (1984) distinguished between hard and soft snags in estimating the density of snags required to support the maximum density of hairy woodpeckers. They assumed a maximum density of 16 pairs/40 ha, an annual rate of excavation of 4 cavities/pair, and a reserve of 3 suitable cavities per pair to arrive at an estimate of 192 suitable snags/40 ha to support the maximum density. They further estimated that 4 hard snags are required to produce 1 soft snag, resulting in an estimate of 768 "hard snag equivalents" (Raphael and White 1984:56) per 40 ha. Although low numbers of snags can, in theory, support low-density woodpecker populations, enough snags to support 40% of the maximum population was assumed to be the minimum that will support a self-sustaining population of hairy woodpeckers in the Pacific Northwest (Bull 1978).

Interspersion and Composition

Territory size in a mature bottomland forest in Illinois averaged 1.1 ha and ranged from 0.6 to 1.5 ha (Calef 1953 cited by Graber et al. 1977). Reported territory size of hairy woodpeckers in the Blue Mountains of Washington and Oregon averaged 2.4 to 3.6 ha (Thomas et al. 1979). Evans and Conner (1979), however, reported an average territory size of 8 ha based on available literature, whereas territories reported for two hairy woodpeckers in Kansas were 9 and 15 ha (Fitch 1958). Home range and territory size are strongly influenced by habitat quality and, therefore, can be quite variable (Conner, unpubl.).

In a study of bird use of various sized forested habitats in New Jersey, hairy woodpeckers did not occur in areas of <2 ha (Galli et al. 1976). A minimum width of riparian forest necessary to support breeding populations of hairy woodpeckers in Iowa was 40 m (Stauffer and Best 1980). Robbins (1979) compared frequency of occurrence of hairy woodpeckers at Breeding Bird Survey stops in Maryland to the amount of contiguous forested area. The greatest decrease in frequency of occurrence was recorded at 4 ha of contiguous forested habitat, and Robbins (1979) proposed this value as a preliminary estimate of the minimum area necessary to support a viable breeding population of hairy woodpeckers. Conner (unpubl.), however, believes that 4 ha may represent the minimal area that hairy woodpeckers will use, but that such a small area could not support a viable breeding population, which he considers to be a minimum

of 250 pairs. He suggested a minimum habitat area of 12 ha to support several breeding pairs of hairy woodpeckers (R.N. Conner, U.S. Forest Service, Nacogdoches, TX; letter dated December 1, 1981).

Although the hairy woodpecker is considered a resident species throughout its range, altitudinal migrations between mountainous areas and lower elevations do occur (Bailey and Niedrach 1965).

Special Considerations

The hairy woodpecker has been classed as a "tolerant species" to habitat alteration in Iowa (Stauffer and Best 1980), but also has been suggested as a sensitive environmental indicator of the ponderosa pine community (Diem and Zeveloff 1980).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model was developed for application within forested habitat throughout the entire range of the hairy woodpecker. Use of the model differs, however, between forests in the eastern United States and the western United States. The differences in application are described in the model.

Season. This model was developed to evaluate the year-round habitat of the hairy woodpecker.

Cover types. This model was developed to evaluate habitat in the following forested cover types: Deciduous Forest (DF), Evergreen Forest (EF), Deciduous Forested Wetland (DFW), and Evergreen Forested Wetland (EFW) (terminology follows U.S. Fish and Wildlife Service 1981).

Minimum habitat area. A minimum of 4 ha of forested habitat has been estimated to be necessary to support a viable breeding population of hairy woodpeckers (Robbins 1979), although Conner (unpubl.) believes that such a small area may represent the minimum needed to support one pair rather than a viable breeding population. Conner (unpubl.) suggested 12 ha as a reasonable estimate of the area needed to support several pairs of hairy woodpeckers. Additionally, forested riparian zones should be at least 40 m wide to be considered as potential breeding habitat for hairy woodpeckers (Stauffer and Best 1980).

Verification level. An earlier draft of the HSI model for the hairy woodpecker was used in a field evaluation of model outputs compared to expert opinion (O'Neil et al. 1988). The following species experts participated in the field evaluation:

Dr. F.J. Alsop, III, East Tennessee State University, Johnson City

Dr. C.E. Bock, University of Colorado, Boulder

Dr. R.N. Conner, U.S. Forest Service, Nacogdoches, TX

Dr. J.A. Jackson, Box Z, Mississippi State, MS

Dr. F.C. James, Florida State University, Tallahassee

Dr. B.J. Schardien Jackson, Mississippi State, MS

Initial results indicated that outputs from the earlier model were poorly correlated ($r=0.07$, $P>0.50$) with habitat ratings by experts for 40 sites in eastern Tennessee (O'Neil et al. 1988). Important habitat criteria identified by the experts were used to modify the model in an attempt to more closely mimic the procedures used by experts to rate habitats. The major changes to the model as a result of the field evaluation were (1) optimum suitability for the average diameter of overstory trees was changed from 25 to 38 cm; (2) snags were assigned greater importance than live trees for nesting; (3) the variable "percent canopy cover of pines" was added to reflect a strong negative correlation ($r=-0.91$, $P<0.001$) between this variable and habitat ratings by species authorities; (4) the mathematical function used to calculate the cover suitability index was changed from a geometric mean to a multiplicative function; and (5) the suitability relationship for tree canopy closure was changed from a preference for moderate canopy closure to a preference for dense forest canopy. Correlation of outputs from the modified model to habitat ratings by species authorities improved considerably ($r=0.82$, $P<0.001$) (O'Neil et al. 1988).

All of the changes to the model as a result of the field evaluation were based on input from species experts and reflect hairy woodpecker ecology in forests in the eastern United States. The variable "percent canopy cover of pines" is not recommended as an appropriate variable in western forests; use of the model in western vs. eastern forests is described below. The current model is the direct result of the field evaluation; it has not been field tested.

Model Description

Overview. The hairy woodpecker can satisfy all of its habitat requirements within any one of the forested cover types listed above. Reproductive and cover needs are evaluated in this model. Although sufficient food is an obvious life requisite of the hairy woodpecker, I assume in this model that food will never be more limiting than cover and reproductive requirements and that water is not a limiting factor.

The following sections identify important habitat variables, describe suitability levels of the variables, and describe the relationships between variables.

Reproduction component. The hairy woodpecker is able to adapt to a variety of habitats, but suitable reproductive habitats must (1) be dominated by trees of sufficient size and decay for nesting, (2) have adequate snag densities, or (3) have some combination of the two.

The number of snags ≥25.4 cm dbh necessary to support maximum densities of hairy woodpeckers has been estimated to range from 180/40 ha (Thomas et al. 1979) to 200/40 ha (Evans and Conner 1979), or 4.5 to 5 snags/ha; a snag density of 5/ha is assumed to represent optimal conditions for reproduction (Figure 1a). This estimate refers specifically to nesting and roosting requirements and may not adequately satisfy foraging needs (Conner, unpubl.). Potential population density is assumed to decrease proportionally with a decrease in snag density. Although I assume in this model that low snag densities will support low woodpecker densities, Bull (1978) assumed that snag densities <40% of those needed for maximum population density would not support a self-sustaining population.

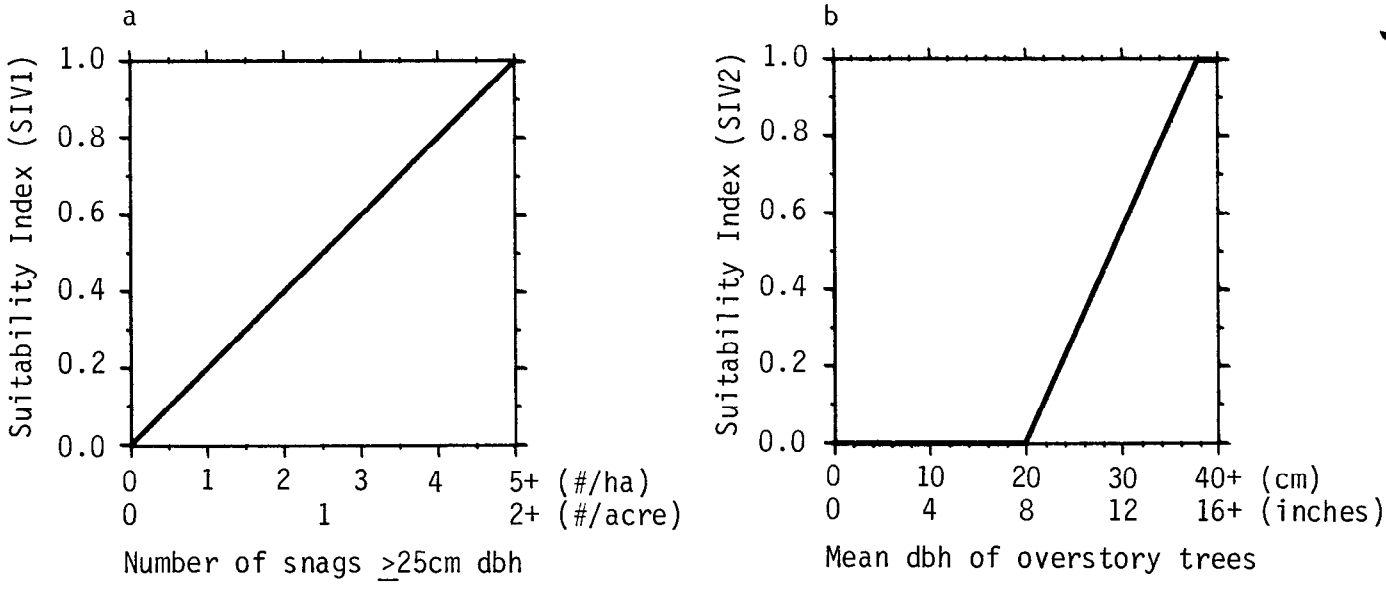


Figure 1. Relationships between variables used to evaluate reproductive habitat for the hairy woodpecker and suitability levels for the variables.

Hairy woodpeckers can excavate cavities in live trees provided that heartrot is present, and thus may inhabit a forested area even in the absence of snags. Runde and Capen (1987) believed that trees >30 cm dbh would be most useful to hairy woodpeckers, downy woodpeckers, and yellow-bellied sapsuckers (Syphrapicus varius). For this model, I assume that if the average dbh of overstory trees is ≥38 cm, then trees will be of optimum size for nesting. I assume that an adequate number of available (i.e., with heartrot) live trees will be present if the average dbh of overstory trees is ≥38 cm. There is little evidence correlating tree diameter and presence of heartrot, but the alternative is to physically examine trees for heartrot; this level of detail is presumed to be too great for the typical application of this model. Use of the average dbh of overstory trees does not consider the absolute number of available live trees. I assume that if an area meets the minimum requirements to be classified as a forest and is >4 ha, then the total number of trees available for potential nesting will be optimal. Assuming that adequate numbers of trees are present, the size and condition of the trees will determine whether the nesting potential will be low or high. The minimum reported dbh of a tree used for nesting by hairy woodpeckers is 20.1 cm (Conner et al. 1975). Thus, I assume that optimal conditions for this variable exist when the average dbh of overstory trees is ≥38 cm, and that conditions are unsuitable when the average dbh of overstory trees is ≤20 cm (Figure 1b). The values defining optimum and suitable levels of this variable are based on results of the field test mentioned earlier.

Overall nesting suitability is a function of the availability of snags or live trees. In the field test, experts consistently rated habitats without snags lower than habitats with snags (O'Neil et al. 1988), presumably because hairy woodpeckers cannot excavate in undecayed trees and prefer to forage on dead snags (Conner, unpubl.). Habitat suitability ratings in habitats without snags that were otherwise suitable were generally between 0.7 and 0.8 (on a 0-1 scale). I assume, therefore, that habitats without snags (i.e., all potential nest sites are in live trees) will have a maximum suitability rating of 0.75. An overall suitability index for nesting (SIN), based on the relationships described above, can be determined with Equation 1.

$$SIN = SIV1 + (0.75 \times SIV2) \quad (1)$$

[Note: If the value resulting from Equation 1 exceeds 1.0, it should be set to 1.0.]

Cover component. Besides having sufficient potential nest sites, at least three other habitat factors affect the overall suitability of a habitat for hairy woodpeckers. These three factors are the seral stage of a forest stand, the degree of canopy cover of the forest, and the proportion of pines in the canopy. These variables are assumed to influence food availability, foraging, nesting suitability, and cover, but are aggregated into a cover component in this model. Because these factors affect overall habitat suitability, they will be used in this model as modifiers of the reproductive value.

A measure of the seral stage of a forest is the average diameter of the overstory trees. Hairy woodpeckers may inhabit young forests, but at lower densities than in older forests. Because they do inhabit forests in a variety of seral stages, however, this habitat variable should not be strictly limiting. I assume in this model that the optimal seral stage exists when the average dbh of overstory trees is >25 cm (Figure 2a). When the average dbh of overstory trees is <15 cm, suitability is assumed to be one-half of optimum, i.e., a suitability index of 0.5.

The literature suggests that hairy woodpeckers apparently prefer forests of moderate canopy cover. Habitat ratings by species experts in the field test, however, tended to be higher in forest stands with a dense canopy, except that closed canopy stands were generally rated lower than stands with <100% canopy cover (O'Neil et al. 1988). I assume that optimal conditions for this variable occur at 85% to 90% (Figure 2b) with complete canopy cover representing less than optimal habitat. I further assume that canopy cover <15% will provide unsuitable habitat conditions. Since the definition of a forest is a cover type with at least 25% tree canopy cover, any forest will have canopy conditions of some positive suitability level for hairy woodpeckers.

Hairy woodpeckers inhabit a variety of deciduous, coniferous, and mixed deciduous-coniferous habitats. Habitat ratings by experts were negatively correlated ($r=-0.91$, $P<0.001$) with the percent canopy closure of pines; sites completely dominated by pines received relatively low habitat ratings (O'Neil et al. 1988). I assume in this model that an increase in the canopy cover of pines in a stand will generally reflect a decrease in habitat suitability for the hairy woodpecker, although a small amount of pines (≤10% canopy cover) is assumed to contribute to the diversity of cover and prey (Figure 2c). Sites completely dominated by pines are assumed to have a suitability index for this variable of 0.2. The apparent influence of pines on hairy woodpecker habitat suitability described above probably does not apply in western coniferous forests (C.E. Bock, Environmental, Population and Organismic Biology, University of Colorado, Boulder; letter dated February 24, 1986). I recommend that the variable "percent canopy cover of pines" be deleted from the model for application in western coniferous forests. It is unclear whether a similar negative relationship exists between other species of conifers in eastern forests and perceived habitat suitability for the hairy woodpecker.

Results from the field test of the earlier model indicated that the product of the suitability indices (Equation 2) for the cover component variables most closely reflected habitat ratings by species experts (O'Neil et al. 1988).

$$SIC = SIV3 \times SIV4 \times SIV5 \qquad (2)$$

As long as an area is classified as a forested type, all of the variables in Equation 2 will be greater than zero, and the index value for the cover component will likewise be greater than zero.

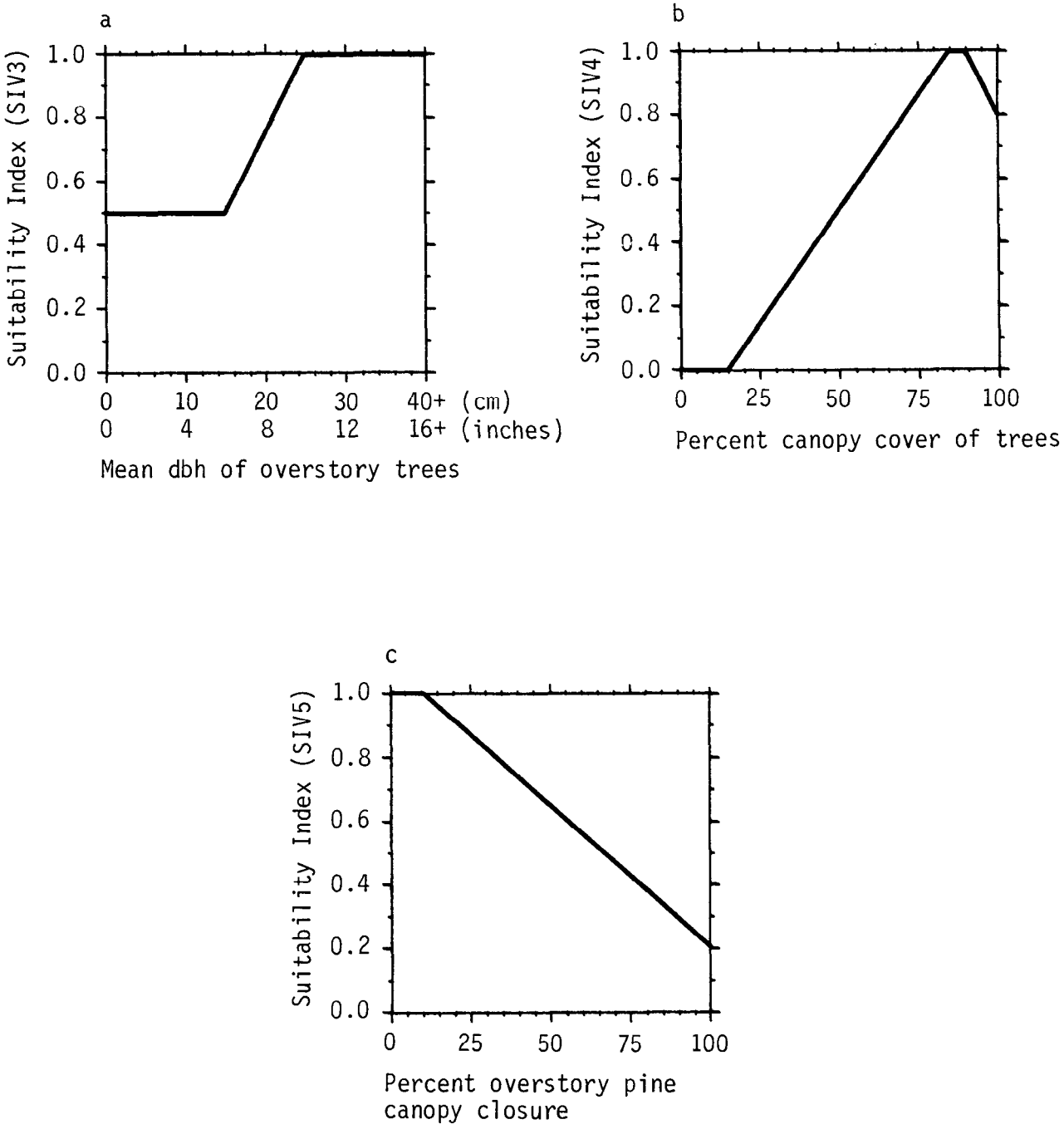


Figure 2. Relationships between variables used to evaluate cover for the hairy woodpecker and suitability levels for the variables.

HSI determination. The suitability index for the cover component is assumed to directly modify the suitability index for the reproduction component (Equation 3) to yield an overall HSI value for the hairy woodpecker in the habitat being evaluated. At optimal cover component conditions (i.e., SIC=1.0), the reproduction component will determine the habitat suitability index. If cover conditions are anything less than optimum, then the reproduction value will be reduced based on the quality of the cover conditions.

$$HSI = SIN \times SIC, \text{ or}$$

$$HSI = [SIV1 + (0.75 \times SIV2)] \times (SIV3 \times SIV4 \times SIV5) \quad (3)$$

[Note: In instances where SIN >1.0, it should be set equal to 1.0 prior to using Equation 3.]

Application of the Model

Summary of model variables. Several habitat variables are used in this model to evaluate habitat suitability for the hairy woodpecker. The relationships between habitat variables, life requisites, cover types, and an HSI are summarized in Figure 3. The definitions and suggested measurement techniques (Hays et al. 1981) for the variables used in this model are listed in Figure 4.

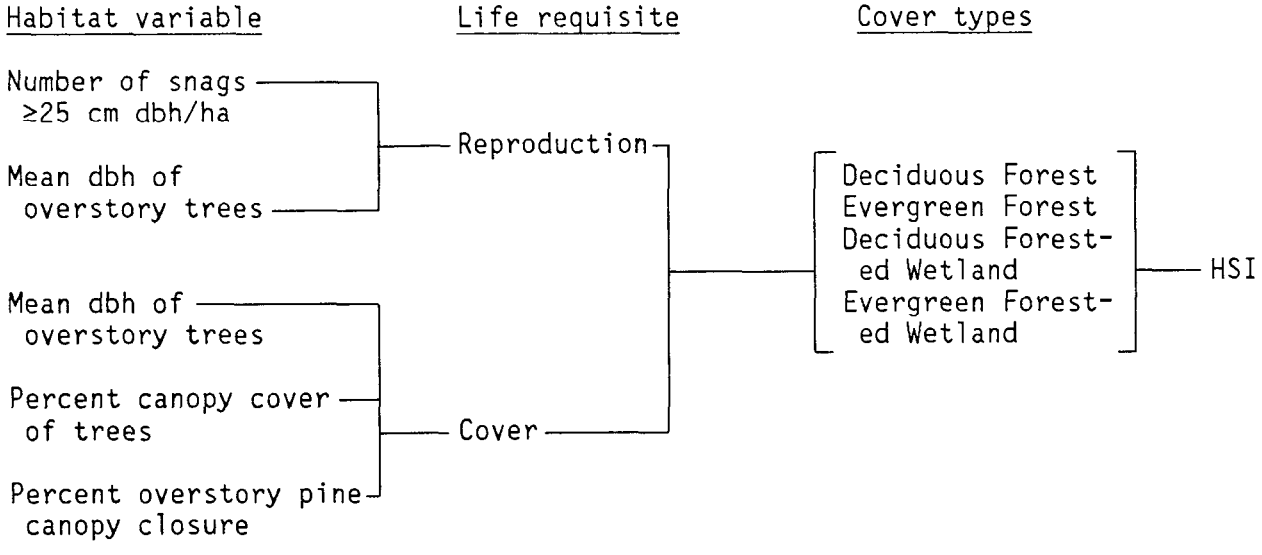


Figure 3. Relationships of habitat variables, life requisites, and cover types to the HSI for the hairy woodpecker.

Variable (definition)	Cover types	Suggested technique
Number of snags ≥25 cm dbh per ha [actual or estimated number of standing dead trees ≥25 cm dbh and ≥1.8 m tall. Trees in which ≥50% of the branches have fallen, or are present but no longer bear foliage, are to be considered snags].	DF,EF,DFW, EFW	Quadrat, remote sensing
Mean dbh of overstory trees [the mean diameter at breast height (1.4 m) above the ground of those trees that are ≥80% of the height of the tallest tree in the stand].	DF,EF,DFW, EFW	Diameter tape
Percent canopy cover of trees [the percent of the ground surface that is shaded by a vertical projection of all woody vegetation >6.0 m tall].	DF,EF,DFW, EFW	Line intercept, remote sensing
Percent overstory pine canopy closure [the percent of the ground surface that is shaded by a vertical projection of all pines (*Pinus* spp.) >6.0 m tall and ≥80% of the height of the tallest tree in the stand; recommended for use in eastern U.S. forests only (see text for explanation)].	DF,EF,DFW, EFW	Line intercept, remote sensing

Figure 4. Definitions of variables and suggested measuring techniques.

Model assumptions. A number of assumptions were made in the development of this HSI model.

1. The criteria identified for evaluation of hairy woodpecker habitat are generally assumed to be appropriate throughout the range of the species. Many of the variables and variable relationships identified in the model resulted from a field test of an earlier HSI model in eastern Tennessee. As a result, the model is probably best suited for application in the southeastern United States. No information is available to indicate the model's applicability to other parts of the United States, except there is adequate information that the presumed negative influence of pines does not apply to western U.S. forests (see number 7 below).

2. Nest sites can be provided by a combination of snags and live trees, but live trees in the absence of snags cannot provide optimal nesting habitat.

3. A measure of the average diameter at breast height of overstory trees is assumed to be an adequate estimator of the suitability of live trees for nesting. An adequate number of trees in suitable condition (i.e., with decayed heartwood) is assumed to be present as long as the cover type is classified as a forest (i.e., has ≥25% canopy cover) and tree diameter is suitable.

4. All tree species are assumed to be available for excavation by hairy woodpeckers. It is possible that some species may not typically have decayed heartwood and, therefore, will be unsuitable for excavation. It is also possible that some tree species will be unsuitable for excavation because of resins or the density of the wood. Little definitive evidence is available, however, to determine whether some tree species are absolutely unsuitable for excavation by hairy woodpeckers.

5. Hairy woodpeckers can inhabit a variety of forested habitats, but potential nesting in live trees will only be provided by older forest stands with large trees.

6. Hairy woodpeckers prefer forest stands with a dense canopy. This assumption may be valid in the southeastern United States but may be invalid in the western United States, where the forest canopy is generally less dense than in the east. The relationships described for percent canopy cover of trees and habitat suitability (Figure 2b) may need to be redefined for use in western forest habitat if the standard of comparison in such applications is intended to be the best regional habitat. Use of the model without modification will yield outputs based on a standard of comparison developed in the southeastern United States.

7. The presence of pines above a minimal level (10%) is considered to be a negative factor in habitat suitability for the hairy woodpecker in this model (Figure 2c). Pine and other coniferous forests in the western United States, however, are regularly used by hairy woodpeckers. I recommend that this variable be eliminated for application in western coniferous forests.

8. The hairy woodpecker breeds and winters throughout most of North America. I assume in this model that the year-round suitability of a habitat is a function of the habitat suitability during both the reproductive and nonreproductive seasons. Model users who wish to evaluate either of the seasons rather than both can simply use the appropriate portion of this model. Users should be aware that model outputs in such instances will refer only to a portion of the year-round needs of the hairy woodpecker.

SOURCES OF OTHER MODELS

Conner and Adkisson (1976) developed a model to distinguish between "possible nesing habitat" and "not nesting habitat" for the hairy woodpecker in oak-hickory forests of southwestern Virginia. Three variables were included in the model: basal area (m^2/ha), canopy height to crown cover (m), and stem density (number/ha). The model includes coefficients for the three variables, an aggregation function, and a linear decision scale. The model was applied to two groups, the first consisting of stands containing hairy woodpecker nests, and the second consisting of six random plots in each of five habitat types; results of the analysis were significant (P=0.02).

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16. Abstract (Limit: 200 words)

A review and synthesis of existing information were used to develop a Habitat Suitability Index (HSI) model for the hairy woodpecker (Picoides villosus). The model consolidates habitat use information into a framework appropriate for field application, and is scaled to produce an index between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). HSI models are designed to be used with Habitat Evaluation Procedures previously developed by the U.S. Fish and Wildlife Service.

17. Document Analysis a. Descriptors

Birds
Wildlife
Habitability
Mathematical models

b. Identifiers/Open-Ended Terms

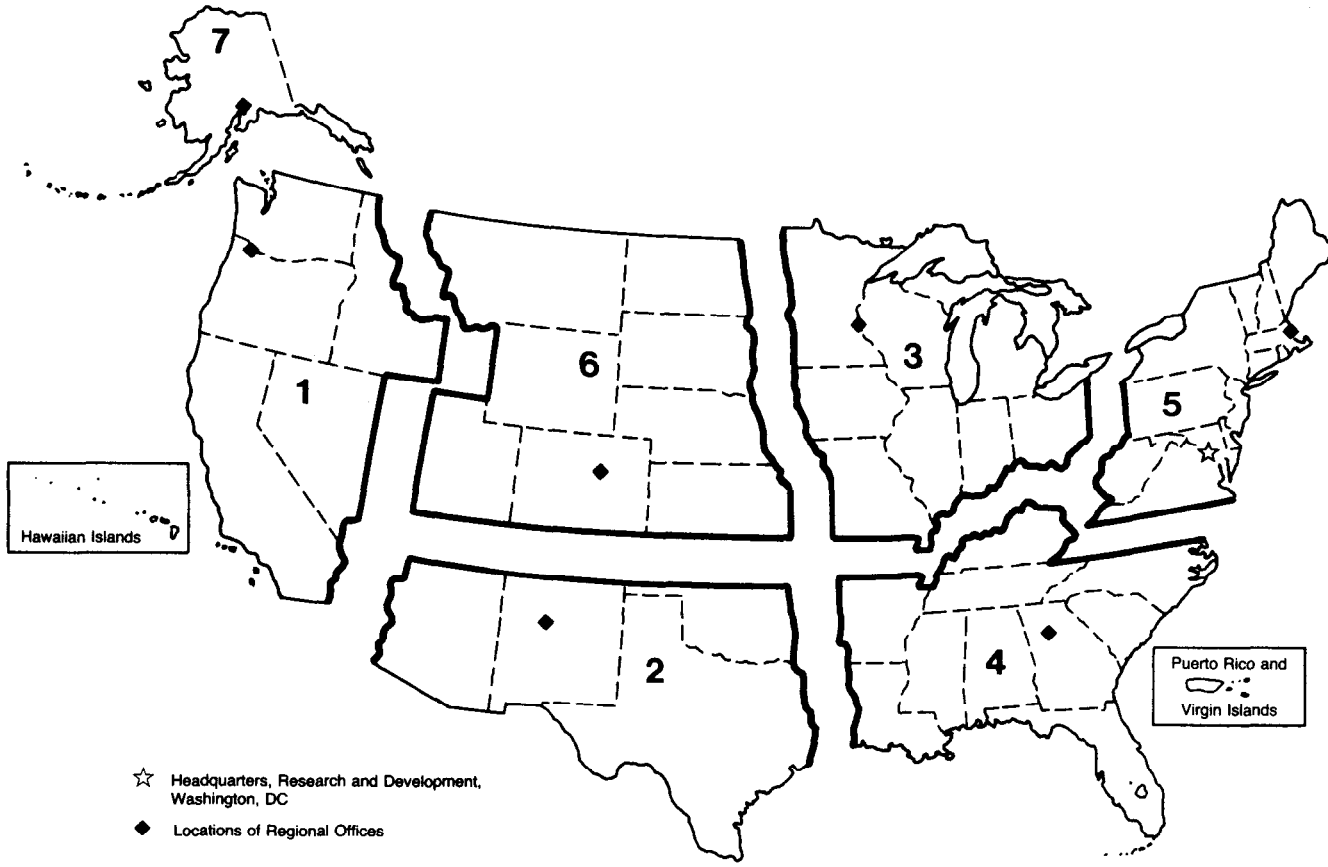
Hairy woodpecker
Picoides villosus
Habitat suitability

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Release unlimited	Unclassified	19
	20. Security Class (This Page) Unclassified	22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

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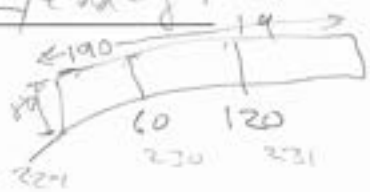
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APPENDIX C: FIELD DATA SHEETS

DATA SHEET TS_30_L HEP P. 21

DATE 12/8/21 TIME 3:15 NAMES Slaven & Dan

PHOTO# 229-231 WYPT #40-end #41-West PLOT#/LOCATION #2 end of project



TRANSECT TOTAL LENGTH (FT) 80? / 80? / _____

RSG MODEL: V1 (SHRUB<3M) (FT) 30 / 20 / _____

V2 (indiv tree hts, ft) 20 Pecan 18 Pecan 35'lo 20'Hill _____ _____

V3 (TREE>3M) (FT) 45 / 55 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (5) / (5) Tree/Shrubs / _____

SNAG (indv diam, in) 6" – limb adjacent ground 20m (2 pieces, Root wad >10" 5–7' above ground)

V5, snag count >4" 1

V6 ALL WOODY 75' / 75' / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 75' / 80' / _____

V3 TREE CANOPY CLOSURE 40' / 50 / _____

V4 # SPECIES (list names) Pecan, VO, Willow, BB, unid tree w/ hanging seeds, Hackberry

V5 UNDERSTORY DENSITY @2FT 80 / 60 @6FT 70 / 50 /

@14FT 50 / 40 AVERAGE (75) / (50) /

YW MODEL: V1 DECID SHRUB COVER 75' / 60' / _____

V2 SHRUB HTS (ft) (nearest .1M) T1 2+M almost all T2 1.5–2+M variable

Buckeye 15 10/8 (6v6) unid 21" 18" 4 grouped unid 30" willow

V3 hydrophytic SHRUB COVER 75' / 55' / _____

V4 tall tree Ø / 20'

DW MODEL: V1 SNAG COUNT >6", see above Ø

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above Ø

V2/V3 DbH overstory 15" Ve 10/8 pecan 11" pecan 21" rock cedar 11' rock oak 5" pecan (8–9 6–8 stems) willow

V4 CANOPY COVER 10% / 40% / _____

(6m+)

DATA SHEET TS_30_L HEP P. 20

DATE 12/8/21 TIME 1:17pm NAMES Dave F, Steve S, G
#226-228 #39 Seed

PHOTO# _____ WYPT #40 Nest PLOT#/LOCATION #20



TRANSECT TOTAL LENGTH (FT) 80' / 80' / _____

RSG MODEL: V1 (SHRUB<3M) (FT) 20 / 90 / _____

V2 (indiv tree hts, ft) 18(@) Pecan 22' 48' will @ 23 LO @ 25 @ VO _____

V3 (TREE>3M) (FT) 25 / 20 / _____ tall/short trees; shrub; tree; tall/short snags

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (5) / (5) / _____

SNAG (indv diam, in) 4+" (6" but <4' off ground) _____ _____
V5, snag count >4" _____

V6 ALL WOODY 45' / 60' / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 45' / 60' / _____

V3 TREE CANOPY CLOSURE 20% / 10% / _____

V4 # SPECIES (list names) Willow, Willow, BirB, Pecan, Live Oak, Valley Oak

V5 UNDERSTORY DENSITY @2FT 50% / 70% @6FT 50 / 50% ___
@14FT 40 / 30% ___ AVERAGE 45% / (50) ___

YW MODEL: V1 DECID SHRUB COVER 40' / 60' / _____ Note: in canopy must be >15 ft

V2 SHRUB HTS (ft) T_1 all > 2m+
(nearest .1M) T_2 almost all >2m+ (w/ 1.8M avg) _____ _____ _____

V3 hydrophytic SHRUB COVER 45' / 60' / _____

Vy Tall tree Ø / Ø

DW MODEL: V1 SNAG COUNT >6", see above (.) = marginal, prefer Ø

Pecan
Pecan (11' (18/34/22/28/26/22)
6" VO
6" LO
12" Pecan dbh

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above [plot entered, obviously Ø]

V2/V3 DbH overstory 11"(pecan (18, 34, 22, 28, 26, 22) large Live Oak
6" VO 6" pecan 6" LO _____ _____ _____
40" large willow thicket
30" large willow thicket

V4 CANOPY COVER Ø / 5% / _____

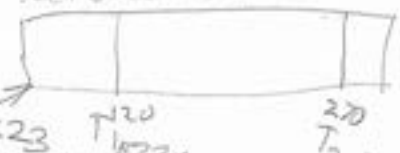
DATA SHEET TS_30_L HEP P. 19

DATE 12/8/21 TIME 11:21am NAMES Steve Sch, Dave F

PHOTO# 223-225 WYPT #38-Send #39-N end PLOT#/LOCATION #19

TRANSECT TOTAL LENGTH (FT) 100 / 90 / ____

all herbaceous stable



RSG MODEL: V1 (SHRUB<3M) (FT) 30 / 0 / ____

V2 (indiv tree hts, ft) 21' fig @8 / 14' will @1 / 15' will @2 / 20' 18' @0 VO / 13' will 20' @1 / (3) Oaks Valley ? / ____

V3 (TREE>3M) (FT) 0 / 0 / ____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (2) / (1) / ____

SNAG (indv diam, in) 6" / 4" / <6" / <6" / <4 / <4

V5, snag count >4" (4)

V6 ALL WOODY 30 / 0 / ____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 50 / 0 / ____

V3 TREE CANOPY CLOSURE 0 / 0 / ____

V4 # SPECIES (list names) (4+) VO Will, Will 2nd, Unid tree w/ Bills, fig, BB Live Oak, Will, Herbs

V5 UNDERSTORY DENSITY @2FT 30 (0) @6FT 30 / 0 / ____

@14FT 10 / 0 ____ AVERAGE (2) / 0 / ____

YW MODEL: V1 DECID SHRUB COVER 30' / 0 / ____

V2 SHRUB HTS (ft) (nearest .1M) T1 = 1.0 - 1.5m ____ ____ ____ ____

T2 = 0 ____ ____ ____ ____

Basal area (large Will Kink @ 30") (Willow ck 25") (VO 3/6/4) (VO 6) willow cheks 20/20 20/20 Fig 20

V3 hydrophytic SHRUB COVER 30' / 0 / ____

V4 tall Tree 0 / 0

DW MODEL: V1 SNAG COUNT >6", see above (1)

V2 BASAL AREA (cruz-all or see HW, below) ____ / ____ / ____

HW MODEL: V1 SNAG COUNT >10", see above (0)

V2/V3 DbH overstory (6/6 Fig) Fig 6 5 5 4 (willows up to 6") ____ Fig 20

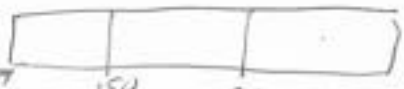
____ ____ ____ ____ ____ ____

V4 CANOPY COVER 0 / 0 / ____

DATA SHEET TS_30_L HEP P. 18

DATE 12/8/21 TIME 1018am NAMES Steve Eich, Dave Fell
220-222 #39 end #18
PHOTO# _____ WYPT #38 N end PLOT#/LOCATION _____

TRANSECT TOTAL LENGTH (FT) 80 / 75 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 40 / 20 / _____ #220

V2 (indiv tree hts, ft) 45' V0 © 25' Will © 25' W © 40' BW © 25' W © _____

V3 (TREE>3M) (FT) 20 / 30 / _____ shrub/tree

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (5) / (5) / _____

SNAG (indv diam, in) (<4) 45" (<4) 6" _____ _____
V5, snag count >4" (2)

V6 ALL WOODY 60 / 65 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 60 / 70 / _____

V3 TREE CANOPY CLOSURE 20 / 65 / _____

V4 # SPECIES (list names) Will, BW, V.O, BB, 2nd will spp

V5 UNDERSTORY DENSITY @2FT 50/30/ @6FT 50/40/
@14FT 20/60/ AVERAGE (40) (40) /

YW MODEL: V1 DECID SHRUB COVER 60' / 30' / _____

V2 SHRUB HTS (ft) T1 - 2+m throughout
(nearest .1M) T2 - 2+m - all shrubs

V3 hydrophytic SHRUB COVER 60 / 30' / _____

V4 tall tree Ø / 40' /

DW MODEL: V1 SNAG COUNT >6", see above (1)

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above Ø
V2/V3 DbH overstory 14/12/8/6 BW; V0 25

V4 CANOPY COVER 15 / 40' / _____

Boyd area
willow thicket 35"
BW 14/12/8/6"
5/3/3/3/3
willow thicket 30"
V0 25"
SM will 25"
stems

DATA SHEET TS_30_L HEP P. 17

DATE 12/7/24 TIME 3:30 NAMES Steve Sly, Jos, Mia.

PHOTO# #217-219 WYPT #36 send #37 end PLOT#/LOCATION #17

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 35 / 85 / _____

V2 (indiv tree hts, ft) 30 BW 35 BW 20 w 24 w 44 bw 6-7 willows 20+ after 20

V3 (TREE>3M) (FT) _____ / 30 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / 5 / _____

SNAG (indv diam, in) 4" (alder) 5 a few others <4" _____ _____ _____ _____

V5, snag count >4" 1

V6 ALL WOODY 50' / 85' / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 85 / 85' / _____

V3 TREE CANOPY CLOSURE 5% / 35% / _____

V4 # SPECIES (list names) BW, Sitka Willow

V5 UNDERSTORY DENSITY @2FT 50 / 85 / _____ @6FT 30 / 60 / _____
@14FT 10 / 25 / _____ AVERAGE 30 / 65 / _____

YW MODEL: V1 DECID SHRUB COVER 50 / 85 / _____

V2 SHRUB HTS (ft) 1.5M 2M _____ _____ Note: interpret as 30 feet max + 5 feet, 2+ m
(nearest .1M) T2 10x30, 2+m _____ _____ matches photo 217

V3 hydrophytic SHRUB COVER 50 / 85 / _____

V4 0 / 0

DW MODEL: V1 SNAG COUNT >6", see above 0

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above 0

V2/V3 DbH overstory (3x 8-9") None 20" Ok 12" BW 24" BW _____ _____ _____ _____ _____

V4 CANOPY COVER 0 / 25% / _____

Bank area of willow 30" wall
willow 4 at 50' wall
8" willow
20" LO
20" w/ thicket
20" w/ thicket
24" BW
12" BW

DATA SHEET TS_30_L HEP Owl on tall willow tree P. 16

DATE 12/7/21 TIME 2:22 NAMES Stenseth, Jess, Mir

#214-216 #35-Seed

PHOTO#_____ WYPT #36 No. 1 PLOT#/LOCATION #16

TRANSECT TOTAL LENGTH (FT) 150' / 120' / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 10 / 60 / _____ Willow BW Willow Willow

V2 (indiv tree hts, ft) 15 _____ 12 _____ 35 _____ 22 _____ 40 _____ 25 _____

V3 (TREE>3M) (FT) 130 / 30 / _____ Tall/Short shrubs, trees, tall shrubs

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / 5 / _____

SNAG (indv diam, in) 10'+ _____ 4" _____ Owl Willow _____ _____ _____

V5, snag count >4" 2

V6 ALL WOODY 135' / 90' / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 135 / Not recorded / _____ guess 90' from here and here

V3 TREE CANOPY CLOSURE 80 / Not recorded / _____ guess 30 ac/belena & ac/here

V4 # SPECIES (list names) Sitka W.11, live Oak, BW, RR, Coyote Bush, Wild rose

V5 UNDERSTORY DENSITY @2FT 90 / 85 / _____ @6FT 90 / 30 / _____

@14FT 80 / 10 / _____ AVERAGE 85 / 40 / _____

YW MODEL: V1 DECID SHRUB COVER 135' / 90" / _____

V2 SHRUB HTS (ft) T1 predominantly 2+ M throughout _____ _____ _____ _____ Basal area at w.11 is 5" 3.0" 100's of 1" stems

(nearest .1M) T2 = 2/3 1.2m + 1/3 2+m _____ _____ _____

V3 hydrophytic SHRUB COVER 135 / 90 / _____

(1/4 tall tree 10'/8"

DW MODEL: V1 SNAG COUNT >6", see above 1

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____ BW 8" w.11 20" willow 8" wild rose 8"

HW MODEL: V1 SNAG COUNT >10", see above 1

V2/V3 DbH overstory 16" w.11 extra-20w.11 extra 28-32w.11 _____

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 10 / 20' / _____

DATA SHEET TS_30_L HEP P. #15

DATE 2/2/21 TIME #12:42p NAMES Steve, Seb, Jess, Mir

2111-213 #34 (end) #35 (mid) just before Bend

PHOTO#_____ WYPT #35 (mid) PLOT#/LOCATION #15

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 40 / 30 / _____

V2 (indiv tree hts, ft) (V) Will 25 / (V) Will 25' / Ponderosa 30 (c) / 22Ø / Will 220 / 12' BW (c) / BL 55 (c) / BW 45 (c) / 35' Ponderosa (c)

V3 (TREE>3M) (FT) Ø / 20 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (1) Evergreen / (5) tall shrub, short shrub / _____

SNAG (indv diam, in) 10" 6" 8" 6" _____ _____

V5, snag count >4" 2

V6 ALL WOODY 50 / 50 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 90 / 60 / _____

V3 TREE CANOPY CLOSURE Ø / Ø / _____

V4 # SPECIES (list names) Red willow, BB, Butt W, Goo, Thirtleaf (Nolapine) spp, Cor, Oak, Blk locust, Walnut

V5 UNDERSTORY DENSITY @2FT 50 / 70 / ___ @6FT Ø / 30 / ___

@14FT Ø / 5 / ___ AVERAGE (5) / (30) / ___

YW MODEL: V1 DECID SHRUB COVER 50 / 50 / _____

V2 SHRUB HTS (ft) T1 N - guess, .5m Note; can't be "half" must be 70% or more _____ _____ _____

(nearest .1M) T2 N half 5m >2m 30% _____

V3 hydrophytic SHRUB COVER 40 / 50 / _____

* V4 Tall Tree Ø/Ø

DW MODEL: V1 SNAG COUNT >6", see above 2

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above 1

V2/V3 DbH overstory 16 (Ponderosa) 8" (Willow Big Stem) 13 7/8" (walnut) 7" Bent 23" _____

13 1/2" (Walnut) _____ _____ _____ _____ _____

V4 CANOPY COVER Ø / 10 / _____ (very little, only 6 in 30m)

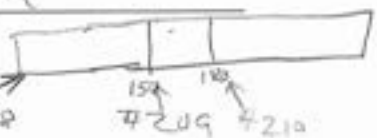
Basal area
BW - 16" stems
Will - 10" stems
Will - 24 stems
BW - 6"
Will - 20"
Red berry willow - 18"
Narrowleaf shrub willows 30+

DATA SHEET TS_30_L HEP P. 14

DATE 12/7/21 #208-210 TIME 1155pm #33 Send NAMES Steve Sch, Jess, Mir.

PHOTO# _____ WYPT #34 Next PLOT#/LOCATION #14

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 32 / 40 / _____

V2 (indiv tree hts, ft) 3 willow 25 20 25 BW 20 _____

V3 (TREE>3M) (FT) 2 45 / 30 / _____ tall/skinny shrubs

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / 5 / _____

SNAG (indv diam, in) 4" 6" 8" (~4x3', some taller or bigger)

V5, snag count >4" 3+

V6 ALL WOODY 77 / 74 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 100 / 100 / _____

V3 TREE CANOPY CLOSURE 40% / 30% / _____ Fuzzy brown bush

V4 # SPECIES (list names) BB, W, RoW, BW, UNID, (5)

V5 UNDERSTORY DENSITY @2FT 80 / 60 / @6FT 30 / 35 / _____
@14FT 40 / 20 / _____ AVERAGE 55 / 32 / _____

YW MODEL: V1 DECID SHRUB COVER 77 / 74 / _____ Rose bushes

V2 SHRUB HTS (ft) (nearest .1M) 1 1.3M BB to 1/2 + 1/2 2m+ willow _____ BW 4x4
2 0.7 x 60% + 40% 2m+ willow _____ BW total 20'
willow total 10'

V3 hydrophytic SHRUB COVER 77 / 74 / _____

(V4 tall tree - 20 / 0

DW MODEL: V1 SNAG COUNT >6", see above 2+ tree/stem diam ctr in work area willows w 4" stems

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____ → see dl method
willow 15"
SW willow - 15"

HW MODEL: V1 SNAG COUNT >10", see above Ø

V2/V3 DbH overstory (2-4" willow) 18" to 24" BW, 4-5 stems 8" (spreading shrub 25" stems) fuzzy 6"

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 30% / 20% / _____

(6m²)

DATA SHEET TS_30_L HEP P. #13

DATE 12/7/21 TIME 10:47am #32 Seed NAMES Steve & Jess, Mer

PHOTO# ~~#206-209~~ #205 WYPT #33 Seed PLOT#/LOCATION #13

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 80 / 80 / _____

V2 (indiv tree hts, ft) 38@ Hackberry 25@ Hackberry BW BW 20' 30' _____

V3 (TREE>3M) (FT) 5 / 5 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 shrub free / 5 shrub tall/short / _____

SNAG (indv diam, in) 4 4 5 4" _____ _____
V5, snag count >4" 4

V6 ALL WOODY 85 / 85 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 100 / 100 / _____

V3 TREE CANOPY CLOSURE 5' / Ø / _____

V4 # SPECIES (list names) BW, Hackberry, Willow, silver, red, wild Brown-fuzzy fruit

V5 UNDERSTORY DENSITY @2FT 90 / 90 / ___ @6FT 30 / 50 / ___ Basal cream
@14FT 10 / 0 / ___ AVERAGE 35 / 35 / ___

BW 6x5'
Hb ~~Hack~~ 18'
willow 20x4'
BW 6x4
Hb 10/9
BW -24" total
BW 24" total
willow - 45"+

YW MODEL: V1 DECID SHRUB COVER 80 / 80 / _____

V2 SHRUB HTS (ft) (nearest .1M) T1 - 1m BB, >3m BB, 2m+ willow _____ _____
T2 - 2m+ (some tall) _____ _____

V3 hydrophytic SHRUB COVER 80 / 80 / _____

V4 - tall tree Ø / Ø

DW MODEL: V1 SNAG COUNT >6", see above Ø

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

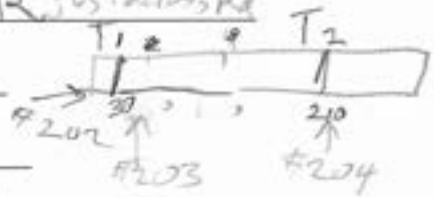
HW MODEL: V1 SNAG COUNT >10", see above Ø
V2/V3 DbH overstory 10/9 12 8 10 15" BW 30" willow
18" _____ _____ _____ _____ _____

V4 CANOPY COVER Ø / Ø / _____

DATA SHEET TS_30_L HEP P. 12

DATE 9/7/21 TIME 9:13AM NAMES Steve Sch, Jess, Mir

PHOTO# _____ WYPT 432-Nend PLOT#/LOCATION #12 Sustacious Rd



TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____

RSG MODEL: V1 (SHRUB<3M) (FT) 75 / 40 / _____

V2 (indiv tree hts, ft) 33 (M) _____ 20 BW 4x20' W 25 BW _____ _____

V3 (TREE>3M) (FT) 30 / 30 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / 5 / _____

SNAG (indv diam, in) 28" 22" 4" 4 _____ _____

V5, snag count >4" 4

V6 ALL WOODY 100 / 75 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 100 / 100 / _____

V3 TREE CANOPY CLOSURE 20 / 30 / _____

V4 # SPECIES (list names) BW BB, Will, Red, Valley Oak

V5 UNDERSTORY DENSITY @2FT 95 / 80 / ___ @6FT 60 / 60 / ___
@14FT 20 / 50 / ___ AVERAGE 60 / 70 / ___

YW MODEL: V1 DECID SHRUB COVER 95 / 75 / _____

V2 SHRUB HTS (ft) (nearest .1M) T_1 = predominantly 2+ m (taller BB here)
~~T_2 = BB (1.8m) + taller 2+ BW~~

V3 hydrophytic SHRUB COVER 95 / 75 / _____

DW MODEL: V1 SNAG COUNT >6", see above 3

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above 2
V2/V3 DbH overstory 14 13 32 4" 4 8

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 20 / 20 / _____

Canted stems est total cover Rec Bush

Basal area est

Willow (14), 13, 32 4" Willow Multi Bush 4x20 1x20 4x15" 30" BW 15" BW Tahoe

DATA SHEET TS_30_L HEP P. 11

DATE 12/3/21 TIME 4:18pm NAMES Schmid, Saw

PHOTO# 199→201 WYPT _____ PLOT#/LOCATION 411 Past Powerline Gate

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____

RSG MODEL: V1 (SHRUB<3M) (FT) 40 / 100 / 199→201

V2 (indiv tree hts, ft) 30 25 30 20 ? _____ _____

V3 (TREE>3M) (FT) 40 / 0 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / 5 / _____

SNAG (indv diam, in) 10+ 10"+ 10"+ _____ _____ _____
V5, snag count >4" _____

V6 ALL WOODY 100 / 100 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 100 / 100 / _____

V3 TREE CANOPY CLOSURE 40 / 0 / _____

V4 # SPECIES (list names) Rose, Willow, Bare

V5 UNDERSTORY DENSITY @2FT 70 / 100 / ___ @6FT 70 / 60 / ___
@14FT 40 / 20 / ___ AVERAGE 60 / 60 / ___

YW MODEL: V1 DECID SHRUB COVER 90 / 100 / _____

V2 SHRUB HTS (ft) (nearest .1M) T_1 – 1.5m+ _____ _____ _____ _____
T_2 – 1.5 – 2m _____ _____ _____

V3 hydrophytic SHRUB COVER 40 / 100 / _____

DW MODEL: V1 SNAG COUNT >6", see above 3

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above 3
V2/V3 DbH overstory 6 6 _____ _____ _____

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 30 / 0 / _____

Just before Powerline Gate

Basal nearest
8 wil
10 Bw
20 Bw (multiple)
6 HD
lowish
25 w ill 8in
30' w ill 13in
8 rel b
3-4 willows
20" total
2 gone within 15' rad.
add up
<40 = 20"
1/3 plot

(No measure) guesses

1/4 tall tree 20 / 0

DATA SHEET TS_30_L HEP P. 10

DATE 12/3/21 TIME 329pm NAMES Steve M+Sch, Sav

196 Next = 30

PHOTO# 197, 198 WYPT Sav 1529 PLOT#/LOCATION #10 under powerline

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 30 / 60 / _____

V2 (indiv tree hts, ft) N15-20 (N20-25) _____ _____ _____ _____

V3 (TREE>3M) (FT) 70 / 40 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 multiple layer tree / 5 Shrub / _____

SNAG (indv diam, in) 6" Broken limb _____ _____ _____ _____ _____

V5, snag count >4" 1

V6 ALL WOODY 100 / 100 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 100 / 100 / _____

V3 TREE CANOPY CLOSURE 90+ / 30% / _____

V4 # SPECIES (list names) RB, BW, UNID Cw/Cottonwood, Peachleaf Willow, UNID Willow, Elderberry, UNID Near top

V5 UNDERSTORY DENSITY @2FT 100 / 100 / ___ @6FT 80 / 80 / ___

@14FT 70 / 50 / ___ AVERAGE 90 / 80 / ___

YW MODEL: V1 DECID SHRUB COVER 100 / 100 / _____

V2 SHRUB HTS (ft) T1 - 2M _____ _____ _____ _____

(nearest .1M) T2 - 20%, 1.2-1.5 BB; some taller than 2m avg ~1.8

V3 hydrophytic SHRUB COVER 100 / 100 / _____

(V4 tall tree - 0/10)

DW MODEL: V1 SNAG COUNT >6", see above 1

Missing data Photos 196, 197 show very dense willows, estimate 2-3" x 50' x 300' / 43560 = 9' / yd = 30,000

V2 BASAL AREA (cruz-all or see HW, below) _____ / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above 0

V2/V3 DbH overstory 15" willow 10" willow _____ _____ _____ _____

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 15 / 25 / _____

DATA SHEET TS_30_L HEP P. 9

DATE 2/3/09 TIME 2:30pm NAMES Steve Sch; Steve M, Savannah

PHOTO# 193 194, 195 WYPT ~~#28~~ #29 PLOT#/LOCATION #9

TRANSECT TOTAL LENGTH (FT) 60 / 50 / _____ (exclude wetland)



RSG MODEL: V1 (SHRUB<3M) (FT) 60 / 0 / _____

V2 (indiv tree hts, ft) 25V 25' _____ _____ _____ _____

V3 (TREE>3M) (FT) 0 / 40 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (5) / _____ / _____

(Note: Not Recorded - noted obscured ground by thick blackberry)

SNAG (indv diam, in) _____ _____ _____ _____ _____ _____

V5, snag count >4" _____

V6 ALL WOODY 60 / 50 / _____

RFCT MODEL: V1(tree hts, see above) 25V

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 60 / 50 / _____

V3 TREE CANOPY CLOSURE 0 / 25 / _____

V4 # SPECIES (list names) BW, RW, Cpd Unids, Red Oak seedlg

% V5 UNDERSTORY DENSITY @2FT 100/100/ @6FT 5:/80/___

@14FT 0 / 70 / ___ AVERAGE 50 / 80 / ___

YW MODEL: V1 DECID SHRUB COVER 60 / 50 / _____

V2 SHRUB HTS (ft) 1 mostly 1.5M BB, Nothing else _____ _____

(nearest .1M) T2 Willows 2+M _____ _____ _____

V3 hydrophytic SHRUB COVER 60 / 50 / _____

(Vy fallax 0 / 0) occasional

DW MODEL: V1 SNAG COUNT >6", see above _____ mostly BB mostly BB

V2 BASAL AREA (cruz-all or see HW, below) this / (Normans) / _____

(10x4 prism)

HW MODEL: V1 SNAG COUNT >10", see above _____

V2/V3 DbH overstory ~8" (ash) (20/10/1), 8+ smaller BW _____

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 0' / 25' / _____

DATA SHEET TS_30_L HEP P. 8

DATE 2/3/21 TIME 1:20 pm NAMES Steve Sch

PHOTO# #190-192 WYPT #275 (#28N) PLOT#/LOCATION #8 South closer to powerline

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 40 / 25' / _____

V2 (indiv tree hts, ft) 10 BW, 21 BW, 30 Fig, 20+ Will, 25 BW 191, 20 BW 192, 25 W

V3 (TREE>3M) (FT) 60 / 75 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (5 tree shrub) / _____ / _____

SNAG (indv diam, in) 4+ 4+ _____ _____ _____ _____

V5, snag count >4" _____

V6 ALL WOODY 85 / 100 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 85 / [Note not recorded] / _____ assume 100

V3 TREE CANOPY CLOSURE 50% / 30% / _____

V4 # SPECIES (list names) BW, Willow Rpd with 1 Blkberry, Fig

V5 UNDERSTORY DENSITY @2FT 85 /100/ @6FT 60/80/
@14FT 55/90/ AVERAGE (70)/(90)/

YW MODEL: V1 DECID SHRUB COVER 85 / 100 / _____

V2 SHRUB HTS (ft) T1 1.1 1.3 1.2 Rest >2m _____ _____ Note: photo interpret 70%>2m
(nearest .1M) T2 1.6=1.8 shrub ~~BB~~ Rest >2m _____ _____

V3 hydrophytic SHRUB COVER 85 / 100' / _____

V4 tall tree ~~P~~ / ~~P~~

DW MODEL: V1 SNAG COUNT >6", see above _____

V2 BASAL AREA (cruz-all or see HW, below) Not possible ~ 1X5? / _____ / _____

HW MODEL: V1 SNAG COUNT >10", see above _____

V2/V3 DbH overstory (6,6,6) BW (6,6) Willow _____ _____

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 50 / 25 / _____

DATA SHEET TS_30_L HEP P. 7

DATE 12/3/21 TIME 11:55 NAMES Steve M, Sch, Sav.
#187 Next #27
PHOTO# 188-189 WYPT Send #26 PLOT#/LOCATION #7, 187 →



TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____

RSG MODEL: V1 (SHRUB<3M) (FT) 30 / [missing data, assume 10'] / _____

V2 (indiv tree hts, ft) 10, 10'✓ 10'✓ 15'✓ (+BW) 40'✓ 30'✓ 18'✓

V3 (TREE>3M) (FT) 70 / 60 / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (5 Shrub) / (5 Sm. T.) / _____

SNAG (indv diam, in) 10 10 10 8+ 8+ 6" _____
V5, snag count >4" 6+

V6 ALL WOODY 90 / 90 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 90 / 90 / _____

V3 TREE CANOPY CLOSURE 60 / [Not all tracked across (40)] / _____

V4 # SPECIES (list names) BW, BB, Red Wil, willow/ hanging seeds, grasses/ground ?s?

V5 UNDERSTORY DENSITY @2FT 100 / 80 / @6FT 70 / 50 / _____
@14FT 60 / 40 / _____ AVERAGE 80 / 65 ← Note this calc. 170/3=55 not 65

YW MODEL: V1 DECID SHRUB COVER 90 / 90 / 80

V2 SHRUB HTS (ft) 1, 30% BB 1.2-1.4, remainder much taller 2+m
(nearest .1M) _____ _____ _____ _____ _____ _____

V3 hydrophytic SHRUB COVER 90 / 90 / _____
(V4 tall trees 0 / 20%)

DW MODEL: V1 SNAG COUNT >6", see above 6+ 4-6"/10+m for ½ site

V2 BASAL AREA (cruz-all or see HW, below) No Estimate / est 10 / _____
+ Cruz (175)

HW MODEL: V1 SNAG COUNT >10", see above 3
V2/V3 DbH overstory 10" 15" _____ _____ _____ _____

_____ _____ _____ _____ _____ _____

V4 CANOPY COVER 60 / 30 / _____

DATA SHEET TS_30_L HEP P. 6

DATE 12/3/21 TIME 1102 am NAMES Steve M, Steve Sh, Savannah

PHOTO# 184-186 WYPT Next #26 Start #25 PLOT#/LOCATION Plot 6 (~¼mi before Power Lines)

TRANSECT TOTAL LENGTH (FT) 100 / 100 /



RSG MODEL: V1 (SHRUB<3M) (FT) 40 / 45 /

V2 (indiv tree hts, ft) 53' (willow) (right) (west) ~50 willows 25-30' tall set by channel

V3 (TREE>3M) (FT) 50 / ≥5 / tall ponderosa + tree shrub

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) (5) / (5) /

SNAG (indv diam, in) ~6-8" (marginal ~8" dbh) Good fallen tree at right

V5, snag count >4" 1

V6 ALL WOODY 70 / 90 /

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 85 / 90 /

V3 TREE CANOPY CLOSURE 5% / 50% /

V4 # SPECIES (list names) Willow, BB, eld, silverwill

V5 UNDERSTORY DENSITY @2FT 100 / 100 / @6FT 60 / 75 /
@14FT 20 / 55 / AVERAGE (60) / (75) /

YW MODEL: V1 DECID SHRUB COVER 70 / 90 /

V2 SHRUB HTS (ft) (nearest .1M) T_1 - 1.1, 1.8, (50% BB) 50% - 2m+ Will / T_2 1.5 (40% BB) 50% 2m+ tall willow

V3 hydrophytic SHRUB COVER 70 / 90 /
(V4 tall tree - 30% - T_2 only)

DW MODEL: V1 SNAG COUNT >6", see above 1

~15 willows 5x @ 6" = 90 qmd tree sales + willows

V2 BASAL AREA (cruz-all or see HW, below) / /

HW MODEL: V1 SNAG COUNT >10", see above Ø

V2/V3 DbH overstory willow 20" ; dense willows ½ site 6"/qmd (T_1)

willows + other ~6-8" stems (6") (T_2)

V4 CANOPY COVER 6m+ Ø / 30' /

DATA SHEET TS_30_L HEP P. 5

DATE 12/3 TIME 9:30 AM NAMES Steve M, Steve S, Savannah

PHOTO# 182 183 WYPT Send 424 PLOT#/LOCATION #5



TRANSECT TOTAL LENGTH (FT) 100 / 100 /

RSG MODEL: V1 (SHRUB<3M) (FT) 10 / 20 /
Buttonbush on E ~ 26-32'

V2 (indiv tree hts, ft) Buttonbush on E 15%×100 + Sq +10 drop = 30'
Bw - 15%×60 = 15+5+5 = 25'

V3 (TREE>3M) (FT) 80 / 80 /

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 3 (5) / 3 (5) /

late SNAG (indv diam, in) (i.e. parchable - can't see any)
V5, snag count >4" —

V6 ALL WOODY 90 / 100 /

RFCT MODEL: V1(tree hts, see above) ~ 30-35'

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 90 / 100 /

V3 TREE CANOPY CLOSURE 80 / 80 /

SM V4 # SPECIES (list names) buttw, Redwil, Sitka Wil, BB

V5 UNDERSTORY DENSITY @2FT 90 / 100 / @6FT 90 / 80 /
@14FT 85 / 90 / AVERAGE 90 / 90 /

YW MODEL: V1 DECID SHRUB COVER 90 / 100 /

V2 SHRUB HTS (ft) (nearest .1M) T1 — 20% 1.4, 80% 2+M
T2 20% 1.6 80% 2+M

V3 hydrophytic SHRUB COVER 90 / 100 /

late V4 (Note - forgot to record, est 30% based on measured hts and photos 181 and 182)

DW MODEL: V1 SNAG COUNT >6", see above
est thick willow stems 6+"/sq m + trees, likely high.

late V2 BASAL AREA (cruz-all or see HW, below) — / — /

HW MODEL: V1 SNAG COUNT >10", see above (—)
V2/V3 DbH overstory Buttonwill (4, 4, 6) est
some much larger - look in Corps Notes

V4 CANOPY COVER 60 / 70 /
est est

DATA SHEET TS_30_L HEP P. 4

DATE 12/2 TIME 3:30 NAMES Steve, Jess/Sam

PHOTO# 178-180 WYPT 24-N 23-S PLOT#/LOCATION #4

TRANSECT TOTAL LENGTH (FT) 100 / 100 / _____



RSG MODEL: V1 (SHRUB<3M) (FT) 50 / 90 / _____

V2 (indiv tree hts, ft) 55' (E) 35' (E) ranging dbh 5-8" to 60' tall

V3 (TREE>3M) (FT) 20 / 70 / _____ tree/overstory

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 tree/overstory / 5 tall/short shrubs/trees / _____

SNAG (indv diam, in) 5" 6" 6" 5+" _____ _____

V5, snag count >4" (4)

V6 ALL WOODY 70 / 90 / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 100 / 90 / _____

V3 TREE CANOPY CLOSURE 20 / 70 / _____

V4 # SPECIES (list names) BB, WP Red Osier Dogwood, BrHw, Willow, Silver

V5 UNDERSTORY DENSITY @2FT 79 90 @6FT 30/80/___

@14FT 20 60 AVERAGE (HD) / (TS) / ___

YW MODEL: V1 DECID SHRUB COVER 50 / 90 / _____

V2 SHRUB HTS (ft) T1 - Predom BB 1.6 M _____ _____

(nearest .1M) T2 Predom WP Willow 2+M _____

V3 hydrophytic SHRUB COVER 50 / 90 / _____

DW MODEL: V1 SNAG COUNT >6", see above (2)

V2 BASAL AREA (cruz-all or see HW, below) (No transect units) / _____ / _____ likely high 6" (m²)

HW MODEL: V1 SNAG COUNT >10", see above (0)

V2/V3 DbH overstory 30" 7" 4" 4" 6" 6"

8" 7" 6" 10" _____ _____

V4 CANOPY COVER 20 / 50 / _____ non-native disturbance? (NO)

DATA SHEET TS_30_L HEP P. 3

DATE 12/2/21 TIME 110pm NAMES Jessica/Savannah/Shane

PHOTO# 175-177 WYPT 21-Seed 22-Need PLOT#/LOCATION #3

TRANSECT TOTAL LENGTH (FT) 120 / 100 / _____

RSG MODEL: V1 (SHRUB<3M) (FT) (None shrubs below) / (100% understory) / _____

V2 (indiv tree hts, ft) 30' (elevator walnut) 47' 25' 41' _____ _____

V3 (TREE>3M) (FT) 80' / 80' / _____

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / 5 / _____ (5 = trees/shrubs/ferns/forbs/shrubs)

SNAG (indv diam, in) 6" (just under 4") _____ _____ _____ _____

V5, snag count >4" 1

V6 ALL WOODY 120' / 90' / _____

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 120' / [Note not recorded on transect 100 from photo 177] / _____

V3 TREE CANOPY CLOSURE 80' / 50' / _____

V4 # SPECIES (list names) Willow, BB, bath, Walnut

V5 UNDERSTORY DENSITY @2FT 50 / 100 / 85 @6FT 60 / 100 / _____
@14FT 40 80 _____ AVERAGE 50 / 90 / _____

YW MODEL: V1 DECID SHRUB COVER 60' / 100' / _____

V2 SHRUB HTS (ft) T1 - all 2+ M _____ _____ _____ _____
(nearest .1M) T2 - all 2+ M _____ _____ _____ _____

V3 hydrophytic SHRUB COVER 70' / 100' / _____ (V4 tall within 30') 60% / 0 ← But nearby walnut 10%

DW MODEL: V1 SNAG COUNT >6", see above 1 (2x20' very difficult to walk through)

V2 BASAL AREA (cruz-all or see HW, below) 2x10 / _____ square feet/acre

HW MODEL: V1 SNAG COUNT >10", see above 0

V2/V3 DbH overstory 26 16 16 16 14 4
4 4 15 16 _____ _____

V4 CANOPY COVER 80' / 20' / _____ ↑ Not much tree thstrata

nonnative dominance - alot but NOT >50%

DATA SHEET TS_30_L HEP P. 2

DATE 12/2/24 TIME 11:58pm NAMES Steve, Jessica

PHOTO# 172-174 WYPT #5 #20 PLOT#/LOCATION #2 goes out towards big narrative clump.

TRANSECT TOTAL LENGTH (FT) 100 / 100 / ← estimated 100' from map

RSG MODEL: V1 (SHRUB<3M) (FT) 77 / 82 / 174 (Cassins understory)



V2 (indiv tree hts, ft) T1 - many willows 16-20' tall; 55' / / / / / /

V3 (TREE>3M) (FT) 77 / 82 /

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / 5 /

SNAG (indv diam, in) 6" 10" 10" / / /

V5, snag count >4" 3 (includes Nonnative)

V6 ALL WOODY 77 / 82 /

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 77 / 82 /

V3 TREE CANOPY CLOSURE 20 / (Not good) (Tree) /

V4 # SPECIES (list names) BB, willow, button willow

V5 UNDERSTORY DENSITY @2FT 77 / 82 / @6FT 77 / 82 / (includes herb area)

@14FT 30 / 60 / AVERAGE 60 / 70 /

YW MODEL: V1 DECID SHRUB COVER 77 / 82 /

V2 SHRUB HTS (ft) numerous 2+ will / / / / / /
(nearest .1M)

V3 hydrophytic SHRUB COVER 77 / 82 /

(V4 - tall tree) - 0

DW MODEL: V1 SNAG COUNT >6", see above 3

(Not measured) - grass 3-4'/sq m

V2 BASAL AREA (cruz-all or see HW, below) / /

HW MODEL: V1 SNAG COUNT >10", see above 2

V2/V3 DbH overstory T1 - 4 / / 0 and 4 250 - 18, 16 / /

/ / / / / /

V4 CANOPY COVER 20% (>6m) / (Cannot see heterogeneous 20% if include grass) /

nonnative dominant? (NO) overall plot.

DATA SHEET TS_30_L HEP P. 1

DATE 12/2/21 TIME 9-30am NAMES Schamberg, Jessica, Savannah

PHOTO# 108-0170 WYPT #3 -Nest #4 -Sind PLOT#/LOCATION 1st plot Herring Cove



TRANSECT TOTAL LENGTH (FT) 651 / 1001 /

RSG MODEL: V1 (SHRUB<3M) (FT) 118 / 89 /

V2 (indiv tree hts, ft) 14' 50' 20' 22' willow other willows 20+

V3 (TREE>3M) (FT) 12' / 70 /

V4 LAYER CATEGORY (SELECT 1,2,3,4,5) 5 / / est visual multi stemmed

SNAG (indv diam, in) 10"< / / / / / /
V5, snag count >4" 1

V6 ALL WOODY 18 / 79' /

RFCT MODEL: V1(tree hts, see above)

V2 RIPARIAN STAND WIDTH (all woody + small gaps) 20 / [20 ft wide pilot point 171] /

V3 TREE CANOPY CLOSURE 0 / 20 / (shallow)

V4 # SPECIES (list names) BS, ash / Will, oak 4 (4)

V5 UNDERSTORY DENSITY @2FT 30 / 80 / @6FT 15 / 60 /
@14FT 0 / 20 / AVERAGE 15 / 55 /

YW MODEL: V1 DECID SHRUB COVER 18 / 79 /

V2 SHRUB HTS (ft) 2+ 0.9 1.2 (numerous willows 2+m)
(nearest .1M) average 2+

V3 hydrophytic SHRUB COVER 18 / 79 /

DW MODEL: V1 SNAG COUNT >6", see above 1 (V4 tall tree - photo interpret [NO tree coded on site] = Ø thick willow est 8"/10' sp)

V2 BASAL AREA (cruz-all or see HW, below) see Basal Area Calc / /

HW MODEL: V1 SNAG COUNT >10", see above 1
V2/V3 DbH overstory (9 10 10 6) - willow

V4 CANOPY COVER 10? / 25 / (tallest willows est 22' tall)

APPENDIX D. Plates



Plate 1: TS_30_L impact area; 3-41 are plot boundary waypoints (see Appendix C, datasheets).



Plate 2. Adjacent Corridor mitigation option for TS_30_L (Elmwood parcel in figure above).

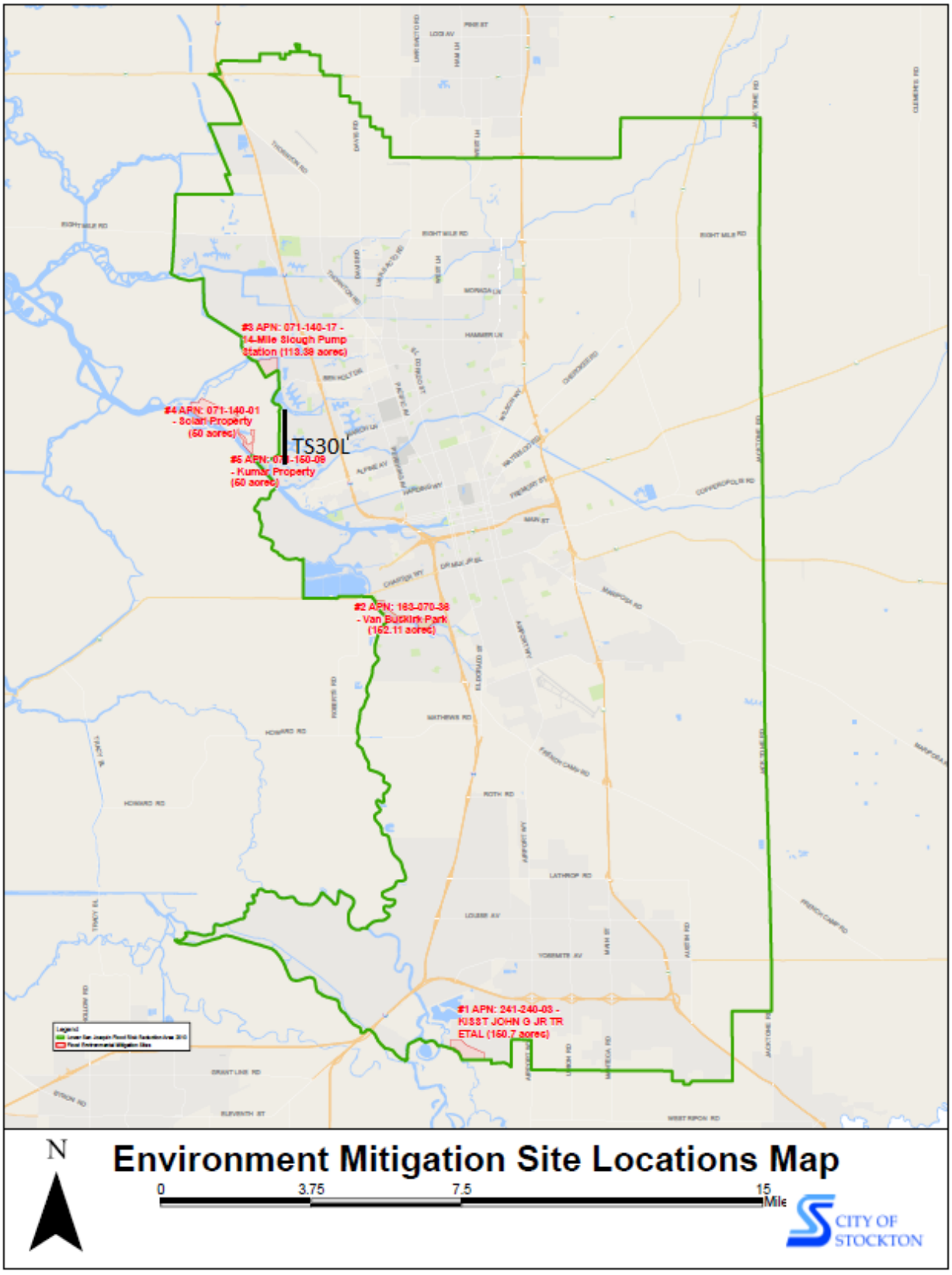
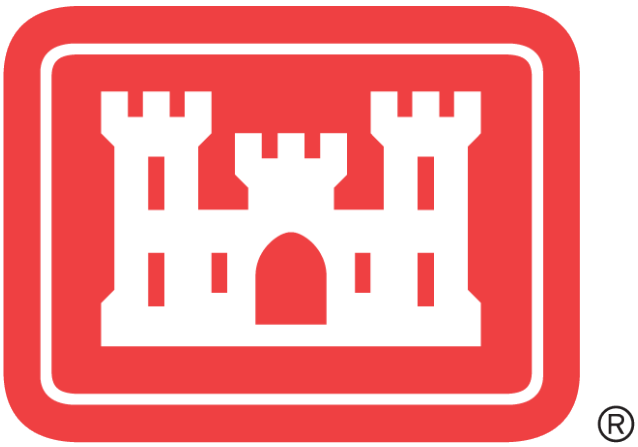


Plate 3: Location of non-adjacent mitigation options for TS_30_L.

Supplemental Biological Assessment

Lower San Joaquin River, California, Project
America's Water Infrastructure Act of 2018
Reach TS-30L Levee Improvements



May 2023

U.S. Army Corps of Engineers

Sacramento District

Environmental Resources Branch

1325 J Street

Sacramento, CA 95814-2922

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I. INTRODUCTION

The U.S. Army Corps of Engineers, Sacramento District (USACE) is requesting reinitiation of consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) (16 U.S.C. § 1536) to evaluate anticipated effects to listed species and their habitats from planned improvements to the Ten Mile Slough, mile marker 30, left bank segment (TS-30L) as part of the Lower San Joaquin River Project, San Joaquin County, California (LSJR), fully described in the Lower San Joaquin River Feasibility Study Recommended Plan (LSJRFS), San Joaquin County, California (LSJRFS, January 2018). The LSJR Project is a cooperative flood risk management effort by the USACE with its Non-Federal Sponsors (NFSs) – the San Joaquin Area Flood Control Agency (SJAFCA) and the Central Valley Flood Protection Board (CVFPB), represented by California Department of Water Resources (DWR) – to reduce flood risk in the Stockton area. The LSJR Project was authorized for construction in America's Water Infrastructure Act of 2018 (Public Law [P.L.] 115-270), which expedited the completion of the feasibility study and allowed the study to proceed directly to the preconstruction engineering and design phase of the project, as described in Section 1322(b)(2)(F) of the Water Resources Development Act of 2016 (P.L. 114-322). The overall purpose of the LSJR Project is to decrease flood risk by achieving a 200-year level of protection to north and central Stockton. A Biological Opinion (BO) for the LSJR Project was initially issued on June 13, 2016, entitled "Formal Consultation on the Lower San Joaquin River Feasibility Study, San Joaquin County, California" (Reference number 08ESMF00-2015-F-0206; USFWS 2016). Amendments and supplements to the 2016 LSJR BO, as described in the Consultation History section of this document, discuss changes and design refinements which have occurred after the initial consultation period.

This Supplemental Biological Assessment (SBA) supplements the Biological Assessment (BA), Terrestrial & Aquatic Species, San Joaquin River Basin, Lower San Joaquin River, CA Interim Feasibility Study (2015 LSJR BA) that USACE submitted to the USFWS on November 6, 2015. The Smith Canal element of the LSJR Project is currently under construction with mitigation provided as described in the August 19, 2019, Smith Canal supplemental BO (2019 Smith Canal BO). Consultation for the Smith Canal element remains on-going due to additional design refinements. This SBA seeks re-consultation over only the TS-30L elements of the project. Details of final design for TS-30L were unknown at the time the 2015 LSJR BA was submitted. This SBA provides technical information and analysis assessing the adverse effects that the TS-30L improvement work may have on Federally threatened, endangered, or candidate species and their designated critical habitat.

Specifically, reinitiation is being pursued for two reasons: (1) compensation measures in the 2016 LSJR BO for the Valley Elderberry Longhorn Beetle (VELB) direct that transplants and compensatory seedlings of elderberry occur within the Fourteen Mile Slough setback area or an approved conservation bank; otherwise USACE will

coordinate the use of a new site through reinitiation of formal consultation; and (2) where removal of vegetation is not otherwise required for construction of the project features, conservation measures for all species direct that USACE evaluate the suitability of the levees for a vegetation variance (now called a design deviation). If that evaluation is not completed or a deviation is not approved then USACE would reinitiate consultation. While the original design contemplated removal of vegetation on the land and waterside slopes to accommodate project features, inclusion of an armored patrol road within the waterside easement, and associated vegetation removal was not analyzed in the original consultation.

This SBA will satisfy Section 7 consultation for construction, operations and maintenance, and mitigation activities for TS-30L. Courtesy copies of all letter correspondence will be sent to the California Department of Fish and Wildlife (CDFW) and the National Marine Fisheries Service (NMFS). If the project conditions change significantly, USACE will initiate additional consultation as appropriate.

A. Threatened, Endangered, Proposed Threatened, or Proposed Endangered Species

USACE received a species list for the Project Area from the USFWS's Information for Planning and Consultation (IPaC) online system on May 8, 2023 (Project Code 2023-0079350; Appendix A). USACE determined that the proposed action would have "No Effect" on six of these species as explained in Table 1. Therefore, these six species are not discussed further in this document.

Threatened, Endangered, or Proposed Species that may be affected by the proposed action:

Giant garter snake (*Thamnophis gigas*) **T** [
Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) **T**

E = Endangered, **T** = Threatened, **P** = Proposed, and **CH** = Critical Habitat.

B. Critical Habitat

There is no designated Critical Habitat within the TS-30L Project Area. There is critical habitat for the Delta Smelt (*Hypomesus transpacificus*) near the TS-30L Project Area. Designated Critical Habitat for the Delta Smelt includes the existing contiguous waters contained within the Delta. The agricultural ditch adjacent to TS-30L is not hydrologically connected to the rest of the system and, therefore, does not meet the definition of an existing contiguous water of the Delta. In addition, due to the level of disconnection between the agricultural ditch and the remainder of the system, it is highly unlikely that indirect effects from the project could have impact on the nearby aquatic ecosystem. Therefore, effects to Delta Smelt Designated Critical Habitat are not discussed further.

C. Candidate Species

The monarch butterfly has been listed as a Candidate Species for listing under the Endangered Species Act. It has been considered in this document.

Monarch butterfly (*Danaus plexippus*) **C**

Table 1 - Summary of Effects to Listed Species

Evolutionarily Significant Unit (ESU) / Distinct Population Segment (DPS) / Other	Listing Status	Resource Agency Jurisdiction	Critical Habitat Designation/Action Area within Designated Critical Habitat (DCH)	Factors Affecting Determination	ESA Section 7 Effects Determination
Mammals					
Riparian Brush Rabbit (*Sylvilagus bachmani riparius*)	Endangered (February 23, 2000: 65 FR 8881-8890)	USFWS	None designated	The TS-30L Project Area contains only marginal dense brushy vegetation that could serve as habitat for the Riparian Brush Rabbit and the nearest documented occurrence is over 10 miles away (CDFW 2023). Therefore, it is highly improbable that Riparian Brush Rabbit would be affected by construction of the TS-30L levee improvements.	No effect
Reptiles					
Giant Garter Snake (*Thamnophis gigas*; GGS)	Threatened (October 20, 1993: 58 FR 54053)	USFWS	None designated	Replacement of the current earthen vegetated waterside slope with riprap would permanently alter habitat in the Project Area. Since snakes use small mammal burrows, soil crevices, and/or rock crevices for shelter for brumation during the winter season and aestivating during extremely hot days during their active period, the proposed project will likely have an adverse effect on giant garter snakes. While snakes could use rock crevices as shelter, the thermal properties of rock limit their usage, as compared to soil. During the summer months, rocky crevices can be a desirable benefit (Huey et.al., 1989, Sabo, 2003; and O'Sullivan et.al., 2023). However, in the winter, earthen burrows may be preferable (Huey, 1991; and Sprague and Bateman, 2018). In addition, during construction of the project, the waterside agricultural ditch would be unavailable as forage habitat. Staging areas would also temporarily be unavailable as habitat. Increased traffic near the rice fields along the haul routes also present the possibility of a mortality.	May affect, likely to adversely affect

Table 1 - Summary of Effects to Listed Species (continued)

Evolutionarily Significant Unit (ESU) / Distinct Population Segment (DPS) / Other	Listing Status	Resource Agency Jurisdiction	Critical Habitat Designation/Action Area within Designated Critical Habitat (DCH)	Factors Affecting Determination	ESA Section 7 Effects Determination
Amphibians					
California Tiger Salamander (*Ambystoma californiense*), Central California DPS	Threatened (May 4, 2004: 69 FR 24876)	USFWS	Outside DCH	The TS-30L Project Area is outside the extant documented range of this species (CDFW 2023). Grassland, savannah, open woodland, and vernal pool habitats would remain consistent with regional baseline conditions. Therefore, available habitat would not be diminished.	No effect
Evolutionarily Significant Unit (ESU) / Distinct Population Segment (DPS) / Other	**Listing Status**	**Resource Agency Jurisdiction**	**Critical Habitat Designation/Action Area within Designated Critical Habitat (DCH)**	**Factors Affecting Determination**	**ESA Section 7 Effects Determination**
Insects					
Monarch Butterfly (*Danaus plexippus*)	Candidate (December 17, 2020: 85 FR 81813)	USFWS	None designated	The existing landside slope is covered in aggregate and, is therefore unvegetated. The waterside slope is vegetated along portions of its length. Some of these species may provide nectar sources for monarch butterflies; however, a monarch specific survey has not been conducted. Removal of waterside vegetation could remove potential nectar sources. However, planting on the landside and plantings in the San Joaquin River WestLongitudinal mitigation area would reduce the duration of these adverse effects.	Not Applicable
Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*; VELB)	Threatened (August 8, 1980: 45 FR 52803)	USFWS	Outside DCH	Construction of the project would require transplanting 10 existing elderberry shrubs and the permanent loss of 11.4 acres of associated riparian habitat. Offsite compensation would replace this acreage. However, there would be a time lag before planted seedlings reached suitable size to serve as host plants for the species.	May affect, likely to adversely affect

Table 1 - Summary of Effects to Listed Species (continued)

Evolutionarily Significant Unit (ESU) / Distinct Population Segment (DPS) / Other	Listing Status	Resource Agency Jurisdiction	Critical Habitat Designation/Action Area within Designated Critical Habitat (DCH)	Factors Affecting Determination	ESA Section 7 Effects Determination
Crustaceans					
Vernal Pool Fairy Shrimp (*Branchinecta lynchi*)	Threatened (September 19, 1994: 59 FR 48136)	USFWS	Outside DCH	There are no known vernal pools near the TS-30L Project Area nor any in a proximate enough distance such that any hydrologic changes induced by the project could affect hydrolically connected vernal pools.	No effect
Vernal Pool Tadpole Shrimp (*Lepidurus packardi*)	Endangered (September 19, 1994: 59 FR 48136)	USFWS	Outside DCH	There are no known vernal pools near the TS-30L Project Area nor any in a proximate enough distance such that any hydrologic changes induced by the project could affect hydrolically connected vernal pools.	No effect
Flowering Plants					
Large-flowered Fiddleneck (*Amsinckia grandiflora*)	Endangered (May 8, 1985: 50 FR 19374)	USFWS	Outside DCH	The TS-30L site lacks hilly grasslands with steep, north facing slopes and shade. This project would not reduce regionally available habitat.	No effect
Palmate-bracted Bird's beak (*Cordylanthus palmatus*)	Endangered (July 1, 1986: 51 FR 23765)	USFWS	None designated	The TS-30L site lacks suitable habitat–saline alkaline seasonally-flooded lowland plains (CDFW 2022). Regional saline alkaline seasonally-flooded lowland plains vegetation would remain consistent with baseline conditions.	No effect

II. CONSULTATION TO DATE

USACE received the 2016 LSJR BO for the overall project on June 13, 2016, based on information known at the time of the completion of the feasibility study.

In addition, USACE is currently engaged in formal consultation with the USFWS for efforts on the Smith Canal portion of the LSJR Project. Construction of the Smith Canal effort is led by the NFS, SJAFCA, with USACE Regulatory as the responsible Federal agency. USFWS issued the 2019 Smith Canal BO for the Smith Canal segment on August 19, 2019. Consultation histories for completed consultations, and those in progress, for Smith Canal are detailed in the respective BOs and BAs.

Several staff level meetings, teleconferences, and phone calls have been completed throughout the development of TS-30L and the mitigation site. Listed below are site visits conducted in support of the TS-30L project, major meetings involving leadership, as well as a summary of recent discussions.

Consultation history

USACE has been conducting regular meetings with USFWS for the TS-30L Project since December 8, 2020. These have been separated into environmental coordination and mitigation specific meetings both occurring on a roughly bi-weekly basis via WebEX.

March 9, 2021 – USFWS (Steven Schoenberg) joined USACE (Robert Skillen) at TS-30Lthe TS30L for site visit.

November 2021 – Sacramento District (SPK) Planning Division leadership (Dan Artho) and Bay Delta Office Leadership (Daniel Welsh, Stephanie Milsap) met to discuss concerns with TS-30L mitigation and BO status.

December 2021 – USFWS- Led (Steven Schoenberg) SPK staff to complete TS-30L Habitat Evaluation Procedures Surveys.

2July 26, 2022 – USACE and the NFS (SJAFCA and DWR) met with USFWS (Steven Schoenberg) to conduct a site visit of proposed mitigation sites.

III. DESCRIPTION OF PROPOSED ACTION

A. Background

The LSJR Feasibility Study's recommended plan, which covers North and Central Stockton, would be constructed in phases based on flood risk reduction benefits. Phases are as follows:

TS-30L
Phase A- Shima Tract
Phase B- Fourteenmile closure structure and Fourteenmile Levees
Phase C- Southern end of Tenmile Slough and Calaveras River Right Bank
Phase D- Calaveras River Left Bank
Phase E- San Joaquin River and French Camp Slough

The Feasibility Study concluded that the Delta Front (Tenmile Slough, Fourteenmile Slough, and the Shima Tract) represents the greatest risk, therefore construction of the Project will begin with the Delta Front levees. Reach TS-30L is part of Delta Front and was selected for final design and construction. It is the first segment of the LSJR Project that is proposed for construction by USACE.

USACE, SJAFCA, and the CVFPB propose fix-in-place improvements to the levee at TS-30L. Reach TS-30L levee improvements include modifying approximately 5,900 feet of existing levee geometry to meet current levee design and operation standards, providing seepage mitigation measures via cutoff wall installation, adding rock slope protection to protect against wave-run up and installing all-weather maintenance and access roads to allow inspection and flood fighting. To compensate for unavoidable resource impacts associated with the levee improvements at TS-30L, USACE is proposing to construct a mitigation site at a nearby privately owned parcel of land currently used for agriculture, hereafter referred to as the San Joaquin River West Parcel[1]. A summary of changes to the TS-30L levee improvements based on the current, updated designs are given in Table 2.

[1] In the draft mitigation strategy plan released to USFWSUSFWS on April 10, 2023, this parcel was named the Longitudinal Parcel; however, the forthcoming National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) documents refer to the parcel as the San Joaquin River West Parcel.

Table 2- Summary of Changes to the Project Description

Project Element	Original Project Design	Revised Project Design	Original Project Effect	Revised Project Effect
Levee Crown	20-foot crown width, cutoff wall installed through the center of the crown	No change	Degrade levee halfway, permanent loss of associated vegetation	No change
Landside Slope	2H[2]:1V	3H:1V	Permanent loss of all landside vegetation	No change
Waterside Slope	3H:1V with erosion protection	2.5H:1V with erosion protection	Permanent loss of up to 80 percent of waterside vegetation	Permanent loss of all waterside vegetation
Landside Access Road	None proposed	All weather access and patrol road	None	Permanent loss of additional habitat to accommodate patrol road
Waterside Access Road	None proposed	All weather access and patrol road	None	Permanent loss of additional habitat to accommodate patrol road
Borrow Areas	Detail not provided at time of Feasibility Study	Stockton East Water District proposed borrow area	Unknown	No effect
Haul Routes	Detail not provided at time of Feasibility Study	Utilization of existing roads	Unknown	No effect
Staging Areas	Detail not provided at time of Feasibility Study	North and south staging areas on agricultural land and vacant parcel	Unknown	Temporary loss of rice field habitats
Compensatory Mitigation	Purchase of mitigation credits and elderberry transplant to 14-mile Slough setback area	Construction of compensation area at Longitudinal Parcel, transplant elderberries to USFWS approved conservation bank	Full compensation of unavoidable adverse effects	No change
On-going OMRR&R	Continuation of typical maintenance procedures	No change	Permanent loss of habitat due to grouting rodent burrows	No change
Schedule	Completed in one season	No change	Temporary loss of habitat associated with staging, borrow and some construction areas	No change

[2] H:V means horizontal to vertical, such that 2H:1V means for every 2 feet of horizontal distance, there is a 1-foot increase in height.

B. Project Location

TS-30L is a dry-land levee located on the west side of Stockton between Fourteenmile Slough and the San Joaquin River with a north-south orientation (Figure 1). It is about 1.1 miles long and separates the Brookside residential development (land side) on the east from the Wright Elmwood Agricultural Tract (water side) on the west. TS-30L is bounded on the south by West March Lane and on the north by Fourteenmile Slough.

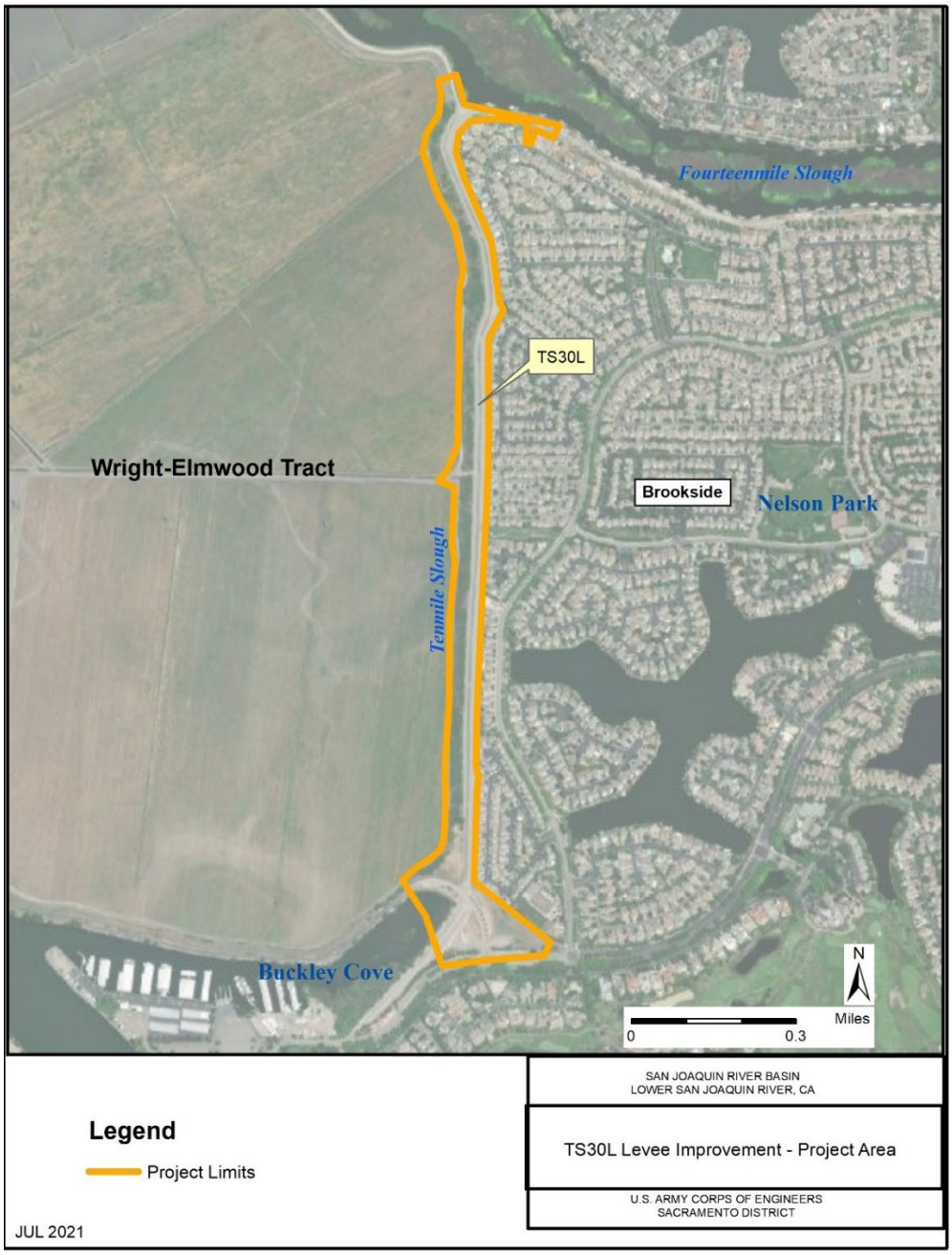


Figure 1- TS 30L location and context. Northern staging area, borrow area, and haul routes are not shown in this figure.

C. Construction of the Levee Improvement

The proposed improvements for TS-30L, described in Appendix A of the 2015 LSJR BA and the 2016 LSJR BO for the LSJR Project, from Fourteenmile slough to March Lane included a cutoff wall, geometry improvements, and erosion protection. Levee geometry improvements involve clearing and grubbing the waterside levee crest edge and landside slope, then adding material to the landside to meet current USACE levee design criteria for side slopes and crown width. Levees would have two access roads located along the levee crown and within the landside levee toe access easement. Erosion protection (riprap) would be placed on the waterside slope at a thickness of two feet. Full designs are given in Appendix B of this document.

To accommodate levee improvements, all vegetation within the grading limits would be removed (Appendix B). The project footprint has been reduced to the extent feasible to preserve as much vegetation as possible while still allowing construction to proceed safely. These updates to the plans are shown in red in Figures 2, 3, and 4.

Consistent with the original project designs, a soil-bentonite slurry seepage cutoff wall would be installed to an average depth of 21 feet below current ground surface elevation. To construct the cutoff wall, the levee would be degraded by 1/3 to ½ of its current height. Then a 12-foot-wide trench would be excavated in the levee centerline and filled with bentonite slurry to a depth of 21 feet below ground surface. Subsequently, a soil-bentonite mix would be used to backfill the trench and displace the slurry. After the soil-bentonite has cured, the levee would be reconstructed.

For TS-30L, the levee would be reshaped to achieve a waterside slope of 2.5H:1V and a landside slope of 3H:1V along its length, reshaping from the current 3H:1V and 2H:1V slopes, respectively. The reshaped levee would be widened to a 20-foot-wide crown along its length with the levee centerline shifted 20 feet towards the waterside. The landside levee toe will be shifted 10 feet towards waterside to accommodate the 15-foot landside access road. The 2015 LSJR BA and 2016 LSJR BO previously described changes in levee slope and width as primarily occurring on the landside; however, material will be added to the waterside instead to avoid impacting the residential neighborhood to the east.

Following levee reconstruction, rockslope protection consisting of a 2-foot-thick layer of 12-inch diameter riprap would be added to the waterside along the entire length from the crown to the patrol road. Riprap will be sourced from one or more commercial quarries from the greater Stockton area or the Sierra Nevada foothills. The landside slope would be covered and armored with three inches of ¾-inch aggregate from the crown to the patrol road.

The levee crown would be armored with a 6-inch-thick aggregate base covered with triple-pass chip seal to form the levee road. The existing waterside agricultural ditch

would be recreated upon completion of construction waterward of the new patrol road. The waterside patrol road would be slightly elevated above the existing ground surface upon completion of the improvements to prevent flooding from the agricultural ditch. The waterside patrol road, land side patrol road, and access ramps would be surfaced with four inches-inch-thick aggregate base.

Piezometers would be installed along the new waterside toe, just inland of the patrol road, to a depth of approximately six feet to 10 feet below ground surface spaced every 500 feet to monitor soil pore pressure and compaction. The top of the piezometers would be at grade level. The piezometer network would remain in perpetuity.

Construction of the levee improvements would likely be phased as follows: mobilization, vegetation removal, earthwork to degrade the levee and move the levee centerline westward, installation of cutoff wall, levee reconstruction and compaction, placement of erosion protection, installation of maintenance roads, installation of piezometers, demobilization, and site clean-up.

Earlier designs envisioned a larger footprint to accommodate construction (shown in Appendix B); however, USACE revised designs to reduce impacts and preserve, to the extent practical, a habitat connectivity corridor, shown in Figures 2, Figure 3, and Figure 4. It is estimated that an additional 57 trees and shrubs to the west of the waterside patrol road would be preserved. Non-native species, if any, would not be preserved.

Upon completion of the work, areas west of the waterside patrol road would be re-seeded with a native seed mix that would benefit pollinator species.

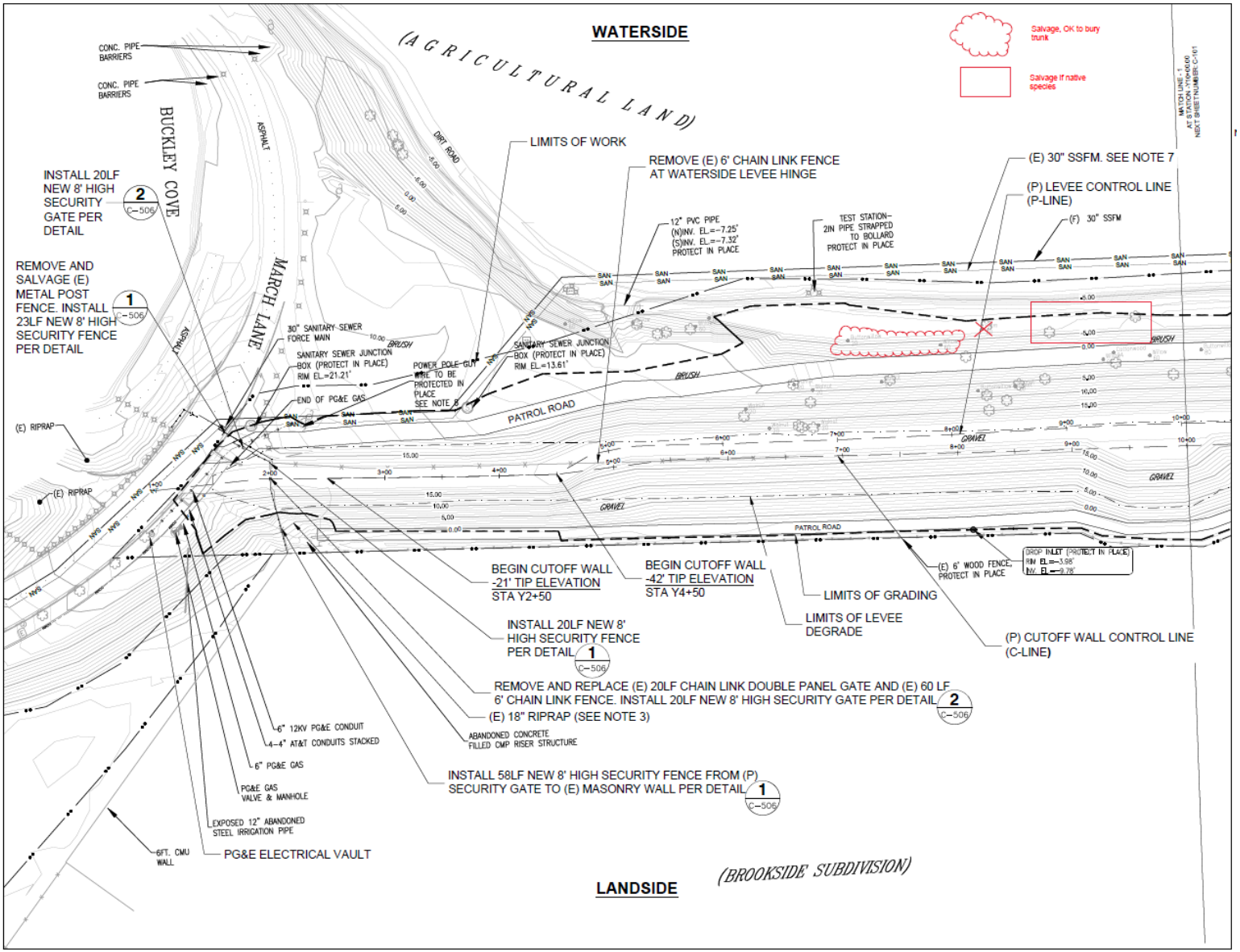


Figure 2- Preserved vegetation on the waterside based on footprint reduction since 100% designs, first section

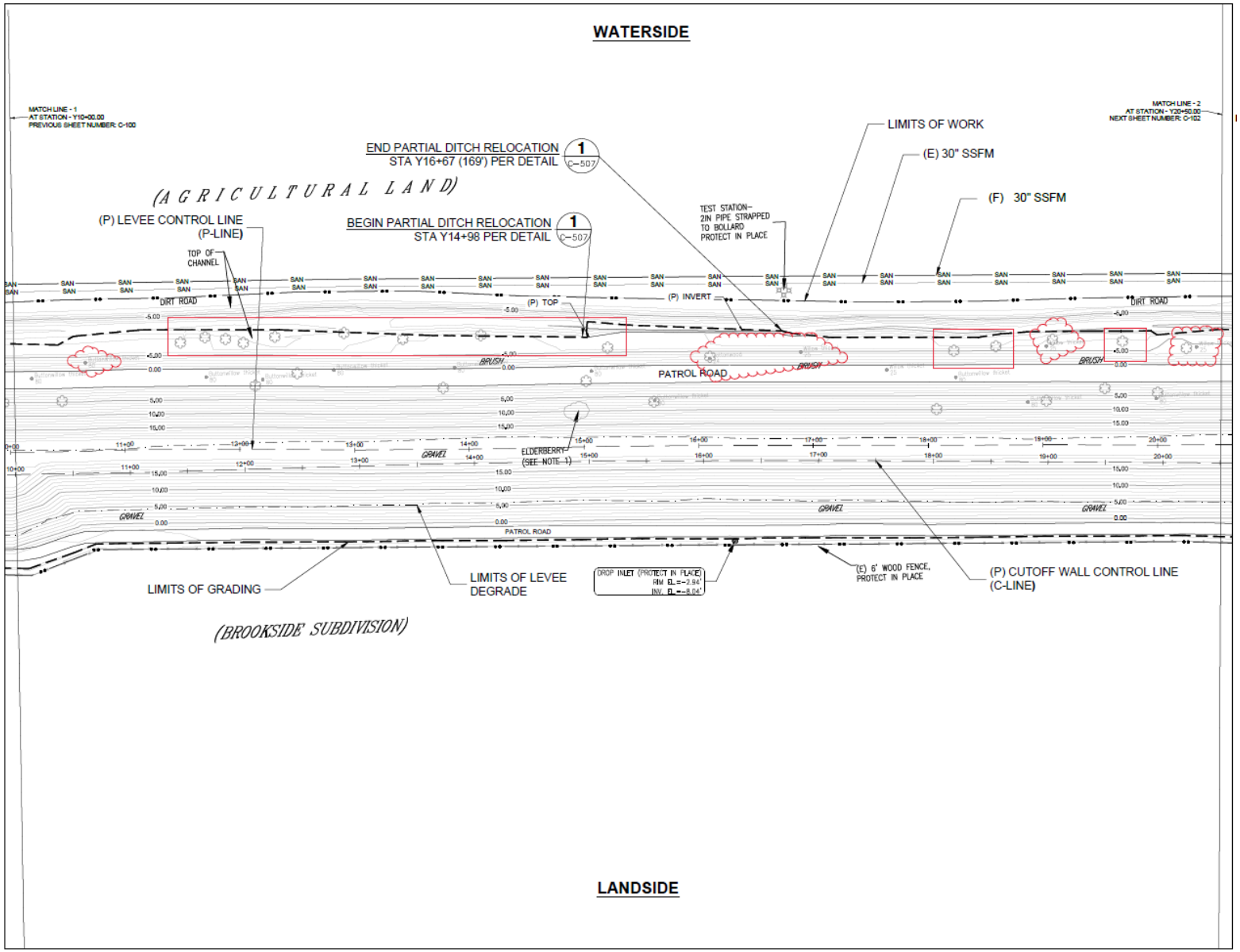


Figure 3- Preserved waterside vegetation based on footprint reduction since 100% designs, second section

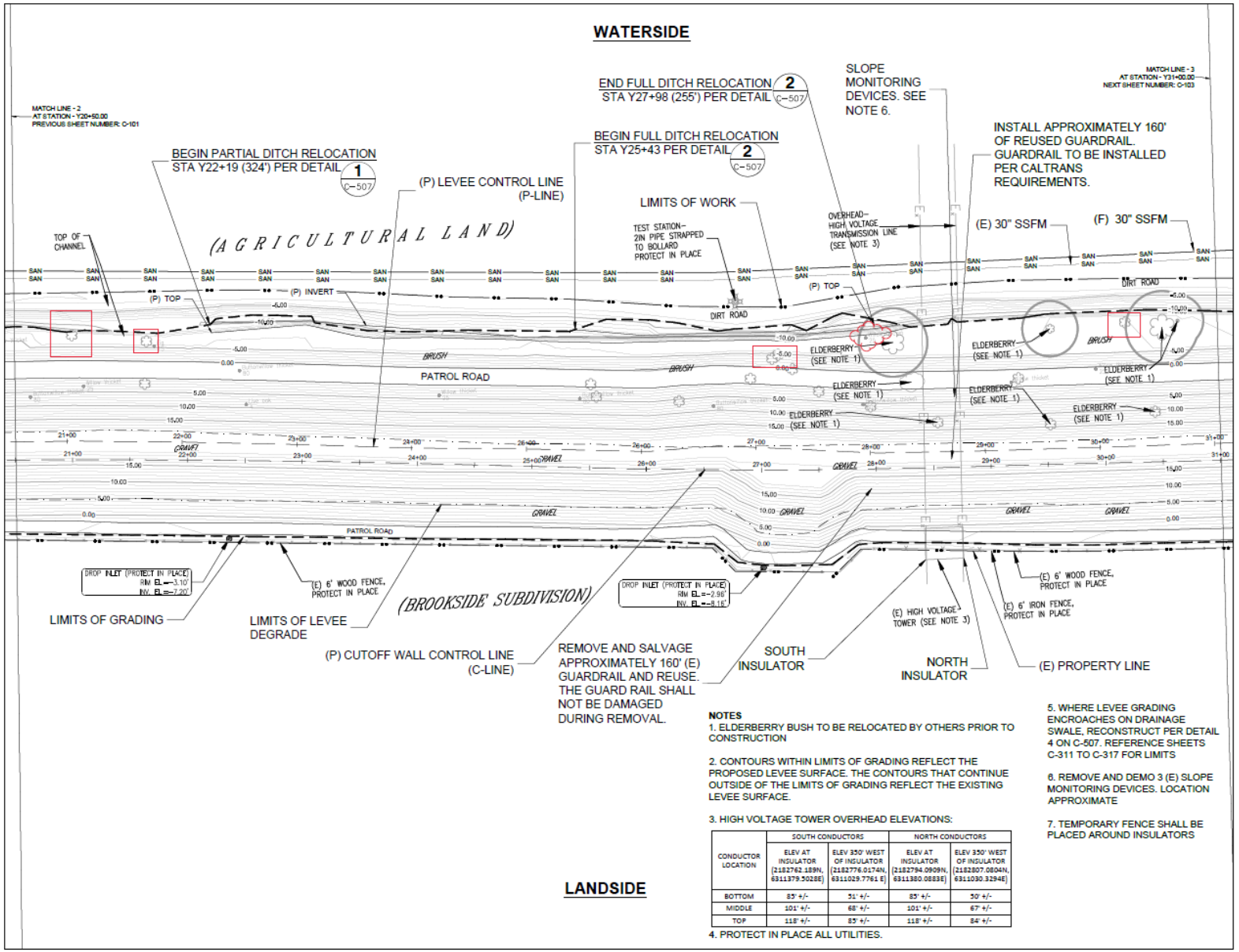


Figure 4- Preserved waterside vegetation based on footprint reduction since 100% designs, third section

D. Staging Areas

The southern staging area is a 1.7-acre corner lot located adjacent to March Lane and Brookside Road (Figure 5). The northern staging area is 9.8 acres and is in a rice field at the northern end of Reach TS-30L (Figure 5). The northern staging area will be allowed to dry and then leveled to facilitate equipment access. Temporary piping will be installed to convey water from an irrigation ditch along the perimeter to the surrounding rice fields. Upon completion of the levee improvement project, the staging areas would be restored to their pre-disturbance conditions and returned to their original purposes.



Figure 5- Staging areas in relation to the project site

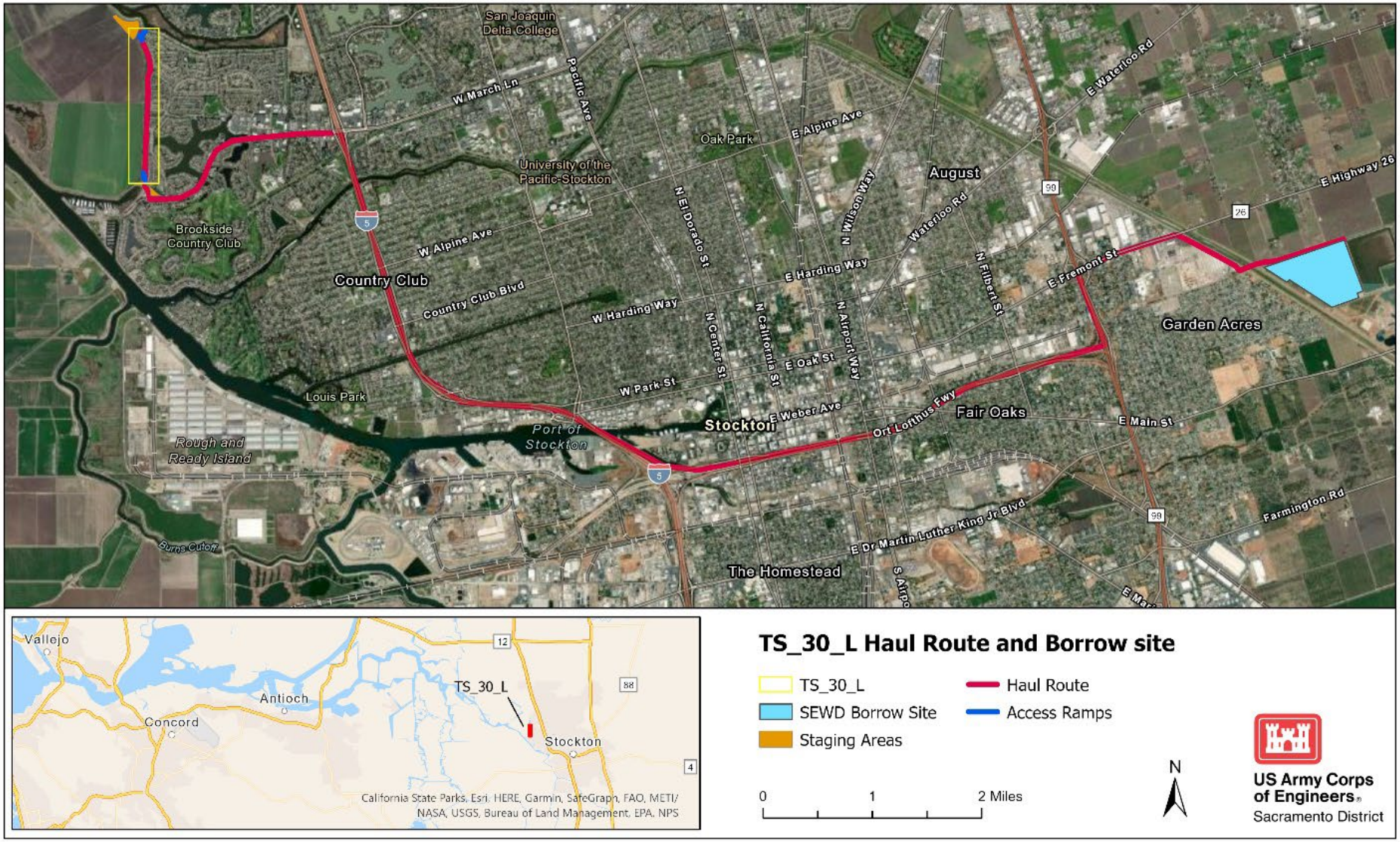


Figure 6- Borrow area and haul routes in relation to the project site

E. Borrow Areas

The proposed borrow site is located 11 miles east of TS-30L on 110 acres of agricultural land (Figure 6); fill material would be hauled by truck from this location to construct the levee improvements. The borrow area would not be restored to grade following the project, rather, the borrow site will be used by the Stockton East Water District (SEWD) as a groundwater recharge basin after construction is completed. The borrow site would be reseeded with a native seed mix to prevent erosion when not holding water.

F. Haul Routes

The haul route from the borrow site will utilize SEWD-owned roads, then cross over the Stockton Diverting Canal before using public streets to cross the city (Figure 6). The route will then follow Cardinal Avenue to State Route (SR) 26, then SR 99, SR 4, Interstate 5, and the West March Lane exit. March Lane leads directly to the southern end of Reach TS-30L. No trees would be removed along the haul route; however, trees with branches overhanging the roadway would be limbed as necessary to allow access by large trucks.

G. Compensatory Mitigation Areas

To compensate for unavoidable adverse impacts to habitat from the construction of the project, USACE would construct a mitigation site at the San Joaquin River West Parcel (Figure 7). Fifty acres of the parcel would be acquired for mitigation. The parcel is currently privately owned and used for annual crops such as wheat, alfalfa, and hay. The parcel is also seasonally fallowed. The parcel is located 1.7 miles from TS-30L at the confluence of the San Joaquin River and White Slough but is separated from those waterbodies by a levee. Numerous irrigation ditches run through the site. Compensatory mitigation plans are currently at the 10 percent level of design and are included in Appendix C.

Targeted species and acreages that would be included are 40.865 acres of riparian habitat suitable for VELB and 2.163 acres of aquatic habitat for giant garter snakes (GGS). Included in these acres are a part of the total 42.084 acres of riparian habitat for commitments under the Fish and Wildlife Coordination Act (FWCA) (which includes the acres that are suitable for VELB), and 2.163 acres of wetland habitat for commitments under the FWCA (which includes the acres that are suitable for GGS). All acres in the compensation area would contain pollinator supporting habitat, milkweed species (*Asclepias* sp.) have been specifically included on 9.620 acres. Where habitat types overlap, *e.g.*, riparian for VELB and riparian under the FWCA, these acres are combined (stacked) rather than constructed and accounted for separately.



Figure 7- Aerial image of the San Joaquin River West parcel

Soil surveys and professional elevation surveys would be conducted in May of 2023 to determine if soils would require amendments and depth to groundwater. These results would be shared with USFWS when received. Construction of the mitigation site would require minor earthwork to bring the site to appropriate grade. Material removed to lower grades to the appropriate elevation for the target communities would be reused on other areas of the parcel to raise elevations. It is not anticipated that any material would need to be imported to or exported from the site to achieve the habitat mitigation goals. Existing ditches would be enhanced into wetlands by widening the channels to allow a gentle bank and planting native species along the margins. Riparian habitat would be planted in the remainder of the site. Existing native trees would be retained, non-native and invasive species would be removed. Plant material would be sourced from local native plant nurseries. In the event that a species of interest could not be acquired locally, the plants would be grown directly by the contractor. Following earthwork and planting, beaver exclusion fencing, and deer friendly fencing would be placed around the perimeter of the site to allow plants to establish. Irrigation lines would be installed to ensure plant establishment. Following the plant establishment period, the fencing and irrigation lines would be removed. It is estimated that the plant establishment period would last between 3-5 years; however, achievement of ecological success criteria would be the determining factor in completion of the plant establishment period. Proposed ecological success criteria are included in the LSJR Mitigation Strategy and Implementation Plan. Final ecological success criteria would be developed jointly between USACE and USFWS in the long-term habitat management plan. The proposed mitigation site construction schedule is given in Table 3 below.

Table 3 - Compensatory Mitigation Schedule

Action	Start Date	Projected Completion
10 % Designs	March 2023	May 2023
Soil and Elevation Surveys	March 2023	June 2023
Plant Acquisition	May 2023	August 2023
35% Designs	May 2023	June 2023
95% Designs	August 2023	November 2023
100% Designs	November 2023	December 2023
Property Acquisition	October 2023	December 2023
Mitigation Site Pre-construction survey and submittals	December 2023	April 2024
Construction/Earthwork	May 2024	August 2024
Site Planting	August 2024	August 2025
Plant Establishment Period	August 2025	August 2030
Long-Term Maintenance	August 2030	Perpetuity

Maintenance and access roads would remain on the site. Signage designating the area as sensitive habitat would be installed around the site and remain in perpetuity.

Full construction and planting plans are given in Appendix C. The plans are currently at the10 percent level of design. Continuing design refinements would be made with involvement of USFWS through existing bi-weekly mitigation meetings and through formal comment on the plans. In addition, long-term and operations and maintenance manuals will be completed with continuing input and involvement from the USFWS.

H. Construction Schedule

Construction on the TS-30L levee improvement project would follow the schedule outlined in Table 4. Vegetation removal would consist of removing the aboveground mass of trees and shrubs using chainsaws, mowers, brush hogs, and other similar equipment. Ground disturbance and grubbing would not be completed at the vegetation removal phase.

Table 4 - TS-30L Construction Schedule

Action	Start Date	Projected Completion
Vegetation Removal	December 2023	February 2024
Elderberry Transplant	December 2023	February 2024
Construction	September 2024	March 2025
Revegetation of temporarily disturbed areas including staging, borrow areas, and areas west of the waterside patrol road	March 2025	May 2025

I. On-going Operation & Maintenance Repair, Replacement, and Rehabilitation (OMRR&R) Activities

Actions to maintain the levee in the proposed condition in perpetuity would include, but are not limited to, the following:

- Grouting of rodent burrows;
- Mowing of landside vegetation up to two times per year;
- Replacement of riprap, as needed, up to 600 cubic yards (cy) of material per occurrence;
- Replacement of aggregate, as needed, up to 600 cyubic ards of material per occurrence;
- Replenishment of chip seal;
- Repair and re-compaction of patrol roads, up to one cumulative mile per occurrence;
- Removal of encroachments (fences, decks, patios, etc.), as needed;
- Removal of woody vegetation from the levee crown and slopes, up to twice per year;

- Noxious weed abatement, about twice per year or more frequently, as needed;
- Repairs to the levee structure during emergency flood operations including sandbagging on the landside, as needed;
- Minor repair and replacement of piezometer network; and
- Personnel access for inspections, as needed, minimum of twice per year.

J. Avoidance and Minimization Measures

Avoidance and minimization measures are adapted from the 2016 LSJR BO. Additions to proposed to avoidance and minimization measures are shown in **bold** text, removals are shown in strikeout text (~~example text~~). Avoidance and minimization measures are considered part of the Proposed Action and have been integrated into project plans and specifications.

1. VALLEY ELDERBERRY LONGHORN BEETLE

Construction Phase

Avoidance and Minimization Measures

The following is a summary of measures based on the **Framework for Assessing Impact to the Valley Elderberry Longhorn Beetle, May 2017 (USFWS, 2017).** ~~*Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (USFWS 1999a; Appendix B).~~ These measures will be implemented to minimize any potential effects on VELB or their habitat, including restoration and maintenance activities, long-term, protection, and compensation if shrubs cannot be avoided during construction.

- When a 100-foot (or wider) buffer is established and maintained around elderberry shrubs, complete avoidance (i.e., no adverse effects) will be assumed.
- Where encroachment on the 100-foot buffer has been approved by the USFWS, a setback of 20 feet from the dripline of each elderberry shrub will be maintained whenever possible.
- Shrubs that are closer than 100 feet to any work, but outside the construction footprint (construction, ETL compliance, OMRRR) are assumed to be avoided by the application of other avoidance measures such as signage, fencing, worker education, and post-construction monitoring that demonstrates no effect on health and viability (see compensation measures, below), and will not be subject to transplantation or the need for offset compensation.
- During construction activities, all areas to be avoided will be fenced and flagged.
- Contractors will be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with these requirements.

- Signs will be erected every 50 feet along the edge of the avoidance area, identifying the area as an environmentally sensitive area.
- Any damage done to the buffer area will be restored.
- Buffer areas will continue to be protected after construction from adverse effects of the project, such as during maintenance actions.
- No insecticides, herbicides, fertilizers, or other chemicals that might harm the beetle or its host plant will be used in the buffer areas.
- Trimming of elderberry plants may be subject to mitigation measures.
- Elderberry shrubs that cannot be avoided would be transplanted ~~to an appropriate riparian area at least 100 feet from construction activities or~~ to an approved conservation bank. **Proposed banks are included in Appendix E.**
- Elderberry shrubs to be removed will be transplanted during their dormant season **(approximately November, after they have lost their leaves, through the first two weeks in February). If transplantation occurs during the growing season, increased mitigation ratios will apply.**
- Any areas that receive transplanted elderberry shrubs and elderberry cuttings will be protected in perpetuity.
- The Corps will work to develop and identify off-site compensation areas prior to or concurrent with any take of VELB.
- The Corps will submit its site suitability study to the Service for review and comment prior to implementation; and request and receive written concurrence from the Service that the site(s) is suitable for compensation for this project prior to construction.
- Management of compensation areas will include all measures specified in USFWS's conservation guidelines (**USFWS 2017**~~1999a~~) related to weed and litter control, fencing, and the placement of signs.
- Monitoring of compensation areas will occur for five consecutive years. Annual monitoring reports will be submitted to the Service **for those five years**.
- Dust control measures shall be implemented when construction activities take place within 100 feet of elderberry shrubs.
- Off-site areas will be protected in perpetuity and have a funding source for maintenance (endowment).

<u>Compensation Measures</u>

Compensation for landside and waterside effects to VELB will be addressed in accordance with the **Framework for Assessing Impact to the Valley Elderberry Longhorn Beetle, May 2017**~~the VELB Guidelines~~ (USFWS **2017**~~1999~~). Shrubs will be removed and transplanted to an approved Conservation Bank ~~for VELB Recovery or to an approved site within the Action Area and outside the levee footprint~~. Transplanted shrubs will be moved prior to construction during dormancy, approximately November through the first **two**~~2~~ weeks in February after they lose their leaves. Transplanting during the dormant period will reduce shock to the plant and increase transplantation success. However, transplanted elderberry shrubs may experience stress, a decline in health, or death due to changes in soil, hydrology, microclimate, or associated

vegetation. ~~Transplanted elderberry shrubs and compensatory seedlings and associated native plants would be planted at a USFWS and Corps approved site, which could include one or both of the proposed habitat compensation areas described below (see "Proposed Habitat Compensation Sites" subsection below).~~ **USACE proposes to construct compensatory habitat at the San Joaquin River West Parcel. Compensatory seedlings and associate plantings would be planted at a rate of 3 acres created for every 1 acre lost.**

Operation and Maintenance Phase

The avoidance, minimization, and compensation measures described here are examples of the types of measures that may be appropriate during the operation and maintenance phase of the project.

Avoidance and Minimization Measures
When a 100-foot (or wider) buffer is established and maintained around elderberry shrubs, complete avoidance (i.e., no adverse effects) will be assumed.

- Where encroachment on the 100-foot buffer has been approved by the USFWS, a setback of 20 feet from the dripline of each elderberry shrub will be maintained whenever possible.
- During maintenance activities, all areas to be avoided will be fenced and flagged.
- Maintenance personnel will be briefed on the need to avoid damaging elderberry shrubs and the possible penalties for not complying with these requirements.
- Dust control measures shall be implemented when Operations, and Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) activities take place **within 100 feet of elderberry shrubs**.
- Maintenance workers will be trained on identification of elderberry plants.
- No restrictions or measures are required for areas which are to be maintained free of any woody vegetation; it is assumed these areas will be maintained on an interval such that any elderberry plants will not achieve the minimum 1 inch necessary for potential beetle occupation.

2. GIANT GARTER SNAKE

Construction Phase

Avoidance and Minimization Measures
The following measures will be implemented to minimize effects on GGS habitat that occurs within 200 feet of any construction activity. These measures are based on USFWS guidelines for restoration and standard avoidance measures included as appendices in USFWS (1997).

- For each discrete reach affecting snake habitat, construction will be initiated during the snake active period (May 1-October 1) and prior to September 15, but may continue beyond the active period provided that work is continuous (lapses shall be no greater than 24 hours).
- All construction personnel, including workers and contractors, will participate in a worker environmental awareness training program conducted by a Service-approved biologist prior to commencement of construction activities.
- A GGS survey would be conducted 24 hours prior to construction in potential habitat. Should there be any interruption in work for greater than two weeks; a biologist would survey the Project Area again no later than 24 hours prior to the restart of work.
- **The biological monitor would conduct a morning inspection before each work day, including the work site, and any parked equipment, and the exclusion fence; (c) and an additional second inspection of habitat during construction for each work day.**
- **Exclusionary fencing would be installed between potential habitat and ground disturbance areas fencing will be buried at least six inches below the ground to prevent snakes from burrowing and moving under the fence, and will be inspected daily.**
- GGS encountered during construction activities will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from GGS aquatic habitat.
- GGS habitat within 200 feet of construction activities will be designated as an environmentally sensitive area and delineated with signs or fencing. This area will be avoided by all construction personnel.
- If a frac-out is identified, all work will stop, including the recycling of the bentonite fluid. In the event of a frac-out into water, the location and extent of the frac-out will be determined, and the frac-out will be monitored for 4 hours to determine whether the fluid congeals (bentonite will usually harden, effectively sealing the frac-out location).
- USFWS, NMFS, CDFW, and the Regional Water Quality Control Board will be notified immediately of any spills and will be consulted regarding clean-up procedures. A Brady barrel will be onsite and used if a frac-out occurs. Containment materials, such as straw bales, also will be onsite prior to and during all operations, and a vacuum truck will be on retainer and available to be operational onsite within notice of 2 hours. The site supervisor will take any necessary follow-up response actions in coordination with agency representatives. The site supervisor will coordinate the mobilization of equipment stored at staging areas (e.g., vacuum trucks) as needed.

- If the frac-out has reached the surface, any material contaminated with bentonite will be removed by hand to a depth of 1-foot, contained, and properly disposed of, as required by law. The drilling contractor will be responsible for ensuring that the bentonite is either properly disposed of at an approved Class II disposal facility or properly recycled in an approved manner.
- Project-related vehicles will observe a ~~20~~**15**-mile-per-hour speed limit within construction areas, except on existing paved roads where they will adhere to the posted speed limits.
- Aquatic habitat for the snake which will be affected by construction will be inspected for the snake, then dewatered, and maintained dry and absent of aquatic prey for 5 days prior to the initiation of construction activities. If complete dewatering is not possible, the Service will be contacted to determine if any additional measures may be necessary to minimize effects to the snake.

Compensation Measures

- Habitat (primarily upland) temporarily impacted for one **construction** season (~~May 1- October 1~~ **lasting six calendar months and commencing during the snake active season**) will be restored after construction by applying appropriate erosion control techniques and replanting/seeding with appropriate native plants. This includes upland snake habitat primarily between the edge of the levee crown to the waterside easement of work locations (excludes hard surfaces) impacted by cutoff wall and reshaping actions; all temporary fill and construction debris shall be removed prior to such restoration work. Aquatic ditches will be recreated.
- Aquatic habitat permanently impacted will be replaced at a 3:1ratio.
- Upland habitat permanently impacted will be replaced at a 1:1ratio.
- Animal burrows exist throughout the project footprint (includes easements). These burrows are a special element of upland habitat used by the snake as refugia. Animal burrows in the footprint will be removed or filled as part of construction activities and new animal burrows will be subject to grouting throughout the project life as part of operation and maintenance. To offset the effect on the snake of construction and grouting of animal burrows for all reaches of the project considered potential snake habitat, there will be a one-time purchase of 22.62 snake credits at an approved snake conservation bank before any project construction. **This purchase has been completed.**
- The Corps will ensure that mitigation is acquired prior to any disturbance of snake habitat. Habitat will be protected, managed, and maintained, in perpetuity.
- Quantify alternative snake refugia (i.e., alternatives to animal burrows, consisting of upland features within 30 ft of snake aquatic habitat, including but not limited to brush piles; riprap with voids sufficient to allow

snake use; animal burrows in uplands outside of maintenance zones but within levees, including islands). This assessment will be done within one year prior to the initial onset of project work, and repeated at five year intervals until completion of all project work in the LSJRFS.

Permanent impacts to GGS aquatic habitat within the construction area would be compensated **by creating GGS habitat at the San Joaquin River West Parcel at a ratio of 3:1 for permanent impacts to aquatic habitat.** No permanent impacts to GGS upland habitat is anticipated. ~~Purchasing bank credits from a USFWS and Corps approved conservation bank per an agreed upon compensation ratio~~.

Operations and Maintenance Phase
The avoidance, minimization, and compensation measures described here are examples of the types of measures that may be appropriate during the O&M phase of the project.

Avoidance and Minimization Measures

- Snake-impacting OMRR&R activities will be planned so that they would occur between May 1 and October 1 during the snake's active season to minimize impacts to the species.
- Grouting of animal burrows on upland within 30 water side ft of snake aquatic habitat will only be done between May 1 and September 1, and during times of day when air temperatures are between 13 and 34 degrees Centigrade (55.4 and 93.2 Fahrenheit). Grouting will be permitted without restriction on levee road and ramp road surfaces, on the land side of the levee, and on upland farther than 30 feet from the water side.
- Construction personnel will participate in USFWS-approved worker environmental awareness program.
- A GGS survey would be conducted 24 hours prior to OMRR&R activities in potential habitat. Should there be any interruption in work for greater than two weeks; a biologist would survey the Project Area again no later than 24 hours prior to the restart of work.
- GGS encountered during OMRR&R activities will be allowed to move away from construction activities on their own.
- Movement of heavy equipment to and from the construction site will be restricted to established roadways. Stockpiling of construction materials will be restricted to designated staging areas, which will be located more than 200 feet away from GGS aquatic habitat.

Summary of Impacts and Mitigation

Species or Habitat Type	Location of Impact	Magnitude of Impact	Duration of Impact	Compensation Ratio	Total Compensation[3]	Location of Compensation
GGS Upland	Northern Staging Area	9.8 acres	Temporary- one construction season	Restore after completion of construction	9.8 acres	On-site
GGS Upland	Waterside slope up to existing aggregate within the project footprint	13.88 acres	Temporary- one construction season	Restore after completion of construction[4]	13.88 acres	On-site
GGS Aquatic	Agricultural ditch	2.3 acres	Temporary- one construction season	Restore after completion of construction	2.3 acres	On-site
GGS Aquatic	Wetland habitat near ditch	0.6 acres	Permanent	3:1	1.8 acres	San Joaquin River West
VELB Existing Shrubs	Waterside slope	10 shrubs	Permanent	N/A	Transplant 10 shrubs	USFWS-approved bank
VELB Riparian	Waterside slope	11.4 acres	Permanent	3:1	34.2 acres	San Joaquin River West
FWCA Riparian Habitat	Waterside slope	13.88 acres	Permanent	2.5:1	34.7 acres	San Joaquin River West
FWCA Wetland Habitat	Wetland habitat near ditch	0.6 acres	Permanent	3:1	1.8 acres	San Joaquin River West

[3] VELB Riparian and FWCA Riparian acres are combined; 34.7 acres of habitat would be created at San Joaquin River West and count for both. GGS aquatic and FWCA Wetland are combined; 1.8 acres of habitat would be created at San Joaquin River West and count for both.

[4] Riprap provides upland habitat for this species and is considered restoration following construction completion.

K. Action Area

The action area is defined as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” 50 CFR § 402.02. The action area encompasses all area(s) in which the effects of the action will be felt. The action area is defined by measurable or detectable changes (stressors) in land, air and water, or other measurable factors that result from the proposed action and interrelated or interdependent actions.

The action area for the TS-30L levee improvement includes the levee improvement areas, borrow area, staging areas, haul routes, compensation area, and portions of the surrounding agricultural fields. Since there is not a hydrologic connection between the agricultural ditch and other nearby waterbodies, it is not anticipated that effects would be carried downstream. In addition, best management practices (BMP’s) would reduce these effects to the extent feasible. Air quality BMP’s would also reduce the effects of fugitive dust and constrain the impacts to the Project Areas. Haul routes and roads are currently used as roads, and, therefore, no additional effects are anticipated along the haul routes. Although TS-30L is a portion of the larger LSJR project, overall effects for the LSJR project have been analyzed in the 2016 BO. and a summary of these effects is given in Table 5. Effects to the action area in this SBA will focus on the changes to the TS-30L area. Future documents will assess additional changes to the other areas of the LSJR project as those details are developed.

Table 5 - Summary of LSJR Project Effects

Action Area (Sub-Regions)	Cost Reaches	Waterway	Reach Description	Proposed Measure(s)	Waterside Vegetation Clared for Construction & ETL Compliance	Total Existing Woody Riparian (WR)/SRA Within Project Footprint	Total # Acres Waterside Woody Riparian Lost (Lower Levee)	Total Linear Footage Waterside SRA Lost	Qualitatitive Value[1] of Habitat (Species)
Mosher Slough	MC_30L (6,600 ft)	Mosher Slough	Thornton road to railroad tracks	Cutoff Wall	Removal of 100 vegetation in upper half of levee within contruction footprint. Removal of upto 75% of vegetation on lower half of levee slope for ETL compliance.	3.5 acres (WR) 0 lf (SRA)	1.5 acres	0 lf	Low quality habitat for all life stages of delta smelt. Poor water quality for juvenile rearing and migration for salmon, steelhead and green sturgon.
	MC_10L_20L (10,700 ft)		Shima Tract to Thornton Road	Cutoff Wall, Levee Height fix (sea level rise)					
Delta Front	ST_10R_20R (5,700 ft)	Shima Tract	Mosher Slough to Fivemile Slough	Cutoff Wall, Erosion protection (landside)	Removal of 100 vegetation in upper half of levee within contruction footprint. Removal of upto 75% of vegetation on lower half of levee slope for ETL compliance.	2.75 acres (WR) 0 lf (SRA)	.75 acres	0 lf	Low quality habitat for all life stages of delta smelt. Poor water qualityfor juvenile rearing and migration for salmon, steelhead and green sturgon.
	FS_10R (1,700 ft)	Fivemile Slough	Shima Tract to Fourteenmile Slough						
	FM_60L (1,600 ft) FM_50L (300 ft) FM_40L (1,500 ft) FM_30L (7,000 ft)	Fourteenmile Slough	Fivemile Slough to Proposed Closure Structure	Seismic fix, slope, Reshaping Levee Height Fix(sea level rise), Erosion protection(Landside)	Removal of 100% vegetation in upper half of levee within contruction footprint. Removal of upto 75% of vegetation on lower half of levee slope for ETL compliance. Removal of all vegetation for Closure structure easement.				High quality for spawning and rearing habitat for delta smelt. Poor water quality habitat for juvenile rearing and migration for salmon, steelhead, and green sturgeon.
				Closure structure					
			Approx 1,500 ft west of Fivemile Slough	Seismic fix, Levee Height Fix(sea level rise), Erosion protection(Landside)					
			Approx 1250 feet Southeast setback out from proposed closure structure	Seismix fix (adjacent levee). Erosion protection (landside), Setback levee					
			From setback cut South to Tenmile Slough						
	TS_30L (5,900 ft) TS_20L (1,600 ft)	Tenmile Slough	Fourteenmile Slough to March Lane	Cutoff wall, Slope reshaping, Erosion protection(waterside)	Removal of 100% vegetation in upper half of levee within construction footprint. **Removal of 100% vegetation on lower half of levee slope.**				High quality for spawning and rearing habitat for delta smelt. Poor water quality habitat for juvenile rearing CH for delta smelt. Low quality habitat for salmon steelhead, and green sturgeon.
			March Lane to West March Lane/Buckley Clove Way						
	TS_10L (4,000 ft)	Tenmile Slough/Buckley Cove Marina/San Joaquin River	West March Lane/Buckley Cove Way to Calaveras river.	Seismic fix, Slope Reshaping					
Calaveras River	CR_10R-80R (23,000 Ft)	Calaveras River- Right/North Bank	San Joauin River to NEl Dorado St	Cutoff Wall	Removal of 100% vegetation in upper half of levee within construction footprint. Removal of upto 75% of vegetation on lower half of levee slope for ETL compliance.	11 acres (WR) 10.406 lf (SRA)	3.0 acres	7,805 lf	High quality habitat for delta smelt spawning and rearing. High quality habitat for steelhead adult migration and juvenile rearing and migration. Medium quality habitat for green sturgeon juvenile rearing and migration at confisence of Calaveras River. Medium quality EFH for salmon.
		Calaveras River- Left/South Bank	San Joauin River to approx I-5						
		Calaveras River- Left/South Bank	Approx I-5 to approx NPershing Ave	Cutoff Wall, Slope Reshaping					
		Calaveras River - Left/South Bank	Approx N Pershing ave to approx NPacific st	Cutoff Wall					
		Calaveras River - Left/South Bank	Approx N Pacific to El Dorado Street						
San Joaquin River Downstream of French Camp Slough	SC_30 (800 ft)	Smith Canal	At the mouth of the cnal between Brown's Island and Dad's Point.	Closure structure	Removal of 100% vegetation in upper half of levee within contruction footprint. Removal of upto 75% of vegetation on lower half of levee slope for ETL compliance. Removal of all vegetation for Closure structure easement.	9 acres (WR) 7,949 lf (SRA)	3 acres	6,318 lf	**SJR**: High quality habitat for delta smelt spawning and rearing. High quality habitat for steelhead adult migration and juvenile rearing and migration. High quality habitat for green sturgeon juvenile rearing and migration at confluence. **Smith Canal**: Low quality habitat for delta smelt and green sturgeon. Low quality habitat for salmon and steelhead juvenile rearing and migration.
	SJR_10R (8,600 ft)	San Joaquin River	For approx 2,100 ft upstream of Calaveras River to the proposed Smith Canal Closure Structure	Cutoff Wall, Levee Height fix (sea level rise)					
	SJR_20R (600 ft)	Smith Canal	Dad's Point from the closure structure to approx 375 ft down Monte Diablo Ave	Floodwall					
	SJR_30R (3,500 ft)	San Joaquin River	Railroad bridge just upstream of Port of Stockton to Burns Cutoff	Cutoff Wall, Slope Reshaping	Removal of 100% vegetation in upper half of levee within contruction footprint. Removal of upto 75% of vegetation on lower half of levee slope for ETL compliance.				**SJR**: High quality habitat for delta smelt spawning and rearing. High quality habitat for steelhead and salmon adult migration and juvenile rearing and migration. High quality habitat for green sturgeon juvenile rearing and migration at confluence.
	SJR_40R-70R (12,600 ft)		Burns Cutoff to French Camp Slough	Cutoff Wall					
French Camp Slough and Duck Creek	FCS_10R (9,000 ft)		Part of CS-E-9 "a" and "b" NEPA Reaches	Cutoff Wall	Removal of 100% vegetation in upper half of levee within construction footprint. Removal of upto 75% vegetation on lower half of levee slope for ETL compliance.	4.75 acres (WR) 7,153 lf (SRA)	.75 acres	5,509 lf	Low quality habitat for delta smelt. Low quality habitat for straying juvenile rearing and migrating salmon, steelhead and green sturgeon. Medium quality habitat for salmon and steelhead highwater habitat.
	DC_10R	Duck Creek ("a" only)	French Camp Slough to 500 ft past I-5 crossing	Cutoff Wall					
	DC_20R	Duck Creek	500 ft past I5 crossing to approx Odell Ave	New Levee					
	DC_30R	Duck Creek	Approx Odell Ave to Mckinley Ave	Fix in-place Cutoff Wall, Levee Reshaping, Levee height Fix					

[1]High, Medium and low qualitative values were based on best professional judgement and personal communications with Jeff Stuart (NMFS). Parameters considered include d temperature, pollutants, dissolved oxygen and flows.

Levee Improvement Areas
Existing habitats within the construction footprint were described in the supplemental Coordination Act Report completed in 2022 with the results of a Habitat Evaluation Procedures (HEP) survey led by USFWS to evaluate the quality of the acres of riparian habitat that would be impacted at TS-30L. Riparian scrub-shrub, riparian forest, and wetland cover types are present at TS-30L. In addition, an aquatic resource delineation was conducted by USACE on March 9, 2021, for the irrigation ditch and the wetlands located between the ditch and the TS-30L levee. The findings of the surveys indicate that riparian cover types combined consist of 11.4 acres on the waterside slopes and toe, 2.3 acres of irrigation ditch adjacent to some segments of the waterside toe, and 0.6 acres of wetland adjacent to and associated with the ditch. Habitat surveys conducted in support of the project (not including the supplemental CAR report) are included in Appendix D. The landside of the levee slopes consists of crushed aggregate and are unvegetated.

Habitats in this area on the waterside levee slope, and the footprint of the land and waterside patrol roads, would be permanently lost starting with the vegetation removal phase as described in Table 4. Since the waterside slope would be converted to riprap without soil, vegetation would not regrow. Similarly, within the boundaries of the patrol road, no vegetation would be allowed to regrow, and these areas would be considered developed lands from a habitat perspective.

During the construction, the airspace above the improvement area could also be unavailable as habitat or a transit corridor due to vehicular traffic and fugitive dust. The ground below the improvement area would be subject to vibration from heavy equipment for the duration of the construction phase as noted in Table 4. Areas within the levee improvement footprint would also be subject to noise for the duration of the project.

Borrow Area
The U.S. Bureau of Reclamation (USBR) described the proposed borrow site as heavily disturbed from annual crop production of corn, asparagus, and tomatoes with bare ground in the winter (USBR, 2018). The USBR further identified that regular cultivation practices such as herbicide spraying and mowing prevented the establishment of riparian vegetation within the ditches that provide water to the parcel (USBR, 2018).

Areas within the proposed borrow area would be subject to temporary vegetation removal, noise, and dust for the duration of the construction phase of the project. Upon completion of the project, the borrow area would be converted from a fallowed field to a groundwater infiltration set aside. After completion of fill extraction, the area would be reseeded with a native seed mix. In future years, seasonal wetlands could develop in this area; however, the future condition of the borrow area is beyond the scope of this analysis.

Staging Areas
The northern staging area is an irrigated rice field. The southern staging area is an undeveloped parcel of land covered in non-native herbaceous vegetation, with ornamental trees along the perimeter.

Areas used for staging would be subject to vegetation removal, dust, noise, vibration, and vehicular traffic for the duration of the construction phase of the project. Staging areas would be surrounded by both wildlife exclusion fencing as well as chain link fencing for the duration of the construction phase making these areas unavailable as habitat for the entirety of construction. Following construction, these areas would be returned to their previous uses. The northern staging area would return to rice cultivation and the southern staging area would be reseeded with a native seed mix.

Haul Routes
All haul routes are along existing paved and dirt roads and are therefore either paved or kept free of vegetation.

Haul routes would be subject to additional vehicular traffic than usual. Since many heavy-duty trucks would be using these routes, there would likely be more noise and vibration than usual. Low hanging branches along roadways would be removed to allow access for truck traffic. Since load are required to be covered, and dirt roads would be regularly sprayed with water, it is not anticipated that there would be any additional fugitive dust.

Compensation Area- San Joaquin River West Parcel
Habitat surveys within the proposed compensation parcel were conducted in December 2022. Habitat is primarily annual grasses and nonnative forbs. The parcel is used for agriculture but was fallowed at the time of survey.

Habitats in the compensation area would be subject to noise, fugitive dust, vibration, and increased vehicular traffic starting with the construction as listed in Table 3. Most existing vegetation would be removed, except for native trees. After planting is completed as described in Table 3, habitat benefits would begin to accrue as vegetation matures and is able to provide food and shelter. Over time, the mitigation area will provide more valuable habitat than its original state. Minor periodic disturbances associated with personnel conducting hand weeding, signage repair, and other maintenance task would occur regularly for the life of the site; however, these disturbances are expected to be low in intensity and short in duration.

Surrounding Agricultural Fields
The surrounding agricultural fields are annually used for rice cultivation. Ditches line and run through the parcel, with some amount of volunteer vegetation, such as bulrush (*Schoenoeplectus* sp.) and cattail (*Typha* sp.), along some of them.

The surrounding agricultural fields are likely to experience some degree of spillover from the construction of the levee improvement. With the implementation of air quality management BMP's, fugitive dusts are anticipated to be restricted to the construction site, borrow areas and staging areas. Construction sites are generally 95dB throughout their area with periodic exceedances of 100dB (NRC, 2012). Given that the topography of the site is generally flat, noise from the site could be expected to extend approximately 3200 feet from the construction site. The distance at which ground vibrations can be felt varies based on soil type, water content, and equipment used. Since these calculations have not been completed, the maximum distance for type of equipment used would be 800 feet (NHDOT, 2012) and is the distance assumed.

IV. STATUS OF THE SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

For species that are described and covered in this consultation, habitat preferences and distributions are based on published data, agency documents, review of the IPaC from the USFWS (Project Code: 2023-0079350) and environmental surveys.

A. Giant Garter Snake

Status. The USFWS listed GGS as a threatened species under the ESA on October 20, 1993 (58 FR 54053). A Recovery Plan was approved in 2017 (USFWS 2017). Recovery actions are focused on protecting existing, occupied habitat and identifying and protecting areas for habitat restoration, enhancement, or creation, including areas that are needed to provide connectivity between populations (USFWS 2017). Critical habitat has not been designated for this species.

Distribution. GGS inhabit agricultural wetlands and other waterways such as rice fields, irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands in the Central Valley (USFWS 2020). Historical records suggest that GGS inhabited freshwater marshes, streams, and wetlands throughout the length of the Sacramento and San Joaquin Valleys in Central California (USFWS 2017). Today only about five percent of its historical wetland habitat acreage remains. Currently, this species is only known from nine isolated population clusters within the Central Valley, from Chico to an area just southwest of Fresno (USFWS 2017).

GGS have been reduced in distribution and abundance due to habitat loss and degradation throughout the Central Valley. Several factors may degrade habitat for the species, including upstream watershed modifications, water storage and diversion projects, and urban and agricultural development. Contamination from agricultural runoff

may also have detrimental effects. On-going agricultural practices such as tilling, grading, harvesting and operation of other equipment may also result in mortality and increased rates of predation. Clearing and maintenance of irrigation canals and draining of rice fields may also result in mortality and degradation of habitat (USFWS; 2017).

There are known populations of GGS within the counties of the Project Area (CDFW 2023). There are two known occurrences of GGS within two miles of the Project Area. One is located near the Roberts Island II Dredged Material Placement Site on the left bank of the San Joaquin River, and another near Louis Park in Stockton (CDFW 2023).

The aquatic ditch and surrounding wetland habitat and rice fields are considered suitable habitat for GGS. The levee itself could be considered suitable as upland brumation and aestivation habitat for GGS. The northern staging area is also considered suitable habitat as GGS are known to use rice fields as foraging habitat.

Life History. GGS feed primarily on small fishes, tadpoles, and frogs in agricultural wetlands and associated waterways, including irrigation and drainage canals, rice fields, marshes, sloughs, ponds, low-gradient streams, and adjacent uplands. They use small mammal burrows and other soil crevices above prevailing flood elevations throughout the winter dormancy period, and require emergent, herbaceous wetland vegetation, such as cattails and bulrushes, as escape cover and foraging habitat during the active season (early April to mid-October). They have also been observed using revetment as cover (Halstead et al. 2010). GGS are believed to be most numerous in rice-growing regions (USFWS 2017). The snakes are typically absent from the larger rivers, wetlands with sand, gravel, or rock substrates, and riparian areas lacking suitable basking sites or suitable prey populations (USFWS 2017). Habitually, GGS hibernate from October to March in abandoned burrows of small mammals located above prevailing flood elevations, and breeds during March and April.

B. Valley Elderberry Longhorn Beetle

VELB are a medium-sized beetle native to riparian habitats in the Sacramento and San Joaquin Valleys of California. They are nearly always found on or close to their host plant, elderberry. Males range in length from about one-half to nearly one inch with antennae about as long as their bodies. Females are slightly broader than males and have shorter antennae. Adult males have red-orange wing covers with four elongate spots, while adult females have dark colored wing cover.

Throughout its range, the beetle is estimated to inhabit approximately 20 percent of all suitable elderberry shrubs. Elderberry shrubs are found in or near riparian and oak woodland habitats. The presence of exit holes in elderberry stems indicates previous valley elderberry longhorn beetle habitat use. Exit holes are cylindrical and approximately 0.25 inch in diameter. Exit holes can be found on stems that are one or

more inches in diameter. The holes may be located on the stems from a few inches to about nine to 10 feet above the ground (Barr 1991).

Status. The USFWS listed VELB as threatened under the ESA on August 8,1980 (45 FR 52803). A final, revised Recovery Plan was approved in 2019 (USFWS 2019). The recovery strategy includes: 1) the establishment of sufficiently large populations throughout the species' range to ensure each population has the resiliency to withstand stochastic events; 2) maintaining the species' current level of representation (genetic and ecological diversity) so it potentially has the capacity to adapt to future environmental changes; and 3) increasing the species' current level of redundancy through the establishment of a sufficiently large number of local- and meta-populations widely distributed throughout the species' range to allow the species to withstand catastrophic events (USFWS 2019). Critical habitat was designated along the American River within Sacramento County in 1980 (45 FR 52803 USFWS 2019a). The proposed action falls outside the critical habitat.

Distribution. VELB's range extends from southern Shasta County to Madera County up to 500 feet elevation (USFWS 2019). Ten elderberry shrubs are present within the TS-30L Project Area but no exit holes were documented during site surveys. CNDDB lists the nearest occurrence about six miles from the project site.

Since the shrubs are present in riparian habitat, and the land use of the property to the west has not changed since large scale agriculture began, it is reasonable to assume that the shrubs in the project site are suitable habitat for VELB.

Life History. VELB's life history is assumed to follow a sequence of events similar to those of related taxa. Female beetles deposit eggs in crevices in the bark of living elderberry shrubs. Presumably, the eggs hatch shortly after they are laid, and the larvae bore into the pith of the trunk or stem. When larvae are ready to pupate, they move through the pith of the plant, open an emergence hole through the bark and return to the pith for pupation. Adults exit through the emergence holes and can sometimes be found on elderberry foliage, flowers, or stems or on adjacent vegetation. The entire life cycle of VELB is thought to encompass 2 years, from the time eggs are laid and hatch until adults emerge and die (USFWS 2019).

C. Monarch Butterfly

Adult monarch butterflies have two sets of bright orange wings with a black border, black veins spanning three to four inches in length. A double row of white spots is visible on the upper side of the wings. Caterpillars have black, yellow, and white stripes (USFWS 2021).

Status. The USFWS determined that the monarch butterfly is a candidate species for listing under the ESA on December 17, 2020, based on a 12-month finding in response

to a petition to list the species under the act (85 FR 81813). Listing the monarch butterfly was found to be warranted but precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants (85 FR 81813). As of May 3, 2022, the listing priority number remains eight in the candidate notification of review (87 FR 26152).

Monarch butterflies are facing a number of threats which are contributing to their decline including conversion of grasslands to agriculture, exposure to pesticides and loss of host plants due to herbicides, loss of overwintering sites in Mexico and California, urban development, and climate change (85 FR 81813).

Distribution. The monarch butterfly exists in several populations throughout the world (Nail, Drizd, and Voorhies, 2019). Within Western North America, northwestern populations are understood to migrate between Washington and Oregon to California, and more northeasterly populations from Idaho and Montana south to Mexico (Dingle, et al., 2005). There are numerous citizen science, non-governmental organizations, and government agencies that track populations and occurrences of monarch butterflies. Records within CNDDB only identify overwintering sites, which are located along the California Coast (CDFW, 2023); however, Journey North tracks all monarch butterfly sightings. Journey North reported adult monarch butterflies within two miles of the Project Area within the last five years (Journey North, 2023).

Life History. Monarchs have a complex migratory lifecycle that is completed intergenerationally. Eggs are laid on a number of milkweed (*Asclepias* sp.) where the caterpillars will feed exclusively for five instar stages before a roughly 2-week pupation (Journey North, 2023). Breeding adults live only two to five weeks, but overwintering adults can live six to nine months (USFWS, 2023). Migration in the Western United States commences from overwintering on the coast around February with groups disassociating eastward and northward as they move inland in the spring, ovipositing opportunistically (Dingle, et.al., 2005). Subsequent generations return roughly south-southwest in the autumn.

V. ENVIRONMENTAL BASELINE AND CUMULATIVE EFFECTS

This section will be used along with the species and critical habitat information from the preceding section to describe the pre-action condition of the species and critical habitat that will be exposed to the stressors and subsidies of the action(s) under consultation. The purpose of this section is also to provide a summary of the relevant local information on the impacts that other factors (human and natural) in the action area have had on the viability of the species and value of critical habitat. These other factors may have occurred in the past, may continue to affect the species and habitat today, or will affect the species and habitat in the future.

A. Environmental Baseline

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species or its habitat and ecosystem within the Project Area (USFWS and NMFS, 1998). The environmental baseline "includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process" (50 CFR § 402.02).

Agricultural Uses

Historically, the parcel on which the TS-30L segment is located, would have been a seasonal wetland or marsh, likely with emergent vegetation, and numerous dendritic channels. However, land in and around Stockton has been used for agricultural purposes for over 150 years (Visit Stockton, 2023). Cultivation of the land for crops has historically involved draining wetlands, channelizing waterways into irrigation ditches, alteration of natural hydrology, plowing, removal of native vegetation, extirpation of native species, destruction of soil structure, alteration of soil chemistry, and alteration of land grade.

Levee Maintenance

Levee maintenance activities consist of regularly grouting (filling with cement) rodent burrows, routine uses of rodenticide, herbicide, and insecticide to control for unwanted biota, burning of vegetation on the levee, periodic placement of rock substrates (bank hardening), and vehicular traffic. Increased vehicular traffic can result in mortalities on road surfaces as well as introduce non-native plant species.

Utility Maintenance Activities

Periodic utility maintenance activities include ground disturbance to access underground pipes and vegetation removal for access to utilities. Vehicular access to offroad areas to access utilities can result in mortalities for wildlife, soil compaction, and introduction of non-native species.

Recreational Uses

Recreational uses of the Project Area result in increased noise and disturbance of some species in the surrounding area. Disturbance of native wildlife by domestics, sometimes resulting in mortality, sometimes also occurs due to outdoor and feral cats, as well as dogs off leash. Pets can also transmit diseases to wildlife through feces or harass wildlife out of territories through scent marking.

B. Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated (*i.e.*, not interrelated, or interdependent) to the proposed action are not

considered in this analysis because they will be subject to separate consultation pursuant to Section 7 of the ESA.

Construction of the proposed groundwater recharge basin at the SEWD borrow site is likely to occur with or without the completion of this project, as that action has been separately funded by USBR. However, the groundwater recharge basin project proponents would likely need to find another project for which to provide fill.

The immediate vicinity of the TS-30L project, as bounded by the San Joaquin River to the south and west and White Slough to the north and east up to the Brookside development, is listed in the City of Stockton General Plan (City of Stockton, 2018) and the County of San Joaquin General Plan (County of San Joaquin, 2022) as an agricultural/open space set aside. Further, the area is subject to the Delta Plan (Delta Stewardship Council, 2019), which restricts incompatible activities, such as residential development.

Within the Greater Stockton Area, residential and commercial development continue. The parcel immediately to the north, referred to as the Shima Tract is scheduled for residential development under the Sanctuary plan (City of Stockton, 2021). All areas to the west of the proposed project are not planned for development for the foreseeable future (Delta Stewardship Council, 2019).

Continued development for residential and commercial purposes will continue to reduce the habitat available for all species in the region for the foreseeable future.

VI. EFFECTS OF THE ACTION

Initial evaluation of the effects of the proposed project indicated that there could be an effect on several resources. Section VI.A describes potential direct and indirect effects on Federally listed species in the Project Area, and Section VI.B describes potential effects on the environment and how these effects could directly or indirectly affect these species.

A. Potential Effects to Listed Species

Section 9 of the ESA prohibits the take of listed threatened and endangered species. Under this act, “take” means to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct” (16 U.S.C. § 1532[19]). The proposed project could result in take of some special status species that have the potential to occur in the vicinity of the Project Area.

Giant Garter Snake

The proposed action **May Affect, and is Likely to Adversely Affect**, giant garter snakes. Construction of the project would result in a direct loss of 0.6 acres of aquatic habitat. In addition, there would be a temporary loss of the 2.3 acres of habitat within the irrigation ditch, and a temporary loss of 9.8 acres of foraging habitat due to use of the northern staging area, and a temporary loss of 11.6 acres of upland GGS habitat to account for the levee slopes within 200 feet of aquatic habitat. Fencing would be installed to exclude GGS from the project site, including staging areas, and would remain for the duration of the construction. A service approved biologist would inspect the fencing daily to verify its integrity and ensure no GGS are within the Project Areas. While this measure would reduce the chances for mortality, it makes habitat temporarily completely unavailable within the Project Area. Upon completion of the project, the northern staging area would be returned to cultivation and available for use as foraging habitat. The levee slopes would consist of riprap which is also suitable as upland habitat for GGS.

Since snakes use small mammal burrows, soil crevices, and/or rock crevices for shelter for brumation during the winter season and aestivating during extremely hot days during their active period any ground disturbing work near GGS suitable habitat carries the risk of crushing a snake in its burrow. However, the proposed action would commence during the active season for the snakes; therefore, it is anticipated that the chances for mortality are low, since noise, vibration, and general disturbance in the area would deter the snakes from the construction footprint. In addition, installation of wildlife exclusion fencing, and use of biological monitors would reduce the chances of a snake entering or remaining in the construction areas. It is likely that there would be excess ground vibration beyond the project construction area and, therefore, the proposed project will likely have some additional adverse effect by harassing snakes away from suitable habitat, just outside the construction area. In addition, due to increased vehicular traffic near GGS habitat, there is an elevated chance that a snake could be hit by a construction vehicle while basking on a road. However, use of wildlife exclusion fencing, biological monitors, and enforcement of a speed limit of 15 mph within the Project Area would reduce these effects to the extent practical. These effects would cease following the completion of construction.

Valley Elderberry Longhorn Beetle

The proposed action **May Affect, and is Likely to Adversely Affect,** the valley elderberry longhorn beetle. Ten elderberry shrubs would be permanently transplanted to a conservation bank, permanently moving suitable habitat from the current area to the conservation bank and the San Joaquin River West compensation area. Transplant stress could result in the loss or reduction in health of the mature shrubs which could adversely affect any present larvae. In addition, there would be a time lag between the removal of the habitat and the compensation seedlings reaching a suitable size to provide habitat benefits.

Transplanting of shrubs currently existing within the project footprint would occur during the dormant season for the plant and would be conducted by persons familiar with the work. These measures would reduce the chances for mortality or stress to the shrubs to the extent practical. Further, since construction work would be completed outside of the VELB flight season, it is extremely unlikely that a mortality would occur.

Currently, the shrubs on the waterside slope of the levee are subject to pesticide drift from the adjacent rice field, in addition to dust from the adjacent road. The San Joaquin River West Parcel would plant compensatory seedlings in the interior areas of the parcel to reduce the chances of pesticide drift. The compensation ratio of 3:1 accounts for the time lag required for the compensatory seedlings to reach an appropriate size to provide a habitat benefit. In the long run, habitat in the San Joaquin River West compensation area would be of higher quality and subject to less disturbance than the relict shrubs currently present on the waterside levee slope.

Monarch Butterfly

The Monarch butterfly is currently listed as a candidate ESA species due to loss of habitat, use of pesticides, and climate change. Candidate species receive no statutory protection under the ESA. However, USFWS encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under the ESA. Construction of the project would result in a short-term loss of habitat due to loss of vegetation on the levee slopes for the Monarch butterfly. However, construction of the compensation area would result in the creation of a greater amount of superior habitat, since pollinator specific species to be included in the area would not be subject to pesticide drift, compared to those currently present on the levee slopes. Since the loss of habitat would only last for one season, the effect is expected to be muted and inclusion of pollinator species within the compensation area will benefit the species in the long run.

B. Environmental and Indirect Effects

1. ENVIRONMENTAL EFFECTS

Levee improvements would result in a permanent loss of vegetation along the waterside of the structure. Within the greater area, no landscape level effects are anticipated. Changes to the levee structure are not anticipated to cause environmental effects beyond the direct take of habitat which would be fully compensated at the San Joaquin River West Parcel.

2. INDIRECT EFFECTS

Indirect effects, as defined by the ESA, are those effects that are caused by the proposed action and are later in time but are still reasonably certain to occur. Since rock heats differently than soil, it can be anticipated that there would be a long-term shift in

the microclimate of the immediate vicinity. Areas directly around the levee could be expected to be slightly warmer during the summer months for longer into the night than an earthen bank would be. In the summer months, this would be a benefit to GGS, who are ectotherms, as they could use the additional warmth for additional active hours and metabolic support. However, in the winter, the effect would be reversed as the insulative properties of stone are far inferior to those of natural soil. Therefore, the quality of winter refugia would be reduced. Taken together, the overall effect is insignificant.

VII. CONCLUSION

In conclusion, the proposed levee improvements at TS-30L, as described in this SBA, **may affect, and are likely to adversely affect,** the giant garter snake and the valley elderberry longhorn beetle. This determination is based on the understanding of the actions required to complete the proposed action.

Implementation of avoidance and minimization measures proposed would reduce mortality and adverse effects to the extent attainable while achieving the project objectives and construction of the compensation area as described would fully compensate for unavoidable adverse effects to the listed species.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To:
Project Code: 2023-0079350
Project Name: TS_30_L Levee Improvement

May 08, 2023

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

San Francisco Bay-Delta Fish And Wildlife
650 Capitol Mall
Suite 8-300
Sacramento, CA 95814
(916) 930-5603

PROJECT SUMMARY

Project Code: 2023-0079350
Project Name: TS_30_L Levee Improvement
Project Type: Levee / Dike - Maintenance/Modification
Project Description: Located in Stockton a total size of 144 acres. The levee improvements will include moving 6000ft of levee next to an agricultural ditch.
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@37.9687459,-121.2156245884236,14z



Counties: San Joaquin County, California

ENDANGERED SPECIES ACT SPECIES

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Riparian Brush Rabbit *Sylvilagus bachmani riparius*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/6189

REPTILES

NAME	STATUS
Giant Garter Snake *Thamnophis gigas*	Threatened

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/4482

AMPHIBIANS

NAME	STATUS
California Tiger Salamander *Ambystoma californiense*	Threatened

Population: U.S.A. (Central CA DPS)
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/2076

FISHES

NAME	STATUS
Longfin Smelt *Spirinchus thaleichthys* Population: San Francisco Bay-Delta DPS No critical habitat has been designated for this species.	Proposed Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7850	Threatened

CRUSTACEANS

NAME	STATUS
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

FLOWERING PLANTS

NAME	STATUS
Large-flowered Fiddleneck *Amsinckia grandiflora* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/5558	Endangered
Palmate-bracted Bird's Beak *Cordylanthus palmatus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1616	Endangered

CRITICAL HABITATS

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* For information on why this critical habitat appears for your project, even though Delta Smelt is not on the list of potentially affected species at this location, contact the local field office. https://ecos.fws.gov/ecp/species/321#crithab	Final

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Belding's Savannah Sparrow *Passerculus sandwichensis beldingi* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8	Breeds Apr 1 to Aug 15
Bullock's Oriole *Icterus bullockii* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Mar 21 to Jul 25
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31

NAME	BREEDING SEASON
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Common Yellowthroat *Geothlypis trichas sinuosa* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/2084	Breeds May 20 to Jul 31
Lawrence's Goldfinch *Carduelis lawrencei* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9464	Breeds Mar 20 to Sep 20
Long-eared Owl *asio otus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Nuttall's Woodpecker *Picoides nuttallii* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9410	Breeds Apr 1 to Jul 20
Oak Titmouse *Baeolophus inornatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9656	Breeds Mar 15 to Jul 15
Olive-sided Flycatcher *Contopus cooperi* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Tricolored Blackbird *Agelaius tricolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3910	Breeds Mar 15 to Aug 10
Western Grebe *aechmophorus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31
Wrentit *Chamaea fasciata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 10
Yellow-billed Magpie *Pica nuttalli* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9726	Breeds Apr 1 to Jul 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

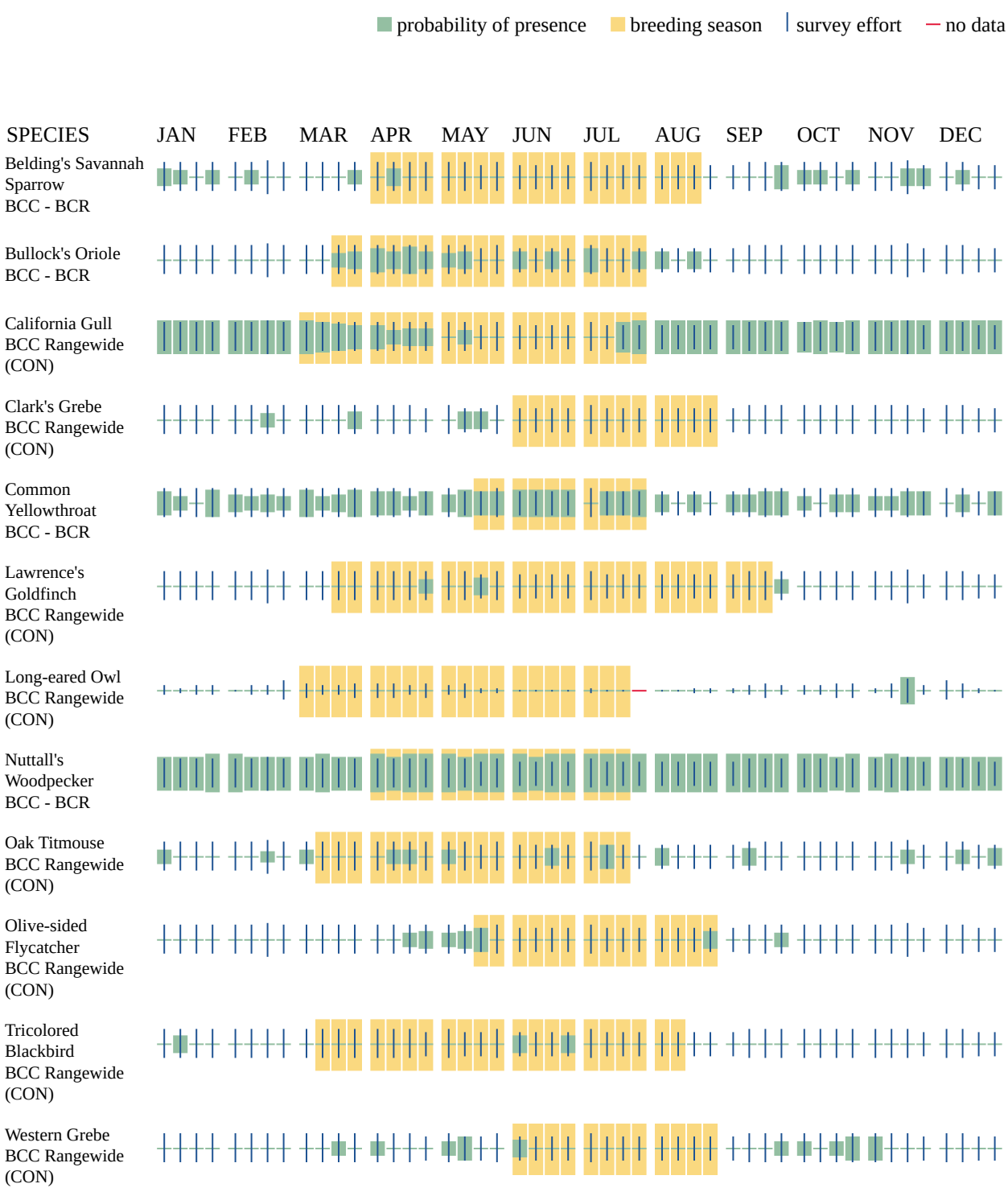
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

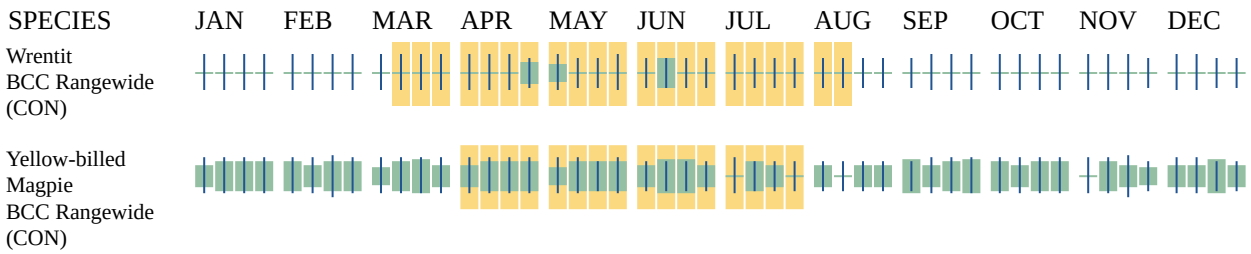
Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

MIGRATORY BIRDS FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

WETLAND INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE VISIT HTTPS://WWW.FWS.GOV/WETLANDS/DATA/MAPPER.HTML OR CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

IPAC USER CONTACT INFORMATION

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Appendix B
TS-30L Construction Plans

US Army Corps of Engineers®
SACRAMENTO DISTRICT

LOWER SAN JOAQUIN RIVER REACH TS_30_L LEVEE IMPROVEMENT SAN JOAQUIN COUNTY, CALIFORNIA PROJECT 475448



SOLICITATION NO.:
CONTRACT NO.:
DESIGN FILE NO.: 7-04-1877
ISSUE DATE: NOVEMBER 2022

REGISTERED PROFESSIONAL ENGINEER
SERGIO JIMENEZ
NO. C 55698
Exp. 12/31/22
CIVIL
STATE OF CALIFORNIA

USACE SACRAMENTO SIGNATURE BLOCK
PREPARED UNDER THE DIRECTION OF:

JAMES HANDURA
COLONEL, CORPS OF ENGINEERS, SACRAMENTO DISTRICT

APPROVED BY:

RICK POEPPELMAN, P.E.
CHIEF, ENGINEERING DIVISION

APPROVED FUNCTIONAL ADEQUACY:

WILLIAM HALL, P.E.
CHIEF, CIVIL WORKS DESIGN BRANCH

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QUALITY CHECKED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30_L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

TITLE SHEET

SHEET ID
G-001

FINAL SUBMITTAL

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4	G-004	GENERAL NOTES
5	G-005	BORROW SITE AND HAUL ROUTES
6	G-006	STAGING AND STOCKPILE AREA AND HAUL ROUTES
7	V-001	PROJECT SURVEY CONTROL AND CONTROL LINE PLAN AND TABLES
8	V-002	PROPOSED LEVEE CENTERLINE CONTROL LINE PLAN AND TABLES
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16	B-202	BORING LOG PLAN AND PROFILE STA 30+00 TO 60+00
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19	V-102	AERIAL PLAN STA 20+50 TO 31+00
20	V-103	AERIAL PLAN STA 31+00 TO 41+50
21	V-104	AERIAL PLAN STA 41+50 TO 52+00
22	V-105	AERIAL PLAN STA 52+00 TO 62+00
23	C-100	LEVEE PLAN STA 1+00 TO 10+00
24	C-101	LEVEE PLAN STA 10+00 TO 20+50
25	C-102	LEVEE PLAN STA 20+50 TO 31+00
26	C-103	LEVEE PLAN STA 31+00 TO 41+50
27	C-104	LEVEE PLAN STA 41+50 TO 52+00
28	C-105	LEVEE PLAN STA 52+00 TO 62+00
29	C-200	LEVEE PROFILE STA 1+00 TO 10+50
30	C-201	LEVEE PROFILE STA 10+50 TO 21+00
31	C-202	LEVEE PROFILE STA 21+00 TO 31+50
32	C-203	LEVEE PROFILE STA 31+50 TO 42+00
33	C-204	LEVEE PROFILE STA 42+00 TO 52+50
34	C-205	LEVEE PROFILE STA 52+50 TO 63+00
35	C-311	CROSS SECTIONS STA 1+00 TO 9+00
36	C-312	CROSS SECTIONS STA 10+00 TO 18+00
37	C-313	CROSS SECTIONS STA 19+00 TO 27+00
38	C-314	CROSS SECTIONS STA 28+00 TO 36+00
39	C-315	CROSS SECTIONS STA 37+00 TO 45+00
40	C-316	CROSS SECTIONS STA 46+00 TO 54+00
41	C-317	CROSS SECTIONS STA 55+00 TO 61+00
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53	CG-101	EROSION CONTROL PLAN STA 10+00 TO 20+50
54	CG-102	EROSION CONTROL PLAN STA 20+50 TO 31+00
55	CG-103	EROSION CONTROL PLAN STA 31+00 TO 41+50
56	CG-104	EROSION CONTROL PLAN STA 41+50 TO 51+50
57	CG-105	EROSION CONTROL PLAN STA 51+50 TO 61+00

ABBREVIATIONS

AB	AGGREGATE BASE
AC	ASPHALT CONCRETE
ALT	ALTERNATE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
AVE	AVENUE
BLDG	BUILDING
BVCE	BEGIN VERTICAL CURVE ELEVATION
BVCS	BEGIN VERTICAL CURVE STATION
CL	CENTERLINE, CONTROL LINE
CLR	CLEARANCE
CONC	CONCRETE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
DI	DROP INLET
DWSE	DESIGN WATER SURFACE ELEVATION
DWG	DRAWING
(E)	EXISTING, EAST
E	EASTING
EG	EXISTING GRADE
ELEV, EL	ELEVATION
EP	EDGE OF PAVEMENT
ES	EDGE OF SHOULDER
ETW	EDGE OF TRAVELED WAY
EVCE	END VERTICAL CURVE ELEVATION
EXIST	EXISTING
(F)	FUTURE
FG	FINISHED GRADE
FT	FEET
FTG	FOOTING
GALV	GALVANIZED
GB	GRADE BREAK
H	HORIZONTAL
HMA	HOT MIX ASPHALT
HP	HINGE POINT
HSS	HIGH STRENGTH STEEL
ID	INSIDE DIAMETER
IN	INCHES
INV	INVERT
IP	IRON PIPE
JBOX	JUNCTION BOX
LF	LENGTH FOOT
LN	LANE
LT	LEFT
LVC	LENGTH OF VERTICAL CURVE
MAX	MAXIMUM
MIN	MINIMUM
(N)	NORTH
N	NORTHING
NO	NUMBER
NTS	NOT TO SCALE
Ø	DIAMETER
OC	ON CENTER
OD	OUTSIDE DIAMETER
OG	ORIGINAL GROUND
(P)	PROPOSED
PC	POINT OF CURVATURE
PG	PROFILE GRADE
PG&E	PACIFIC GAS & ELECTRIC
PI	POINT OF INTERSECTION
PIP	PROTECT IN PLACE
PP	POWER POLE
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL INTERSECTION
R	RADIUS
R/W	RIGHT OF WAY
RD	ROAD
RT	RIGHT
(S)	SOUTH
SB	SOIL-BENTONITE
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SHT	SHEET
SR	STATE ROUTE
SS	SANITARY SEWER
SSFM	SANITARY SEWER FORCE MAIN
SSMH	SANITARY SEWER MANHOLE
STA	STATION
STD	STANDARD
TCE	TEMPORARY CONSTRUCTION EASEMENT
TOL	TOP OF LEVEE
TOP	TOP OF PIPE
TOT	TOTAL
TOW	TOP OF WALL
T-UG	TELEPHONE UNDERGROUND
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
USCS	UNIFIED SOIL CLASSIFICATION SYSTEM
UPRR	UNION PACIFIC RAILROAD
V	VERTICAL
VAR	VARIES
(W)	WEST
WSE	WATER SURFACE ELEVATION

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QA/QC PERFORMED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

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LOWER SAN JOAQUIN RIVER REACH
WS SAN JOE IMPROVEMENT PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

SHEET INDEX AND ABBREVIATIONS

SHEET ID
G-002

FINAL SUBMITTAL

EXISTING TOPOGRAPHIC FEATURES

LEGEND

EXISTING	DESCRIPTION
	BOLLARD
	BORE HOLE
	CATCH BASIN
	CONTROL POINT
X X	FENCE
COMM	ABOVE GROUND COMMUNICATION LINE
COMM	UNDERGROUND COMMUNICATION LINE
E E	ELECTRICAL LINE ABOVE GROUND
E E	ELECTRICAL LINE UNDERGROUND
FUEL	FUEL LINE
	FIRE HYDRANT ASSEMBLY
G	GAS LINE
	GAS METER
	GUY WIRE
	HAUL ROUTE
	MANHOLE
	PIPE GATE
	APPROX. PARCEL BOUNDARY
R/W	PROPERTY RIGHT-OF-WAY
	BOUNDARY EASEMENT
PB	PULL BOX
SAN	SANITARY SEWER
S	SANITARY SEWER MANHOLE
	SHRUB
	SIGN
x 2524.4	SPOT ELEV
SD	STORM DRAIN LINE
	STREET LIGHT
T	TELEPHONE LINE UNDERGROUND
	TREE
	UTILITY POLE
W W	WATER LINE
W	WATER MANHOLE WITH AIR RELEASE VALVE
W	WATER METER OR WATER CONNECTION
	WATER VALVE OR GAS VALVE OR AIRE RELEASE VALVE

PROPOSED SITE PLAN SYMBOLOGY

PROPOSED	DESCRIPTION
	INDICATES DIRECTION OF BANK SLOPE, BOTH EXISTING (E) AND PROPOSED (P)
CP–X	HORIZONTAL CONTROL POINT
	RC RETAINING WALL
	DESIGN WATER SURFACE ELEVATION
X X	FENCE
	V-DITCH FLOW LINE
22.04 (P)	SPOT GRADING
	(P) RIP RAP
	(P) AGGREGATE BASE
	(P) AGGREGATE SURFACING
	EROSION CONTROL SEEDING
	TEMPORARY FIBER ROLL
SF	SILT FENCE
	LIMITS OF WORK
	LIMITS OF GRADING
	LIMITS OF LEVEE DEGRADE
	GUARDRAIL
	STAGING/STOCKPILE AREA
	REMOVE PAVEMENT
	REMOVE AGGREGATE SURFACE COURSE
	HOT MIX ASPHALT
	REMOVE CONCRETE WALL

GENERAL SYMBOLOGY

#
PLAN
SCALE:

PLAN TITLE

ARROW INDICATES DIRECTION OF SECTION CUT
SECTION LETTER
X
XXX
SHEET WHERE SECTION IS LOCATED

SECTION CUT MARKER

SECTION LETTER
A
SECTION
SCALE:

SECTION TITLE

DETAIL NUMBER
#
XXX
SHEET WHERE DETAIL IS LOCATED

DETAIL MARKER

#
DETAIL
SCALE:

DETAIL TITLE

DETAIL NUMBER
ARROW INDICATES POINT OF VIEW
#
XXX
SHEET WHERE DETAIL IS LOCATED

SINGLE ELEVATION OR PHOTO MARKER

Y28+50
STATION
CONTROL LINE

STATIONING DESIGNATION

N
NORTH ARROW
ARROW INDICATES DIRECTION OF PLAN NORTH

NOTE

THESE LEGENDS & SYMBOLS APPLY TO THE ENTIRE SET OF CONTRACT DRAWINGS.

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS, SW LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

SYMBOLS AND LEGENDS

SHEET ID
G-003

FINAL SUBMITTAL

GENERAL NOTES

1. BASIS OF SURVEY DATA IS NAD83 (HORIZONTAL) AND NAVD88 (VERTICAL). TOPOGRAPHIC SURVEY WAS PROVIDED BY USACE DATED JULY 2020.

2. THE BASELINE INFORMATION SHOWN ON THE DRAWINGS IS A CONSTRUCTION REFERENCE LINE ESTABLISHED FOR THE PROJECT FACILITIES SHOWN. THE CONTRACTOR SHALL STAKE THE BASELINE AND ANY OFFSETS REQUIRED.

3. AERIAL PHOTOS, INCLUDED IN THE DRAWINGS ARE PROVIDED FOR REFERENCE ONLY.

4. UTILITY INFORMATION ON THE PROJECT DRAWINGS WAS COMPILED FROM DATA PROVIDED BY THE UTILITY OWNERS AND PRE-CONSTRUCTION POTHOLING. THE LOCATIONS SHOWN ARE APPROXIMATE. PRIOR TO COMMENCING FABRICATION OR CONSTRUCTION, THE ACTUAL DIMENSIONS, SIZES, MATERIALS, LOCATIONS, AND ELEVATIONS OF ALL EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR. THE CONTRACTOR IS CAUTIONED THAT ONLY ACTUAL EXCAVATION WILL REVEAL THE DIMENSIONS, SIZES, MATERIALS, LOCATIONS, AND DEPTH OF THE UNDERGROUND UTILITIES. ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES SHALL BE PROTECTED FROM DAMAGE BY CONSTRUCTION EQUIPMENT AND OPERATIONS. EXCAVATION WILL NOT BE ALLOWED PRIOR TO UTILITY POTHOLING WITHIN THE LIMITS OF CONSTRUCTION.

5. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXACT LOCATION OF ALL EXISTING UTILITIES AND FOR THE PROTECTION OF AND REPAIR OF DAMAGE TO THEM. CONTACT 811 (USA NORTH 811), 48 HOURS BEFORE WORK IS TO BEGIN.

6. PRIOR TO BEGINNING WORK, THE CONTRACTOR SHALL CONTACT ALL UTILITY COMPANIES WITH REGARD TO WORKING OVER, UNDER, OR AROUND EXISTING FACILITIES AND TO OBTAIN INFORMATION REGARDING RESTRICTIONS THAT ARE REQUIRED TO PREVENT DAMAGE TO THE FACILITIES.THE KNOWN UTILITIES THAT SHOULD BE CONTACTED ARE AS FOLLOWS:
   1-PG&E GAS: JEREMIAH CAMARENA (559) 355-6044
   2-PG&E ELECTRIC: BRAD JOAQUIN (209) 323-8106
   3-AT&T: DON SEELYE (209) 474-4364
   4-CITY OF STOCKTON: ALI GHAREGOZLOO (209) 937-8460

7. THE CONTRACTOR SHALL COMPLY WITH THE CORPS OF ENGINEERS SAFETY & HEALTH MANUAL (EM 385-1-1) AND OBTAIN A PERMIT FROM THE STATE DIVISION OF OCCUPATIONAL SAFETY AND HEALTH (2424 ARDEN WAY, SUITE 165, SACRAMENTO, CA; PHONE NO. (916) 263-2800 FOR ALL TRENCH EXCAVATION FIVE (5) FEET OR MORE IN DEPTH PRIOR TO BEGINNING ANY EXCAVATION. A COPY OF THIS PERMIT SHALL BE AVAILABLE AT THE SITE AT ALL TIMES.

8. THE CONTRACTOR SHALL PROVIDE TEMPORARY FENCING, GATES, OR BARRIERS WHENEVER EXISTING FENCING, GATES, OR BARRIERS ARE REMOVED BY THE END OF EACH WORK DAY ON WHICH FENCE REMOVAL OCCURS. GATES AND FENCES AT ALL ACCESS LOCATIONS SHALL BE PROTECTED AND LOCKED DURING NON-WORKING HOURS. PG&E REQUIRES A TEMPORARY FENCE TO BE PLACED AROUND THEIR POWER POLE(S) AND GUY CABLE(S).

9. EXISTING FENCING DESIGNATED ON THE DRAWINGS TO BE REMOVED MAY, IF SERVICEABLE, BE SALVAGED AND REINSTALLED OR REPLACED IN KIND. FENCING SHALL BE INSTALLED AS INDICATED ON THE PLANS OR AT OTHER LOCATIONS DESIGNATED BY THE CONTRACTING OFFICER. FENCING THAT IS NOT IN SERVICEABLE CONDITION SHALL BE DISPOSED OF BY THE CONTRACTOR IN ACCORDANCE WITH THE SPECIFICATIONS.

10. THE CONTRACTOR SHALL KEEP ROADWAYS CLEAR OF MUD AND DEBRIS AT ALL TIMES. MAINTAIN DUST CONTROL PER THE SPECIFICATIONS. CONTRACTOR SHALL PROVIDE DUST CONTROL ON ALL HAUL ROUTE ROADS AND LEVEE ROADS AT ALL TIMES DURING CONSTRUCTION.

11. A SILT FENCE OR OTHER APPROVED TEMPORARY EROSION CONTROL MEASURE SHALL BE INSTALLED AS REQUIRED BY THE STORM WATER POLLUTION PREVENTION PLAN (SWPPP) PREPARED BY THE CONTRACTOR.

12. EARTHEN MATERIAL FOR BACKFILL SHALL BE FROM SOURCE APPROVED BY THE CONTRACTING OFFICER PRIOR TO ACQUISITION OF MATERIAL.

13. THE PROJECT SCHEDULE AND WORK PLAN MUST BE APPROVED BY THE CONTRACTING OFFICER, PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. PHASE 1 ACTIVITIES DETAILED ON SHEET C-503 SHALL BE COMPLETED BEFORE PHASE 2 CONSTRUCTION ACTIVITIES CAN BEGIN. PHASE 1 ACTIVITIES MAY OCCUR, WITH CONTRACTING OFFICER APPROVAL, OUTSIDE OF THE CONSTRUCTION SEASON CONSTRAINTS IN ACCORDANCE WITH THE SPECIFICATIONS.

14. TIME OF WORK PERFORMED BY THE CONTRACTOR SHALL BE IN CONFORMANCE WITH THE HOURS IDENTIFIED IN THE SPECIFICATIONS.

15. ANY TEMPORARY EARTHWORK ASSOCIATED WITH CONSTRUCTION MUST BE APPROVED IN ADVANCE BY THE CONTRACTING OFFICER.

16. FINISHED SLOPE BANKS FROM STATION 4+50 TO 61+00 ARE 2.4H:1V WATERSIDE AND 2.9H:1V LANDSIDE UNLESS OTHERWISE NOTED.

17. THE CONTRACTOR SHALL BE RESPONSIBLE FOR AND FURNISH, INSTALL, AND MAINTAIN TEMPORARY SIGNS, BRIDGES, BARRICADES, FLAGMEN, AND OTHER FACILITIES TO ADEQUATELY SAFEGUARD THE GENERAL PUBLIC AND WORK, AND TO PROVIDE FOR THE PROPER ROUTING OF VEHICULAR AND PEDESTRIAN TRAFFIC. CONSTRUCTION OPERATIONS SHALL COMPLY WITH THE WORK AREA AND THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICE (CAMUTCD). THE CONTRACTOR SHALL PREPARE A TRAFFIC CONTROL PLAN IN ACCORDANCE WITH THE SPECIFICATIONS, ACQUIRING ALL PERMITS REQUIRED BY LOCAL AUTHORITIES. PUBLIC SAFETY AND TRAFFIC CONTROLS SHALL BE PROVIDED IN ACCORDANCE WITH THE CALTRANS STANDARD SPECIFICATIONS, SECTION 12, TEMPORARY TRAFFIC CONTROL, THE MANUAL ON TRAFFIC CONTROL DEVICES, CALIFORNIA EDITION, EM 385-1-1, AND ANY LOCAL TRAFFIC CONTROL REQUIREMENTS, AND AS DIRECTED BY THE CONTRACTING OFFICER. SAFE VEHICULAR AND PEDESTRIAN ACCESS SHALL BE PROVIDED AT ALL TIMES DURING CONSTRUCTION.

18. UNLESS OTHERWISE NOTED, NO TEMPORARY OR PERMANENT EXCAVATIONS ARE ALLOWED.

19. THE ENGINEER OF RECORD PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS.

20. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING SURVEY MONUMENTS AND OTHER SURVEY MARKERS DURING CONSTRUCTION. CONTRACTORS LICENSED SURVEYOR SHALL TIE DOWN ANY EXISTING SURVEY MONUMENTS, PROPERTY PINS PRIOR TO START OF CONSTRUCTION AND FILE IT AT THE COUNTY RECORDERS OFFICE. ALL SUCH MONUMENTS OR MARKERS DESTROYED DURING CONSTRUCTION SHALL BE REPLACED AT THE CONTRACTORS EXPENSE, BY A CALIFORNIA LICENSED LAND SURVEYOR. ALL DAMAGED SURVEY MONUMENTS SHALL BE RESTORED BY A LICENSED SURVEYOR AND A FINAL RECORD OF SURVEY SHALL BE FILED AT THE COUNTY'S RECORDER'S OFFICE.

21. THE CONTRACTOR SHALL COMPLY WITH ALL STATE HISTORIC PRESERVATION OFFICE (SHPO) REQUIREMENTS IF ANY ARCHAEOLOGICAL ASSETS ARE UNCOVERED.

22. THE CONTRACTOR SHALL COMPLY WITH ALL FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

23. THE CONTRACTOR IS RESPONSIBLE FOR THE PROPER DISPOSAL OF ALL DEMOLISHED EQUIPMENT AND MATERIALS IN ACCORDANCE WITH LOCAL STATE AND FEDERAL LAWS.

24. THE CONTRACTOR MAY NOT ENTER ANY EXISTING BUILDINGS OR PROPERTY WITHOUT THE EXPRESS WRITTEN CONSENT OF THE OWNER. NOTIFY THE CONTRACTING OFFICER AND PROVIDE EVIDENCE OF CONSENT PRIOR TO ENTRANCE OF PRIVATE PROPERTY.

25. EXISTING PRIVATE FEATURES AND ENCROACHMENTS TO BE PROTECTED IN PLACE OR NOT DISTURBED ARE NOT PART OF THE FEDERAL FLOOD RISK REDUCTION PROJECT. EXISTING UTILITIES LOCATED OUTSIDE THE LIMITS OF GROUND DISTURBANCE ARE SHOWN FOR CONTRACTOR AWARENESS AND PROTECTION. THESE ITEMS HAVE NOT BEEN EVALUATED FOR CONFORMANCE WITH APPLICABLE STATE AND FEDERAL REQUIREMENTS REGARDING ASSESSMENT AND ACCEPTANCE OF LEVEE PENETRATIONS. THEIR INCLUSION IN THE DRAWINGS DOES NOT INDICATE BY REFERENCE THAT THEY ARE DETERMINE TO MEET STATE AND FEDERAL REQUIREMENTS.

US Army Corps of Engineers®

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DRAWN BY: M. HARRINGTON
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SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

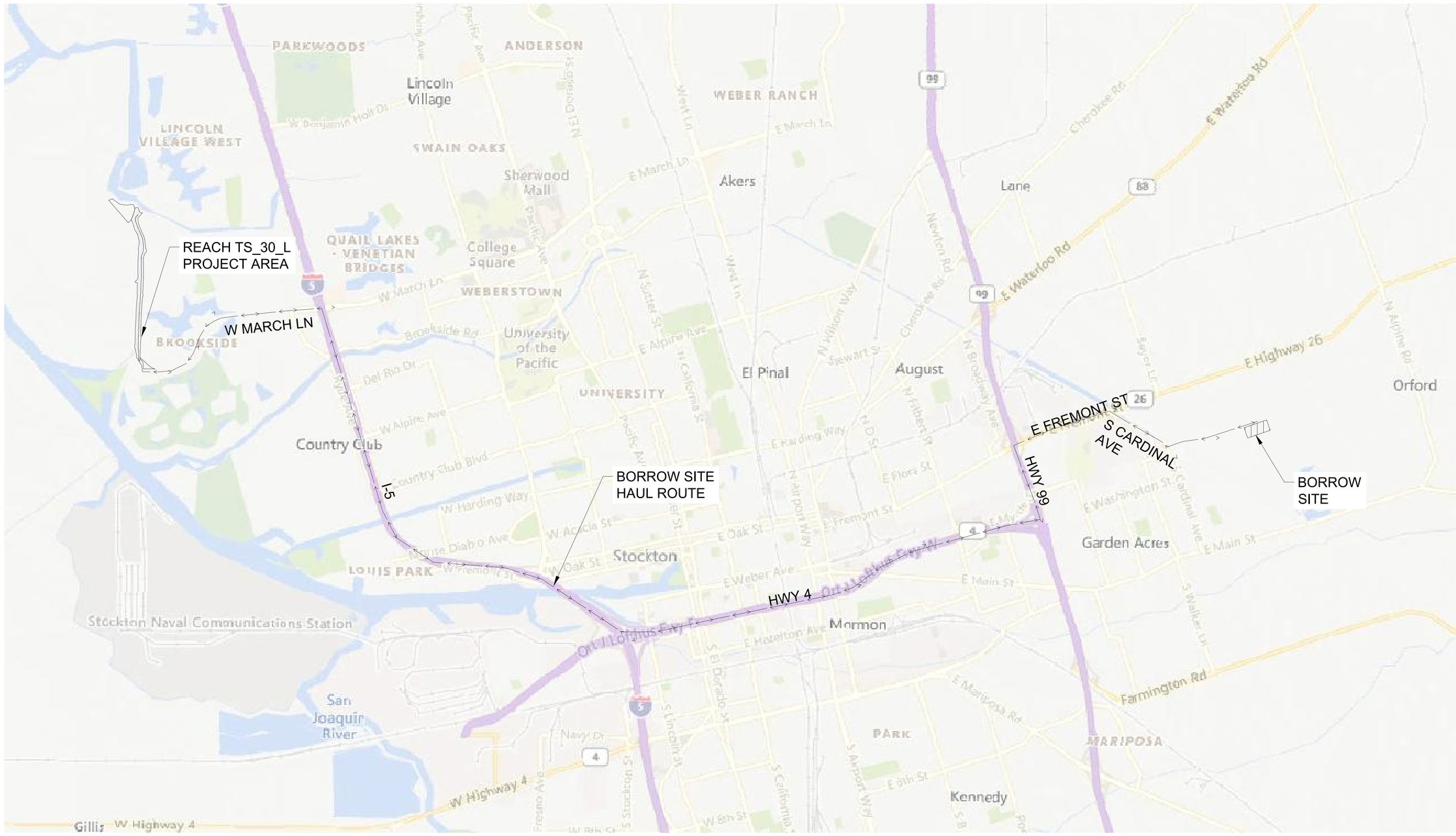
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TSI SAN JOE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

GENERAL NOTES

SHEET ID
G-004

FINAL SUBMITTAL



US Army Corps of Engineers®

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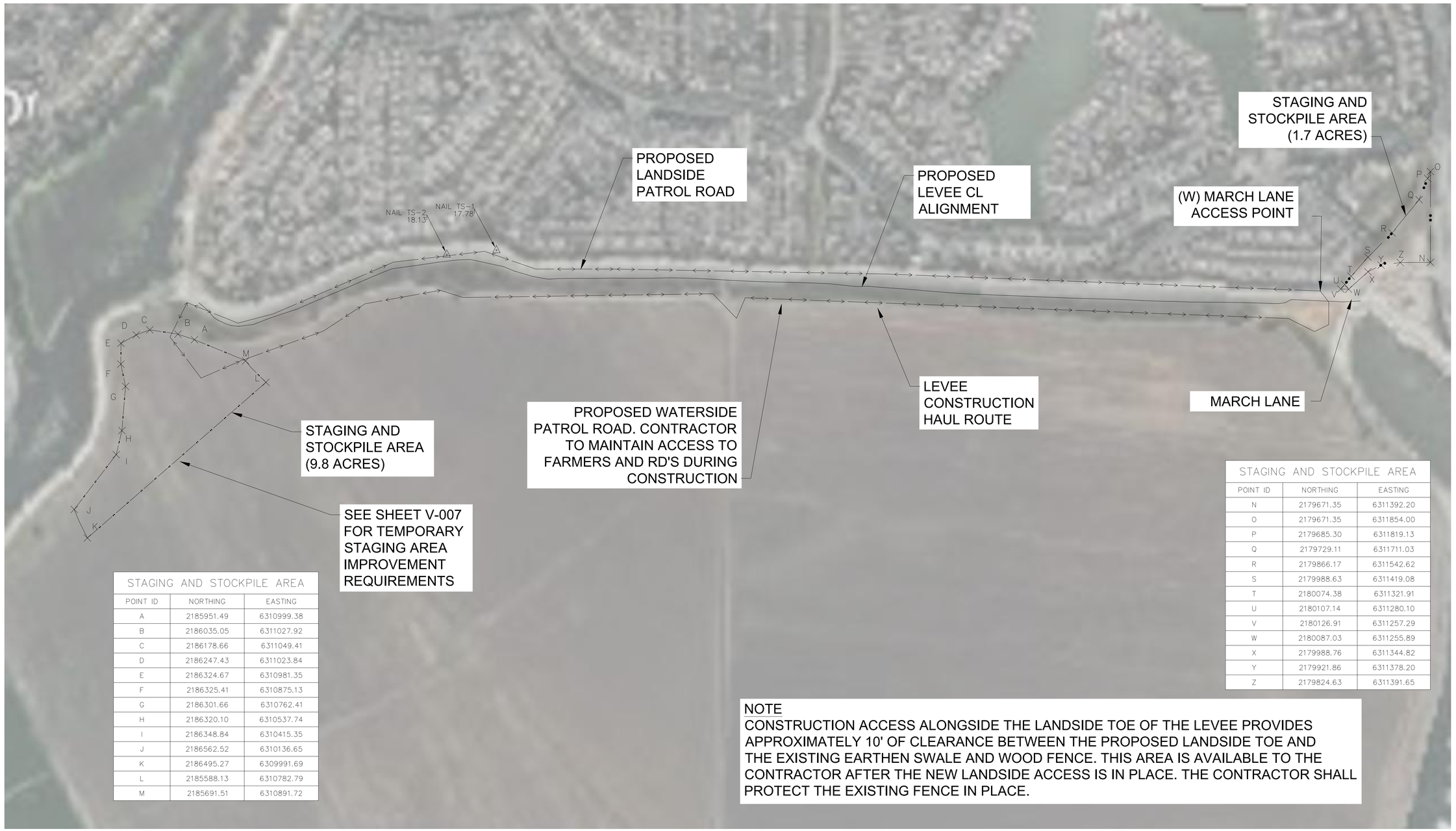
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
N. SAN JOAQUIN LEVEE PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

BORROW SITE AND HAUL ROUTES

SHEET ID
G-005

FINAL SUBMITTAL



N

0 125' 250'

SCALE 1"=250'

STAGING AND STOCKPILE AREA		
POINT ID	NORTHING	EASTING
A	2185951.49	6310999.38
B	2186035.05	6311027.92
C	2186178.66	6311049.41
D	2186247.43	6311023.84
E	2186324.67	6310981.35
F	2186325.41	6310875.13
G	2186301.66	6310762.41
H	2186320.10	6310537.74
I	2186348.84	6310415.35
J	2186562.52	6310136.65
K	2186495.27	6309991.69
L	2185588.13	6310782.79
M	2185691.51	6310891.72

STAGING AND STOCKPILE AREA		
POINT ID	NORTHING	EASTING
N	2179671.35	6311392.20
O	2179671.35	6311854.00
P	2179685.30	6311819.13
Q	2179729.11	6311711.03
R	2179866.17	6311542.62
S	2179988.63	6311419.08
T	2180074.38	6311321.91
U	2180107.14	6311280.10
V	2180126.91	6311257.29
W	2180087.03	6311255.89
X	2179988.76	6311344.82
Y	2179921.86	6311378.20
Z	2179824.63	6311391.65

NOTE

CONSTRUCTION ACCESS ALONGSIDE THE LANDSIDE TOE OF THE LEVEE PROVIDES APPROXIMATELY 10' OF CLEARANCE BETWEEN THE PROPOSED LANDSIDE TOE AND THE EXISTING EARTHEN SWALE AND WOOD FENCE. THIS AREA IS AVAILABLE TO THE CONTRACTOR AFTER THE NEW LANDSIDE ACCESS IS IN PLACE. THE CONTRACTOR SHALL PROTECT THE EXISTING FENCE IN PLACE.

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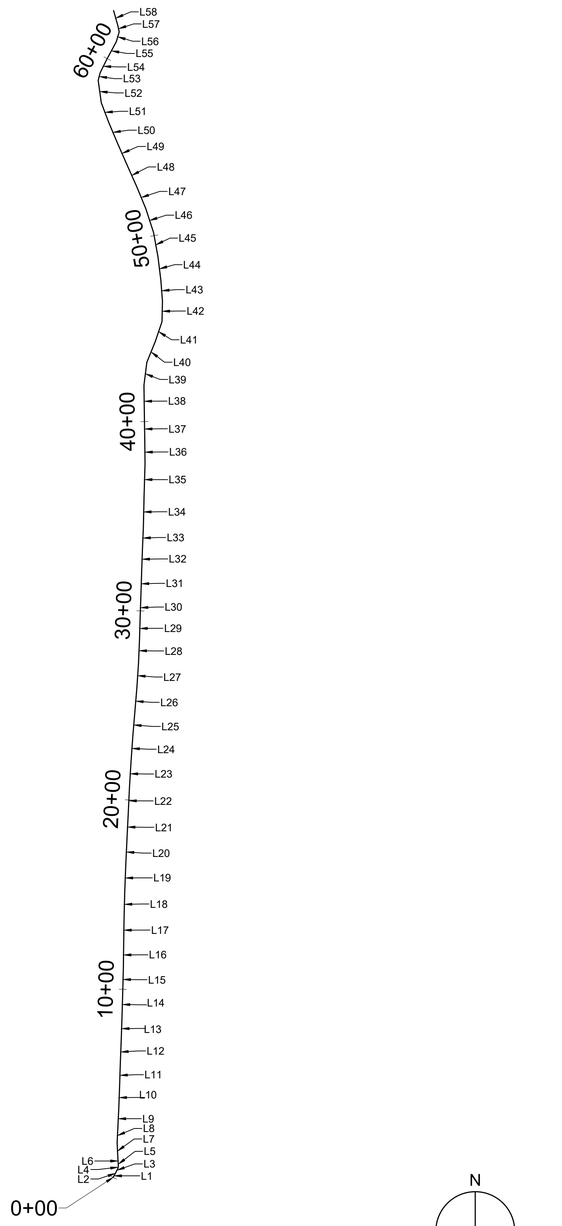
PETERSON BRUSTAD INC.
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LOWER SAN JOAQUIN RIVER REACH
TSMA LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

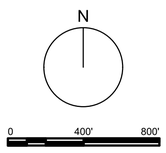
STAGING AND STOCKPILE AREA AND HAUL ROUTES

SHEET ID
G-006

FINAL SUBMITTAL



TS_30_L LEVEE
Y-LINE ALIGNMENT



TS_30_L ALIGNMENT Y-LINE TABLE

LINE TABLE: Y-LINE

LINE ID	STATION START	STATION END	LENGTH	BEARING	LINE STARTS (N,E)	LINE ENDS (N,E)
L1	-0+00.00	0+18.48	18.482	N28° 38' 53.62"E	(2179935.27,6311170.79)	(2179951.49,6311179.66)
L2	0+18.48	0+30.52	12.042	N28° 38' 53.62"E	(2179951.49,6311179.66)	(2179962.06,6311185.43)
L3	0+30.52	0+54.50	23.977	N26° 36' 07.14"E	(2179962.06,6311185.43)	(2179983.50,6311196.17)
L4	0+54.50	0+65.76	11.261	N08° 21' 53.54"E	(2179983.50,6311196.17)	(2179994.64,6311197.80)
L5	0+65.76	0+85.35	19.589	N02° 30' 21.33"W	(2179994.64,6311197.80)	(2180014.21,6311196.95)
L6	0+85.35	1+00.00	14.648	N03° 47' 06.70"W	(2180014.21,6311196.95)	(2180028.82,6311195.98)
L7	1+00.00	1+90.44	90.436	N02° 48' 33.43"W	(2180028.82,6311195.98)	(2180119.15,6311191.55)
L8	1+90.44	2+63.53	73.093	N02° 50' 54.60"E	(2180119.15,6311191.55)	(2180192.15,6311195.18)
L9	2+63.53	3+69.55	106.018	N02° 44' 13.85"E	(2180192.15,6311195.18)	(2180298.05,6311200.24)
L10	3+69.55	4+86.18	116.631	N02° 05' 31.81"E	(2180298.05,6311200.24)	(2180414.60,6311204.50)
L11	4+86.18	6+04.50	118.326	N01° 53' 46.98"E	(2180414.60,6311204.50)	(2180532.87,6311208.42)
L12	6+04.50	7+32.80	128.296	N02° 11' 54.72"E	(2180532.87,6311208.42)	(2180661.07,6311213.34)
L13	7+32.80	8+51.13	118.332	N01° 59' 03.87"E	(2180661.07,6311213.34)	(2180779.33,6311217.44)
L14	8+51.13	9+87.92	136.791	N01° 39' 47.84"E	(2180779.33,6311217.44)	(2180916.06,6311221.41)
L15	9+87.92	11+15.44	127.517	N01° 27' 30.91"E	(2180916.06,6311221.41)	(2181043.54,6311224.65)
L16	11+15.44	12+46.79	131.345	N00° 43' 57.25"E	(2181043.54,6311224.65)	(2181174.87,6311226.33)
L17	12+46.79	13+77.30	130.516	N00° 49' 53.41"E	(2181174.87,6311226.33)	(2181305.38,6311228.23)
L18	13+77.30	15+19.04	141.735	N01° 32' 20.82"E	(2181305.38,6311228.23)	(2181447.06,6311232.03)
L19	15+19.04	16+56.45	137.411	N02° 14' 16.04"E	(2181447.06,6311232.03)	(2181584.37,6311237.40)
L20	16+56.45	17+93.22	136.775	N02° 32' 38.80"E	(2181584.37,6311237.40)	(2181721.01,6311243.47)
L21	17+93.22	19+20.70	127.475	N02° 58' 29.86"E	(2181721.01,6311243.47)	(2181848.31,6311250.08)
L22	19+20.70	20+70.59	149.894	N02° 39' 36.65"E	(2181848.31,6311250.08)	(2181998.04,6311257.04)
L23	20+70.59	22+06.01	135.416	N03° 26' 42.59"E	(2181998.04,6311257.04)	(2182133.21,6311265.18)
L24	22+06.01	23+38.37	132.367	N04° 03' 37.19"E	(2182133.21,6311265.18)	(2182265.25,6311274.55)
L25	23+38.37	24+54.61	116.235	N04° 45' 01.39"E	(2182265.25,6311274.55)	(2182381.08,6311284.18)
L26	24+54.61	25+90.59	135.985	N04° 51' 03.46"E	(2182381.08,6311284.18)	(2182516.58,6311295.68)
L27	25+90.59	27+24.78	134.190	N03° 47' 41.14"E	(2182516.58,6311295.68)	(2182650.48,6311304.56)
L28	27+24.78	28+54.49	129.702	N02° 23' 37.41"E	(2182650.48,6311304.56)	(2182780.06,6311309.98)
L29	28+54.49	29+59.37	104.883	N01° 38' 17.40"E	(2182780.06,6311309.98)	(2182884.90,6311312.97)
L30	29+59.37	30+73.98	114.612	N02° 03' 59.84"E	(2182884.90,6311312.97)	(2182999.44,6311317.11)
L31	30+73.98	32+12.51	138.528	N01° 42' 55.90"E	(2182999.44,6311317.11)	(2183137.91,6311321.25)
L32	32+12.51	33+33.48	120.975	N02° 04' 40.87"E	(2183137.91,6311321.25)	(2183258.80,6311325.64)
L33	33+33.48	34+35.51	102.024	N02° 22' 50.69"E	(2183258.80,6311325.64)	(2183360.74,6311329.88)
L34	34+35.51	36+09.45	173.940	N01° 22' 35.69"E	(2183360.74,6311329.88)	(2183534.63,6311334.06)
L35	36+09.45	37+77.48	168.036	N01° 38' 32.19"E	(2183534.63,6311334.06)	(2183702.60,6311338.87)
L36	37+77.48	38+99.28	121.795	N00° 38' 07.66"W	(2183702.60,6311338.87)	(2183824.38,6311337.52)
L37	38+99.28	40+21.58	122.306	N00° 53' 45.62"W	(2183824.38,6311337.52)	(2183946.67,6311335.61)
L38	40+21.58	41+91.75	170.170	N00° 50' 29.23"W	(2183946.67,6311335.61)	(2184116.83,6311333.11)
L39	41+91.75	43+14.13	122.375	N07° 20' 44.33"E	(2184116.83,6311333.11)	(2184238.20,6311348.76)
L40	43+14.13	44+31.68	117.548	N21° 59' 40.28"E	(2184238.20,6311348.76)	(2184347.19,6311392.78)
L41	44+31.68	45+43.26	111.580	N18° 47' 28.62"E	(2184347.19,6311392.78)	(2184452.82,6311428.72)
L42	45+43.26	46+51.73	108.468	N01° 05' 42.39"E	(2184452.82,6311428.72)	(2184561.27,6311430.80)
L43	46+51.73	47+60.22	108.498	N04° 22' 07.21"W	(2184561.27,6311430.80)	(2184669.45,6311422.53)
L44	47+60.22	48+83.66	123.437	N07° 00' 56.86"W	(2184669.45,6311422.53)	(2184791.97,6311407.45)
L45	48+83.66	50+16.77	133.110	N10° 09' 47.07"W	(2184791.97,6311407.45)	(2184922.99,6311383.97)
L46	50+16.77	51+50.06	133.292	N18° 06' 53.38"W	(2184922.99,6311383.97)	(2185049.67,6311342.52)
L47	51+50.06	52+75.13	125.069	N22° 24' 07.10"W	(2185049.67,6311342.52)	(2185165.30,6311294.86)
L48	52+75.13	54+03.71	128.580	N24° 00' 40.29"W	(2185165.30,6311294.86)	(2185282.76,6311242.54)
L49	54+03.71	55+28.85	125.144	N23° 37' 19.85"W	(2185282.76,6311242.54)	(2185397.41,6311192.39)
L50	55+28.85	56+46.45	117.598	N22° 54' 22.82"W	(2185397.41,6311192.39)	(2185505.74,6311146.62)
L51	56+46.45	57+55.90	109.450	N20° 39' 05.80"W	(2185505.74,6311146.62)	(2185608.16,6311108.02)
L52	57+55.90	58+75.15	119.252	N07° 56' 14.71"W	(2185608.16,6311108.02)	(2185726.26,6311091.55)
L53	58+75.15	59+16.94	41.784	N14° 55' 24.61"E	(2185726.26,6311091.55)	(2185766.64,6311102.31)
L54	59+16.94	59+91.41	74.472	N26° 16' 49.20"E	(2185766.64,6311102.31)	(2185833.41,6311135.29)
L55	59+91.41	61+01.18	109.770	N28° 18' 28.57"E	(2185833.41,6311135.29)	(2185930.06,6311187.34)
L56	61+01.18	61+55.57	54.386	N16° 24' 28.29"E	(2185930.06,6311187.34)	(2185982.23,6311202.70)
L57	61+55.57	61+88.51	32.941	N12° 37' 46.28"W	(2185982.23,6311202.70)	(2186014.37,6311195.50)
L58	61+88.51	62+71.74	83.235	N15° 48' 02.91"W	(2186014.37,6311195.50)	(2186094.46,6311172.84)

SURVEY NOTES

1. GRID COORDINATES ARE IN U.S. SURVEY FEET AND REFER TO THE CALIFORNIA STATE COORDINATE ZONE 3, NAD 83 (2007), AND ARE BASED ON 'HS4763'.
2. ELEVATIONS ARE IN U.S. SURVEY FEET AND REFER TO NAVD 1988, GEOID 09 AND ARE BASED ON CP 'HS4763'.
3. TOPOGRAPHY BY TOTAL STATION & RTK SURVEY METHODS. FIELD SURVEY DATE: MARCH 28 THRU MAY 10th 2020.
4. CONTOUR INTERVAL IS 1FT.
5. SCALE FACTOR = 0.999937996, COMBINED FACTOR = 0.999942239.

SURVEY CONTROL TABULATION

STATION	NORTH	EAST	MON EL	DESCRIPTION
HS4763	2184704.25	6327979.96	15.26	NGS Disc
AA4257	2167471.32	6298381.34	1.08	NGS Disc
TS-1	2184417.11	6311453.94	17.78	NAIL
TS-2	2184669.58	6311431.33	18.13	NAIL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

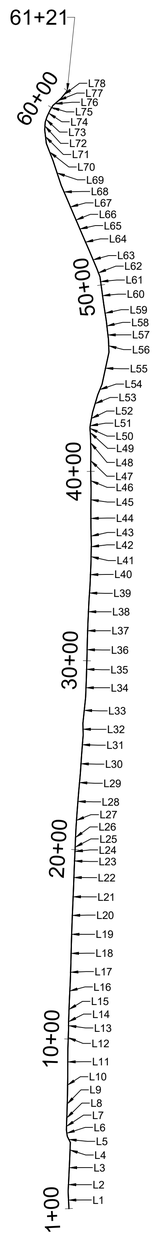
LOWER SAN JOAQUIN RIVER REACH
TSS LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA.

PROJECT SURVEY CONTROL AND CONTROL LINE PLAN AND TABLES

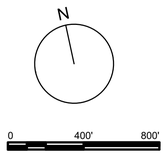
SHEET ID
V-001

FINAL SUBMITTAL

TS_30_L ALIGNMENT P-LINE TABLE



TS_30_L LEVEE
P-LINE ALIGNMENT



LINE TABLE: P-LINE						
LINE ID	STATION START	STATION END	LENGTH	BEARING	LINE STARTS (N,E)	LINE ENDS (N,E)
L1	1+00.00	1+90.44	90.436	N02° 48' 33.43"W	(2180028.82,6311195.98)	(2180119.15,6311191.55)
L2	1+90.44	2+63.53	73.093	N02° 50' 54.60"E	(2180119.15,6311191.55)	(2180192.15,6311195.18)
L3	2+63.53	3+69.55	106.018	N02° 44' 13.85"E	(2180192.15,6311195.18)	(2180298.05,6311200.24)
L4	3+69.55	4+49.93	80.380	N02° 05' 31.81"E	(2180298.05,6311200.24)	(2180378.38,6311203.18)
L5	4+49.93	4+85.43	35.508	N26° 22' 01.35"W	(2180378.38,6311203.18)	(2180410.19,6311187.41)
L6	4+85.43	5+19.01	33.578	N07° 56' 55.29"W	(2180410.19,6311187.41)	(2180443.45,6311182.76)
L7	5+19.01	5+58.38	39.369	N01° 23' 25.08"E	(2180443.45,6311182.76)	(2180482.80,6311183.72)
L8	5+58.38	6+07.74	49.359	N02° 15' 02.37"E	(2180482.80,6311183.72)	(2180532.13,6311185.66)
L9	6+07.74	7+06.11	98.368	N01° 26' 14.43"E	(2180532.13,6311185.66)	(2180630.46,6311188.13)
L10	7+06.11	8+07.93	101.822	N00° 51' 50.55"E	(2180630.46,6311188.13)	(2180732.27,6311189.66)
L11	8+07.93	9+50.12	142.187	N00° 17' 42.96"E	(2180732.27,6311189.66)	(2180874.46,6311190.39)
L12	9+50.12	10+64.41	114.288	N01° 54' 22.40"E	(2180874.46,6311190.39)	(2180988.68,6311194.20)
L13	10+64.41	10+77.14	12.734	N01° 21' 15.35"W	(2180988.68,6311194.20)	(2181001.41,6311193.89)
L14	10+77.14	11+05.78	28.636	N01° 17' 02.43"E	(2181001.41,6311193.89)	(2181030.04,6311194.54)
L15	11+05.78	12+06.13	100.349	N02° 02' 35.41"E	(2181030.04,6311194.54)	(2181130.33,6311198.11)
L16	12+06.13	13+01.67	95.546	N02° 57' 01.11"E	(2181130.33,6311198.11)	(2181225.75,6311203.03)
L17	13+01.67	14+03.22	101.549	N01° 54' 18.06"E	(2181225.75,6311203.03)	(2181327.24,6311206.41)
L18	14+03.22	15+01.04	97.815	N01° 18' 15.39"E	(2181327.24,6311206.41)	(2181425.03,6311208.63)
L19	15+01.04	16+05.14	104.100	N01° 47' 20.93"E	(2181425.03,6311208.63)	(2181529.08,6311211.88)
L20	16+05.14	17+00.24	95.108	N02° 30' 05.32"E	(2181529.08,6311211.88)	(2181624.10,6311216.03)
L21	17+00.24	18+01.93	101.685	N02° 19' 10.40"E	(2181624.10,6311216.03)	(2181725.70,6311220.15)
L22	18+01.93	19+04.00	102.075	N02° 09' 33.22"E	(2181725.70,6311220.15)	(2181827.70,6311224.00)
L23	19+04.00	19+76.80	72.797	N02° 32' 11.29"E	(2181827.70,6311224.00)	(2181900.43,6311227.22)
L24	19+76.80	20+03.85	27.053	N03° 15' 08.83"E	(2181900.43,6311227.22)	(2181927.44,6311228.75)
L25	20+03.85	20+22.91	19.057	N00° 37' 00.20"E	(2181927.44,6311228.75)	(2181946.49,6311228.96)
L26	20+22.91	21+05.77	82.859	N02° 24' 51.02"E	(2181946.49,6311228.96)	(2182029.28,6311232.45)
L27	21+05.77	22+04.51	98.741	N03° 56' 00.35"E	(2182029.28,6311232.45)	(2182127.79,6311239.22)
L28	22+04.51	23+05.63	101.120	N04° 34' 57.31"E	(2182127.79,6311239.22)	(2182228.58,6311247.30)
L29	23+05.63	24+04.87	99.241	N05° 08' 24.72"E	(2182228.58,6311247.30)	(2182327.42,6311256.19)
L30	24+04.87	25+04.72	99.853	N03° 49' 44.89"E	(2182327.42,6311256.19)	(2182427.05,6311262.86)
L31	25+04.72	26+06.15	101.422	N04° 34' 50.81"E	(2182427.05,6311262.86)	(2182528.15,6311270.96)
L32	26+06.15	26+68.85	62.705	N01° 13' 40.17"W	(2182528.15,6311270.96)	(2182590.84,6311269.62)
L33	26+68.85	28+06.31	137.456	N06° 02' 53.89"E	(2182590.84,6311269.62)	(2182727.53,6311284.10)
L34	28+06.31	29+08.23	101.924	N02° 11' 46.66"E	(2182727.53,6311284.10)	(2182829.38,6311288.01)
L35	29+08.23	30+01.03	92.795	N01° 31' 38.55"E	(2182829.38,6311288.01)	(2182922.14,6311290.48)
L36	30+01.03	31+15.52	114.492	N01° 25' 52.78"E	(2182922.14,6311290.48)	(2183036.60,6311293.34)
L37	31+15.52	32+01.43	85.911	N01° 52' 20.80"E	(2183036.60,6311293.34)	(2183122.47,6311296.15)
L38	32+01.43	33+16.01	114.580	N02° 44' 52.31"E	(2183122.47,6311296.15)	(2183236.91,6311301.64)
L39	33+16.01	33+99.33	83.323	N03° 46' 05.54"E	(2183236.91,6311301.64)	(2183320.06,6311307.12)
L40	33+99.33	35+10.40	111.070	N02° 29' 27.65"E	(2183320.06,6311307.12)	(2183431.02,6311311.94)
L41	35+10.40	35+89.65	79.247	N01° 13' 55.91"E	(2183431.02,6311311.94)	(2183510.25,6311313.65)
L42	35+89.65	36+14.62	24.971	N01° 15' 16.21"E	(2183510.25,6311313.65)	(2183535.22,6311314.19)
L43	36+14.62	37+01.69	87.073	N01° 23' 14.21"W	(2183535.22,6311314.19)	(2183622.26,6311312.09)
L44	37+01.69	38+01.57	99.877	N00° 15' 57.70"W	(2183622.26,6311312.09)	(2183722.14,6311311.62)
L45	38+01.57	38+99.75	98.180	N00° 34' 46.38"E	(2183722.14,6311311.62)	(2183820.31,6311312.61)
L46	38+99.75	40+01.60	101.852	N00° 54' 00.55"W	(2183820.31,6311312.61)	(2183922.15,6311311.01)
L47	40+01.60	41+11.64	110.043	N00° 13' 30.03"E	(2183922.15,6311311.01)	(2184032.19,6311311.45)
L48	41+11.64	41+91.08	79.435	N01° 21' 23.98"W	(2184032.19,6311311.45)	(2184111.61,6311309.57)
L49	41+91.08	42+20.31	29.230	N04° 15' 09.13"W	(2184111.61,6311309.57)	(2184140.76,6311307.40)
L50	42+20.31	42+33.99	13.684	N00° 06' 13.70"W	(2184140.76,6311307.40)	(2184154.44,6311307.37)

LINE TABLE: P-LINE						
LINE ID	STATION START	STATION END	LENGTH	BEARING	LINE STARTS (N,E)	LINE ENDS (N,E)
L51	42+33.99	42+47.88	13.888	N07° 09' 36.02"E	(2184154.44,6311307.37)	(2184168.22,6311309.10)
L52	42+47.88	43+12.60	64.725	N10° 18' 23.32"E	(2184168.22,6311309.10)	(2184231.90,6311320.68)
L53	43+12.60	44+09.25	96.649	N16° 16' 52.63"E	(2184231.90,6311320.68)	(2184324.67,6311347.78)
L54	44+09.25	44+69.22	59.962	N22° 16' 25.72"E	(2184324.67,6311347.78)	(2184380.16,6311370.51)
L55	44+69.22	46+42.75	173.535	N12° 11' 29.25"E	(2184380.16,6311370.51)	(2184549.78,6311407.16)
L56	46+42.75	47+10.21	67.459	N02° 14' 57.84"W	(2184549.78,6311407.16)	(2184617.19,6311404.51)
L57	47+10.21	47+57.51	47.305	N06° 49' 52.05"W	(2184617.19,6311404.51)	(2184664.16,6311398.88)
L58	47+57.51	48+06.11	48.595	N06° 19' 37.48"W	(2184664.16,6311398.88)	(2184712.46,6311393.53)
L59	48+06.11	48+93.27	87.158	N08° 45' 24.89"W	(2184712.46,6311393.53)	(2184798.60,6311380.26)
L60	48+93.27	49+93.42	100.154	N07° 53' 01.75"W	(2184798.60,6311380.26)	(2184897.81,6311366.52)
L61	49+93.42	50+43.23	49.811	N07° 38' 27.58"W	(2184897.81,6311366.52)	(2184947.18,6311359.90)
L62	50+43.23	50+88.98	45.747	N21° 00' 39.43"W	(2184947.18,6311359.90)	(2184989.88,6311343.49)
L63	50+88.98	51+91.89	102.907	N22° 54' 05.54"W	(2184989.88,6311343.49)	(2185084.68,6311303.45)
L64	51+91.89	52+92.13	100.241	N23° 23' 25.95"W	(2185084.68,6311303.45)	(2185176.68,6311263.65)
L65	52+92.13	53+43.51	51.386	N23° 03' 50.28"W	(2185176.68,6311263.65)	(2185223.96,6311243.52)
L66	53+43.51	53+94.96	51.445	N23° 13' 03.62"W	(2185223.96,6311243.52)	(2185271.24,6311223.24)
L67	53+94.96	54+93.29	98.336	N23° 05' 31.48"W	(2185271.24,6311223.24)	(2185361.69,6311184.67)
L68	54+93.29	55+67.52	74.229	N23° 26' 05.36"W	(2185361.69,6311184.67)	(2185429.80,6311155.15)
L69	55+67.52	57+06.19	138.666	N18° 17' 46.20"W	(2185429.80,6311155.15)	(2185561.46,6311111.62)
L70	57+06.19	58+03.12	96.926	N21° 06' 10.01"W	(2185561.46,6311111.62)	(2185651.88,6311076.72)
L71	58+03.12	58+75.68	72.569	N07° 04' 15.27"W	(2185651.88,6311076.72)	(2185723.90,6311067.79)
L72	58+75.68	59+15.85	40.162	N04° 07' 56.99"E	(2185723.90,6311067.79)	(2185763.96,6311070.68)
L73	59+15.85	59+46.75	30.908	N18° 04' 44.38"E	(2185763.96,6311070.68)	(2185793.34,6311080.27)
L74	59+46.75	59+87.26	40.510	N25° 16' 24.50"E	(2185793.34,6311080.27)	(2185829.97,6311097.57)
L75	59+87.26	60+14.31	27.048	N32° 20' 33.78"E	(2185829.97,6311097.57)	(2185852.82,6311112.04)
L76	60+14.31	60+38.63	24.316	N49° 28' 56.50"E	(2185852.82,6311112.04)	(2185868.62,6311130.53)
L77	60+38.63	60+70.00	31.373	N48° 50' 28.10"E	(2185868.62,6311130.53)	(2185889.27,6311154.15)
L78	60+70.00	61+21.43	51.427	N39° 22' 23.94"E	(2185889.27,6311154.15)	(2185929.02,6311186.77)

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: E. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXXXX-XX-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

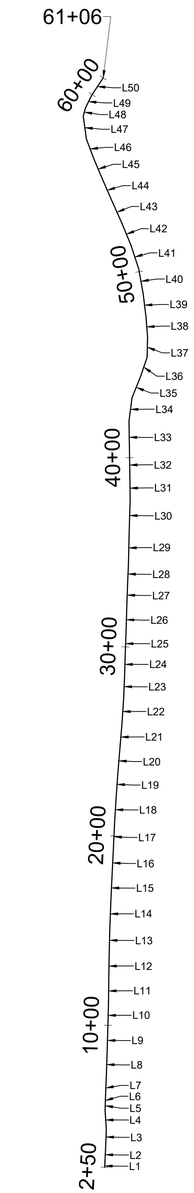
LOWER SAN JOAQUIN RIVER REACH
TS_30_L LEVEE IMPROVEMENTS
SAN JOAQUIN COUNTY, CALIFORNIA

PROPOSED LEVEE CENTERLINE
CONTROL LINE PLAN AND TABLES

SHEET ID
V-002

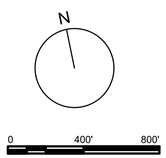
FINAL SUBMITTAL

TS_30_L ALIGNMENT C-LINE TABLE



TS_30_L LEVEE
C-LINE ALIGNMENT

LINE TABLE: C-LINE						
LINE ID	STATION START	STATION END	LENGTH	BEARING	LINE STARTS (N,E)	LINE ENDS (N,E)
L1	2+50.00	2+63.53	13.529	N02° 50' 54.60"E	(2180178.64,6311194.51)	(2180192.15,6311195.18)
L2	2+63.53	3+69.55	106.018	N02° 44' 13.85"E	(2180192.15,6311195.18)	(2180298.05,6311200.24)
L3	3+69.55	4+50.00	80.453	N02° 05' 31.81"E	(2180298.05,6311200.24)	(2180378.45,6311203.18)
L4	4+50.00	5+50.15	100.149	N03° 45' 47.23"W	(2180378.45,6311203.18)	(2180478.38,6311196.61)
L5	5+50.15	6+00.49	50.339	N01° 53' 46.98"E	(2180478.38,6311196.61)	(2180528.70,6311198.27)
L6	6+00.49	6+05.02	4.531	N01° 53' 46.98"E	(2180528.70,6311198.27)	(2180533.22,6311198.42)
L7	6+05.02	7+33.32	128.304	N02° 11' 54.72"E	(2180533.22,6311198.42)	(2180661.43,6311203.34)
L8	7+33.32	8+51.61	118.286	N01° 59' 03.87"E	(2180661.43,6311203.34)	(2180779.65,6311207.44)
L9	8+51.61	9+88.35	136.745	N01° 39' 47.84"E	(2180779.65,6311207.44)	(2180916.34,6311211.41)
L10	9+88.35	11+15.79	127.436	N01° 27' 30.91"E	(2180916.34,6311211.41)	(2181043.73,6311214.65)
L11	11+15.79	12+47.08	131.290	N00° 43' 57.25"E	(2181043.73,6311214.65)	(2181175.01,6311216.33)
L12	12+47.08	13+77.67	130.587	N00° 49' 53.41"E	(2181175.01,6311216.33)	(2181305.58,6311218.23)
L13	13+77.67	15+19.52	141.858	N01° 32' 20.82"E	(2181305.58,6311218.23)	(2181447.39,6311222.04)
L14	15+19.52	16+57.02	137.498	N02° 14' 16.04"E	(2181447.39,6311222.04)	(2181584.78,6311227.41)
L15	16+57.02	17+93.86	136.839	N02° 32' 38.80"E	(2181584.78,6311227.41)	(2181721.49,6311233.48)
L16	17+93.86	19+21.35	127.485	N02° 58' 29.86"E	(2181721.49,6311233.48)	(2181848.80,6311240.10)
L17	19+21.35	20+71.28	149.935	N02° 39' 36.65"E	(2181848.80,6311240.10)	(2181998.57,6311247.06)
L18	20+71.28	22+06.82	135.538	N03° 26' 42.59"E	(2181998.57,6311247.06)	(2182133.87,6311255.20)
L19	22+06.82	23+39.30	132.481	N04° 03' 37.19"E	(2182133.87,6311255.20)	(2182266.01,6311264.58)
L20	23+39.30	24+55.60	116.304	N04° 45' 01.39"E	(2182266.01,6311264.58)	(2182381.92,6311274.21)
L21	24+55.60	25+91.50	135.901	N04° 51' 03.46"E	(2182381.92,6311274.21)	(2182517.33,6311285.71)
L22	25+91.50	27+25.48	133.976	N03° 47' 41.14"E	(2182517.33,6311285.71)	(2182651.01,6311294.57)
L23	27+25.48	28+54.99	129.514	N02° 23' 37.41"E	(2182651.01,6311294.57)	(2182780.42,6311299.98)
L24	28+54.99	29+59.85	104.854	N01° 38' 17.40"E	(2182780.42,6311299.98)	(2182885.23,6311302.98)
L25	29+59.85	30+74.47	114.619	N02° 03' 59.84"E	(2182885.23,6311302.98)	(2182999.77,6311307.11)
L26	30+74.47	32+13.00	138.529	N01° 42' 55.90"E	(2182999.77,6311307.11)	(2183138.24,6311311.26)
L27	32+13.00	33+34.03	121.033	N02° 04' 40.87"E	(2183138.24,6311311.26)	(2183259.19,6311315.65)
L28	33+34.03	34+35.99	101.962	N02° 22' 50.69"E	(2183259.19,6311315.65)	(2183361.07,6311319.88)
L29	34+35.99	36+09.87	173.875	N01° 22' 35.69"E	(2183361.07,6311319.88)	(2183534.89,6311324.06)
L30	36+09.87	37+77.73	167.860	N01° 38' 32.19"E	(2183534.89,6311324.06)	(2183702.68,6311328.87)
L31	37+77.73	38+99.30	121.574	N00° 38' 07.66"W	(2183702.68,6311328.87)	(2183824.25,6311327.52)
L32	38+99.30	40+21.58	122.284	N00° 53' 45.62"W	(2183824.25,6311327.52)	(2183946.52,6311325.61)
L33	40+21.58	41+92.48	170.895	N00° 50' 29.24"W	(2183946.52,6311325.61)	(2184117.39,6311323.10)
L34	41+92.48	43+16.86	124.376	N07° 20' 44.33"E	(2184117.39,6311323.10)	(2184240.75,6311339.00)
L35	43+16.86	44+35.41	118.554	N21° 59' 40.28"E	(2184240.75,6311339.00)	(2184350.68,6311383.40)
L36	44+35.41	45+45.15	109.743	N18° 47' 28.62"E	(2184350.68,6311383.40)	(2184454.57,6311418.75)
L37	45+45.15	46+51.59	106.434	N01° 05' 42.39"E	(2184454.57,6311418.75)	(2184560.98,6311420.79)
L38	46+51.59	47+59.38	107.790	N04° 22' 07.21"W	(2184560.98,6311420.79)	(2184668.46,6311412.58)
L39	47+59.38	48+82.31	122.932	N07° 00' 56.86"W	(2184668.46,6311412.58)	(2184790.47,6311397.56)
L40	48+82.31	50+14.45	132.140	N10° 09' 47.07"W	(2184790.47,6311397.56)	(2184920.54,6311374.25)
L41	50+14.45	51+46.67	132.223	N18° 06' 53.38"W	(2184920.54,6311374.25)	(2185046.21,6311333.14)
L42	51+46.67	52+71.23	124.554	N22° 24' 07.10"W	(2185046.21,6311333.14)	(2185161.36,6311285.67)
L43	52+71.23	53+99.70	128.473	N24° 00' 40.29"W	(2185161.36,6311285.67)	(2185278.72,6311233.39)
L44	53+99.70	55+24.94	125.240	N23° 37' 19.85"W	(2185278.72,6311233.39)	(2185393.46,6311183.21)
L45	55+24.94	56+42.80	117.857	N22° 54' 22.82"W	(2185393.46,6311183.21)	(2185502.03,6311137.33)
L46	56+42.80	57+53.56	110.761	N20° 39' 05.80"W	(2185502.03,6311137.33)	(2185605.67,6311098.27)
L47	57+53.56	58+75.95	122.388	N07° 56' 14.71"W	(2185605.67,6311098.27)	(2185726.89,6311081.37)
L48	58+75.95	59+20.75	44.800	N14° 55' 24.61"E	(2185726.89,6311081.37)	(2185770.18,6311092.91)
L49	59+20.75	59+96.39	75.643	N26° 16' 49.20"E	(2185770.18,6311092.91)	(2185838.00,6311126.40)
L50	59+96.39	61+05.61	109.226	N33° 33' 39.34"E	(2185838.00,6311126.40)	(2185929.02,6311186.78)



US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: C. HUNTER
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

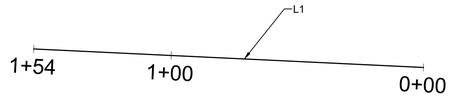
LOWER SAN JOAQUIN RIVER REACH
TS_30_L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

PROPOSED CUTOFF WALL CONTROL LINE PLAN AND TABLES

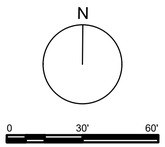
SHEET ID
V-003

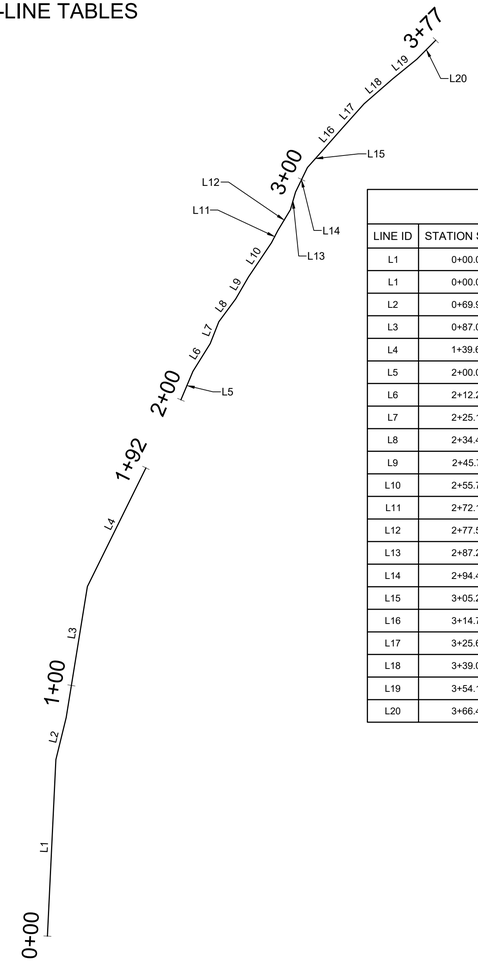
FINAL SUBMITTAL

TS_30_L ALIGNMENT R-LINE TABLES

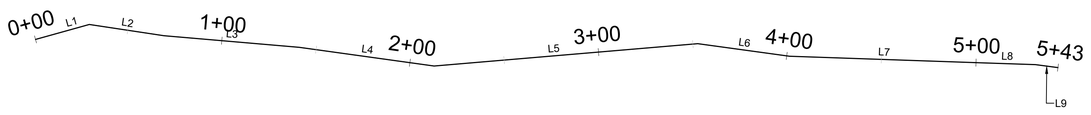


LINE TABLE: MIDDLE RAMP ALIGNMENT						
LINE ID	STATION START	STATION END	LENGTH	BEARING	LINE STARTS (N,E)	LINE ENDS (N,E)
L1	0+00.00	1+54.49	154.488	N87° 16' 52.13"W	(2183228.92,6311301.26)	(2183236.25,6311146.94)

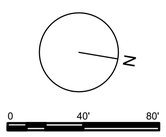


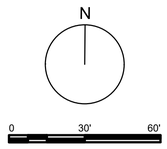


LINE TABLE: NORTHERN RAMP ALIGNMENT						
LINE ID	STATION START	STATION END	LENGTH	BEARING	LINE STARTS (N,E)	LINE ENDS (N,E)
L1	0+00.00	0+69.96	69.962	N02° 45' 26.13"E	(2185591.14,6311100.16)	(2185661.0257,6311103.5267)
L1	0+00.00	1+54.49	154.488	N87° 16' 52.13"W	(2183228.92,6311301.26)	(2183236.2516,6311146.9417)
L2	0+69.96	0+87.07	17.112	N13° 45' 59.56"E	(2185661.03,6311103.53)	(2185677.6462,6311107.5988)
L3	0+87.07	1+39.66	52.583	N09° 10' 56.61"E	(2185677.65,6311107.60)	(2185729.5551,6311115.9898)
L4	1+39.66	1+92.04	52.385	N26° 15' 50.67"E	(2185729.56,6311115.99)	(2185776.5318,6311139.1705)
L5	2+00.00	2+12.26	12.263	N22° 52' 51.37"E	(2185803.48,6311153.02)	(2185814.7754,6311157.7928)
L6	2+12.26	2+25.16	12.901	N31° 53' 09.81"E	(2185814.78,6311157.79)	(2185825.7296,6311164.6075)
L7	2+25.16	2+34.48	9.317	N21° 39' 27.59"E	(2185825.73,6311164.61)	(2185834.3885,6311168.0459)
L8	2+34.48	2+45.71	11.230	N36° 27' 46.22"E	(2185834.39,6311168.05)	(2185843.4198,6311174.7196)
L9	2+45.71	2+55.79	10.084	N30° 09' 47.98"E	(2185843.42,6311174.72)	(2185852.1383,6311179.7864)
L10	2+55.79	2+72.10	16.304	N33° 56' 06.90"E	(2185852.14,6311179.79)	(2185865.6649,6311188.8881)
L11	2+72.10	2+77.57	5.469	N27° 36' 40.22"E	(2185865.66,6311188.89)	(2185870.5111,6311191.4228)
L12	2+77.57	2+87.20	9.628	N31° 03' 44.25"E	(2185870.51,6311191.42)	(2185878.7588,6311196.3907)
L13	2+87.20	2+94.47	7.279	N16° 07' 34.68"E	(2185878.76,6311196.39)	(2185885.7517,6311198.4126)
L14	2+94.47	3+05.24	10.766	N25° 53' 07.00"E	(2185885.75,6311198.41)	(2185895.4376,6311203.1127)
L15	3+05.24	3+14.77	9.527	N41° 43' 11.02"E	(2185895.44,6311203.11)	(2185902.5483,6311209.4525)
L16	3+14.77	3+25.65	10.880	N41° 25' 09.67"E	(2185902.55,6311209.45)	(2185910.7070,6311216.6503)
L17	3+25.65	3+39.04	13.391	N41° 45' 02.52"E	(2185910.71,6311216.65)	(2185920.6976,6311225.5675)
L18	3+39.04	3+54.18	15.145	N48° 58' 13.78"E	(2185920.70,6311225.57)	(2185930.6394,6311236.9923)
L19	3+54.18	3+66.43	12.243	N50° 49' 09.23"E	(2185930.64,6311236.99)	(2185938.3742,6311246.4826)
L20	3+66.43	3+76.99	10.567	N44° 55' 27.85"E	(2185938.37,6311246.48)	(2185945.8561,6311253.9448)



LINE TABLE: MARCH LANE RAMP ALIGNMENT						
LINE ID	STATION START	STATION END	LENGTH	BEARING	LINE STARTS (N,E)	LINE ENDS (N,E)
L1	0+00.00	0+29.47	29.474	N21° 37' 00.77"W	(2180093.68,6311168.18)	(2180121.08,6311157.33)
L2	0+29.47	0+69.31	39.834	N02° 25' 20.84"E	(2180121.08,6311157.33)	(2180160.88,6311159.01)
L3	0+69.31	1+41.05	71.739	N01° 12' 09.75"W	(2180160.88,6311159.01)	(2180232.60,6311157.50)
L4	1+41.05	2+12.88	71.837	N01° 47' 22.42"E	(2180232.60,6311157.50)	(2180304.40,6311159.75)
L5	2+12.88	3+52.59	139.710	N10° 57' 27.13"W	(2180304.40,6311159.75)	(2180441.57,6311133.19)
L6	3+52.59	4+01.45	48.859	N01° 41' 42.50"E	(2180441.57,6311133.19)	(2180490.40,6311134.64)
L7	4+01.45	5+01.45	100.000	N04° 09' 46.72"W	(2180490.40,6311134.64)	(2180590.14,6311127.38)
L8	5+01.45	5+31.45	29.996	N04° 09' 46.72"W	(2180590.14,6311127.38)	(2180620.06,6311125.20)
L9	5+31.45	5+43.39	11.944	N01° 26' 14.43"E	(2180620.06,6311125.20)	(2180632.00,6311125.50)





US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

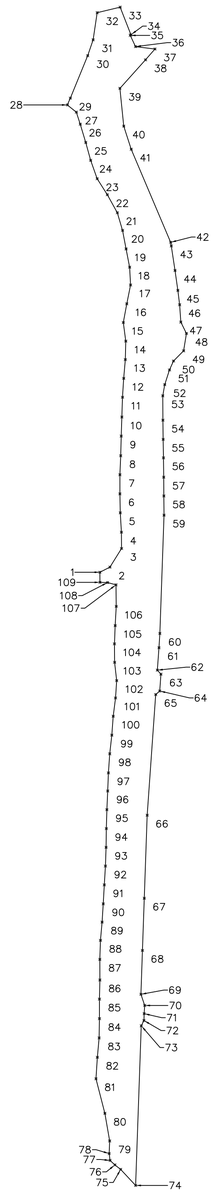
LOWER SAN JOAQUIN RIVER REACH
TS: SAN JOSE AIRPORT WEST
SAN JOAQUIN COUNTY, CALIFORNIA

PROPOSED RAMPS CONTROL LINES AND PLANS AND TABLES

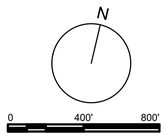
SHEET ID
V-004

FINAL SUBMITTAL

TS_30_L LEVEE LIMIT OF WORK TABLE



TS_30_L LEVEE
LIMITS OF WORK



LIMITS OF WORK POINTS TABLE		
NORTHING	EASTING	POINT ID
2183224.47	6311063.57	1
2183251.51	6311116.68	2
2183349.86	6311178.04	3
2183435.90	6311177.20	4
2183538.30	6311171.37	5
2183638.36	6311169.23	6
2183739.32	6311169.44	7
2183839.63	6311173.66	8
2183943.11	6311176.14	9
2184043.82	6311179.55	10
2184148.12	6311182.88	11
2184247.77	6311189.40	12
2184347.13	6311197.83	13
2184444.52	6311200.38	14
2184542.67	6311187.20	15
2184641.47	6311205.49	16
2184740.76	6311225.49	17
2184834.71	6311220.64	18
2184931.27	6311201.83	19
2185028.91	6311183.33	20
2185122.36	6311155.61	21
2185217.35	6311102.98	22
2185301.74	6311049.34	23
2185398.78	6311014.88	24
2185493.24	6310988.90	25
2185589.58	6310959.93	26
2185653.21	6310939.36	27
2185691.51	6310891.72	28
2185727.12	6310907.67	29
2185951.49	6310999.38	30
2186035.05	6311027.92	31
2186178.28	6311049.35	32
2186207.57	6311170.48	33
2186061.73	6311227.55	34
2186058.39	6311223.79	35
2185999.25	6311252.00	36
2185986.56	6311354.25	37
2185929.35	6311304.41	38
2185778.71	6311169.18	39
2185579.34	6311189.52	40
2185457.47	6311229.04	41
2184966.17	6311437.31	42
2184947.00	6311440.58	43
2184817.54	6311460.17	44
2184712.31	6311475.20	45
2184636.65	6311484.74	46
2184545.04	6311490.82	47
2184484.71	6311520.51	48
2184393.35	6311505.76	49
2184339.38	6311452.39	50

LIMITS OF WORK POINTS TABLE		
NORTHING	EASTING	POINT ID
2184292.33	6311431.01	51
2184214.83	6311405.83	52
2184155.94	6311395.48	53
2184026.99	6311396.39	54
2183925.69	6311397.60	55
2183828.40	6311399.27	56
2183726.25	6311400.56	57
2183627.26	6311401.39	58
2183525.63	6311402.15	59
2182901.38	6311380.24	60
2182826.27	6311375.62	61
2182707.92	6311366.86	62
2182686.38	6311385.78	63
2182597.54	6311379.68	64
2182578.80	6311358.17	65
2181941.56	6311313.41	66
2181503.39	6311297.99	67
2181227.97	6311288.22	68
2180996.72	6311280.24	69
2180937.69	6311300.41	70
2180894.46	6311297.26	71
2180858.28	6311296.16	72
2180830.37	6311282.06	73
2179987.65	6311252.39	74
2180072.23	6311173.26	75
2180096.00	6311142.88	76
2180119.68	6311117.27	77
2180155.93	6311112.50	78
2180222.47	6311115.29	79
2180368.20	6311089.93	80
2180550.78	6311042.87	81
2180664.02	6311050.17	82
2180766.18	6311059.56	83
2180868.12	6311061.39	84
2180971.13	6311061.39	85
2181072.06	6311063.55	86
2181180.68	6311063.20	87
2181281.09	6311066.53	88
2181377.56	6311075.15	89
2181474.11	6311081.21	90
2181574.28	6311086.80	91
2181673.44	6311092.83	92
2181772.30	6311096.37	93
2181871.35	6311097.66	94
2181971.28	6311100.50	95
2182069.84	6311104.91	96
2182165.33	6311108.64	97
2182266.22	6311115.74	98
2182364.52	6311126.49	99
2182464.23	6311134.02	100

LIMITS OF WORK POINTS TABLE		
NORTHING	EASTING	POINT ID
2182560.89	6311146.15	101
2182652.62	6311152.29	102
2182748.81	6311141.20	103
2182846.43	6311140.46	104
2182942.91	6311144.44	105
2183044.23	6311150.09	106
2183158.03	6311148.75	107
2183170.23	6311104.34	108
2183171.02	6311064.11	109

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. LEE
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30_L LEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

PROPOSED LIMITS OF WORK POINT TABLE

SHEET ID
V-005

FINAL SUBMITTAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY:	
DMM / BFL	
DRAWN BY:	
M. HARRINGTON	
CHECKED BY:	
K. GOSTIC	
SUBMITTED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

ISSUE DATE:
NOVEMBER 2022
SOLICITATION NO.:
XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TSJ-SAL LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

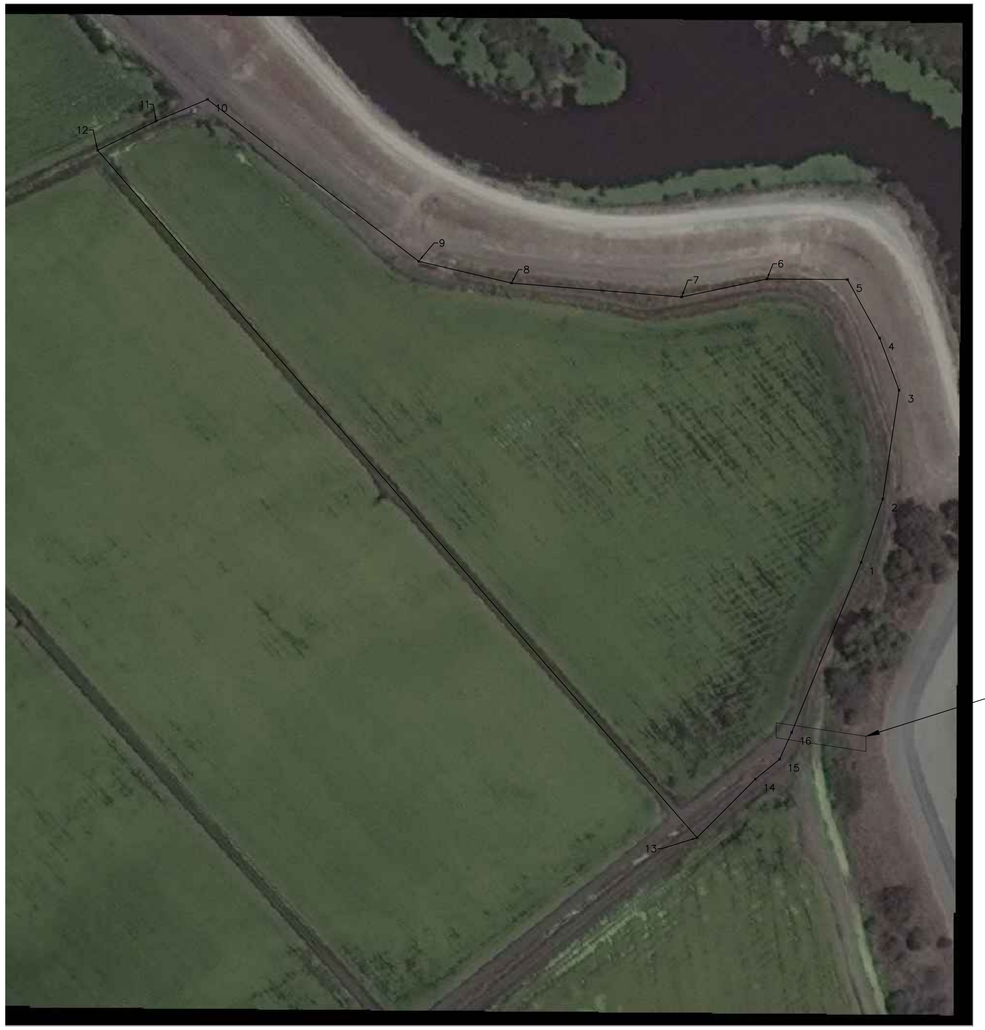
OVERALL SITE PLAN AND KEY MAP

SHEET ID
V-006

FINAL SUBMITTAL

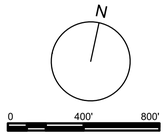
TS_30_L LEVEE STAGING AREA TABLE

STAGING AREA POINTS TABLE		
NORTHING	EASTING	POINT ID
2185951.49	6310999.38	1
2186035.05	6311027.92	2
2186178.66	6311049.41	3
2186247.43	6311023.84	4
2186324.67	6310981.35	5
2186325.41	6310875.13	6
2186301.66	6310762.41	7
2186320.10	6310537.74	8
2186348.84	6310415.35	9
2186562.52	6310136.65	10
2186533.87	6310068.82	11
2186495.27	6309991.69	12
2185588.13	6310782.79	13
2185665.42	6310859.77	14
2185691.51	6310891.72	15
2185727.12	6310907.67	16



TEMPORARY RAMP FROM LEVEE AND PATROL ROAD TO STAGING AREA. INSTALL CULVERT AT IRRIGATION DITCH TO MAINTAIN FLOW.

TS_30_L LEVEE
STAGING AREA



NOTES

1. THE CONTRACTOR SHALL PROVIDE THE TEMPORARY IMPROVEMENTS TO THE STAGING AREA INDICATED ON THIS SHEET. THE CONTRACTOR SHALL PREPARE A SUBMITTAL THAT INCLUDES ALL TEMPORARY IMPROVEMENTS FOR REVIEW AND APPROVAL BY CONTRACTING OFFICER. THESE TEMPORARY IMPROVEMENTS SHALL BE COMPLETED AND ACCEPTED BY THE CONTRACTING OFFICER BEFORE THE STAGING AREA CAN BE USED.

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BERTRAM
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
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U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

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LOWER SAN JOAQUIN RIVER REACH
TS_30_L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

STAGING AREA TEMPORARY IMPROVEMENTS

SHEET ID
V-007

FINAL SUBMITTAL

PLAN LEGEND

- WDR CPT Boring
- WDR SPT Boring
- WDR Vane Shear Boring
- CPT Boring
- SPT Boring
- Historical Boring
- Levee Centerline w/ Station
- Subreach (A to C)

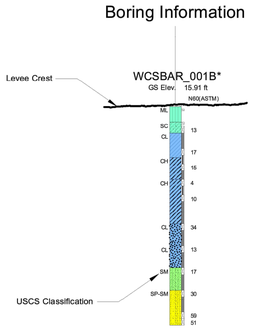
PROFILE LEGEND

- Top of Levee (Ground Surface)
- Cut-off Wall

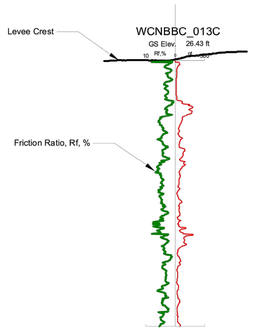
SAMPLER TYPES

- Standard Penetration Test
- Sonic Core
- Modified California
- Cont Core
- Punch Core
- Dry Core
- Standard California
- Bag Sample
- Shelby Tube
- Bulk/Grab Sample

Boring Information



CPT Information



SOIL CLASSIFICATIONS

- Asphalt
- Boulders and cobbles
- Concrete
- Fill
- Boulders and cobbles
- Fat Clay (CH)
- Fat Clay with Sand (CH)
- Fat Clay with Gravel (CH)
- Gravelly Fat Clay (CH)
- Gravelly Fat Clay with Sand (CH)
- Sandy Fat Clay (CH)
- Sandy Fat Clay with Gravel (CH)
- Lean Clay (CL)
- Lean Clay with Sand (CL)
- Silty Clay (CL-ML)
- Silty Clay with Sand (CL-ML)
- Silty Clay with Gravel (CL-ML)
- Gravelly Silty Clay (CL-ML)
- Gravelly Silty Clay with Sand (CL-ML)
- Sandy Silty Clay (CL-ML
- Sandy Silty Clay with Gravel (CL-ML)
- Lean to Fat Clay (CL/CH)
- Lean to Fat Clay with Sand (CL/CH)
- Lean to Fat Clay with Gravel (CL/CH)
- Gravelly Lean to Fat Cla (CL/CH)
- Gravelly Lean to Fat Clay with Sand (CL/CH)
- Sandy Lean to Fat Clay (CL/CH)
- Sandy Lean to Fat Clay with Gravel (CL/CH)
- Silty Clay to Clayey Silt (CL/ML)
- Silty Clay to Clayey Silt with Sand (CL/ML)
- Silty Clay to Clayey Silt with Gravel (CL/ML)
- Gravelly Silty Clay to Clayey Silt (CL/ML)
- Gravelly Silty Clay to Clayey Silt with Sand (CL/ML)
- Sandy Silty Clay to Clayey Silt (CL/ML)
- Sandy Silty Clay to Clay Silt with Gravel (CL/ML)
- Lean Clay with Gravel (CL)
- Gravelly Lean Clay (CL)
- Gravelly Lean Clay with Sand (CL)
- Sandy Lean Clay (CL)
- Sandy Lean Clay with Gravel (CL)
- Clayey Gravel (GC)
- Silty, Clayey Gravel (GC-GM)
- Silty, Clayey Gravel with Sand (GC-GM)
- Clayey Gravel with Sand (GC)
- Silty Gravel (GM)
- Silty Gravel with Sand (GM)
- Poorly Graded Gravel (GP)
- Poorly Graded Gravel with Clay (GP-GC)
- Poorly Graded Gravel with Clay and Sand (GP-GC)
- Poorly Graded Gravel with Silt (GP-GM)
- Poorly Graded Gravel with Silt and Sand (GP-GM)
- Poorly Graded Gravel with Sand (GP)
- Well-Graded Gravel (GW)
- Well-Graded Gravel with Clay (GW-GC)
- Well-Graded Gravel with Clay and Sand (GW-GC)
- Well-Graded Gravel with Silt (GW-GM)
- Well-Graded Gravel with Silt and Sand (GW-GM)
- Well-Graded Gravel with Sand (GW)
- Elastic Silt (MH)
- Elastic Silt with Sand (MH)
- Elastic Silt with Gravel (MH)
- Gravelly Elastic Silt (MH)
- Gravelly Elastic Silt with Sand (MH)
- Sandy Elastic Silt (MH)
- Sandy Elastic Silt with Gravel (MH)
- Silt (ML)
- Silt with Sand (ML)
- Clayey Silt (ML/CL)
- Clayey Silt with Sand (ML/CL)
- Clayey Silt with Gravel (ML/CL)
- Gravelly Clayey Silt (ML/CL)
- Gravelly Clayey Silt with Sand (ML/CL)
- Sandy Clayey Silt (ML/CL)
- Sandy Clayey Silt with Gravel (ML/CL)
- Silt with Gravel (ML)
- Gravelly Silt (ML)
- Gravelly Silt with Sand (ML)
- Sandy Silt (ML)
- Sandy Silt with Gravel (ML)
- Organic Fat Clay (OH)
- Organic Fat Clay with Sand (OH)
- Organic Fat Clay with Gravel (OH)
- Gravelly Organic Fat Clay (OH)
- Gravelly Organic Fat Clay with Sand (OH)
- Sandy Organic Fat Clay (OH)
- Sandy Organic Fat Clay with Gravel (OH)
- Organic Elastic Silt (OH)
- Organic Elastic Silt with Sand (OH)
- Organic Elastic Silt with Gravel (OH)
- Gravelly Organic Elastic Silt (OH)
- Gravelly Organic Elastic Silt with Sand (OH)
- Sandy Organic Elastic Silt (OH)
- Sandy Organic Elastic Silt with Gravel (OH)
- Organic Lean Clay (CL)
- Organic Lean Clay with Sand (OL)
- Organic Lean Clay with Gravel (OL)
- Gravelly Organic Lean Clay (OL)
- Gravelly Organic Lean Clay with Sand (OL)
- Sandy Organic Lean Clay (OL)
- Sandy Organic Lean Cla with Gravel (OL)
- Organic Silt (OL)
- Organic Silt with Sand (OL)
- Organic Silt with Gravel (OL)
- Gravelly Organic Silt (OL)
- Gravelly Organic Silt with Sand (OL)
- Sandy Organic Silt (OL)
- Sandy Organic Silt with Gravel (OL)
- Peat (PT)
- Clayey Sand (SC)
- Silty, Clayey Sand (SC-SM)
- Silty, Clayey Sand with Gravel (SC-SM)
- Clayey Sand with Gravel (SC)
- Silty Sand (SM)
- Silty Sand with Gravel (SM)
- Poorly Graded Sand (SF
- Poorly Graded Sand with Clay (SP-SC)
- Poorly Graded Sand with Clay and Gravel (SP-SC)
- Poorly Graded Sand with Silt (SP-SM)
- Poorly Graded Sand with Silt and Gravel (SP-SM)
- Poorly Graded Sand with Gravel (SP)
- Well-Graded Sand (SW)
- Well-Graded Sand with Clay (SW-SC)
- Well-Graded Sand with Clay and Gravel (SW-SC)
- Well-Graded Sand with Silt (SW-SM)
- Well-Graded Sand with Silt and Gravel (SW-SM)
- Well-Graded Sand with Gravel (SW)
- No Recovery

SURFICIAL GEOLOGY

Surficial Geology was mapped at 1:20,000.

- Geologic contact; dashed where approximate, dotted where concealed, queried where uncertain; solid contacts within 30' of line shown on map.
- W 1937 Water, circa 1937.
- W 1911 Water, circa 1911.
- W 1873 Water, circa 1873.
- W 1854 Water, circa 1854
- C Canal, circa 1937.
- BP BP, Borrow pits present in 1937
- VP Vernal pool; seasonally submerged or saturated depression usually indicative of an underying hardpan.

Geologic Units

- L Levee (made a artificial fill), circa1937.
- R Road embankment (made of artificial fill), circa 1937.
- RR Railroad embankment (made of artificial fill), circa 1937.
- ML Made land; fill material of local and exotic sources, sand, silt, organic, garbage, etc.
- AF Artificial fill, as mapped from 1937 photos.

Historical

- Rob Overbank deposits; sand, silt, and clay; deposited during high-stage water flow, overtopping channel banks.
- Rcs Crevasse splay deposits; fine to coarse sand, with minor lenses of clay deposited from breaching of natural or artifical levees.
- Rch Channel deposits; well sorted sands and fine gravels.
- Rch 1906 Channel deposits, circa 1906; well sorted sands and fine gravels.
- Rch 1873 Channel deposits, circa 1873; well sorted sands and fine gravels.
- Rch 1857 Channel deposits, circa 1857; well sorted sands and fine gravels.
- Rch 1854 Channel deposits, circa 1854; well sorted sands and fine gravels.
- Rb Channel bar deposits; fine gravel, sand, and silt deposited in or along channel lateral margins.
- Rcu Cut off channel (chute); occurs on insides of meander bends within the river channel; on flood plain – entrenchment of overflow channels into hydraulic mining debris.
- Rdc Distributary channel deposits; sand, silt, clay, and trace gravel; hannelized flow conducting sediment to floodplain.
- Rofc Overflow channel; vertically stratified sand, silt and clay in floodplain channels occupied primarily when high-stage water overtops channel banks.
- Rpb Point bar; well sorted sand with minor amounts of silt and clay.
- Rsl Slough deposits; sand, silt and clay, fining upward, low-energy channel deposits.
- Ra Alluvial deposits, undifferentiated; sand, silt, and minor lenses of fine gravel.
- Hfy Alluvial fan deposits; Well graded gravel, sand, silt and clay; volcanic lithologies

Holocene

- Hob Overbank deposits; sand, silt, and clay; deposited during high-stage water flow, overtopping channel banks.
- Hcs Crevasse splay deposits; fine to coarse sand, with minor lenses of gravel deposited from breaching of natural or artifical levees.
- Hdf Distributary fan deposits; sand, silt and clay
- Hofc Overflow channels; vertically stratified sand, silt and clay in channels occupied when high-stage water overtops channel banks.
- Hch Marsh deposits; Undifferentiated marsh deposits above channel deposits
- Hms Channel meander scroll deposits; sand, silt and clay from lateral channel migration
- Hpb Point bar; well sorted sand with minor amounts of silt and clay
- Hpm Basin Deposits
- Hdc Distributary channels; trace gravel, sand, silt, and clay; channelized flow conducting crevasse splay sediment to floodplain
- Hsl Slough deposits; Sand, silt and clay, fining upward, low-energy channel deposits.
- Hsb Slough basin deposits; sand, silt and clay; fining upward, ponded, low-energy channel deposits.
- Ha Alluvial deposits; undifferentiated; sand, silt, and minor lenses of gravel; commonly under cultivation in 1937.
- Ha (Agr) Alluvial deposits undifferentiated; sand, silt, and minor lenses of fine gravel, under cultivation in 1937
- Ha (Urb) Alluvial deposits; undifferentiated; sand, silt, and minor lenses of fine gravel, under urbanization in 1937
- Qch Channel deposits; sorted sands and silts; fining upward.
- Hn Basin deposits; fine sand, silt, and clay.
- Hs Marsh deposits; silt and clay, likely organic-rich; perennially or easonally submerged, as shown on 1937 photography.

Pleistocene

- Qmu Unconsolidated gravel, sand, silt, and clay.
- Qml Unconsolidated to semi-consolidated gravel, sand, silt and clay.
- Qru Semi-consolidated to consolidated gravel, sand, silt and minor clay.
- Qrl Consolidated gravel, sand, silt, and clay, generally associated with strong duripan horizon.
- Qtl Chiefly well consolidated sand with some silt and minor gravel.

Legend

Lower San Joaquin River, Stockton, CA

US Army Corps of Engineers®
SACRAMENTO DISTRICT

FIGURE A-1

DRAFT

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
FS, SOL LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

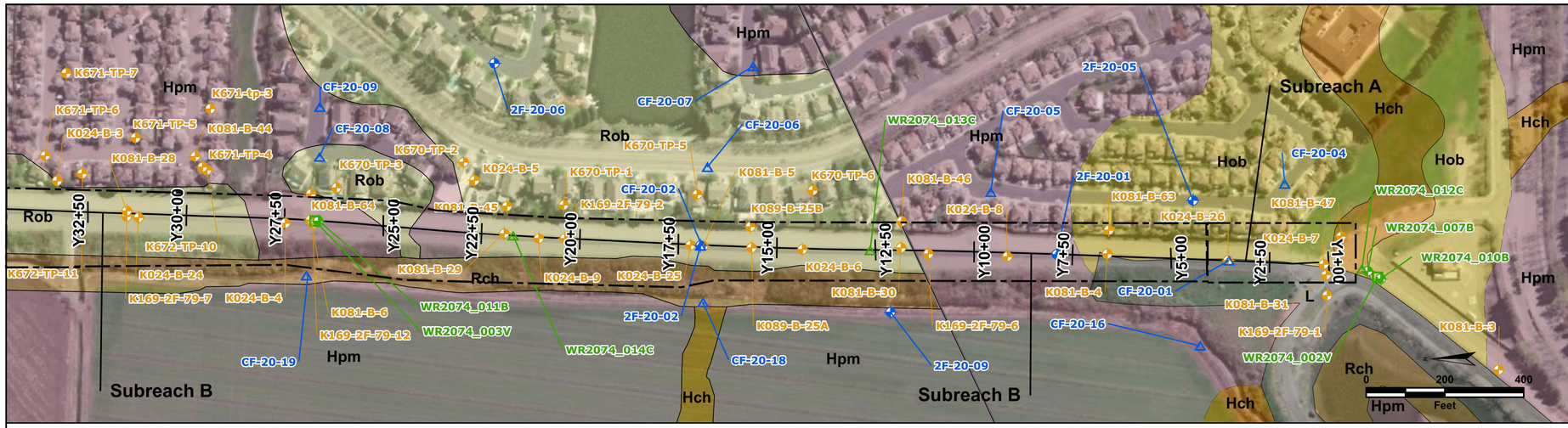
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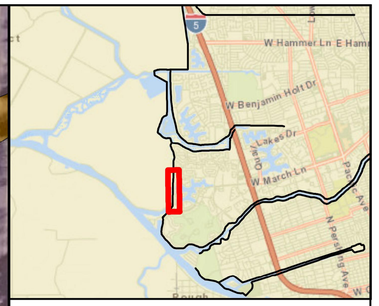
SHEET ID
B-001

FINAL SUBMITTAL

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PLAN & PROFILE NOTES:

1. Stratigraphy shown is approximate based on available exploration data. Actual subsurface conditions may vary.
2. Blow Counts are displayed for SPT, MCAL and CAL sampler types, where information is available.
3. Due to data variety "refusal" is represented by an "R" on some sticks and by "Blows/inch" on others.
4. Geotechnical Data compiled from multiple sources through the use of gINT software.
5. Where %f were not present, due to missing data, the symbol was removed from map view.
6. Data Source: Geomorphic units for the American River Urban Project Levee system, William Lettis & Associates, 2008. Geotechnical Data: USACE and URS See Fig. A-1 for Legend.

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B) HEM differential resistivity data is superimposed on the stick logs using the landside toe as an approximate reference point.

PREVIOUS EXPLORATION SOURCE LEGEND:

K169 - Kleinfelder, 04/26/1979,19790426_Drilling Logs, 10-14 Mile Sloughs - Stockton

K081 - Kleinfelder, 09/29/1989; 19890926_Levee Evaluation for Segment 3, Along 10-Mile & 14-Mile Sloughs & South Buckley Cove, Brookside Project, Stockton, California

K024 - Kleinfelder, 09/29/2006; 20060929_Geotechnical Services, Seepage Evaluation, Levee Along 10-Mile Slough, Brookside Development, Stockton, California

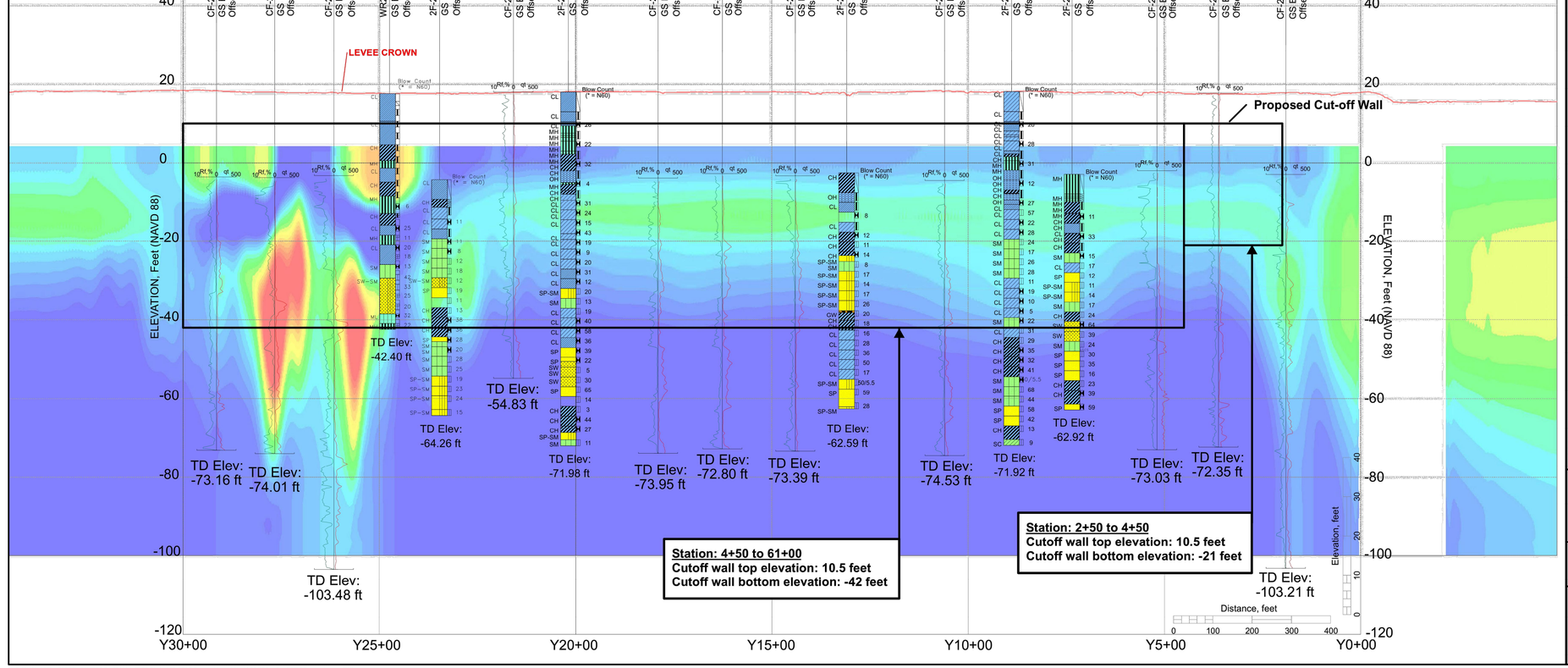
K670 - Kleinfelder, 07/12/1996; 19960712_Report, Geotechnical Investigation, Proposed Unit 30, Brookside Development, Stockton, California

K671 - Kleinfelder, 01/12/2000;20000112_Geotechnical Investigation, Unit 35 Subdivision, Brookside Development, Stockton, California

K672 - Kleinfelder, 01/15/1996;19960115_General Recommendations for Foundations, Unit 18 Subdivision, Brookside Development, Stockton, California

K673 - Kleinfelder, 07/02/1999;19990702_Report, Geotechnical Investigation, Unit 39 Subdivision, Brookside Development, Stockton, California

K089 - Kleinfelder, 09/26/1989;19891211 Summary of Additional Test Drilling Near Boring 25, 10-Mile Slough Levee, Brookside Project, Stockton, California



Differential Resistivity [ohm-m]

5.6 6.3 7.1 7.9 8.9 10.0 11.2 12.6 14.1 15.8 17.7 19.9 22.3 25.1 28.1 31.5 35.4 39.7 44.6 50.0

Plan and Profile (Sta. 30+00 - 0+00)
South Reach
Sheet 1

Lower San Joaquin River

US Army Corps of Engineers
Sacramento District

Reach TS-30-L

DRAFT

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US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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DRAWN BY:
CHECKED BY: M. HARRINGTON
APPROVED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

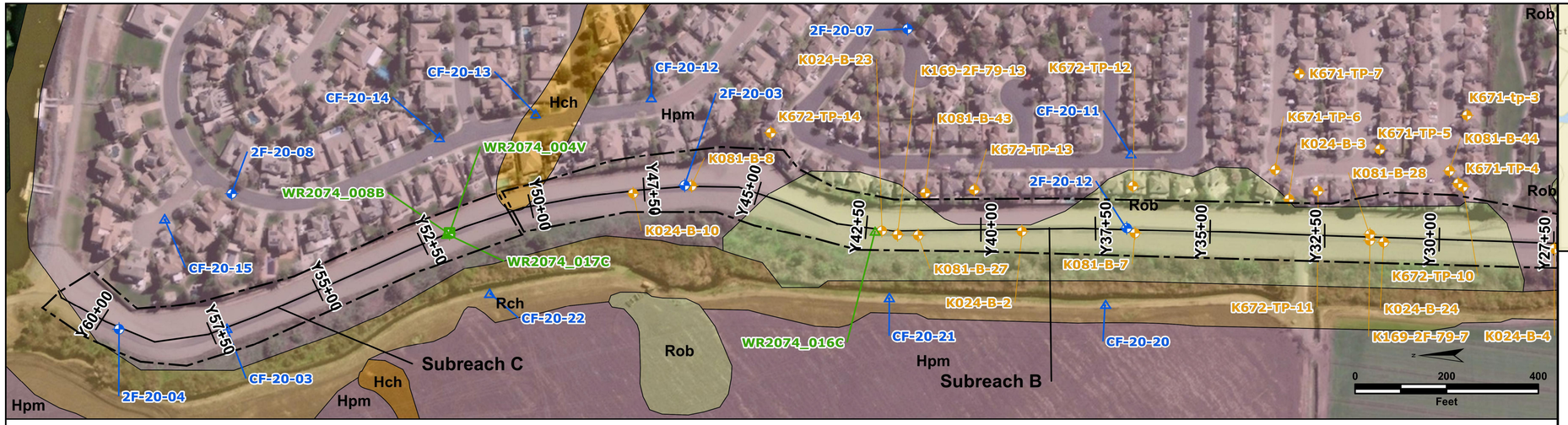
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

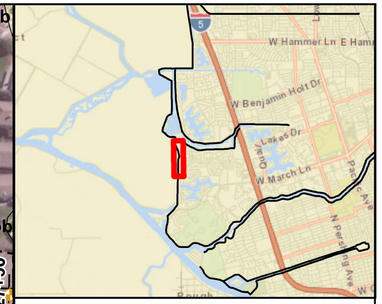
LOWER SAN JOAQUIN RIVER REACH
TS_30 LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

BORING LOG PLAN AND PROFILE STA 1+00 TO 30+00

SHEET ID
B-201

FINAL SUBMITTAL





PLAN & PROFILE NOTES:

1. Stratigraphy shown is approximate based on available exploration data. Actual subsurface conditions may vary.
2. Blow Counts are displayed for SPT, MCAL and CAL sampler types, where information is available.
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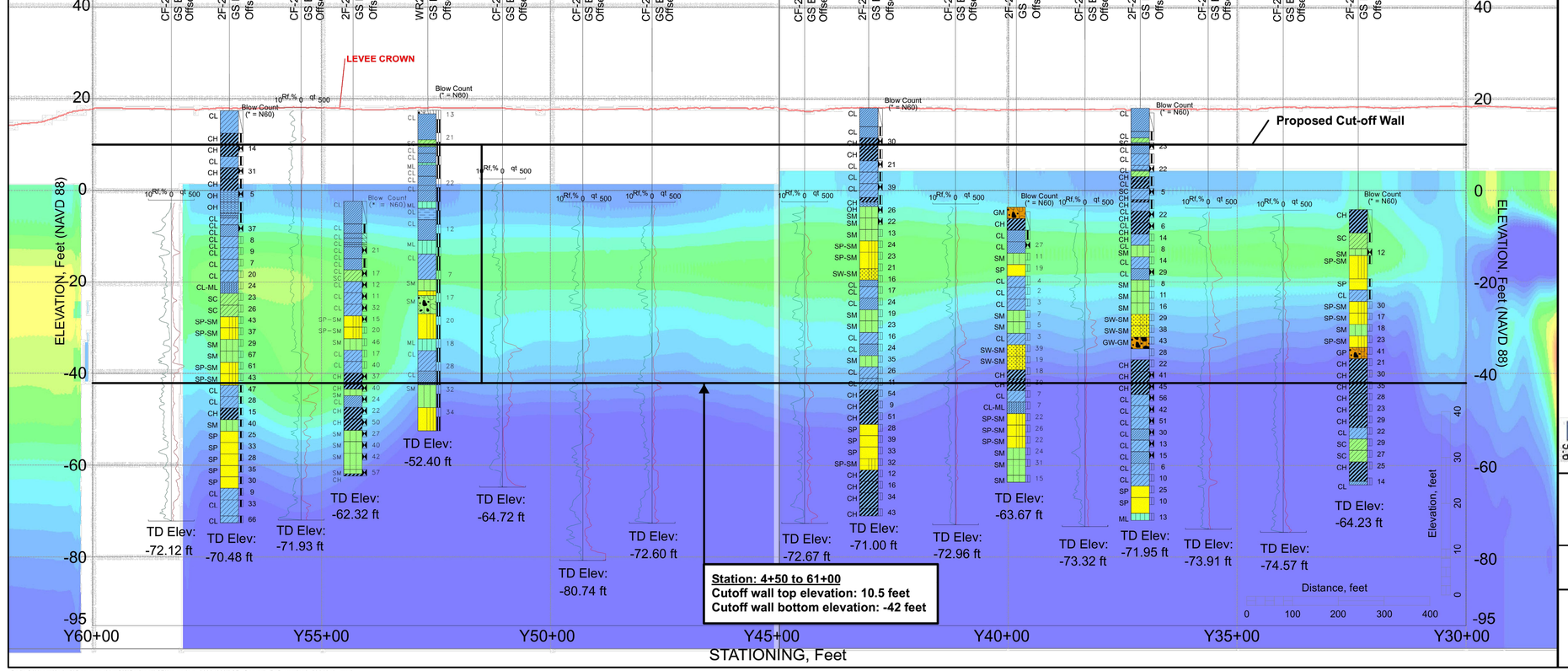
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Differential Resistivity [ohm-m]

5.6 6.3 7.1 7.9 8.9 10.0 11.2 12.6 14.1 15.8 17.7 19.9 22.3 25.1 28.1 31.5 35.4 39.7 44.6 50.0

Plan and Profile (Sta. 60+00 - 30+00)
North Reach
Sheet 2

Lower San Joaquin River

Reach TS-30-L

US Army Corps of Engineers
Sacramento District

DRAFT

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
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SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30 LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

BORING LOG PLAN AND PROFILE STA 30+00 TO 60+00

SHEET ID
B-202

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

NOTES

1. AERIAL IMAGE HAS NOT BEEN ORTHORECTIFIED

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DESIGNED BY: DMM / BFL
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SIZE: ANSI D

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CONTRACT NO.:

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1325 J. ST.
SACRAMENTO, CA 95814

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80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
SOUTH LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

AERIAL PLAN STA 1+00 TO 10+00

SHEET ID
V-100

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

NOTES

1. AERIAL IMAGE HAS NOT BEEN ORTHORECTIFIED

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CONTRACT NO.:

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1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
SAN JOAQUIN RIVER FLOOD
SAN JOAQUIN COUNTY, CALIFORNIA

AERIAL PLAN STA 10+00 TO 20+50

SHEET ID
V-101

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

NOTES

1. AERIAL IMAGE HAS NOT BEEN ORTHORECTIFIED

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DESIGNED BY:	ISSUE DATE:
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M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
QA/QC REVIEWED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

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1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
WS LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

AERIAL PLAN STA 20+50 TO 31+00

SHEET ID
V-102

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

NOTES

1. AERIAL IMAGE HAS NOT BEEN ORTHORECTIFIED

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CHECKED BY:	K. BRUSTAD
APPROVED BY:	S. JIMENEZ
SIZE:	ANSI D

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SACRAMENTO, CA 95814

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80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
SOUTH LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

AERIAL PLAN STA 31+00 TO 41+50

SHEET ID
V-103

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

NOTES

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K. BRUSTAD	
SUBMITTED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

ISSUE DATE:
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SOLICITATION NO.:
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CONTRACT NO.:

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SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
SAN JOAQUIN RIVER FLOOD
SAN JOAQUIN COUNTY, CALIFORNIA

AERIAL PLAN STA 41+50 TO 52+00

SHEET ID
V-104

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

NOTES

1. AERIAL IMAGE HAS NOT BEEN ORTHORECTIFIED

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QA/QC BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

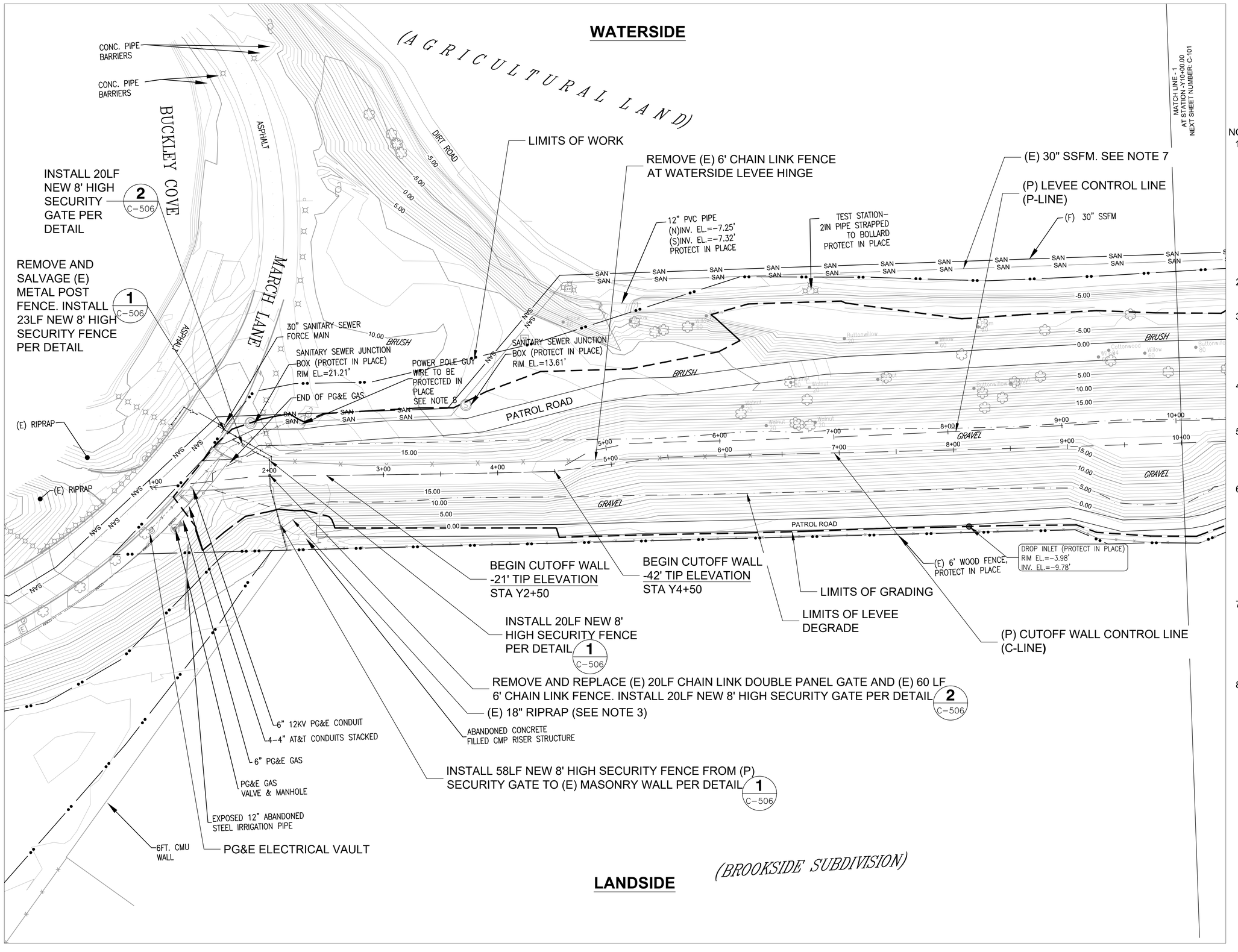
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
LEVEE REHABILITATION
SAN JOAQUIN COUNTY, CALIFORNIA

AERIAL PLAN STA 52+00 TO 62+00

SHEET ID
V-105

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

NOTE:

1. CONTOURS WITHIN LIMITS OF GRADING REFLECT THE PROPOSED LEVEE SURFACE. THE CONTOURS THAT CONTINUE OUTSIDE OF THE LIMITS OF GRADING REFLECT THE EXISTING LEVEE SURFACE.
2. PROTECT IN PLACE ALL UTILITIES.
3. 4. EXISTING 18" RIP RAP (36" THICK) TO BE REMOVED AND REINSTALLED PER SHEET CG-100.
4. TOPSOIL SHALL NOT BE USED ON FINAL LEVEE SLOPES.
5. VIBRATORY ROLLERS SHALL NOT BE USED OVER UTILITIES.
6. WHERE LEVEE GRADING ENCROACHES ON DRAINAGE SWALE, RECONSTRUCT PER DETAIL 4 ON C-507. REFERENCE SHEETS C-311 TO C-317 FOR LIMITS
7. NO EQUIPMENT SHALL GO OVER THE ALIGNMENT OF THE (E) 30" SSFM, AS INDICATED ON THE DRAWINGS.
8. CONTRACTOR MUST PLACE CAUTION TAPE COMPLETELY AROUND PG&E POWER POLE AND GUY WIRE

US Army Corps of Engineers®

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DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QA/QC BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TOE WALL REMEDIATION PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PLAN STA 1+00 TO 10+00

SHEET ID
C-100

FINAL SUBMITTAL

WATERSIDE

MATCH LINE - 1
AT STATION - Y10+00.00
PREVIOUS SHEET NUMBER: C-100

MATCH LINE - 2
AT STATION - Y20+50.00
NEXT SHEET NUMBER: C-102

END PARTIAL DITCH RELOCATION
STA Y16+67 (169') PER DETAIL 1/C-507

BEGIN PARTIAL DITCH RELOCATION
STA Y14+98 PER DETAIL 1/C-507

(AGRICULTURAL LAND)

(P) LEVEE CONTROL LINE
(P-LINE)

TOP OF CHANNEL

LIMITS OF WORK

(E) 30" SSFM

(F) 30" SSFM

TEST STATION–
2IN PIPE STRAPPED
TO BOLLARD
PROTECT IN PLACE

(P) TOP

(P) INVERT

DIRT ROAD

PATROL ROAD

BRUSH

GRAVEL

ELDERBERRY
(SEE NOTE 1)

LIMITS OF GRADING

LIMITS OF LEVEE
DEGRADE

DROP INLET (PROTECT IN PLACE)
RIM EL.=-2.94'
INV. EL.=-8.04'

(E) 6' WOOD FENCE,
PROTECT IN PLACE

(P) CUTOFF WALL CONTROL LINE
(C-LINE)

(BROOKSIDE SUBDIVISION)

LANDSIDE

N

0 40' 80'

SCALE: 1"=40'

NOTES

1. ELDERBERRY BUSH TO BE RELOCATED BY OTHERS PRIOR TO CONSTRUCTION
2. CONTOURS WITHIN LIMITS OF GRADING REFLECT THE PROPOSED LEVEE SURFACE. THE CONTOURS THAT CONTINUE OUTSIDE OF THE LIMITS OF GRADING REFLECT THE EXISTING LEVEE SURFACE.
3. PROTECT IN PLACE ALL UTILITIES
4. WHERE LEVEE GRADING ENCROACHES ON DRAINAGE SWALE, RECONSTRUCT PER DETAIL 4 ON C-507. REFERENCE SHEETS C-311 TO C-317 FOR LIMITS

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

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DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
A/E PM: T. TOLLEFSON
S. JIMENEZ
SIZE: ANSI D

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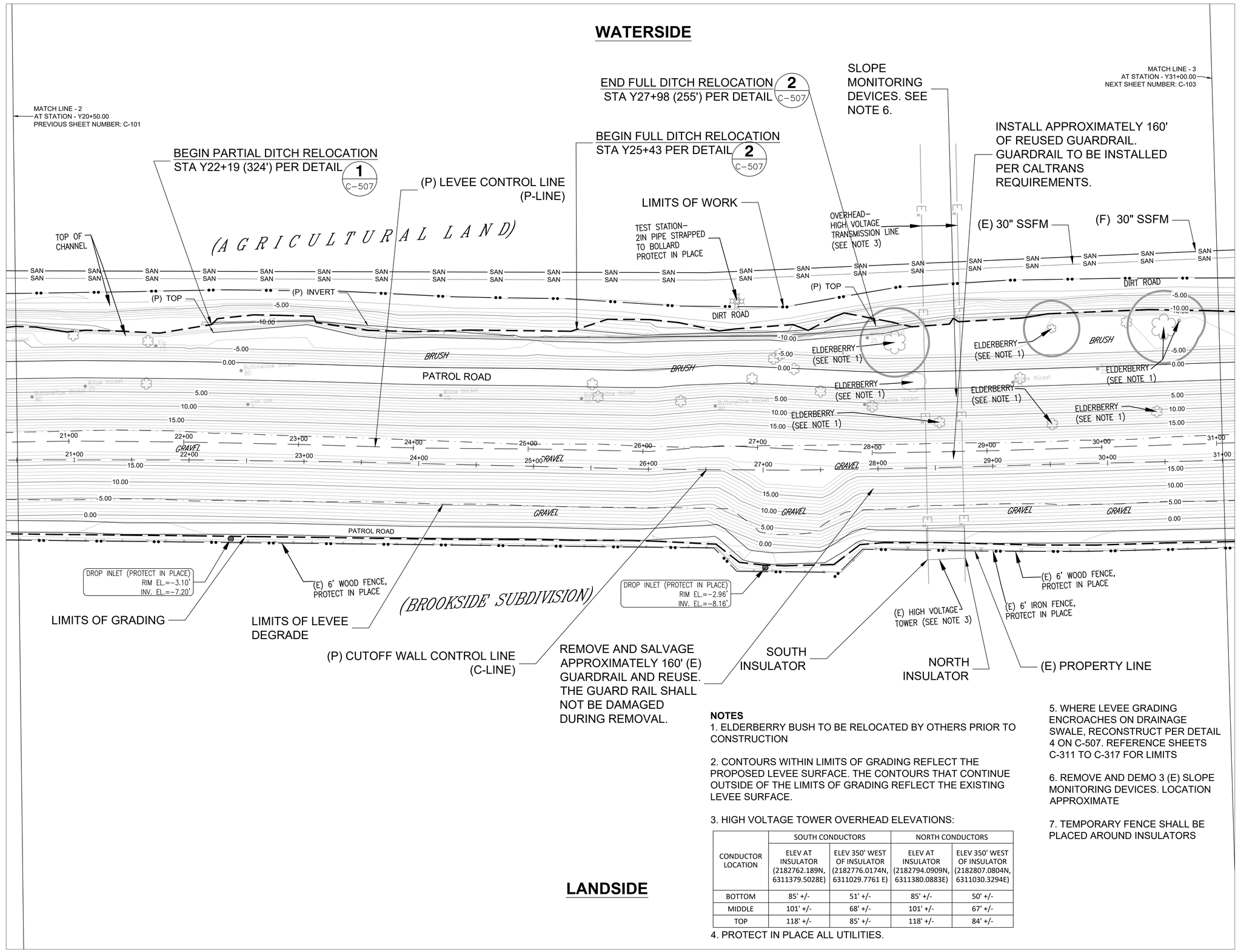
LOWER SAN JOAQUIN RIVER REACH
SW LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PLAN STA 10+00 TO 20+50

SHEET ID
C-101

FINAL SUBMITTAL

WATERSIDE



N

SCALE: 1"=40'

LANDSIDE

NOTES

1. ELDERBERRY BUSH TO BE RELOCATED BY OTHERS PRIOR TO CONSTRUCTION

2. CONTOURS WITHIN LIMITS OF GRADING REFLECT THE PROPOSED LEVEE SURFACE. THE CONTOURS THAT CONTINUE OUTSIDE OF THE LIMITS OF GRADING REFLECT THE EXISTING LEVEE SURFACE.

3. HIGH VOLTAGE TOWER OVERHEAD ELEVATIONS:

CONDUCTOR LOCATION	SOUTH CONDUCTORS		NORTH CONDUCTORS	
	ELEV AT INSULATOR (2182762.189N, 6311379.5028E)	ELEV 350' WEST OF INSULATOR (2182776.0174N, 6311029.7761 E)	ELEV AT INSULATOR (2182794.0909N, 6311380.0883E)	ELEV 350' WEST OF INSULATOR (2182807.0804N, 6311030.3294E)
BOTTOM	85' +/-	51' +/-	85' +/-	50' +/-
MIDDLE	101' +/-	68' +/-	101' +/-	67' +/-
TOP	118' +/-	85' +/-	118' +/-	84' +/-

4. PROTECT IN PLACE ALL UTILITIES.

5. WHERE LEVEE GRADING ENCROACHES ON DRAINAGE SWALE, RECONSTRUCT PER DETAIL 4 ON C-507. REFERENCE SHEETS C-311 TO C-317 FOR LIMITS

6. REMOVE AND DEMO 3 (E) SLOPE MONITORING DEVICES. LOCATION APPROXIMATE

7. TEMPORARY FENCE SHALL BE PLACED AROUND INSULATORS

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXWXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

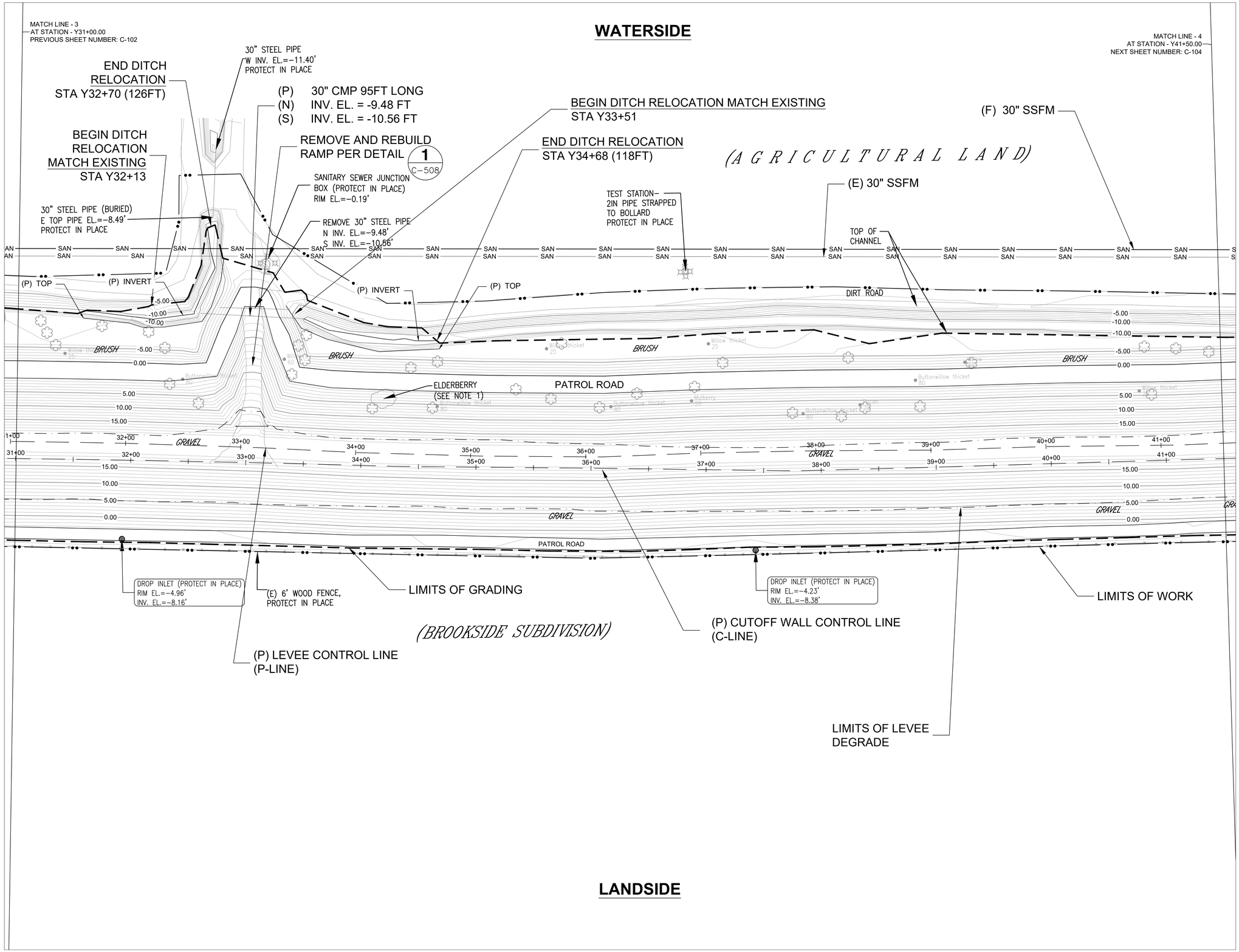
LOWER SAN JOAQUIN RIVER REACH
TS: SAN JOAQUIN COUNTY
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PLAN STA 20+50 TO 31+00

SHEET ID
C-102

FINAL SUBMITTAL

WATERSIDE



LANDSIDE

N

0 40' 80'

SCALE: 1"=40'

NOTES

1. ELDERBERRY BUSH TO BE RELOCATED BY OTHERS PRIOR TO CONSTRUCTION
2. CONTOURS WITHIN LIMITS OF GRADING REFLECT THE PROPOSED LEVEE SURFACE. THE CONTOURS THAT CONTINUE OUTSIDE OF THE LIMITS OF GRADING REFLECT THE EXISTING LEVEE SURFACE.
3. PROTECT IN PLACE ALL UTILITIES.
4. SEE CROSS SECTION AT STA Y33+00 ON SHEET C-314. SURFACE OF RAMP TO HAVE 4" AGGREGATE SURFACING COMPACT TO 100%
5. CONTRACTOR MUST COORDINATE USE OF WATERSIDE RAMP AT STA Y33+00 WITH THE PROPERTY OWNER
6. WHERE LEVEE GRADING ENCROACHES ON DRAINAGE SWALE, RECONSTRUCT PER DETAIL 4 ON C-507. REFERENCE SHEETS C-311 TO C-317 FOR LIMITS

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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CHECKED BY:	K. BRUSTAD
QA/QC BY:	S. JIMENEZ
ISSUE DATE:	NOVEMBER 2022
SOLICITATION NO.:	XXXXXX-XX-X-XXXX
CONTRACT NO.:	
SIZE:	ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

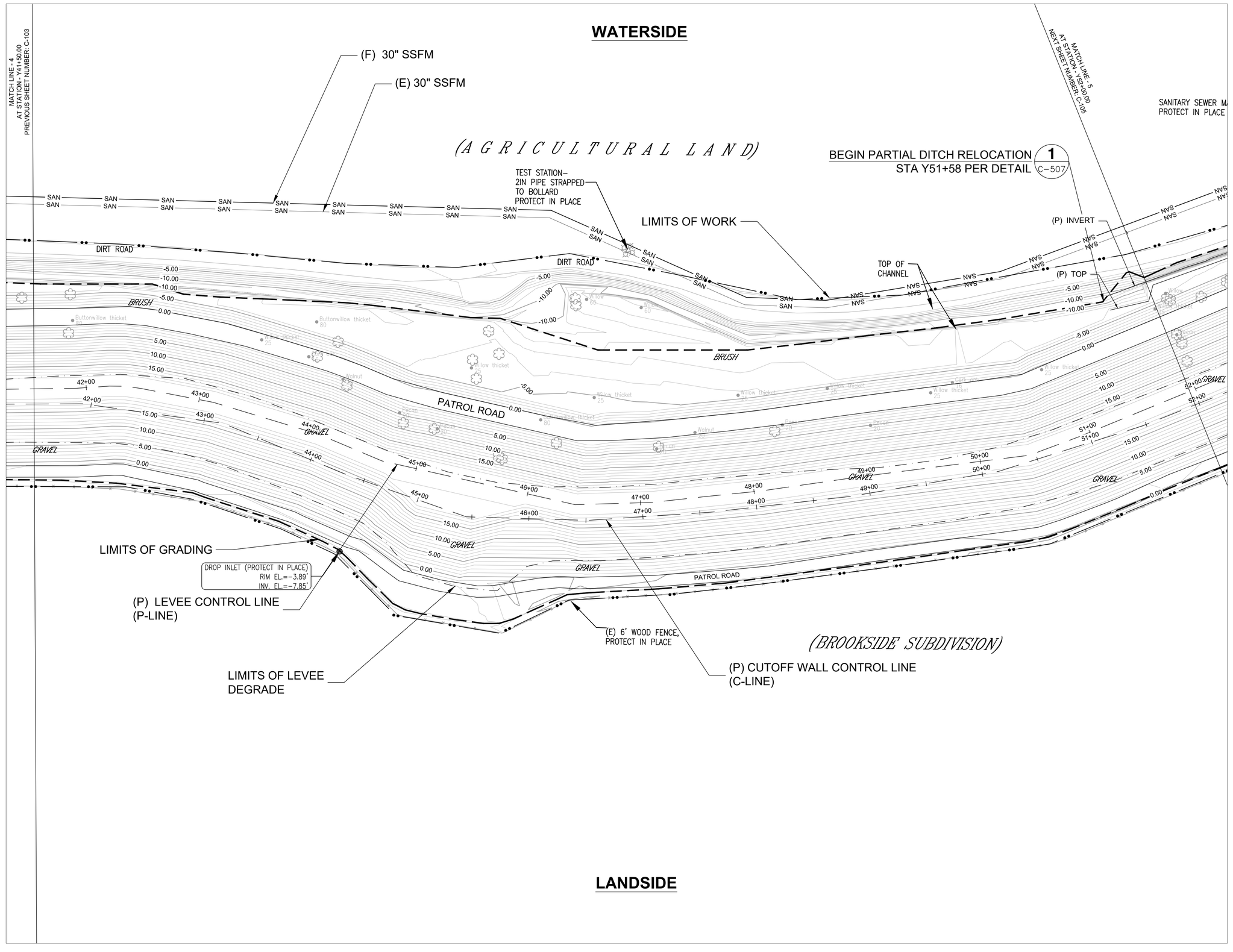
LOWER SAN JOAQUIN RIVER REACH
'S' BEND LEVEE IMPROVEMENT PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PLAN STA 31+00 TO 41+50

SHEET ID
C-103

FINAL SUBMITTAL

WATERSIDE



LANDSIDE

N

0 40' 80'

SCALE: 1"=40'

NOTE:

1. CONTOURS WITHIN LIMITS OF GRADING REFLECT THE PROPOSED LEVEE SURFACE. THE CONTOURS THAT CONTINUE OUTSIDE OF THE LIMITS OF GRADING REFLECT THE EXISTING LEVEE SURFACE.
2. PROTECT IN PLACE ALL UTILITIES
3. WHERE LEVEE GRADING ENCROACHES ON DRAINAGE SWALE, RECONSTRUCT PER DETAIL 4 ON C-507. REFERENCE SHEETS C-311 TO C-317 FOR LIMITS

US Army Corps of Engineers®

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CHECKED BY: K. BRUSTAD
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SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
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CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TSMP LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PLAN STA 41+50 TO 52+00

SHEET ID
C-104

FINAL SUBMITTAL

WATERSIDE

~ TEMPORARY STAGING AND STOCKPILE AREA~
(SEE SHEET V-007)

N

0 40' 80'

SCALE: 1"=40'

NOTE:
1. CONTOURS WITHIN LIMITS OF GRADING REFLECT THE PROPOSED LEVEE SURFACE. THE CONTOURS THAT CONTINUE OUTSIDE OF THE LIMITS OF GRADING REFLECT THE EXISTING LEVEE SURFACE.
2. PROTECT IN PLACE ALL UTILITIES
3. WHERE LEVEE GRADING ENCROACHES ON DRAINAGE SWALE, RECONSTRUCT PER DETAIL 4 ON C-507. REFERENCE SHEETS C-311 TO C-317 FOR LIMITS

BEGIN FULL DITCH RELOCATION
STA Y58+73 PER DETAIL 2 C-507

END FULL DITCH RELOCATION
STA Y60+52 (179') PER DETAIL 2 C-507

END PARTIAL DITCH RELOCATION
STA Y54+22 (264') PER DETAIL 1 C-507

(E) 30" SSFM

24" CMP PIPE PROTECT IN PLACE INV. EL.=-9.38'

24" CMP PIPE PROTECT IN PLACE INV. EL.=-10.28'

(F) 30" SSFM

12" PVC PIPE PROTECT IN PLACE N INV. EL.=-8.29' S INV. EL.=-8.15'

TEST STATION- 2IN PIPE STRAPPED TO BOLLARD PROTECT IN PLACE

TOP OF CHANNEL

LIMITS OF WORK

SANITARY SEWER MANHOLE PROTECT IN PLACE

(P) INVERT

(P) TOP

DIRT ROAD

PATROL ROAD

BRUSH

GRAVEL

DROP INLET (PROTECT IN PLACE)
RIM EL.=-0.98'
INV. EL.=-4.53'

DROP INLET (PROTECT IN PLACE)
RIM EL.=-0.66'
INV. EL.=-6.83'

(E) 6' WOOD FENCE, PROTECT IN PLACE

END CUTOFF WALL
-42' TIP ELEVATION
STA Y61+00

(E) 6' IRON FENCE, PROTECT IN PLACE

(E) SPLIT SWING GATE-IRON, PROTECT IN PLACE

(E) RIPRAP

WATER EDGE

TOP OF LEVEE

(E) CONC. SLAB FOR DOCK

MATCH EXISTING GRADE

FOURTEEN MILE SLOUGH

(AGRICULTURAL LAND)

(BROOKSIDE SUBDIVISION)

LIMITS OF LEVEE DEGRADE

(P) LEVEE CONTROL LINE (P-LINE)

LIMITS OF GRADING

(P) CUTOFF WALL CONTROL LINE (C-LINE)

MATCH LINE - S
AT STATION - Y52+00.00
PREVIOUS SHEET NUMBER: C-104

LANDSIDE

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: J. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

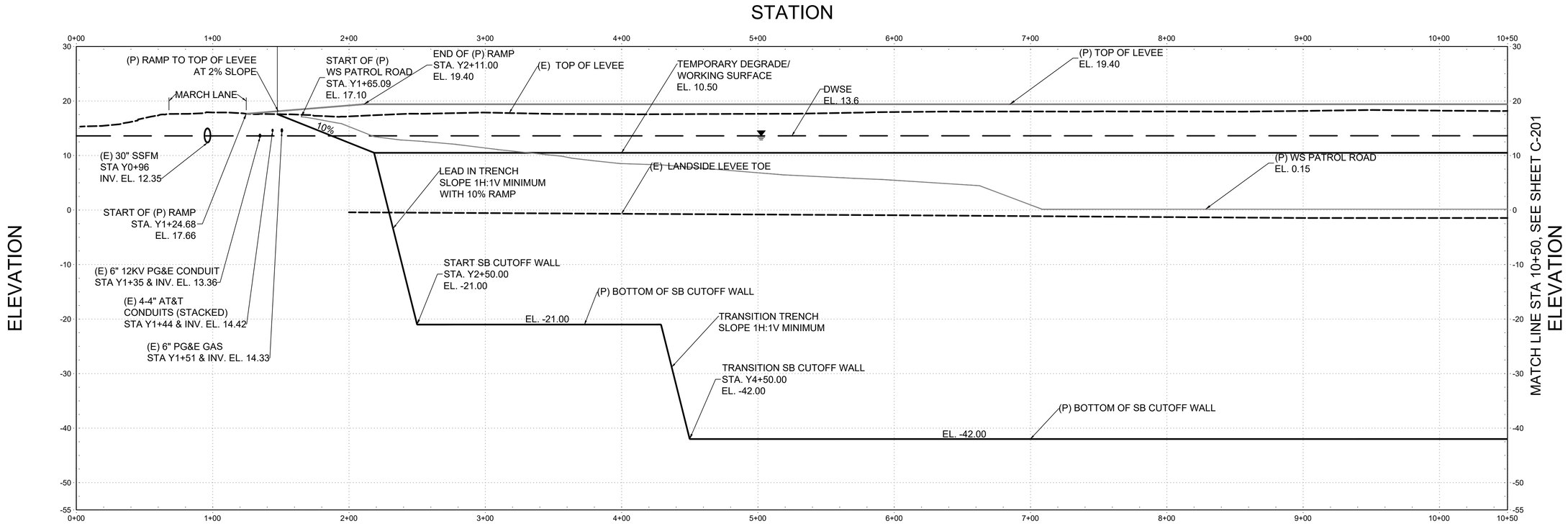
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PLAN STA 52+00 TO 62+00

SHEET ID
C-105

FINAL SUBMITTAL



STATION ALONG EXISTING LEVEE CENTERLINE (Y-LINE)

NOTES:

1. DWSE IS THE MAXIMUM DESIGN WATER LEVEL AT THE PROJECT AREA SHOULD THE AGRICULTURAL LEVEES FAIL.
2. (E) PG&E GAS MAIN HAS 33" OF COVER. NO VIBRATORY EQUIPMENT MAY BE USED WITHIN 12" OF THIS GAS MAIN OR OTHER SHALLOW UTILITIES. CONTRACTOR MUST MAINTAIN 2' OF COVER ABOVE EXISITNG 6" GAS MAIN.

0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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SUBMITTED BY:	S. JIMENEZ
SIZE:	ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
FS SAN JOE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PROFILE STA 1+00 TO 10+50

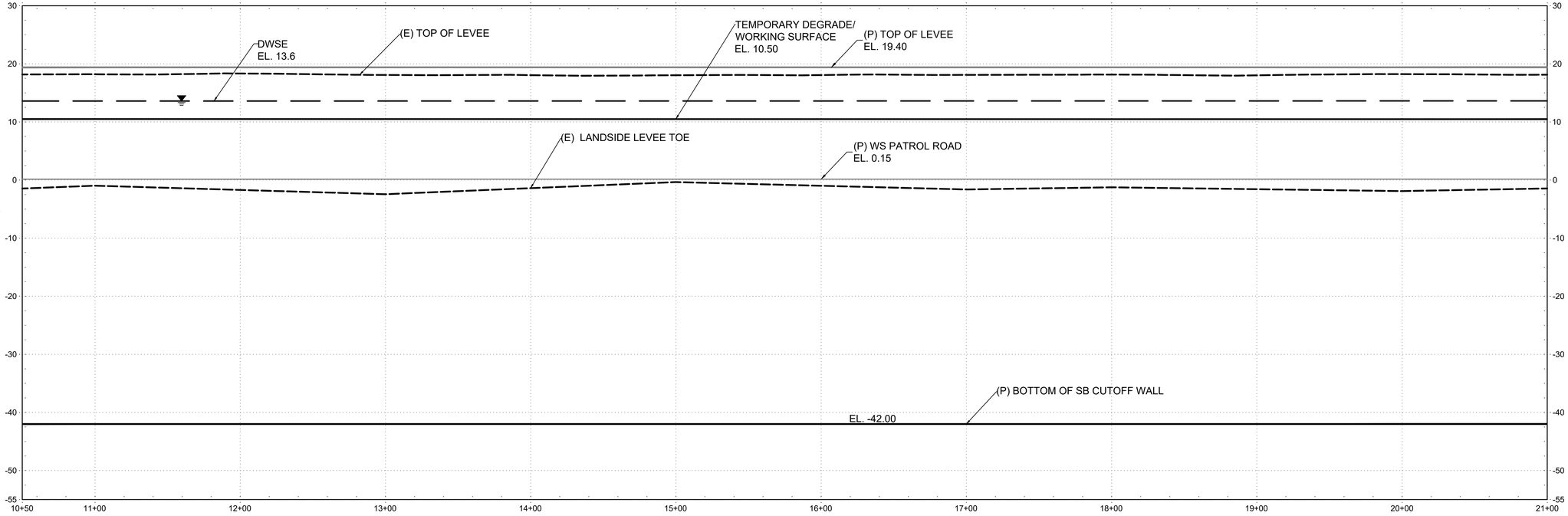
SHEET ID
C-200

FINAL SUBMITTAL

STATION

ELEVATION

MATCH LINE STA 10+50, SEE SHEET C-200



MATCH LINE STA 21+00, SEE SHEET C-202

ELEVATION

STATION ALONG EXISTING LEVEE CENTERLINE (Y-LINE)

NOTES:

1. DWSE IS THE MAXIMUM DESIGN WATER LEVEL AT THE PROJECT AREA SHOULD THE AGRICULTURAL LEVEES FAIL.

0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

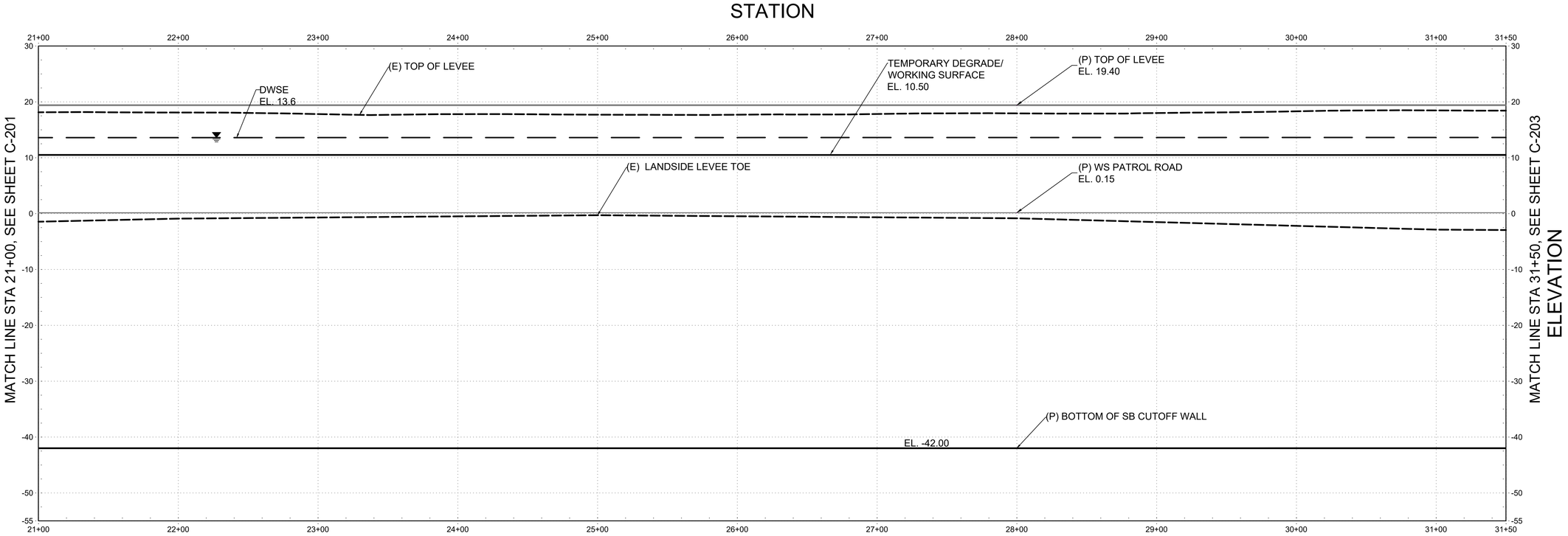
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
LEVEE REHABILITATION PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PROFILE STA 10+50 TO 21+00

SHEET ID
C-201

FINAL SUBMITTAL



STATION ALONG EXISTING LEVEE CENTERLINE (Y-LINE)

NOTES:

1. DWSE IS THE MAXIMUM DESIGN WATER LEVEL AT THE PROJECT AREA SHOULD THE AGRICULTURAL LEVEES FAIL.

0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
DMM / BFL	NOVEMBER 2022
DRAWN BY:	SOLICITATION NO.:
M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
SUBMITTED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

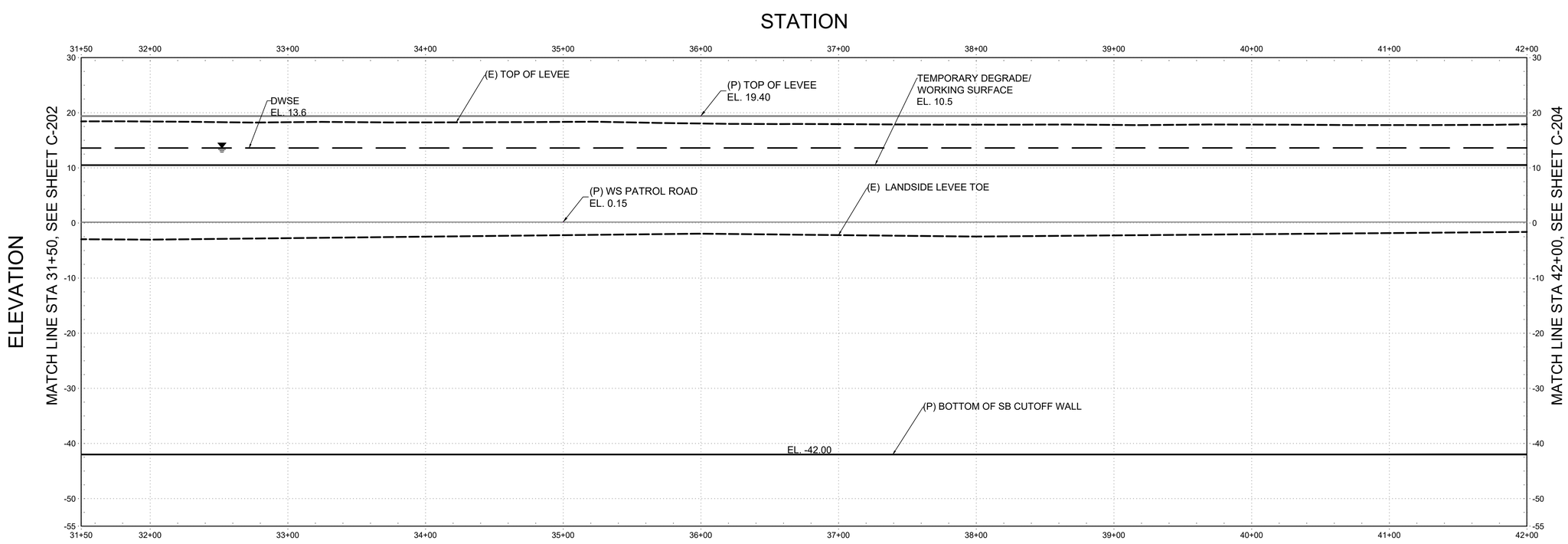
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS SOLUTION PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PROFILE STA 21+00 TO 31+50

SHEET ID
C-202

FINAL SUBMITTAL



STATION ALONG EXISTING LEVEE CENTERLINE (Y-LINE)

NOTES:

1. DWSE IS THE MAXIMUM DESIGN WATER LEVEL AT THE PROJECT AREA SHOULD THE AGRICULTURAL LEVEES FAIL.

0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
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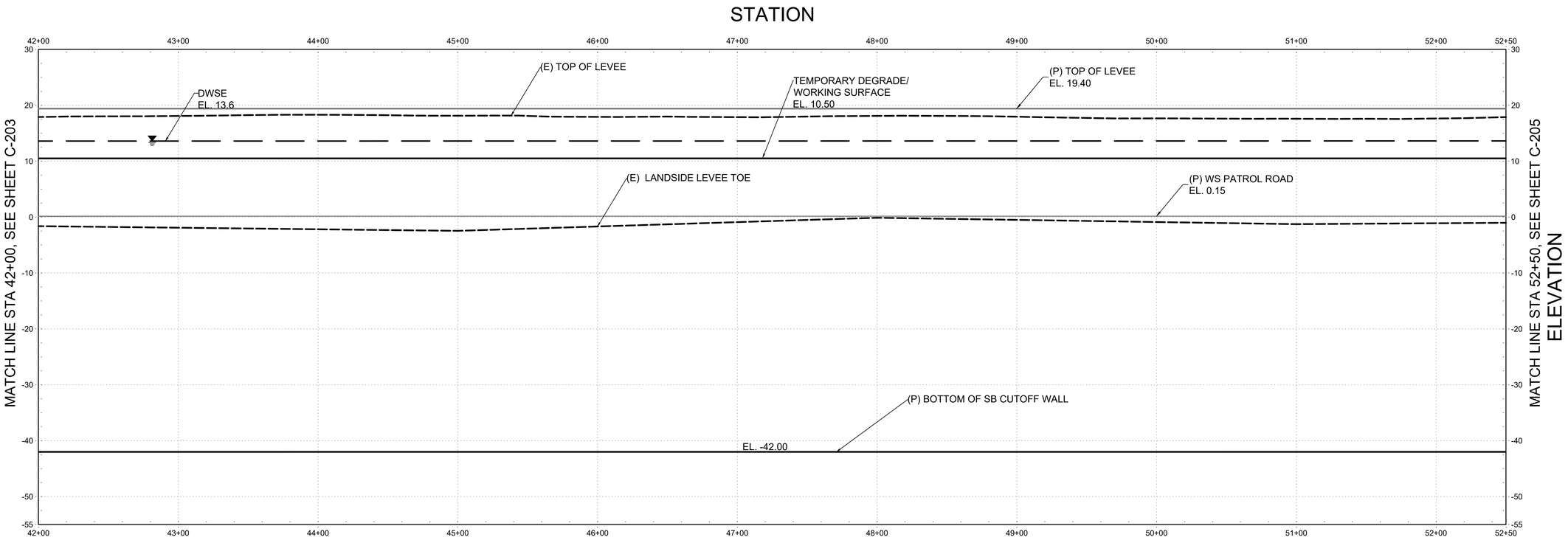
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS, SAN LUIS & DELTA-MENDOTA
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PROFILE STA 31+50 TO 42+00

SHEET ID
C-203

FINAL SUBMITTAL



STATION ALONG EXISTING LEVEE CENTERLINE (Y-LINE)

NOTES:

1. DWSE IS THE MAXIMUM DESIGN WATER LEVEL AT THE PROJECT AREA SHOULD THE AGRICULTURAL LEVEES FAIL.

0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
DMM / BFL	NOVEMBER 2022
DRAWN BY:	SOLICITATION NO.:
M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
QA/QC REVIEWED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
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SACRAMENTO, CA 95814

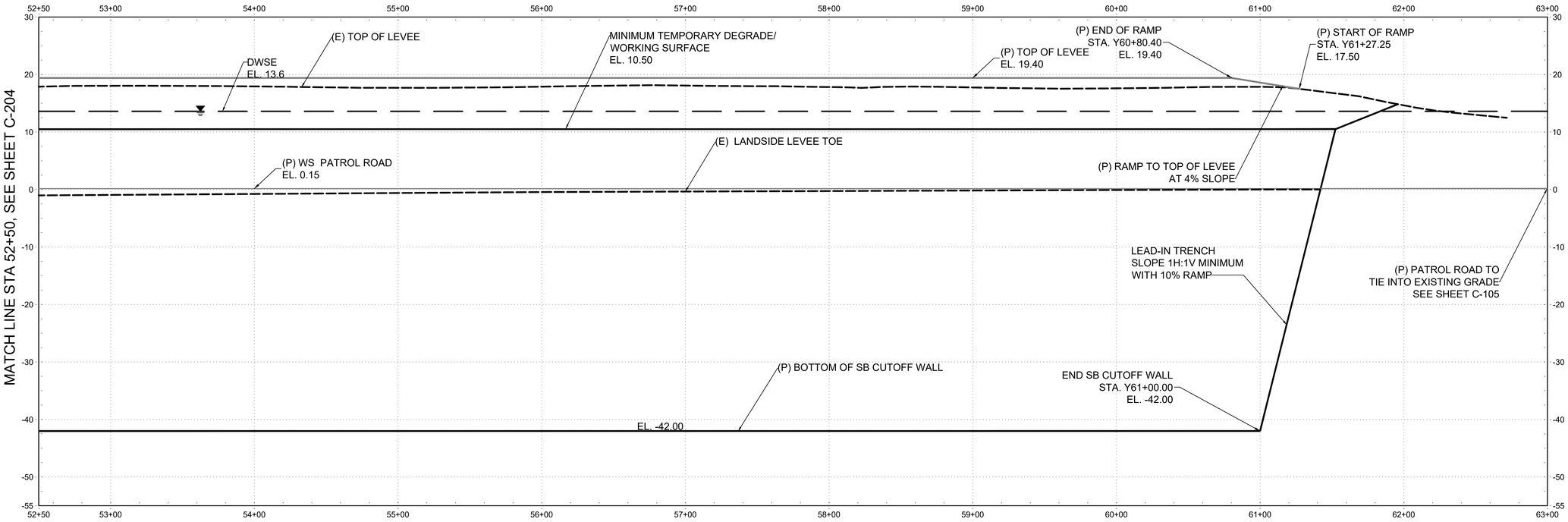
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS SOLUTION PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

LEVEE PROFILE STA 42+00 TO 52+50

SHEET ID
C-204

FINAL SUBMITTAL



NOTES:

1. DWSE IS THE MAXIMUM DESIGN WATER LEVEL AT THE PROJECT AREA SHOULD THE AGRICULTURAL LEVEES FAIL.

0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
DMM / BFL	NOVEMBER 2022
DRAWN BY:	SOLICITATION NO.:
M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
QA/QC PERFORMED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J. ST.
SACRAMENTO, CA 95814

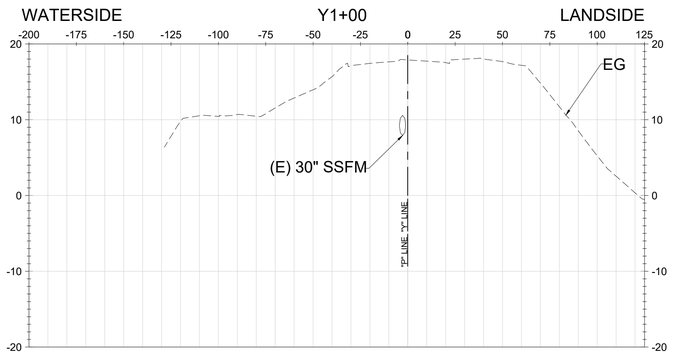
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

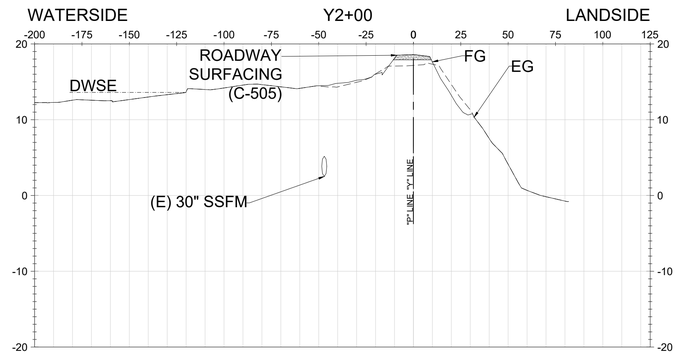
LOWER SAN JOAQUIN RIVER REACH
LEVEE IMPROVEMENT PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

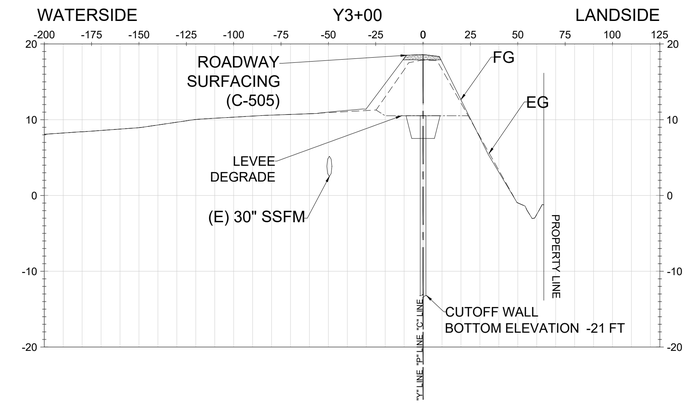
LEVEE PROFILE STA 52+50 TO 63+00

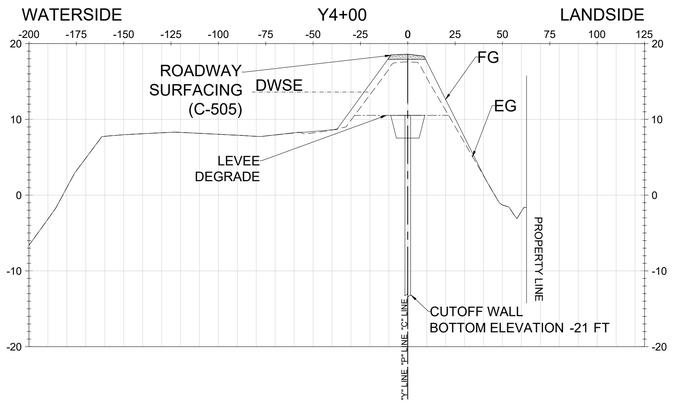
SHEET ID
C-205

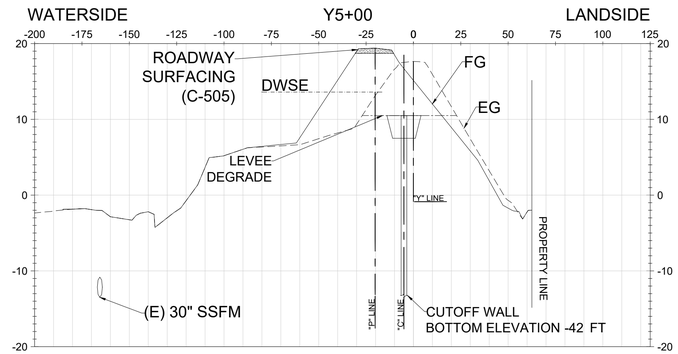
FINAL SUBMITTAL

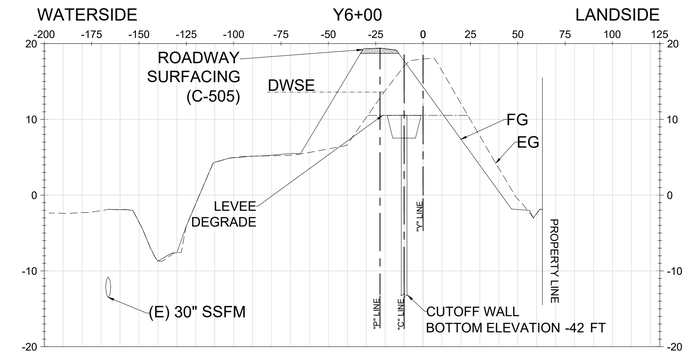


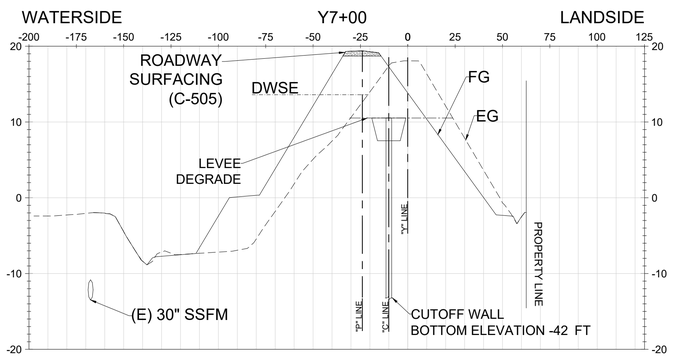


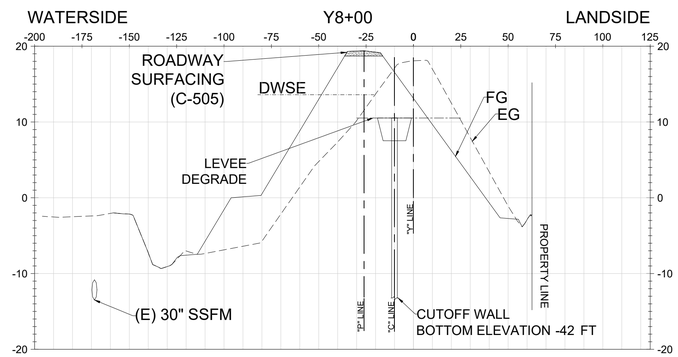


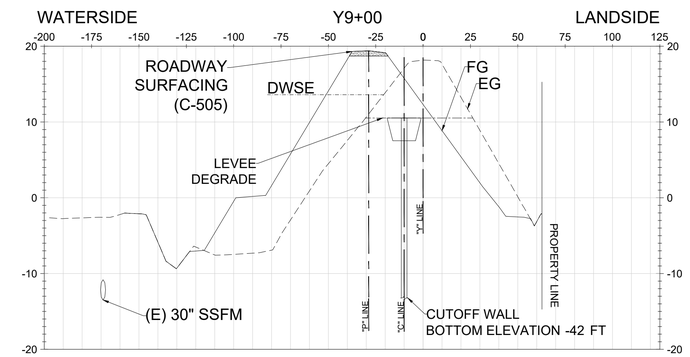












0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QA/QC BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

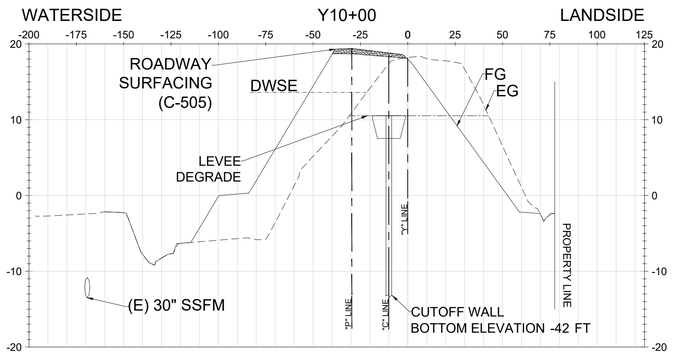
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

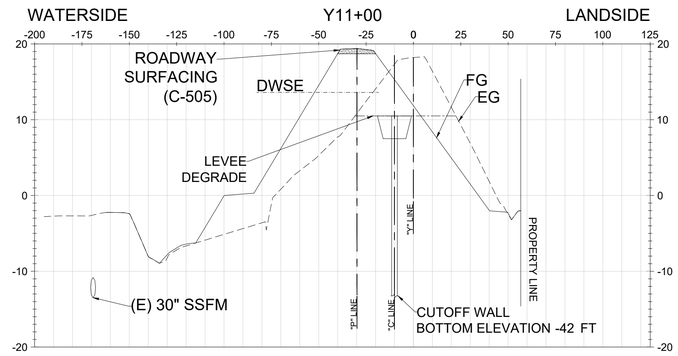
LOWER SAN JOAQUIN RIVER REACH
FS, SAN JOAQUIN RIVER
SAN JOAQUIN COUNTY, CALIFORNIA

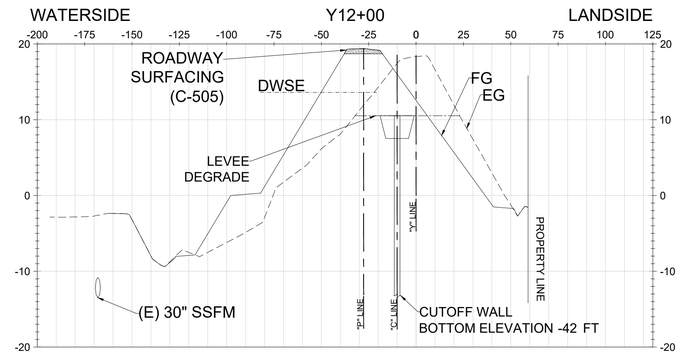
CROSS SECTIONS STA 1+00 TO 9+00

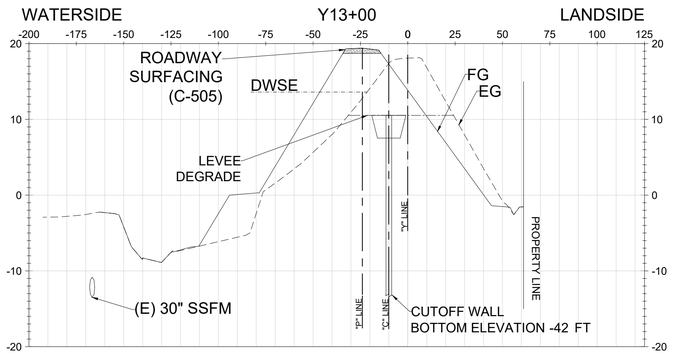
SHEET ID
C-311

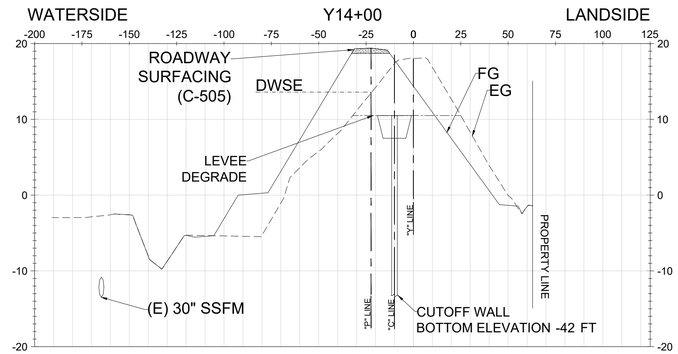
FINAL SUBMITTAL

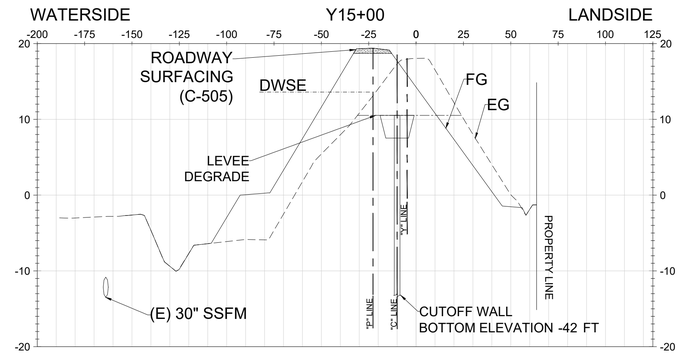


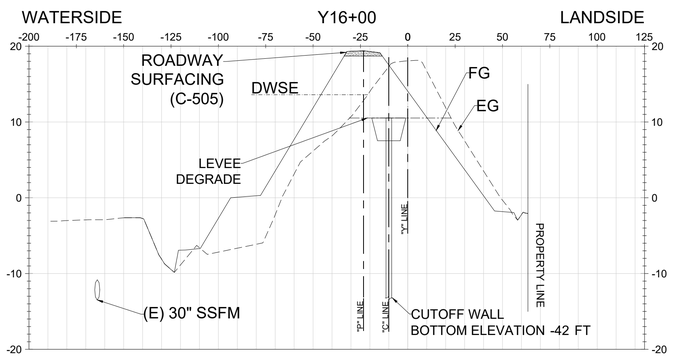


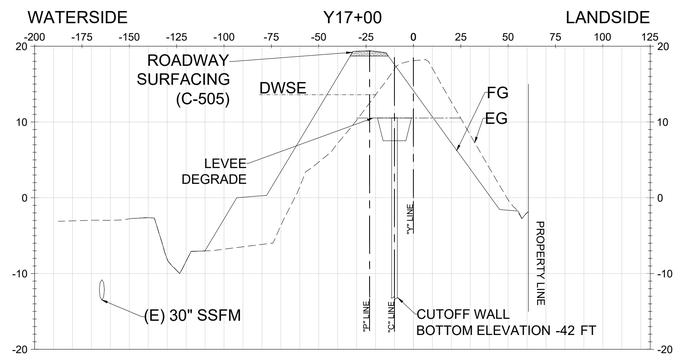


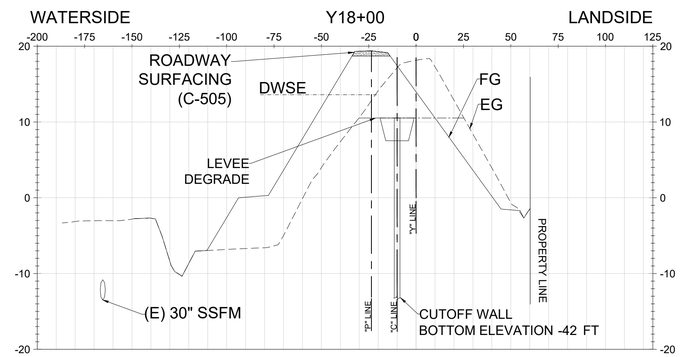












0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QA/QC BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

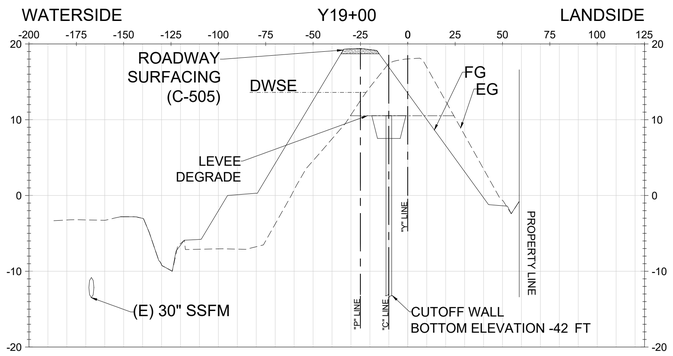
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

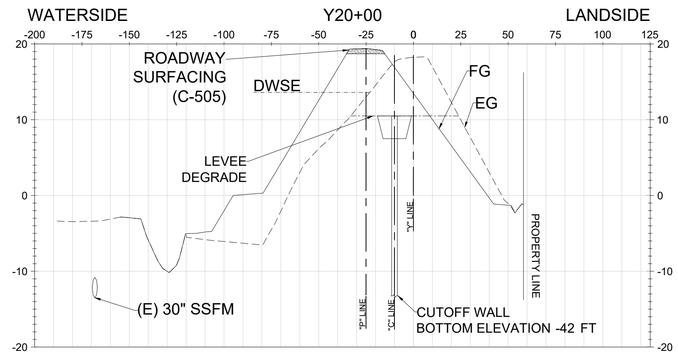
LOWER SAN JOAQUIN RIVER REACH
FS, SAN JOAQUIN RIVER
SAN JOAQUIN COUNTY, CALIFORNIA

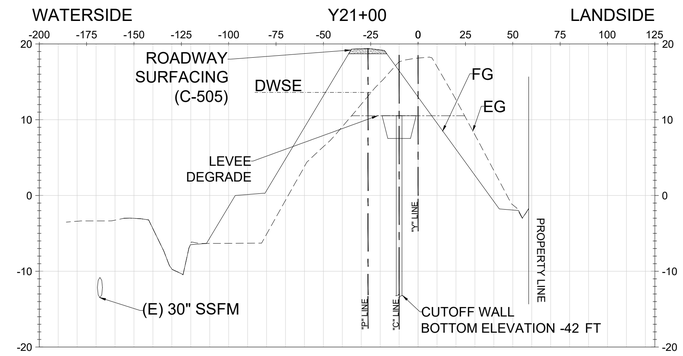
CROSS SECTIONS STA 10+00 TO 18+00

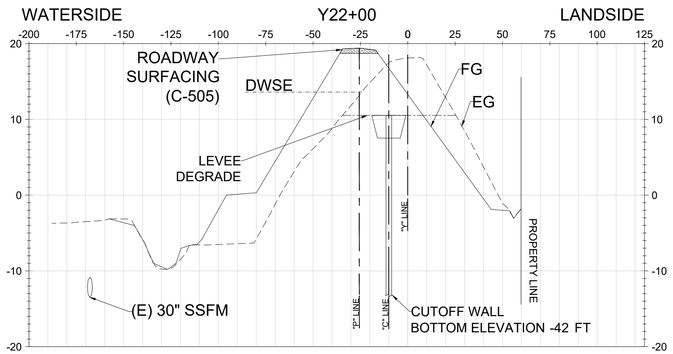
SHEET ID
C-312

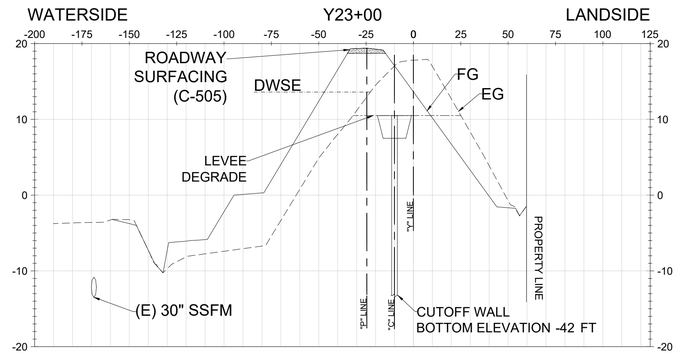
FINAL SUBMITTAL

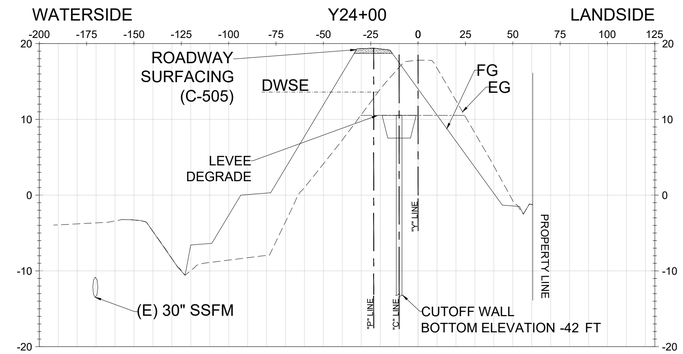


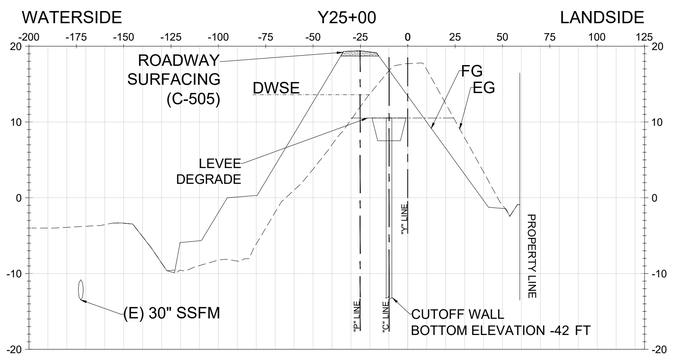


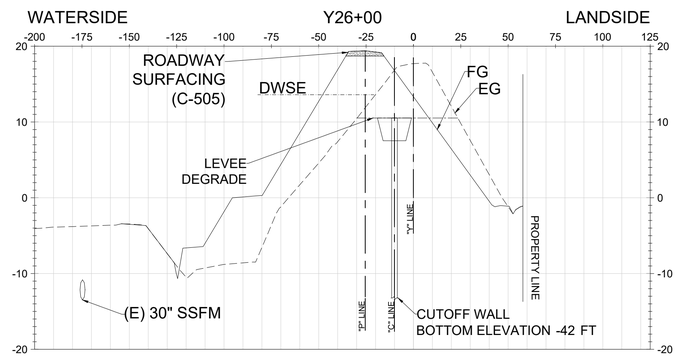


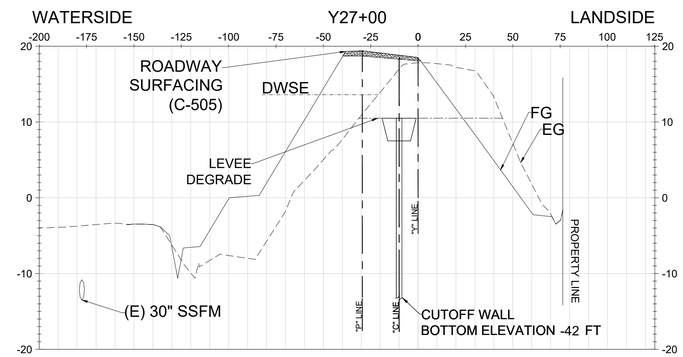












0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QUALITY CONTROL BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

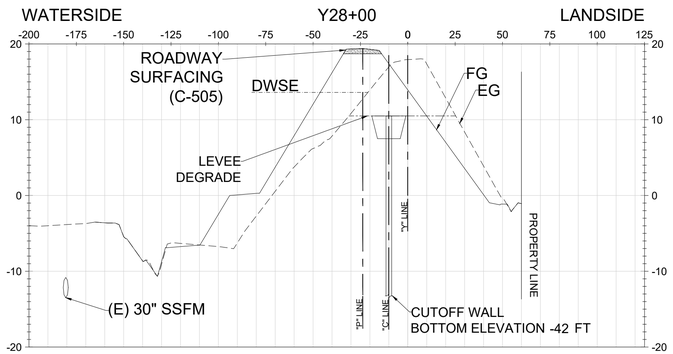
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

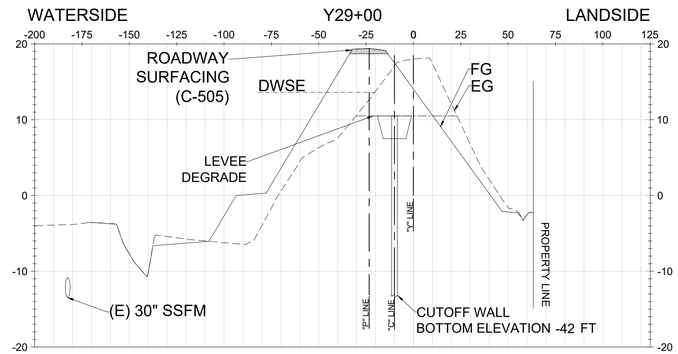
LOWER SAN JOAQUIN RIVER REACH
TS, LOWER JERSEY ISLAND
SAN JOAQUIN COUNTY, CALIFORNIA

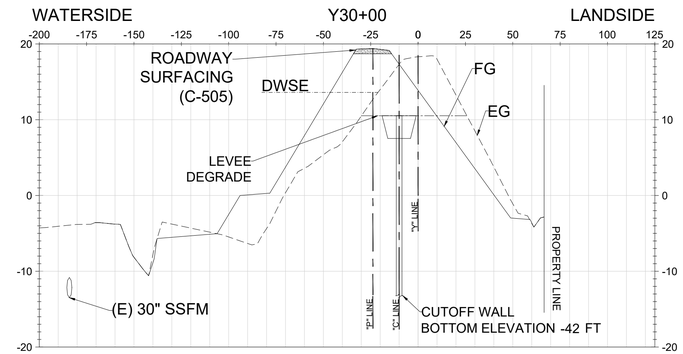
CROSS SECTIONS STA 19+00 TO 27+00

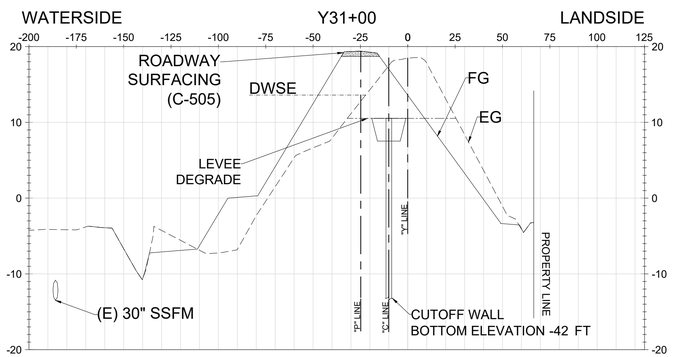
SHEET ID
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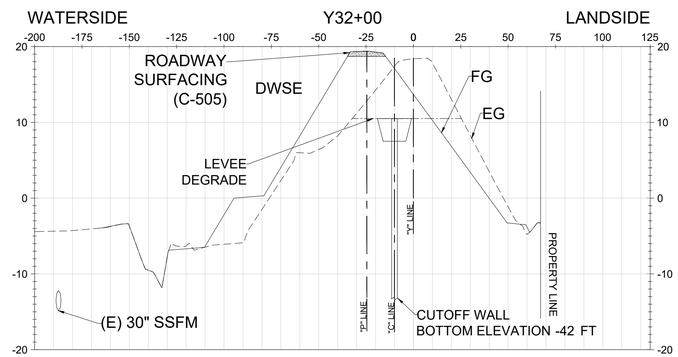
FINAL SUBMITTAL

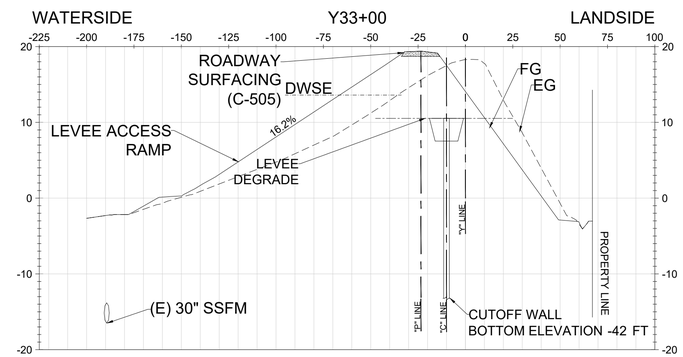


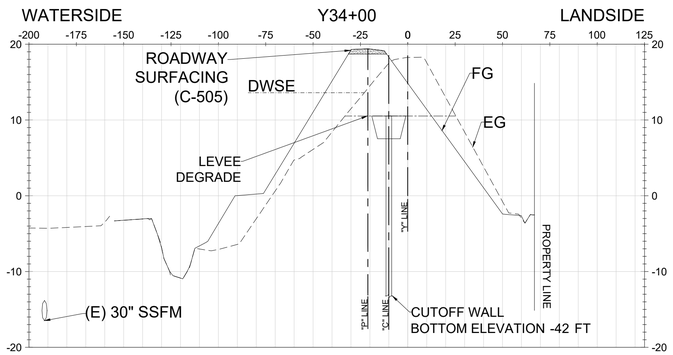


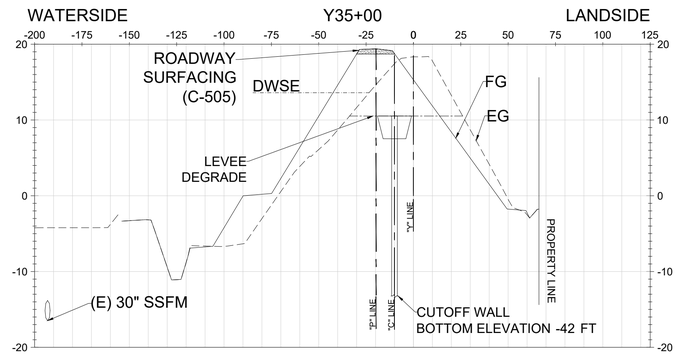


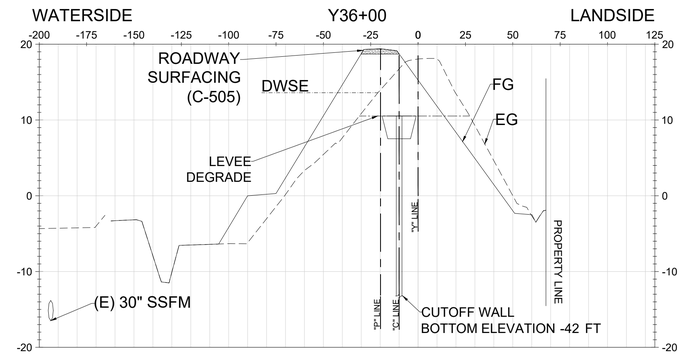












0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.: XXXXXX-XX-X-XXXX

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QUALITY CONTROL BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

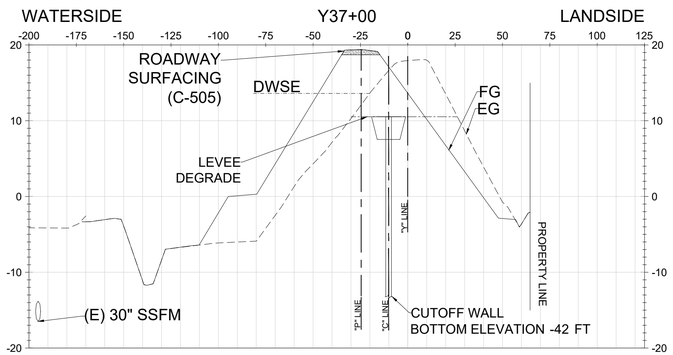
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

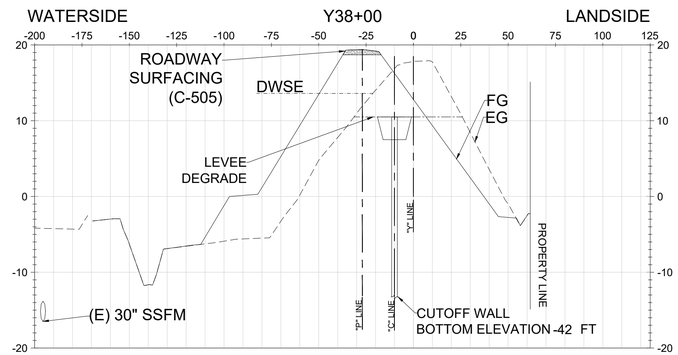
LOWER SAN JOAQUIN RIVER REACH
TYDALL FEATURE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

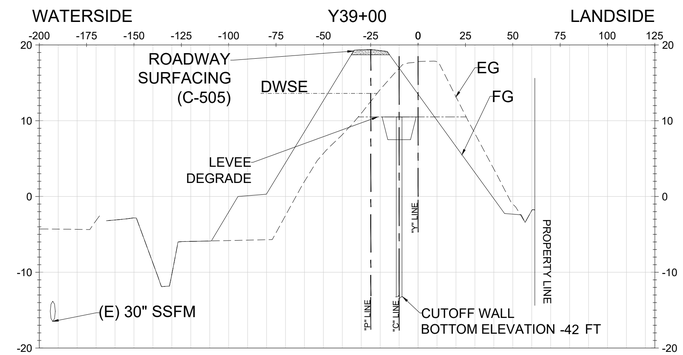
CROSS SECTIONS STA 28+00 TO 36+00

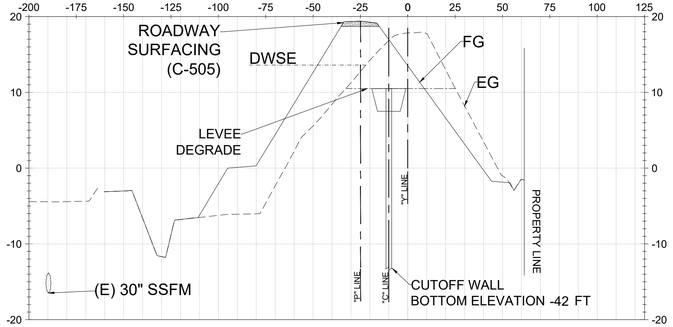
SHEET ID
C-314

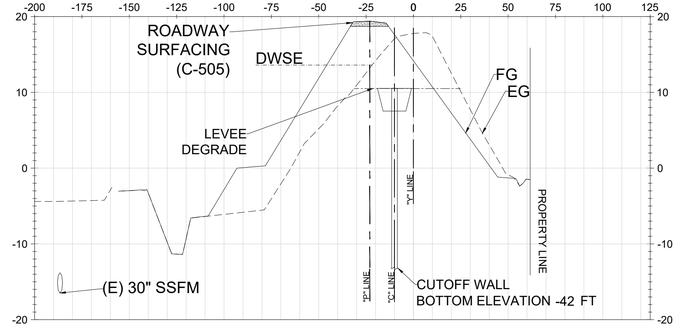
FINAL SUBMITTAL

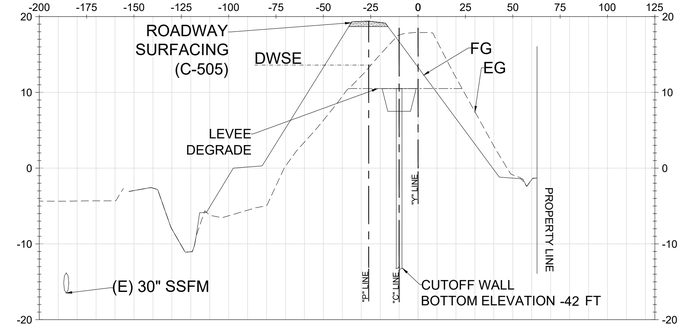


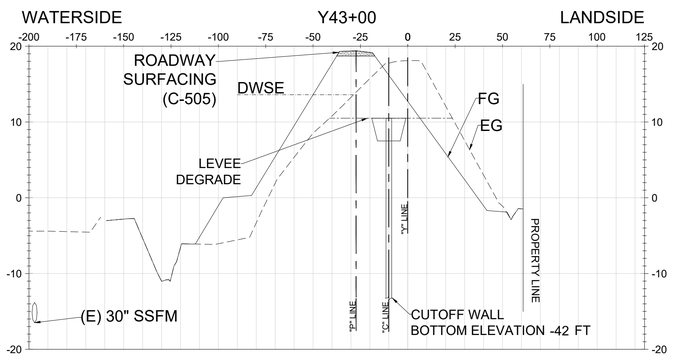


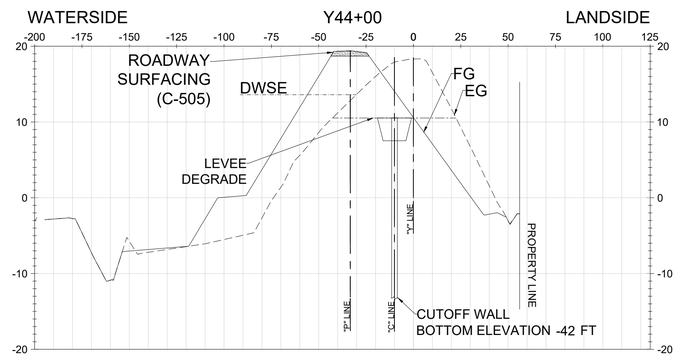


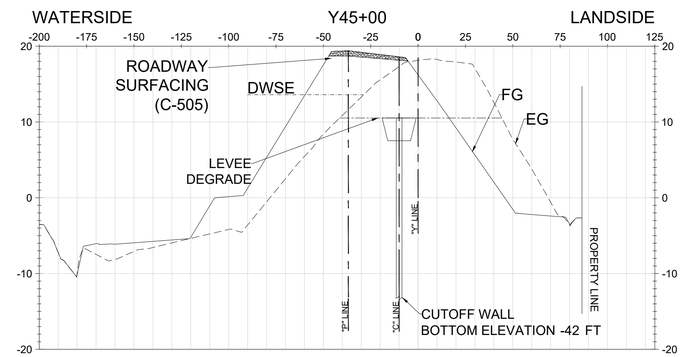












0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

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DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QUALITY CONTROL BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

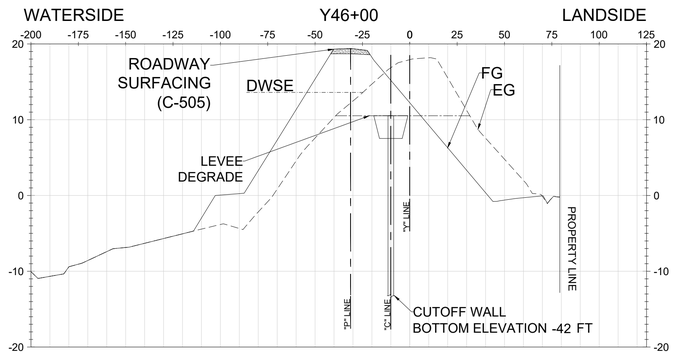
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

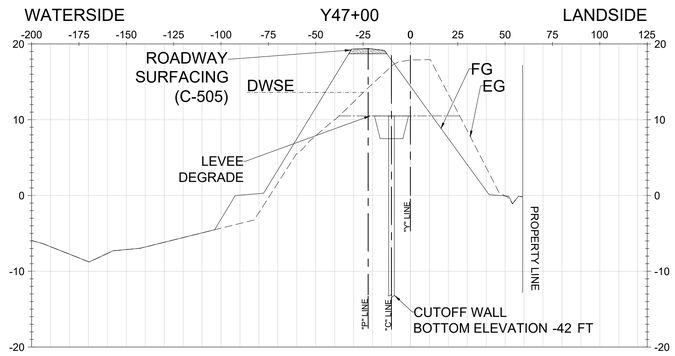
LOWER SAN JOAQUIN RIVER REACH
LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

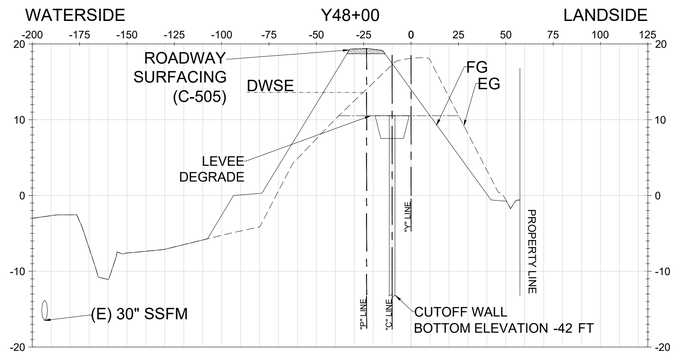
CROSS SECTIONS STA 37+00 TO 45+00

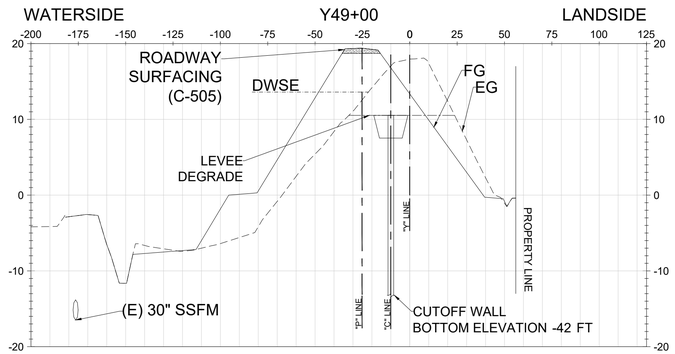
SHEET ID
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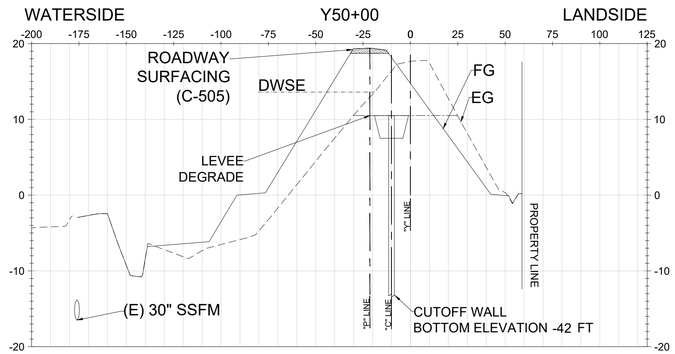
FINAL SUBMITTAL

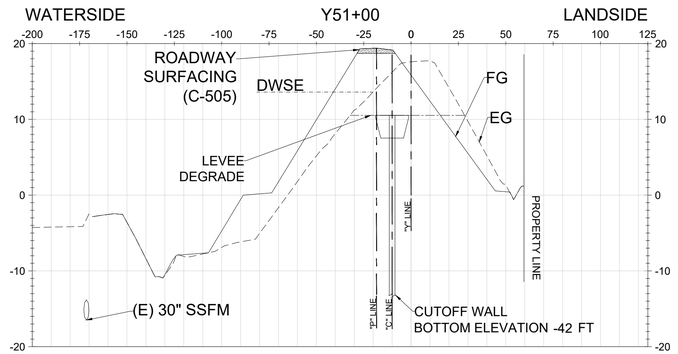


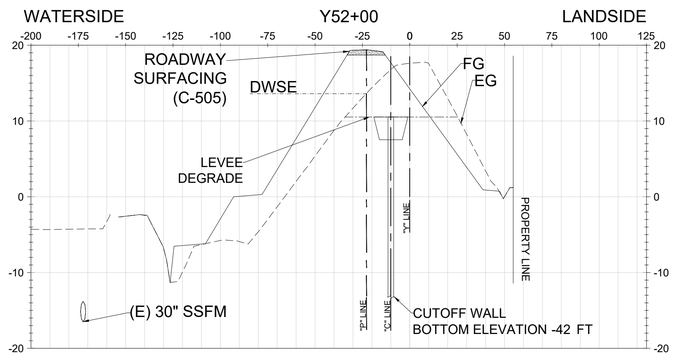


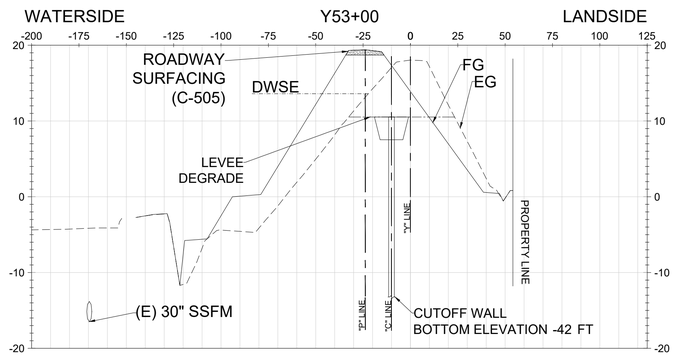


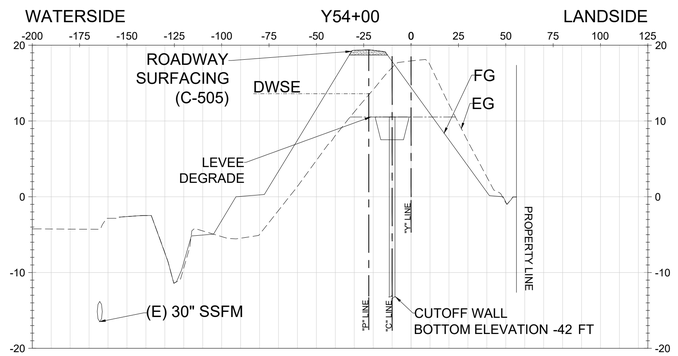












0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QUALITY CONTROL BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

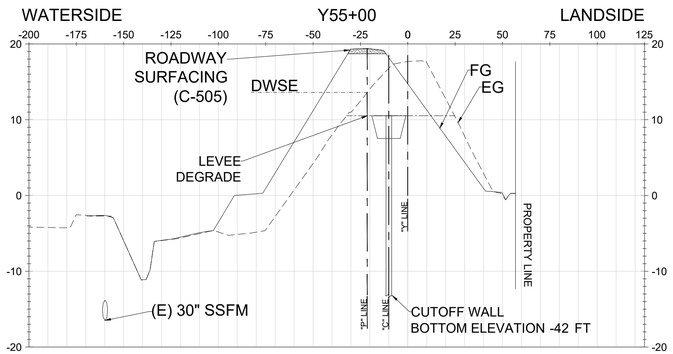
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

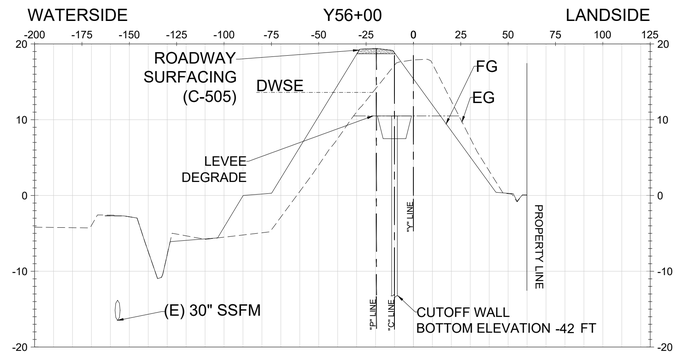
LOWER SAN JOAQUIN RIVER REACH
FS, SAN JOAQUIN RIVER
SAN JOAQUIN COUNTY, CALIFORNIA

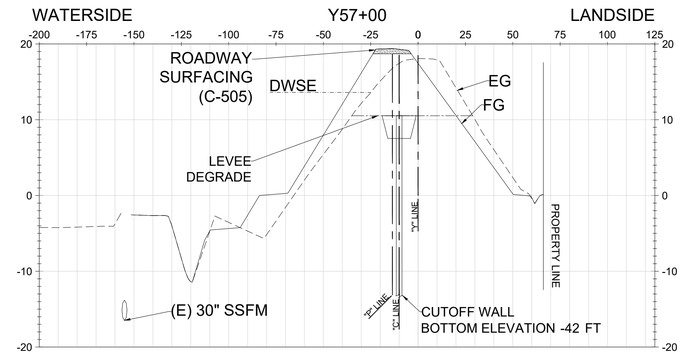
CROSS SECTIONS STA 46+00 TO 54+00

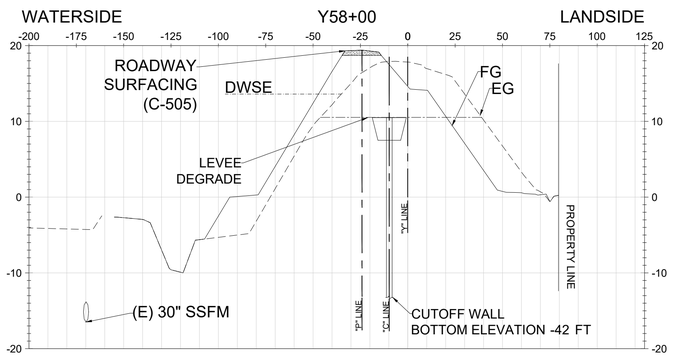
SHEET ID
C-316

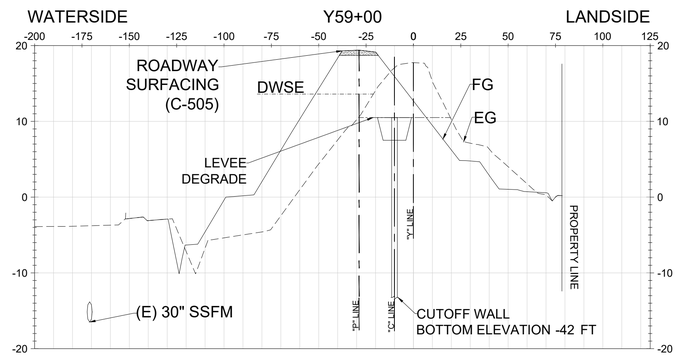
FINAL SUBMITTAL

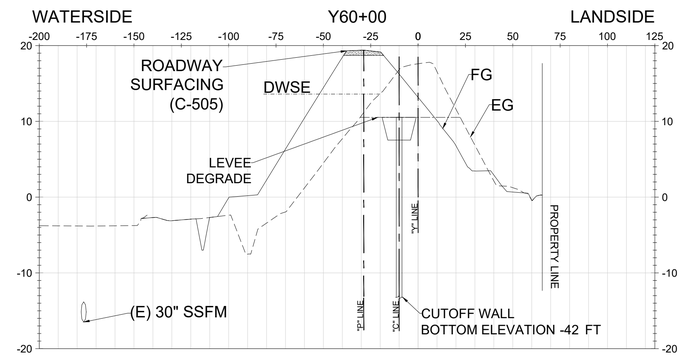


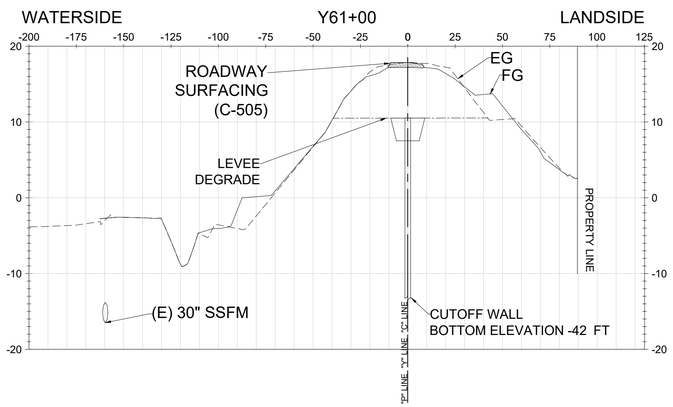












0 40' 80'

SCALE: 1"=40' HORIZONTAL
1"=10' VERTICAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
DMM / BFL	NOVEMBER 2022
DRAWN BY:	SOLICITATION NO.:
M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
QA/QC PERFORMED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

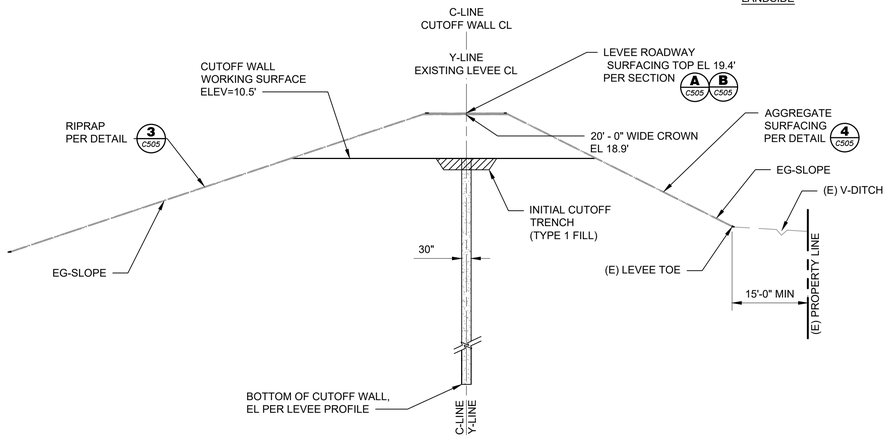
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
SJ_LSJRF_MRP PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

CROSS SECTIONS STA 55+00 TO 61+00

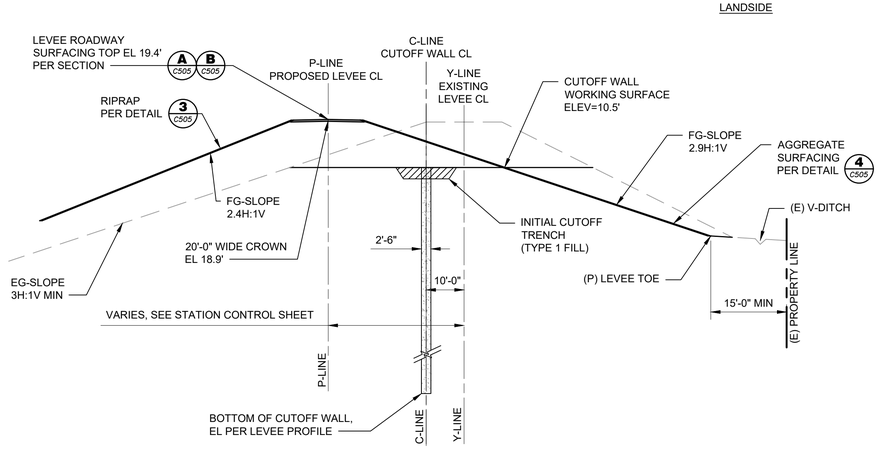
SHEET ID
C-317

FINAL SUBMITTAL



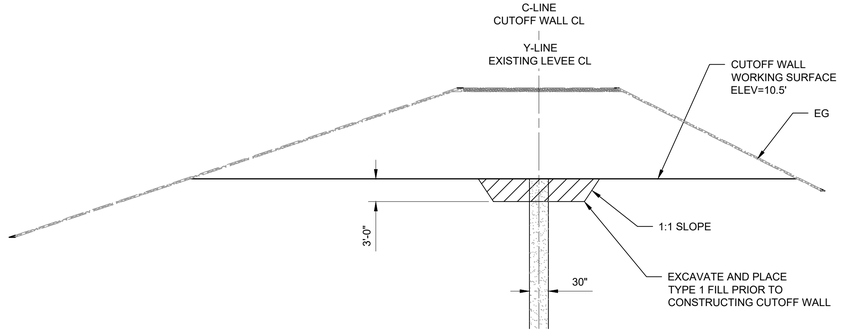
CUTOFF WALL - TYPICAL SECTION (STA 2+50 TO STA 4+50)

SCALE: 1"=20'



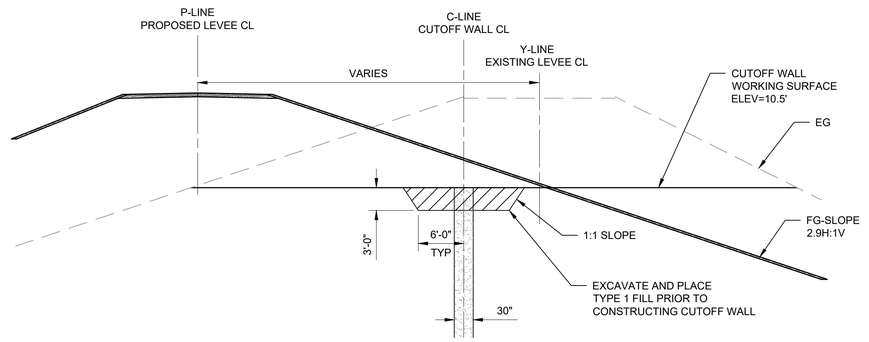
CUTOFF WALL - TYPICAL SECTION (STA 4+50 TO STA 61+00)

SCALE: 1"=20'



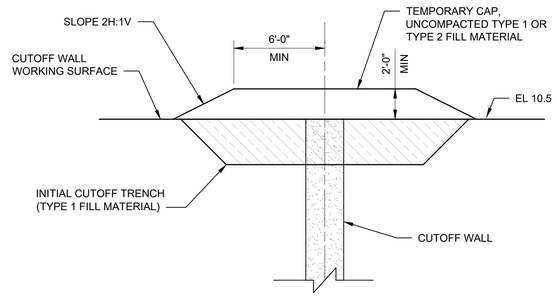
CUTOFF WALL - TYPICAL DETAIL (STA 2+50 TO STA 4+50)

SCALE: 1"=10'



CUTOFF WALL - TYPICAL DETAIL (STA 4+50 TO STA 61+00)

SCALE: 1"=10'



CUTOFF WALL TEMPORARY CAP DETAIL

NTS

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QUALITY CONTROL BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

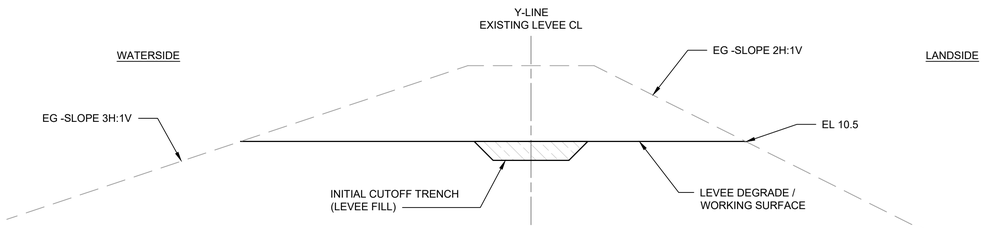
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_3&L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

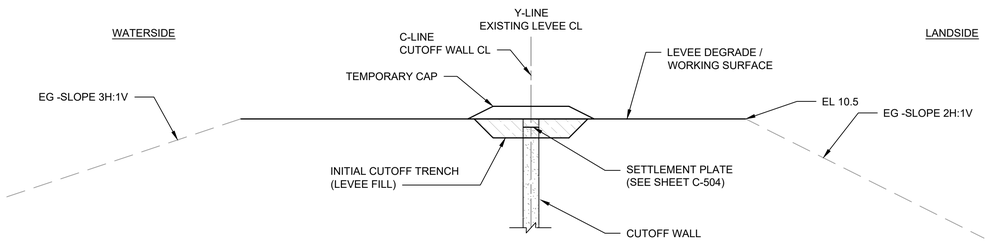
LEVEE CUTOFF WALL SECTION AND DETAIL

SHEET ID
C-501

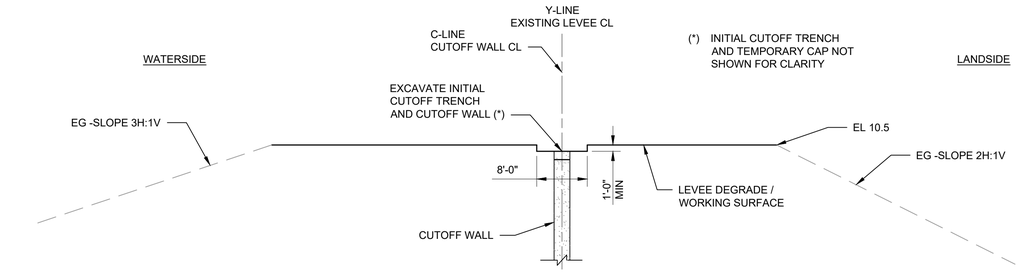
FINAL SUBMITTAL



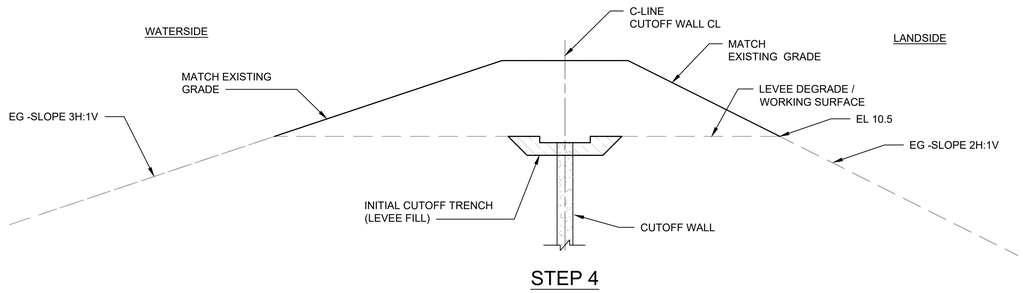
STEP 1



STEP 2



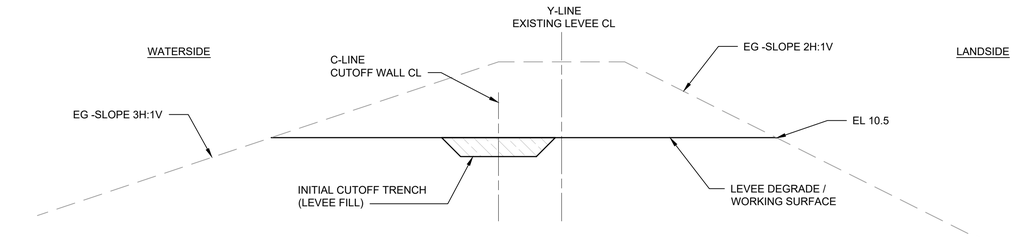
STEP 3



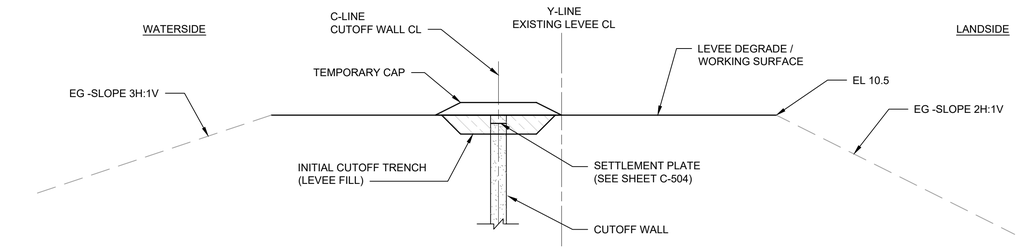
STEP 4

CUTOFF WALL - TYPICAL CONSTRUCTION SEQUENCE (STA 2+50 TO STA 4+50)

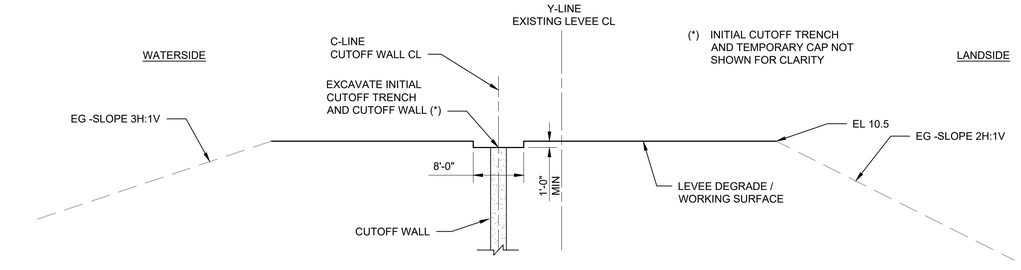
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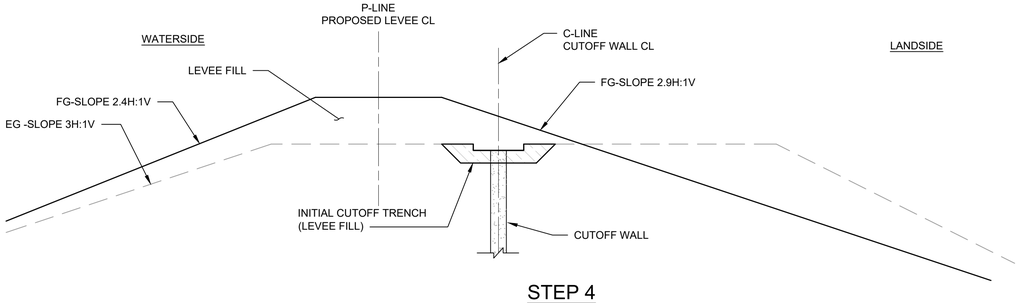
STEP 1



STEP 2



STEP 3



STEP 4

CUTOFF WALL - TYPICAL CONSTRUCTION SEQUENCE (STA 4+50 TO STA 61+00)

NTS

LEGEND

- INITIAL CUTOFF TRENCH
- CUTOFF WALL

CONSTRUCTION SEQUENCE:

STEP 1: DEGRADE LEVEE TO ESTABLISH WORKING SURFACE THEN EXCAVATE INITIAL CUTOFF TRENCH AND FILL WITH TYPE 1 FILL MATERIAL

STEP 2: CONSTRUCT CUTOFF WALL
- INSTALL SETTLEMENT PLATES IN ACCORDANCE WITH THE SPECIFICATIONS
- PLACE TEMPORARY CAP WITH UNCOMPACTED TYPE 1 OR TYPE 2 FILL
- MONITOR SETTLEMENT PLATE IN ACCORDANCE WITH THE SPECIFICATIONS

STEP 3: AFTER APPROVAL BY THE CONTRACTING OFFICER, REMOVE TEMPORARY CAP AND EXCAVATE CUTOFF WALL TO A MINIMUM DEPTH OF 1.0 FT BELOW WORKING SURFACE
- REMOVE SETTLEMENT PLATE
- CONFIRM THAT EXCAVATION EXTENDS INTO ACCEPTABLE CUTOFF WALL MATERIAL AS DETERMINED BY THE CONTRACTING OFFICER
- PLACE SOIL TYPE 1 FILL MATERIAL IN THE EXCAVATION IN ACCORDANCE WITH THE SPECIFICATIONS

STEP 4: RESHAPE AND RECONSTRUCT LEVEE EMBANKMENT
- PLACE LEVEE FILL MATERIAL IN THE EXCAVATION IN ACCORDANCE WITH THE SPECIFICATIONS
- BENCH FILL MATERIAL ON WATERSIDE SLOPE PER SHEET C-503 (STA 4+50 TO STA 61+00 ONLY)

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. DAVID
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_3(N), LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

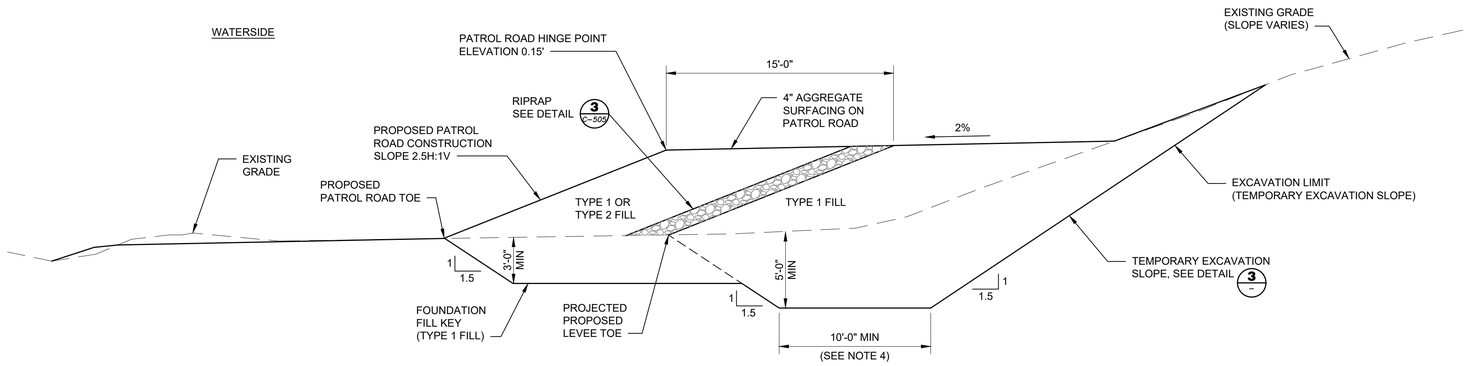
TYPICAL CUTOFF WALL CONSTRUCTION SEQUENCE AND DETAILS

SHEET ID
C-502

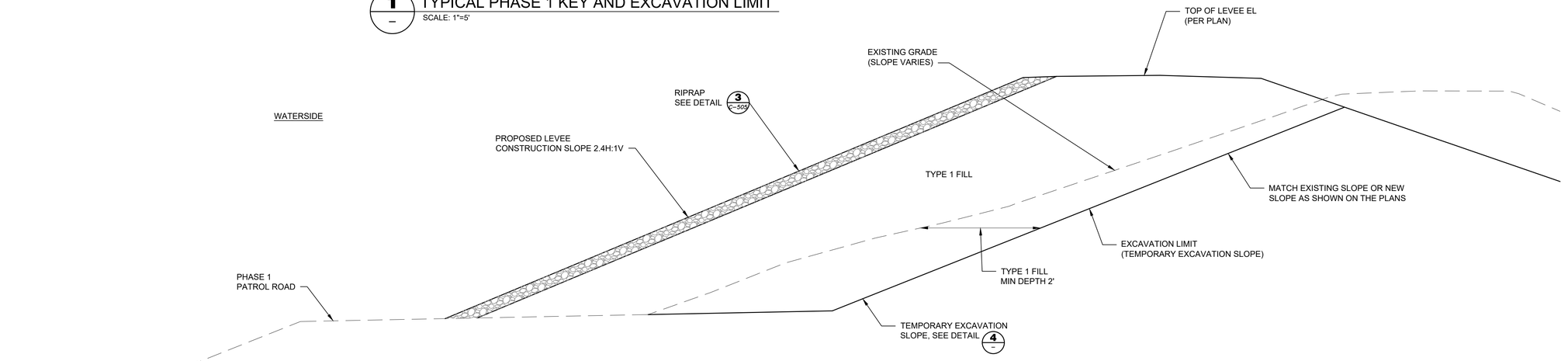
FINAL SUBMITTAL

TYPICAL KEY & BENCHING NOTES:

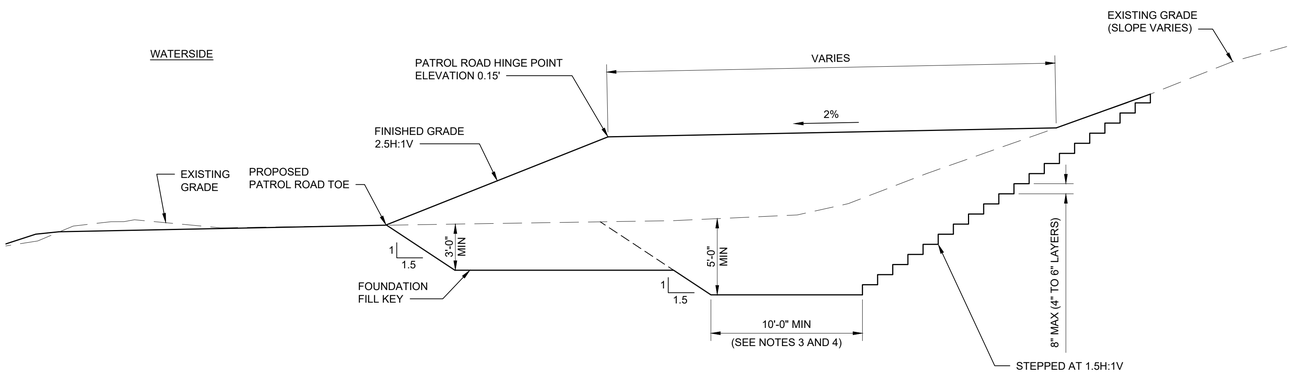
1. PHASE 1 INCLUDES CONSTRUCTION OF THE ELEVATED PATROL ROAD, PATROL ROAD AGGREGATE SURFACING, RIPRAP BELOW THE TOP OF PATROL ROAD ELEVATION, AND ANY IMPROVEMENTS ON THE WATERSIDE OF THE PATROL ROAD. PHASE 2 CONSTRUCTION INCLUDES THE REMAINDER OF THE PROJECT. PHASE 1 ELEMENTS MUST BE CONSTRUCTED AND APPROVED BY CONTRACTING OFFICER PRIOR TO BUILDING PHASE 2 ELEMENTS.
2. PLACE FILL IN HORIZONTAL LIFTS AGAINST VERTICAL FACES CUT INTO EXISTING LEVEE MATERIAL.. EACH LAYER OF FILL SHALL BE 4" TO 6" UNCOMPACTED LAYERS.
3. THE LEVEE KEY TRENCH SHALL BE INSPECTED BY THE GOVERNMENT'S GEOTECHNICAL ENGINEER BEFORE PLACEMENT OF FILL. THE KEY SHALL BE EXTENDED INTO COMPETENT MATERIAL AS DETERMINED BY THE GOVERNMENT'S GEOTECHNICAL ENGINEER.
4. IN NO CASE SHALL THE FOUNDATION KEY WIDTH BE LESS THAN 10'
5. THE BOTTOM OF THE KEY TRENCH SHALL BE SCARIFIED TO A DEPTH OF 8 INCHES AND RECOMPACTED TO 97% MAXIMUM DENSITY PER ASTM 698.
6. NON-STRUCTURAL FILL AND SUBGRADE TO RECEIVE ENGINEERED FILL (INCLUDING KEY) SHALL BE COMPACTED TO 95% MAXIMUM DENSITY PER ASTM 698.
7. LEVEE EMBANKMENT SHALL BE COMPACTED TO 97% MAXIMUM DENSITY PER ASTM 698.
8. 12 INCHES BENEATH AB SHALL BE COMPACTED TO 100% MAXIMUM DENSITY PER ASTM 698.
9. BENCHING IS NOT REQUIRED FOR PLACEMENT OF AGGREGATE SURFACING OR AGGREGATE BASE ON FINAL SUBGRADES.



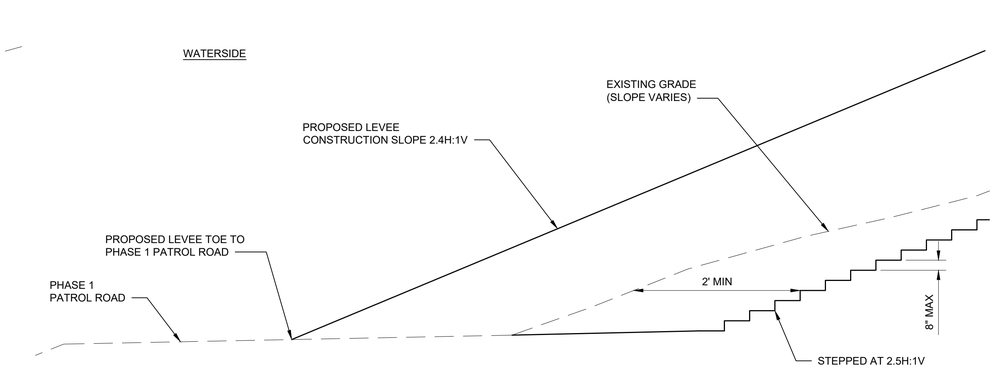
1/– TYPICAL PHASE 1 KEY AND EXCAVATION LIMIT
SCALE: 1"=5'



2/– TYPICAL PHASE 2 KEY AND EXCAVATION LIMIT DETAIL
SCALE: 1"=5'



3/– TYPICAL PHASE 1 KEY AND BENCHING DETAIL
SCALE: 1"=5'



4/– TYPICAL PHASE 2 KEY AND BENCHING DETAIL
SCALE: 1"=5'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

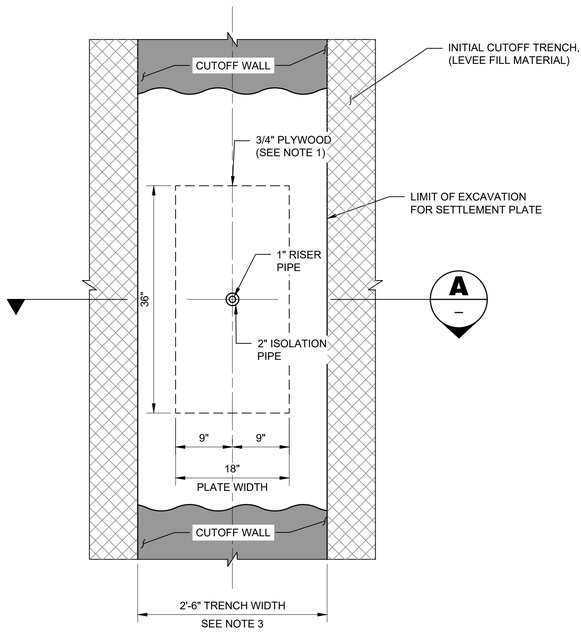
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

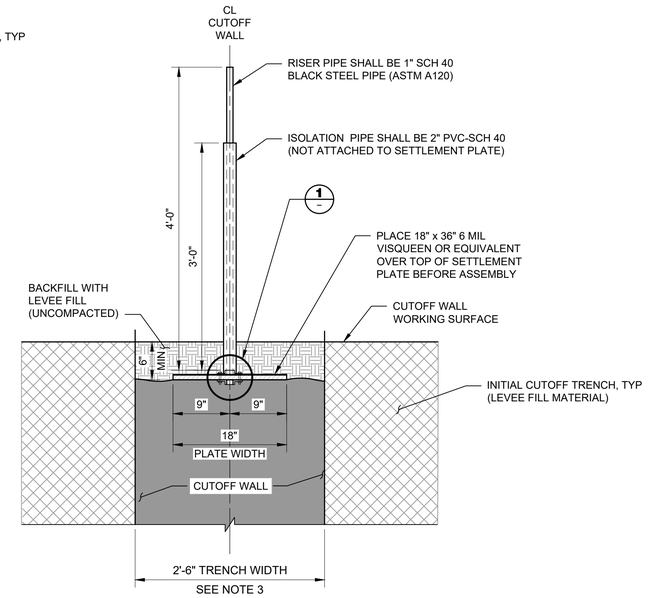
TYPICAL KEY AND BENCHING DETAILS

SHEET ID
C-503

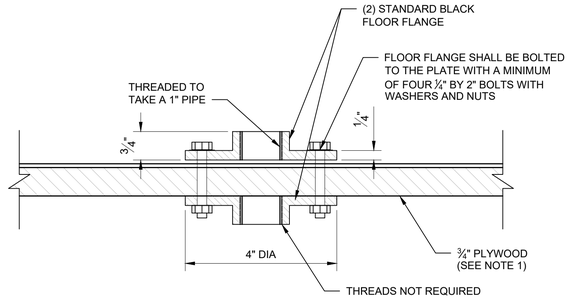
FINAL SUBMITTAL



PLAN
SCALE:



A
–
SECTION
SCALE:



1
–
DETAIL
NTS

NOTES:

1. SETTLEMENT PLATE SHALL BE CONSTRUCTED OF 3/4" PLYWOOD (EXTERIOR) - COATED WITH WATERPROOF SEALANT.
2. SETTLEMENT PLATE INSTALLATION IN ACCORDANCE WITH THE SPECIFICATIONS.
3. WALL WIDTH IN ACCORDANCE WITH THE SPECIFICATIONS.

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
DMM / BFL	NOVEMBER 2022
DRAWN BY:	SOLICITATION NO.:
M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
SUBMITTED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

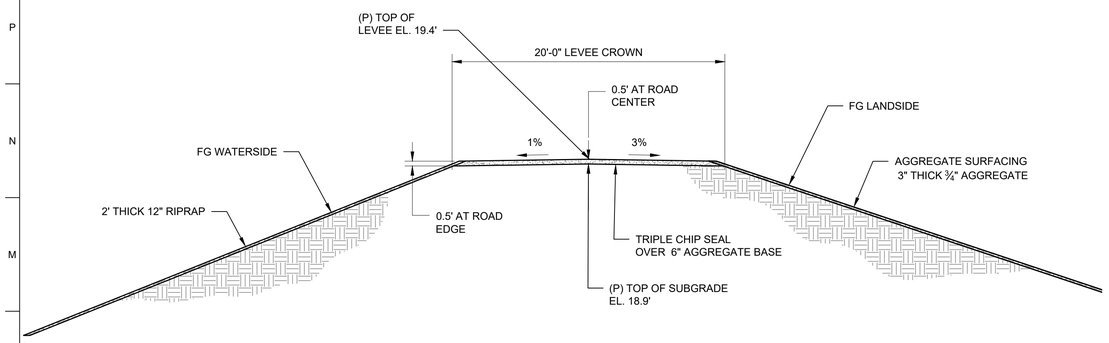
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

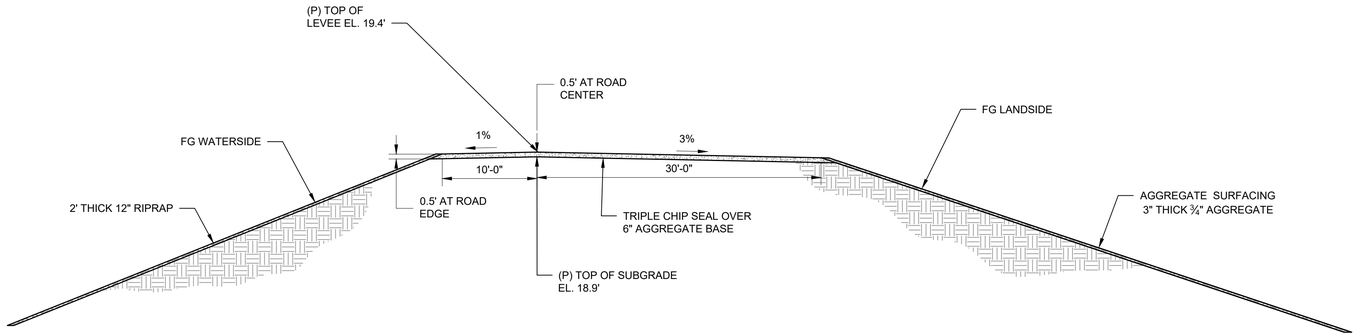
SETTLEMENT PLATE INSTALLATION

SHEET ID
C-504

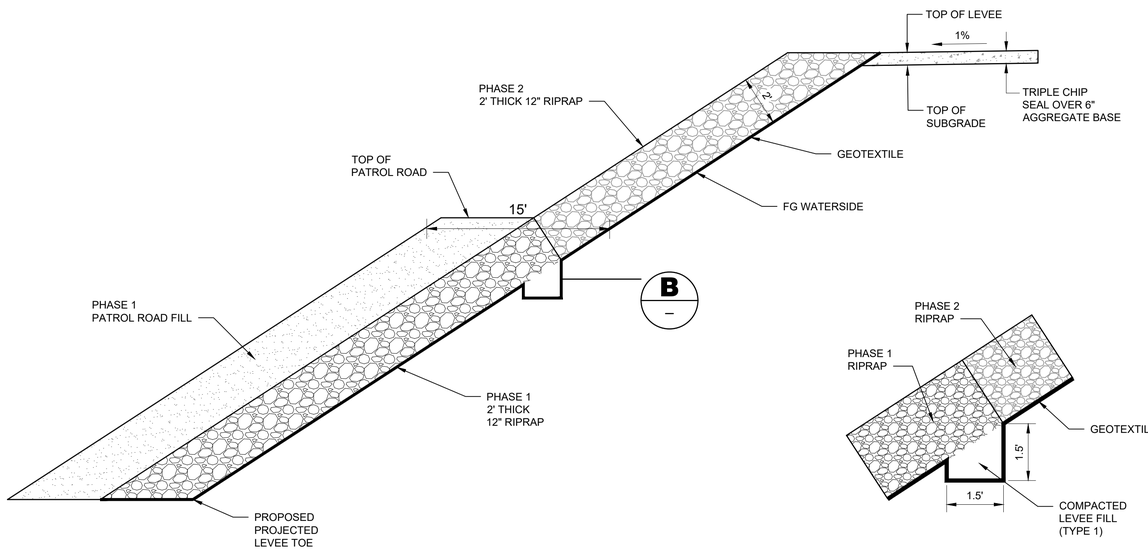
FINAL SUBMITTAL



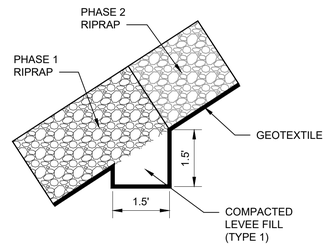
A – TYPICAL LEVEE CROWN ROADWAY SECTION
NTS



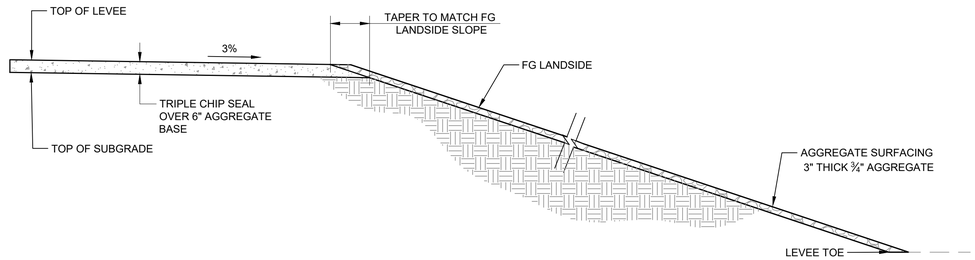
B – TYPICAL LEVEE CROWN ROADWAY WITH TURNOUT SECTION
NTS



3 – TYPICAL WATERSIDE RIPRAP PLACEMENT DETAIL
NTS



B – GEOTEXTILE ANCHOR
NTS



4 – TYPICAL LANDSLIDE AGGREGATE SURFACE DETAIL
NTS

NOTES

1. PHASE 1 INCLUDES CONSTRUCTION OF THE ELEVATED PATROL ROAD, PATROL ROAD AGGREGATE SURFACING, RIPRAP BELOW THE TOP OF THE PATROL ROAD ELEVATION, AND ANY IMPROVEMENT ON THE WATERSIDE OF THE PATROL ROAD. PHASE 2 CONSTRUCTION INCLUDES THE REMAINDER OF THE CONTRACT. PHASE 1 ELEMENTS MUST BE CONSTRUCTED AND APPROVED BY THE CONTRACTING OFFICER PRIOR TO BUILDING PHASE 2 ELEMENTS.

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

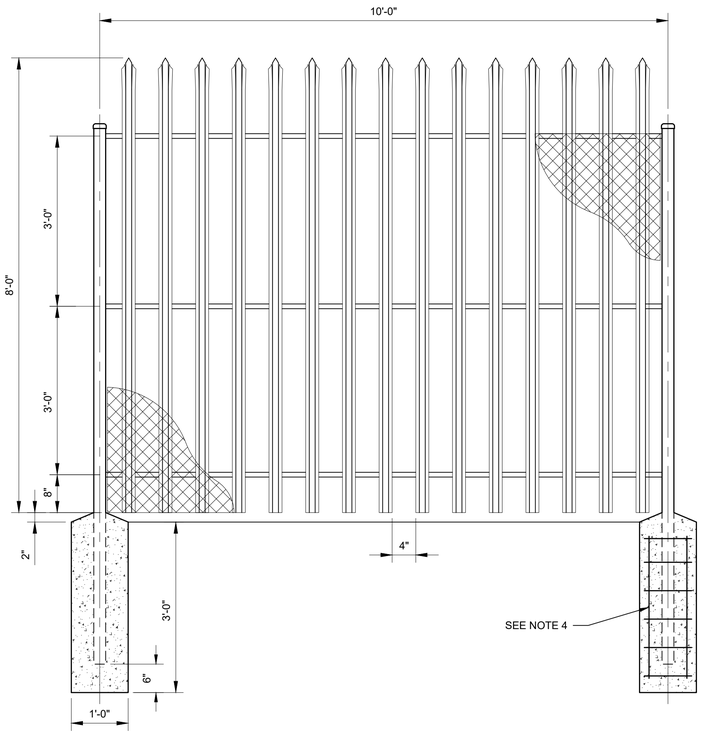
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

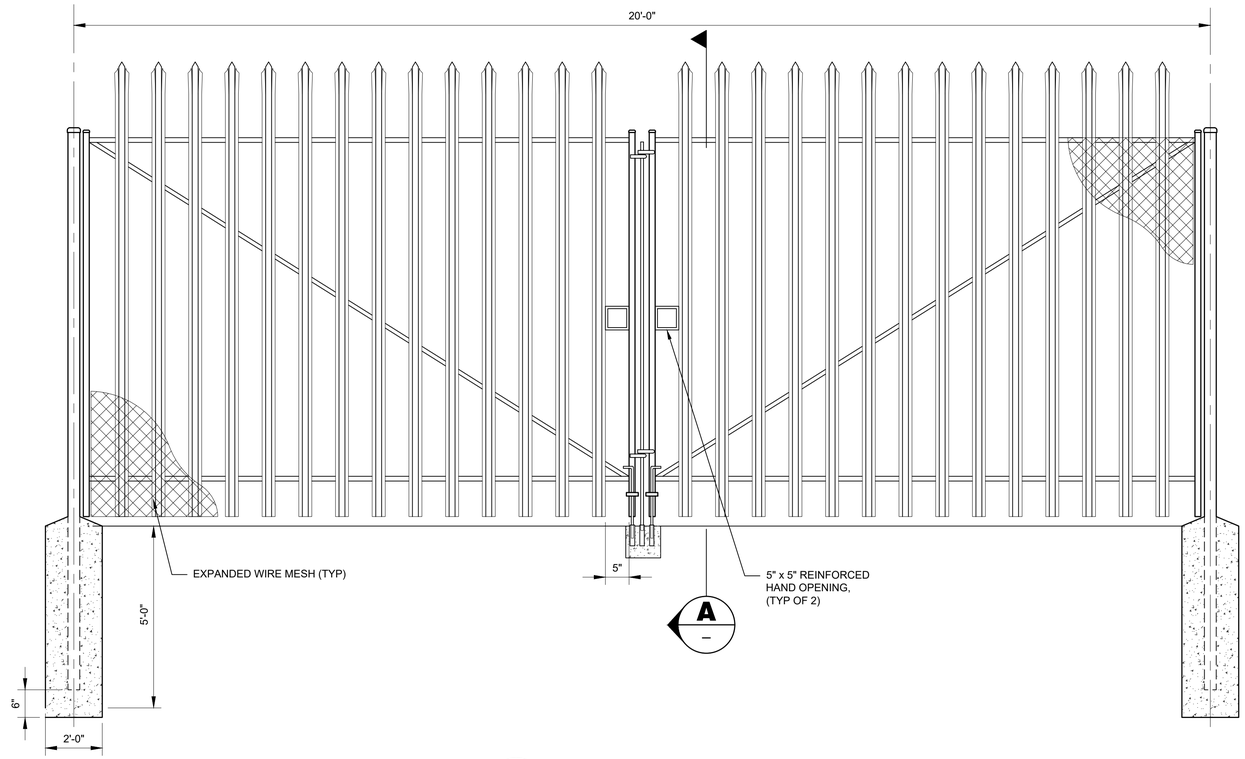
TYPICAL ROADWAY DETAILS

SHEET ID
C-505

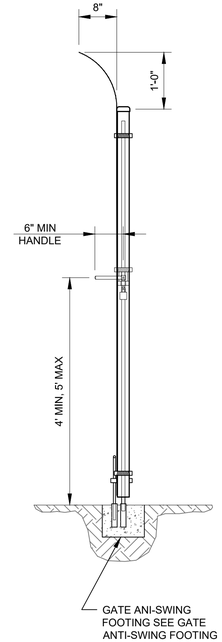
FINAL SUBMITTAL



1 — 8' HIGH SECURITY FENCE DETAIL
NTS



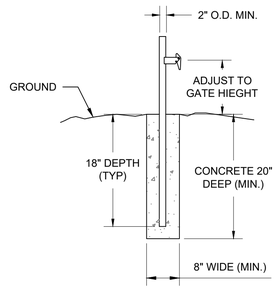
2 — 8' HIGH SECURITY GATE DETAIL
NTS



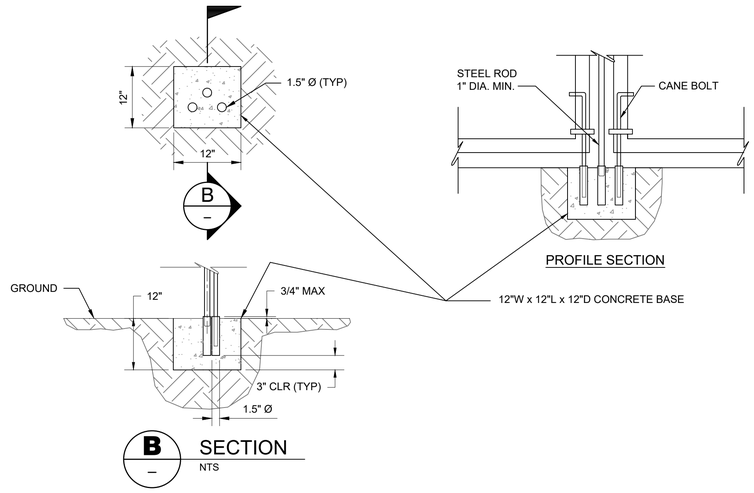
A — SECTION
NTS

NOTES:

1. 8'-0" HIGH COMMERCIAL GRADE CURVED TOP FENCE WITH DOUBLE SWING GATES.
2. SENTRY STYLE FENCE AND GATE SPECIFICATIONS:
   A. RAILS: 1 ½" x 1 ½"x11 GAUGE.
   B. PICKETS: 1"x1"x15 GAUGE @ 5" O.C.
   C. POSTS: 2 ½"x 2 ½"x11 GAUGE @ 10'-0" O.C.
   D. GATE POSTS: 4"x4"x11 GAUGE
3. ALL WELDED STEEL CONSTRUCTION.
4. 4-#4 VERTICAL WITH #3 HOOPS AT 12" O.C. (TYPICAL).
5. WELD CAPS ON ALL POST TUBING.
6. ALL FABRICATIONS SHALL BE POWDER COATED HUNTER GREEN.
7. ALL FIELD WELDS SHALL BE RE-GALVANIZED AND PROPERLY COATED. TWO COATS SHALL BE APPLIED TO PROVIDE A TOTAL DRY FILM THICKNESS OF 4-6 MILS.



GATE KEEPER
NTS



B — SECTION
NTS

GATE ANTI-SWING FOOTING DETAIL
NTS

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM, BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

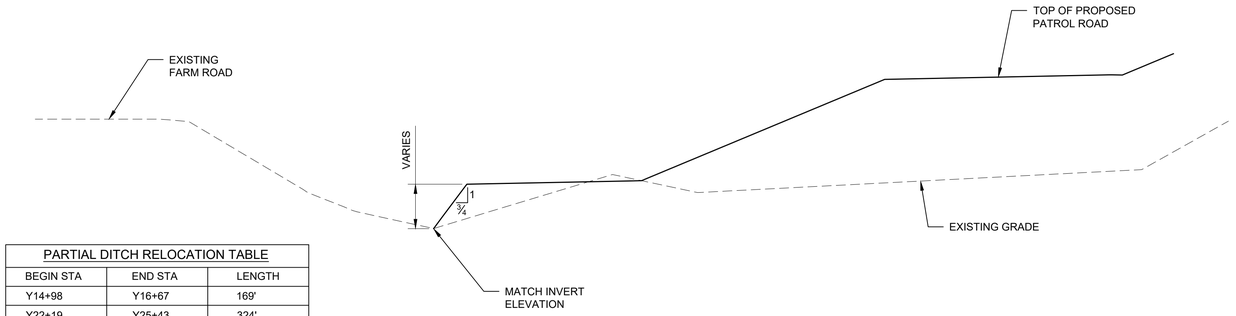
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

SECURITY FENCE DETAILS

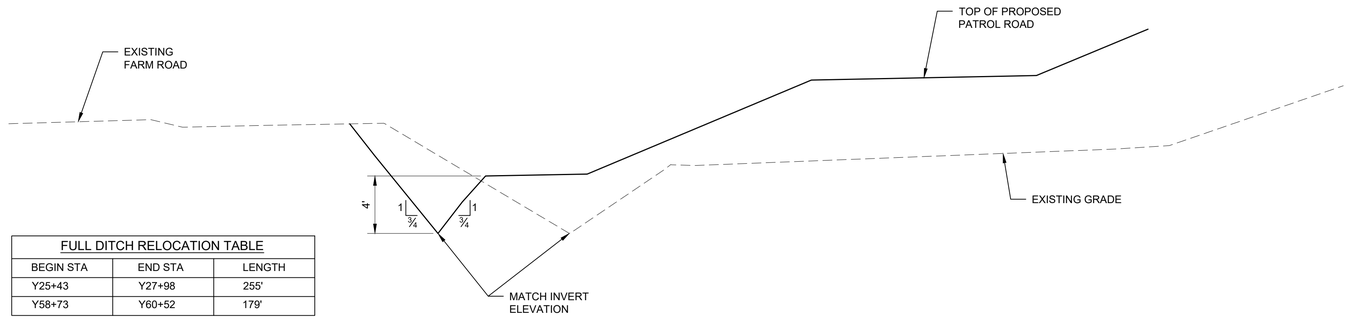
SHEET ID
C-506

FINAL SUBMITTAL



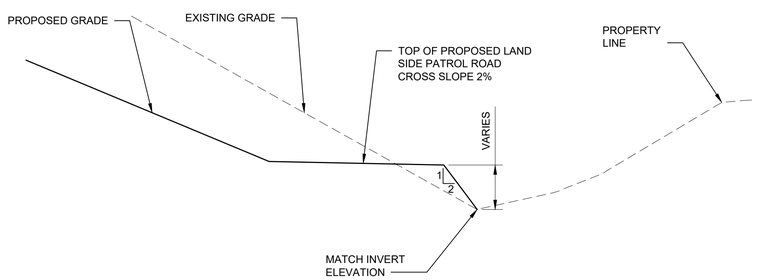
PARTIAL DITCH RELOCATION TABLE		
BEGIN STA	END STA	LENGTH
Y14+98	Y16+67	169'
Y22+19	Y25+43	324'
Y51+58	Y54+22	264'

1 PARTIAL DITCH RELOCATION DETAIL
SCALE: 1"=5'



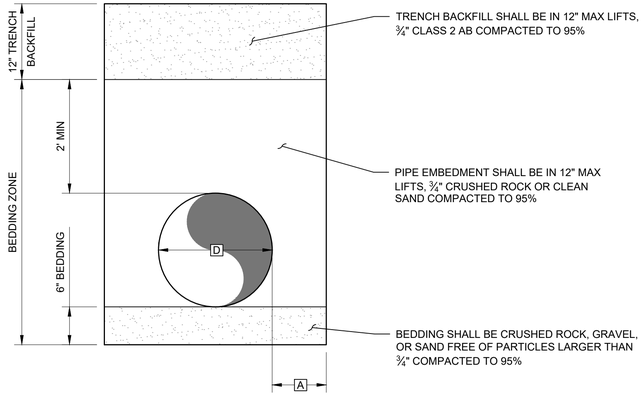
FULL DITCH RELOCATION TABLE		
BEGIN STA	END STA	LENGTH
Y25+43	Y27+98	255'
Y58+73	Y60+52	179'

2 FULL DITCH RELOCATION DETAIL
SCALE: 1"=5'



4 LANDSIDE DITCH SWALE ENCROACHMENT DETAIL
SCALE: 1"=5'

D	A
< 36"	6" MIN
≥ 36"	12" MIN



NOTES:

1. CERTIFICATION OF TRENCH BACKFILL COMPACTION IS REQUIRED PRIOR TO PLACING AB ON FINISHED SUBGRADE.
2. ALL TRENCH WORK 5 FT AND DEEPER SHALL CONFORM TO CAL OSHA STANDARDS.
3. MIN COVER OVER UTILITIES SHALL BE 3' BELOW FINAL GRADE.
4. CONTRACTOR SHALL REMOVE MATERIAL NOT MEETING COMPACTION REQUIREMENTS AND HAVE A GEOTECH ENGINEER PROVIDE RECOMMENDATION ON AN ALTERNATIVE BACKFILL TO BE APPROVED BY THE GOVERNMENT'S GEOTECHNICAL ENGINEER.

3 PIPE TRENCH DETAIL
1" = 1' - 0"

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM, BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

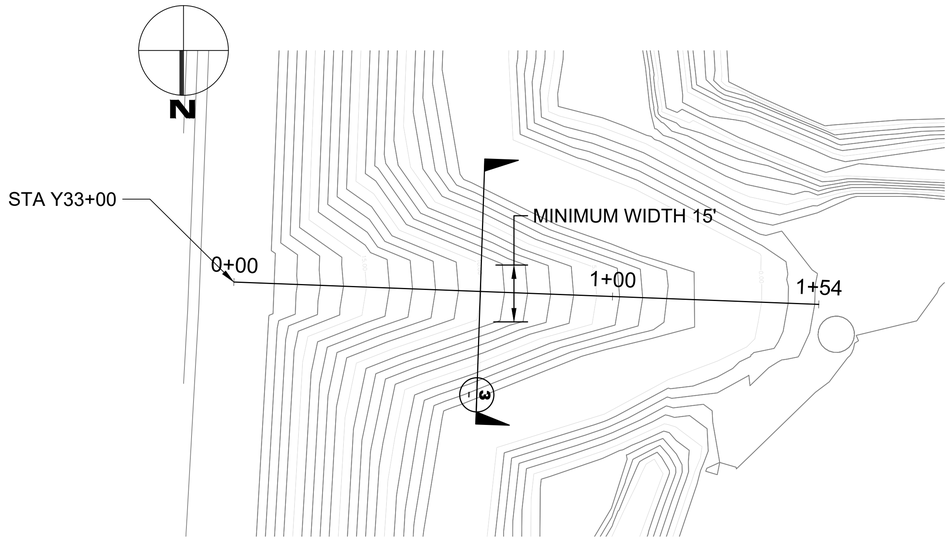
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS_30L LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

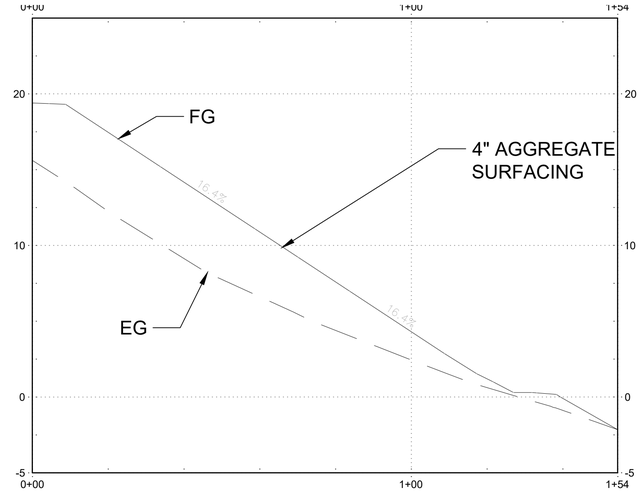
IRRIGATION DITCH RELOCATION

SHEET ID
C-507

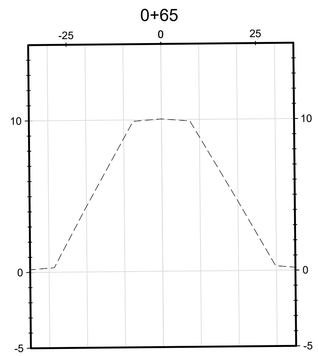
FINAL SUBMITTAL



1 — WATERSIDE ACCESS RAMP PLAN DETAIL
SCALE: 1"=20'



2 — WATERSIDE ACCESS RAMP PROFILE DETAIL
SCALE: 1"=20'



3 — WATERSIDE ACCESS RAMP CROSS SECTION DETAIL
SCALE: 1"=20'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: A. HOLT
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D
ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

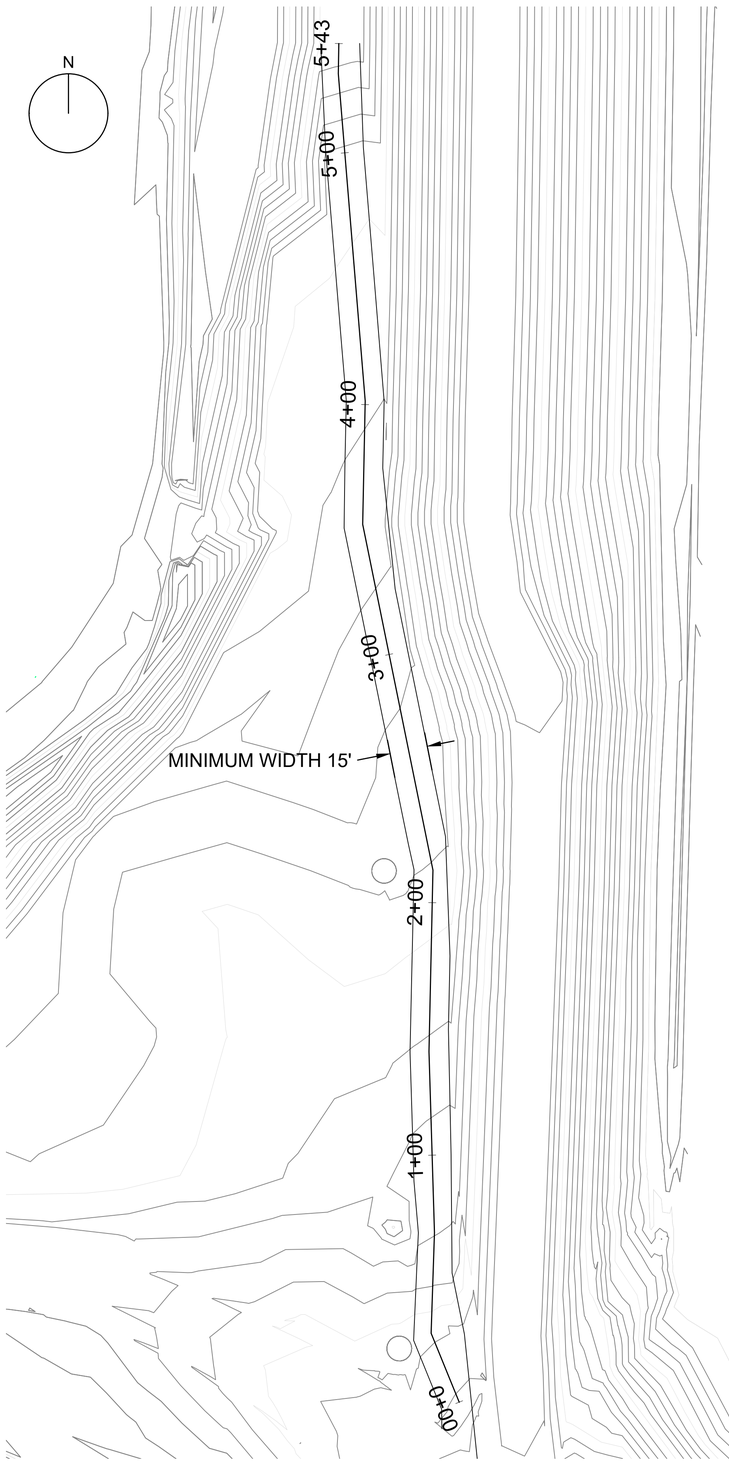
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
LEVEE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

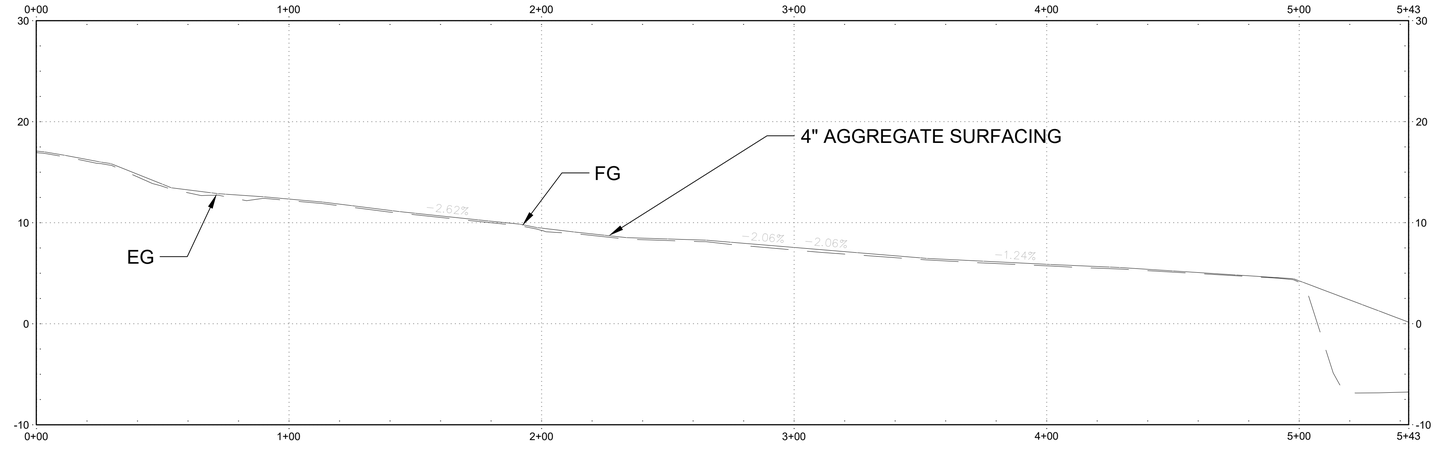
WATERSIDE ACCESS RAMP STA Y33+00 PLAN AND PROFILE

SHEET ID
C-508

FINAL SUBMITTAL



1 — MARCH LANE ACCESS RAMP PLAN DETAIL
SCALE: 1"=30'



2 — MARCH LANE ACCESS RAMP PROFILE DETAIL
SCALE: 1"=30'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: A. HOLLIS
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

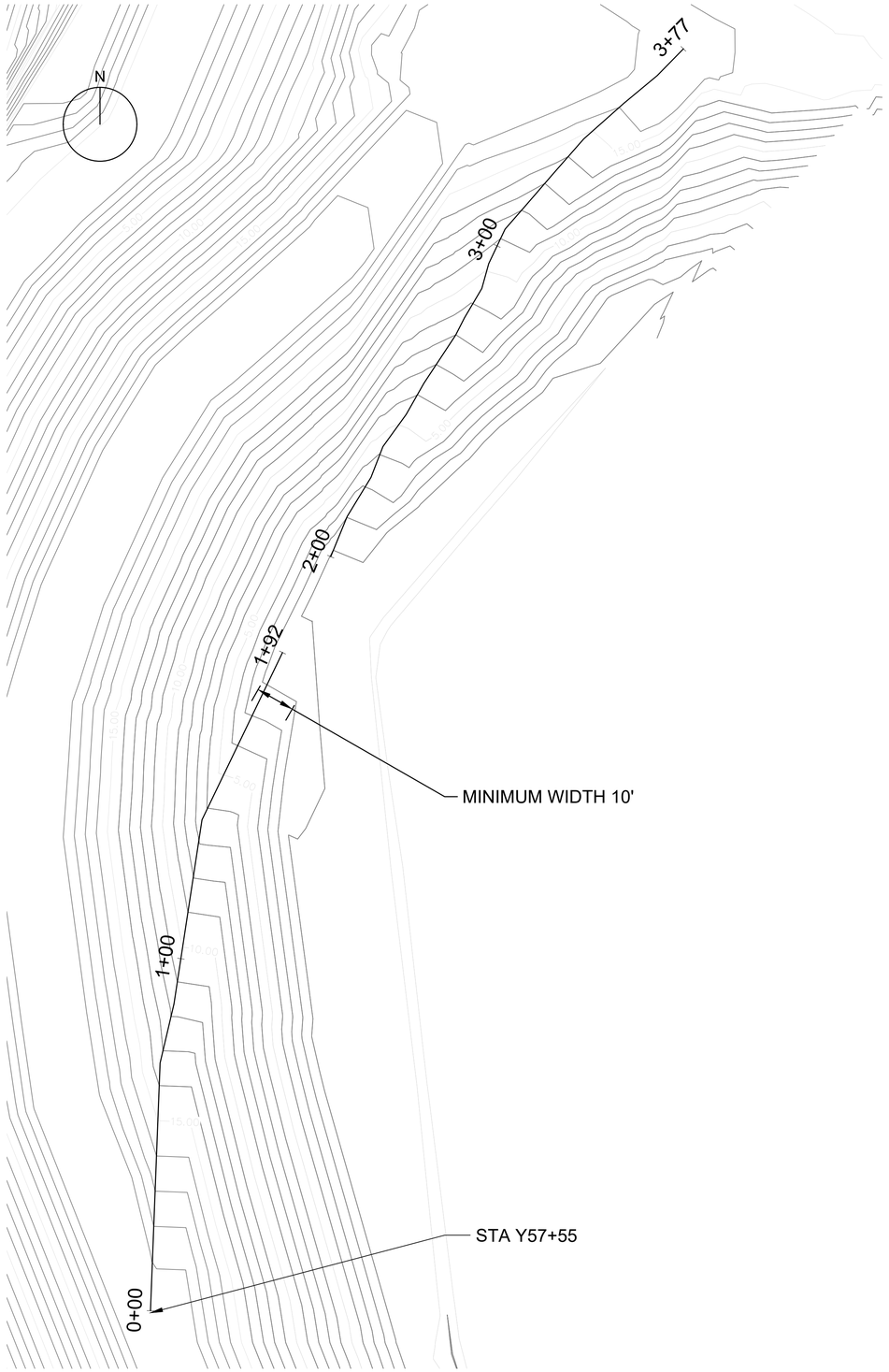
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
LEVEE SEEPAGE IMPROVEMENT
SAN JOAQUIN COUNTY, CALIFORNIA

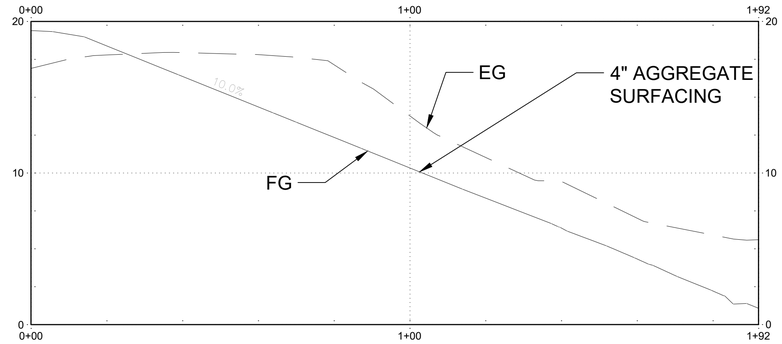
MARCH LANE ACCESS RAMP PLAN AND PROFILE

SHEET ID
C-509

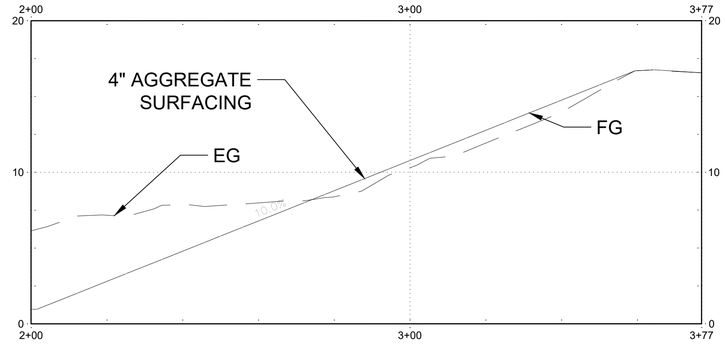
FINAL SUBMITTAL



1 – NORTHERN ACCESS RAMP PLAN DETAIL
SCALE: 1"=20'



2A – NORTHERN ACCESS RAMP PROFILE DETAIL
SCALE: 1"=20'



2B – NORTHERN ACCESS RAMP PROFILE DETAIL
SCALE: 1"=20'

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. KOSTOVSKA
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

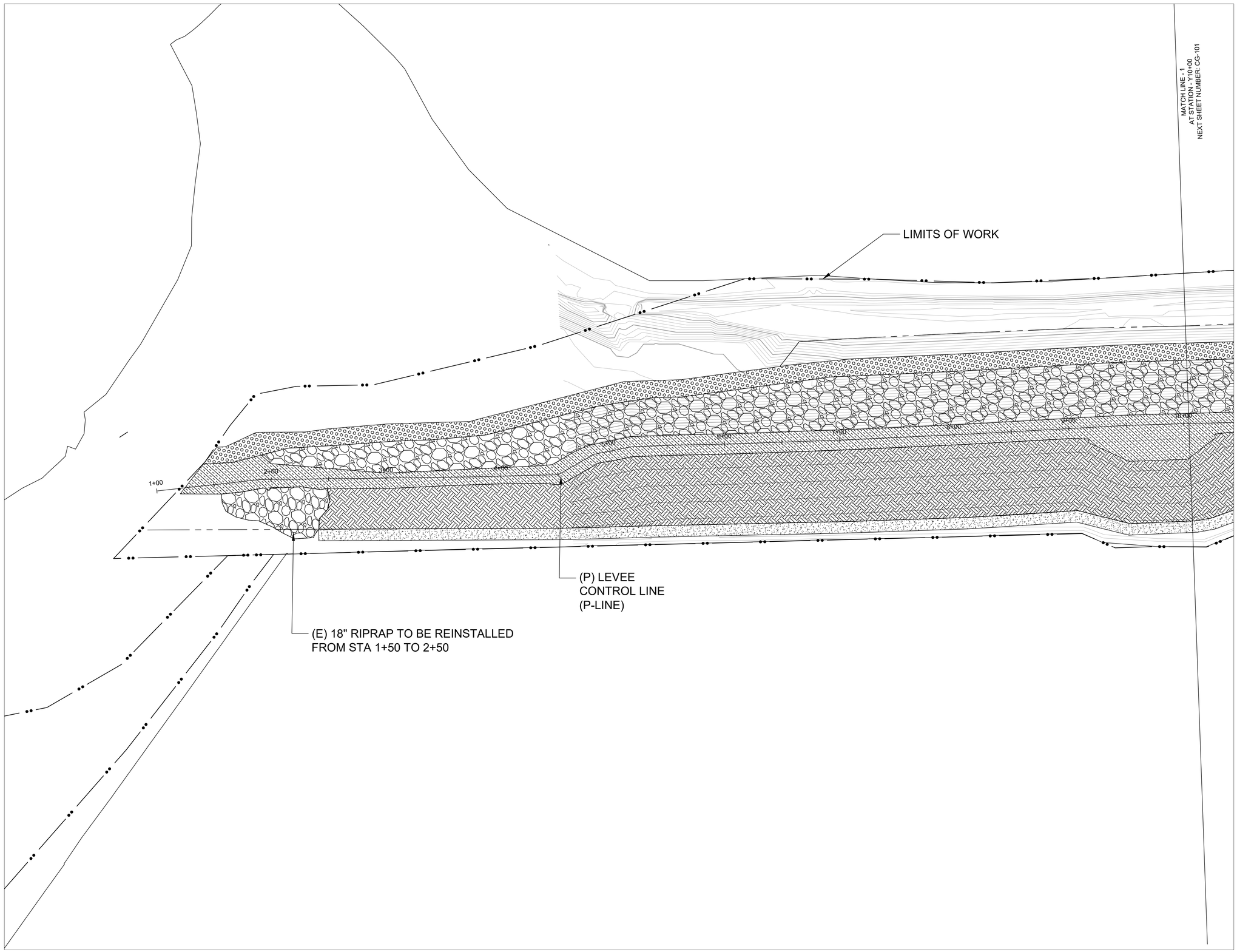
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
LEVEE SYSTEM IMPROVEMENT PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

NORTHERN ACCESS RAMP PLAN AND PROFILE

SHEET ID
C-510

FINAL SUBMITTAL



N

0 40' 80'

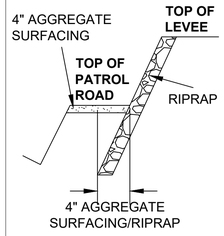
SCALE: 1"=40'

- RIPRAP
- 6" AB WITH TRIPLE CHIP SEAL
- 4" AGGREGATE SURFACING
- 3" AGGREGATE SURFACING
- 4" AGGREGATE SURFACING/RIPRAP (SEE DETAIL 1)

NOTES

1. **PER SPECIFICATIONS, DISTURBED AREAS WITHOUT ROCK OR GRAVEL SURFACING SHALL BE SEEDED.**
2. **TEMPORARY EROSION CONTROL FEATURES SHALL BE PLACED AROUND ALL EXISTING LANDSIDE CATCH BASINS. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**
3. **CONTRACTOR TO PROVIDE SILT FENCE ALONG EXISTING WATERSIDE DITCH. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**

DETAIL 1



US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
APPROVED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J. ST.
SACRAMENTO, CA 95814

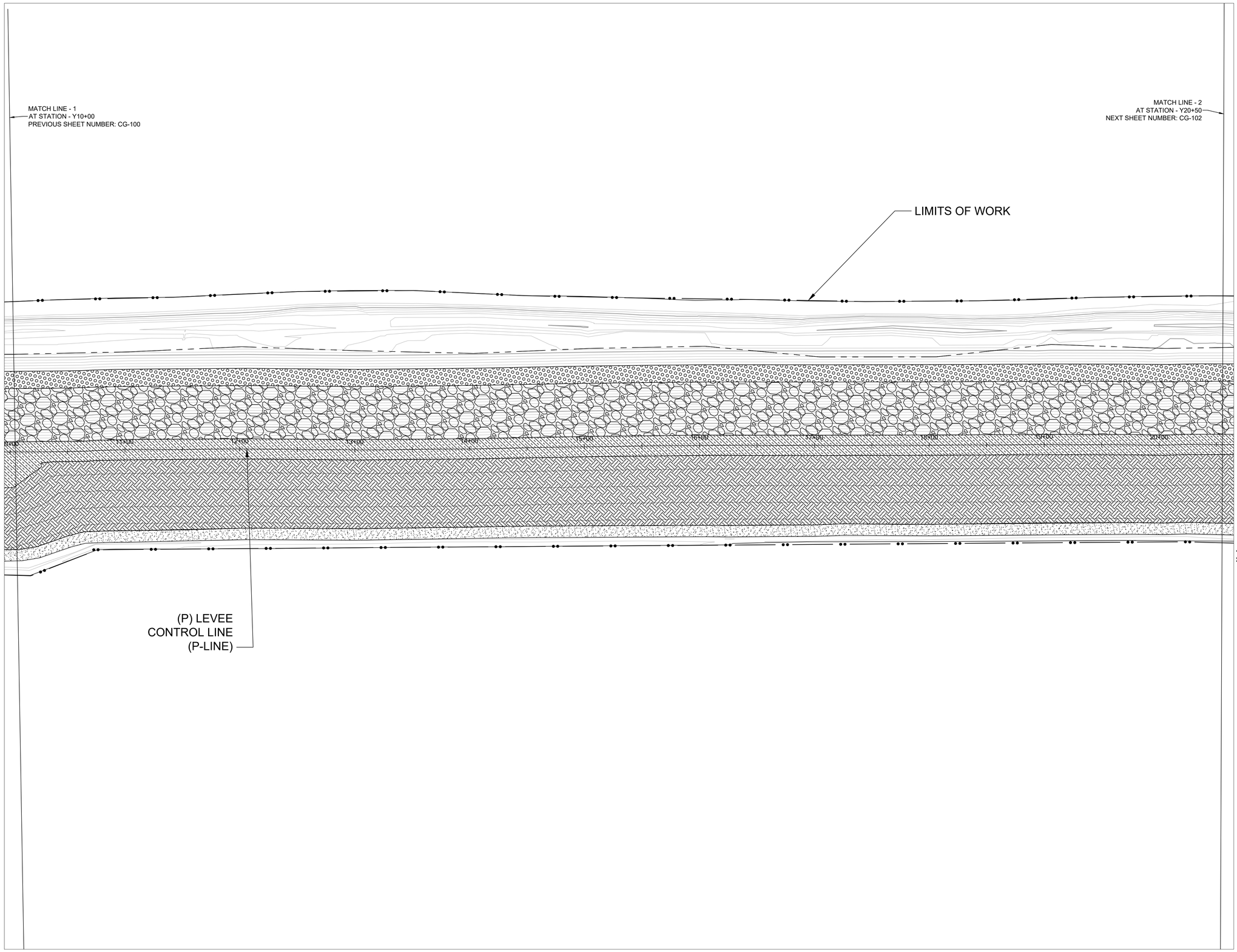
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

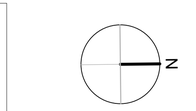
LOWER SAN JOAQUIN RIVER REACH
LOS LUCE MOWRY TRACT
SAN JOAQUIN COUNTY, CALIFORNIA

EROSION CONTROL PLAN STA 1+00 TO 10+00

SHEET ID
CG-100

FINAL SUBMITTAL





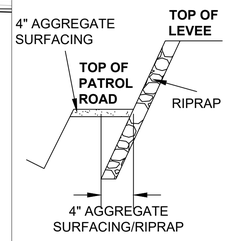
SCALE: 1"=40'

- RIPRAP
- 6" AB WITH TRIPLE CHIP SEAL
- 4" AGGREGATE SURFACING
- 3" AGGREGATE SURFACING
- 4" AGGREGATE SURFACING/RIPRAP (SEE DETAIL 1)

NOTES

1. **PER SPECIFICATIONS, DISTURBED AREAS WITHOUT ROCK OR GRAVEL SURFACING SHALL BE SEEDED.**
2. **TEMPORARY EROSION CONTROL FEATURES SHALL BE PLACED AROUND ALL EXISTING LANDSIDE CATCH BASINS. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**
3. **CONTRACTOR TO PROVIDE SILT FENCE ALONG EXISTING WATERSIDE DITCH. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**

DETAIL 1



US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QA/QC REVIEWED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

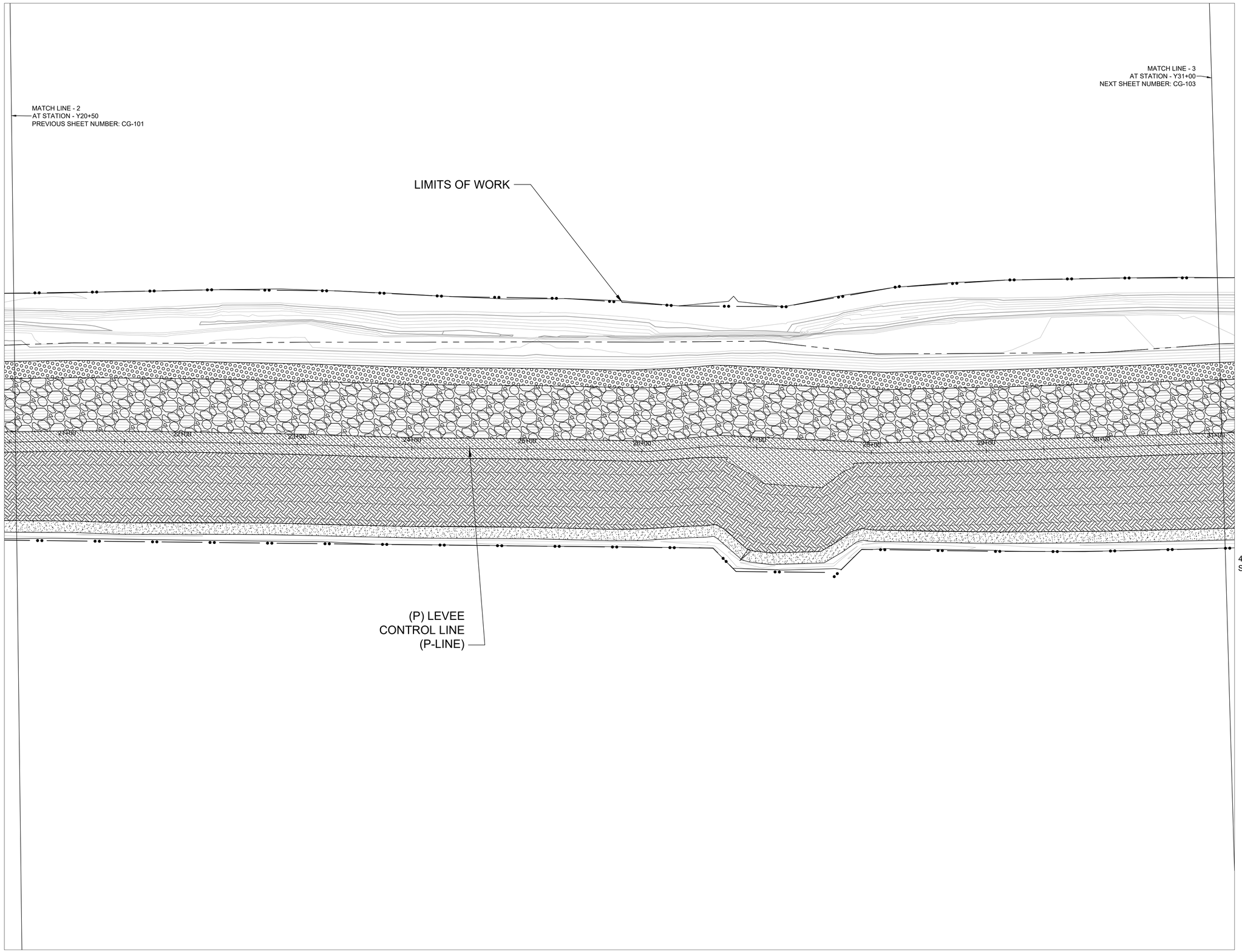
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS SAN JOAQUIN RIVER LEVEE
SAN JOAQUIN COUNTY, CALIFORNIA

EROSION CONTROL PLAN STA 10+00 TO 20+50

SHEET ID
CG-101

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

RIPRAP

6" AB WITH TRIPLE CHIP SEAL

4" AGGREGATE SURFACING

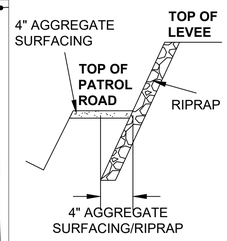
3" AGGREGATE SURFACING

4" AGGREGATE SURFACING/RIPRAP (SEE DETAIL 1)

NOTES

1. **PER SPECIFICATIONS, DISTURBED AREAS WITHOUT ROCK OR GRAVEL SURFACING SHALL BE SEEDED.**
2. **TEMPORARY EROSION CONTROL FEATURES SHALL BE PLACED AROUND ALL EXISTING LANDSIDE CATCH BASINS. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**
3. **CONTRACTOR TO PROVIDE SILT FENCE ALONG EXISTING WATERSIDE DITCH. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**

DETAIL 1



US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
SUBMITTED BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

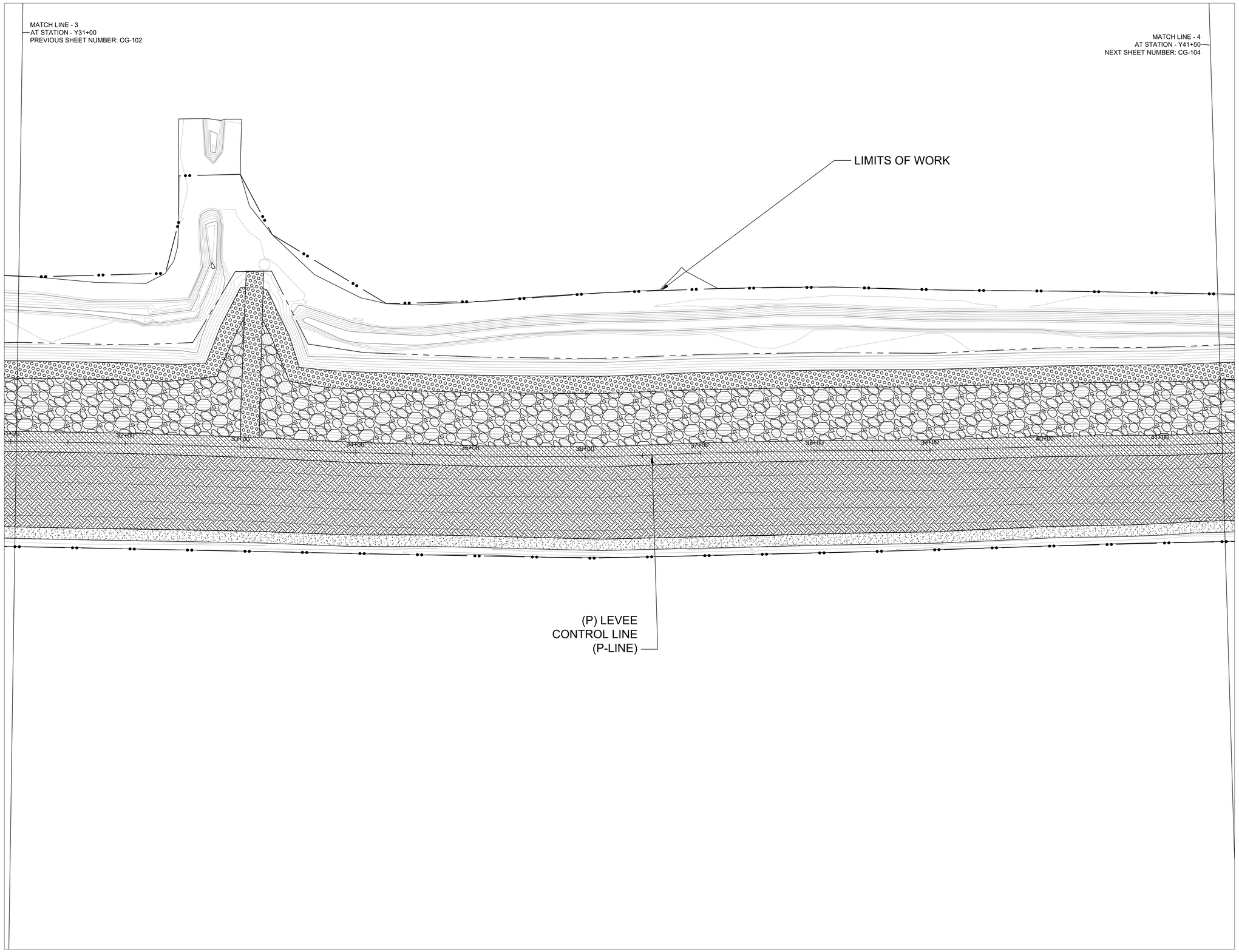
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TSMA (SEEPAGE BERM) PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

EROSION CONTROL PLAN STA 20+50 TO 31+00

SHEET ID
CG-102

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

RIPRAP

6" AB WITH TRIPLE CHIP SEAL

4" AGGREGATE SURFACING

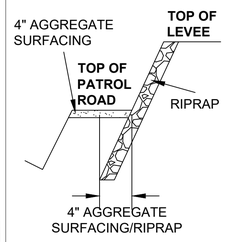
3" AGGREGATE SURFACING

4" AGGREGATE SURFACING/RIPRAP (SEE DETAIL 1)

NOTES

1. **PER SPECIFICATIONS, DISTURBED AREAS WITHOUT ROCK OR GRAVEL SURFACING SHALL BE SEEDED.**
2. **TEMPORARY EROSION CONTROL FEATURES SHALL BE PLACED AROUND ALL EXISTING LANDSIDE CATCH BASINS. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**
3. **CONTRACTOR TO PROVIDE SILT FENCE ALONG EXISTING WATERSIDE DITCH. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**

DETAIL 1



US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

ISSUE DATE: NOVEMBER 2022
SOLICITATION NO.: XXXXXX-XX-X-XXXX
CONTRACT NO.:

DESIGNED BY: DMM / BFL
DRAWN BY: M. HARRINGTON
CHECKED BY: K. BRUSTAD
QUALITY CONTROL BY: S. JIMENEZ
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

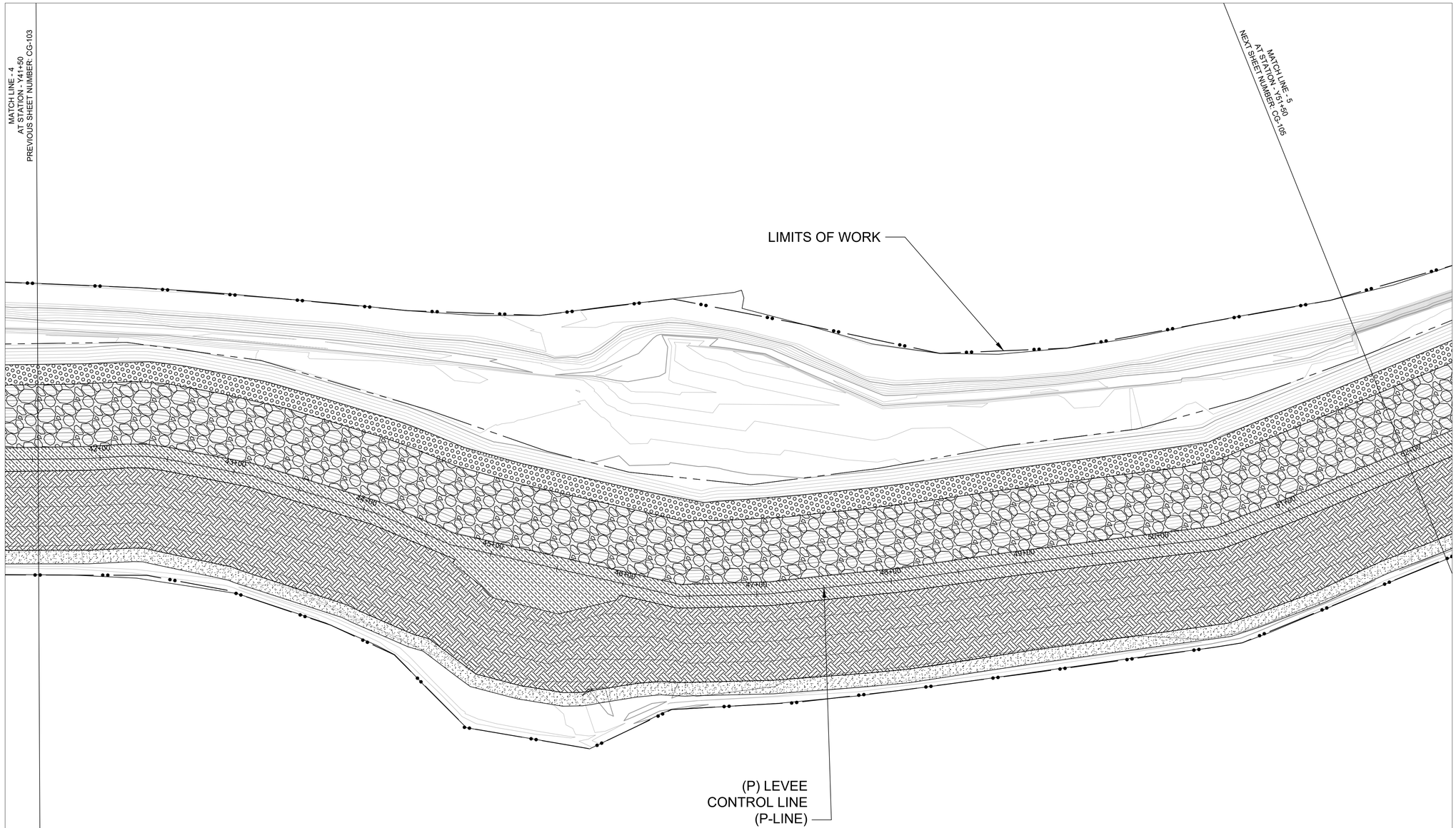
PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
SJ SAN JOSE MISCELLANEOUS
SAN JOAQUIN COUNTY, CALIFORNIA

EROSION CONTROL PLAN STA 31+00 TO 41+50

SHEET ID
CG-103

FINAL SUBMITTAL



N

0 40' 80'

SCALE: 1"=40'

RIPRAP

6" AB WITH TRIPLE CHIP SEAL

4" AGGREGATE SURFACING

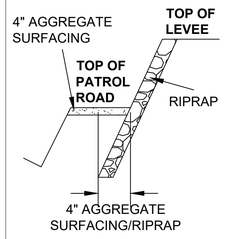
3" AGGREGATE SURFACING

4" AGGREGATE SURFACING/RIPRAP (SEE DETAIL 1)

NOTES

1. **PER SPECIFICATIONS, DISTURBED AREAS WITHOUT ROCK OR GRAVEL SURFACING SHALL BE SEEDED.**
2. **TEMPORARY EROSION CONTROL FEATURES SHALL BE PLACED AROUND ALL EXISTING LANDSIDE CATCH BASINS. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**
3. **CONTRACTOR TO PROVIDE SILT FENCE ALONG EXISTING WATERSIDE DITCH. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**

DETAIL 1



US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY:	ISSUE DATE:
DMM / BFL	NOVEMBER 2022
DRAWN BY:	SOLICITATION NO.:
M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
SUBMITTED BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
VS. SAN JOAQUIN RIVER FLOOD RISK PROJECT
SAN JOAQUIN COUNTY, CALIFORNIA

EROSION CONTROL PLAN STA 41+50 TO 51+50

SHEET ID

CG-104

FINAL SUBMITTAL

LIMITS OF WORK

(P) LEVEE
CONTROL LINE
(P-LINE)

MATCH LINE -5
AT STATION: X+51+50
PREVIOUS SHEET NUMBER: CG-104

61+21

N

0 40' 80'

SCALE: 1"=40'

RIPRAP

6" AB WITH TRIPLE CHIP SEAL

4" AGGREGATE SURFACING

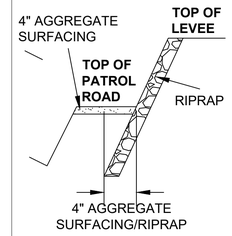
3" AGGREGATE SURFACING

4" AGGREGATE SURFACING/RIPRAP (SEE DETAIL 1)

NOTES

1. **PER SPECIFICATIONS, DISTURBED AREAS WITHOUT ROCK OR GRAVEL SURFACING SHALL BE SEEDED.**
2. **TEMPORARY EROSION CONTROL FEATURES SHALL BE PLACED AROUND ALL EXISTING LANDSIDE CATCH BASINS. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**
3. **CONTRACTOR TO PROVIDE SILT FENCE ALONG EXISTING WATERSIDE DITCH. SEE SHEETS C-100 THROUGH C-105 FOR LOCATIONS.**

DETAIL 1



US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

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DMM / BFL	NOVEMBER 2022
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M. HARRINGTON	XXXXXX-XX-X-XXXX
CHECKED BY:	CONTRACT NO.:
K. BRUSTAD	
QUALITY CONTROL BY:	
S. JIMENEZ	
SIZE:	
ANSI D	

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J ST.
SACRAMENTO, CA 95814

PETERSON BRUSTAD INC.
80 BLUE RAVINE RD SUITE 280
FOLSOM, CA 95630

LOWER SAN JOAQUIN RIVER REACH
TS, LEVEE IMPROVEMENTS
SAN JOAQUIN COUNTY, CALIFORNIA

EROSION CONTROL PLAN STA 51+50 TO 61+00

SHEET ID

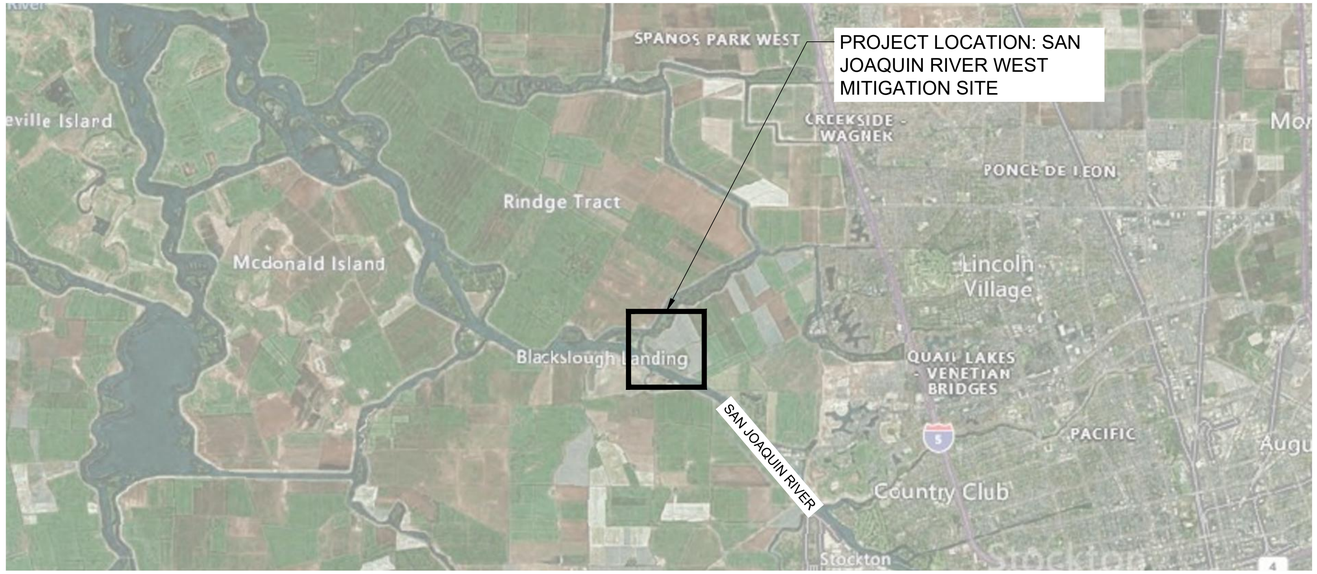
CG-105

FINAL SUBMITTAL

Appendix C-
10% Designs for San Joaquin River West Compensation Site

US Army Corps
of Engineers®
SACRAMENTO DISTRICT

EXHIBIT A, MITIGATION PLANTING AND ESTABLISHMENT PROJECT AT THE SAN JOAQUIN RIVER WEST SITE ON WRIGHT TRACT IN SAN JOAQUIN COUNTY, CA.



SITE MAP

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL): NAD 83 (2011)
CA SPCS ZONE 5
COMBINED FACTOR (CF): X.XXXXXXXXX

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

DRAFT 10% SUBMITTAL

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: B.J.
DRAWN BY: B.J.
CHECKED BY: T.S.
SUBMITTED BY: B.J.
SIZE: ANSI D
ISSUE DATE: XX/XX/2023
SOLICITATION NO.:
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

COVER SHEET

SHEET ID
G-000

SHEET INDEX

G-000	COVER SHEET
G-001	SHEET INDEX AND GENERAL NOTES
G-002	ABBREVIATIONS
G-003	ACCESS PLAN AND EXTERNAL HAUL ROUTES
L-110	EXISTING CONDITIONS AND DEMOLITION PLAN
L-120	LAYOUT PLAN
L-130	GRADING PLAN
L-140	DETAIL REFERENCE
L-150	IRRIGATION PLAN
L-160	PLANTING PLAN
L-161 TO 162	PLANT SCHEDULE
L-170	EROSION CONTROL PLAN
L-171	EROSION CONTROL LEGEND
L-500 TO 505	CONSTRUCTION DETAILS

ABBREVIATIONS

AB	ANCHOR BOLT
ADDM	ADDENDUM
ADJ	ADJACENT, ADJOINING, ADJUSTABLE
APPROX	APPROXIMATE
ASPH	ASPHALT
AUTO	AUTOMATIC
AVG	AVERAGE
BDRY	BOUNDARY
BLDG	BUILDING
BRK	BRICK
BRKT	BRACKET
BTWN	BETWEEN
CB	CATCH BASIN
CF	CUBIC FEET
CI	CURB INLET
CIP	CAST-IN-PLACE
CJ	CONTROL JOINT
CJ	CONSTRUCTION JOINT
CL	CENTER LINE
CLR	CLEAR(ANCE)
CNR	CORNER
CO	CLEANOUT
CNC	CONCRETE
CONN	CONNECT
CONSTR	CONSTRUCTION
CONT	CONTINUE
COR	CONTRACTING OFFICER REPRESENTATIVE
CRCMF	CIRCUMFERENCE
CTR	CENTER
CU FT	CUBIC FEET
CU YD	CUBIC YARDS
CY	CUBIC YARDS
DAT	DATUM
DBL	DOUBLE
DEG	DEGREE
DEMO	DEMOLITION
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DIV	DIVISION
DWG	DRAWING
E	EAST
(E)	EXISTING
EA	EACH
EJ	EXPANSION JOINT
EPY	EPOXY COATING
EQ	EQUAL
EQUIP	EQUIPMENT
EXST	EXISTING
EXT	EXTERIOR
F	FAHRENHEIT
FT	FEET
FTG	FOOTING
GA	GAGE
GAL	GALLON(S)
GALV	GALVANIZED
GALV STL	GALVANIZED STEEL
GEN	GENERAL
ZHDR	HEADER
HP	HIGH POINT
HR	HOUR
HT	HEIGHT
IN	INCH
INT	INTERIOR
LB	POUND
LBL	LABEL
LG	LENGTH
LIN	LINEAR
LONG	LONGITUDINAL
LP	LOW POINT
LT	LIGHT
MAS	MASONRY
MAX	MAXIMUM
MED	MEDIUM
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
mm	MILLIMETER(S)
MOD.	MODIFIED
MTL	METAL
N	NORTH
(N)	NEW
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OHWM	ORDINARY HIGH WATER MARK
PCF	POUNDS PER CUBIC FOOT
PED	PEDESTRIAN
PERIM	PERIMETER
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT.	POINT
R	RADIUS
REV	REVISION
ROW	RIGHT OF WAY
S	SOUTH
SECT	SECTION
SHT	SHEET
SHTHG	SHEATHING
SIM	SIMILAR
SLV	SLEEVE
SPEC	SPECIFICATION
SQ	SQUARE
STA	STATION
STD	STANDARD
TYP	TYPICAL
UTIL	UTILITY
UON	UNLESS OTHERWISE NOTED
W	WEST
W/	WITH
W/O	WITHOUT
WT	WEIGHT
WTH	WIDTH
YD	YARD

GENERAL NOTES

1. CONTRACTOR MUST CONFINE OPERATIONS WITHIN THE LIMITS OF WORK DEPICTED ON THE PLANS. IF AREAS OR FEATURES OUTSIDE DESIGNATED CONSTRUCTION ZONES SUSTAIN IMPACT FROM CONTRACTOR ACTIVITIES, CONTRACTOR SHALL RESTORE TO PRE-WORK CONDITION AT NO COST.
2. ALL EXISTING UTILITY LOCATIONS AND DESCRIPTIONS SHOWN ON PLANS HAVE BEEN COMPILED FROM AVAILABLE RECORDS AND/OR SURVEY. THE GOVERNMENT CANNOT GUARANTEE THE ACCURACY OR COMPLETENESS OF THIS INFORMATION. CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFICATION OF LOCATION AND DEPTH (POTHOLE) OF ALL UTILITIES WITHIN THE WORK ZONE PRIOR TO BEGINNING WORK. CONTRACTOR SHALL PROMPTLY NOTIFY THE GOVERNMENT OF POTENTIAL CONFLICTS. IF CONTRACTOR FAILS TO LOCATE ANY KNOWN UTILITY WITHIN THE WORK ZONE THAT CONFLICTS WITH WORK, CONTRACTOR SHALL CORRECT THE CONFLICT AT THEIR OWN COST. ANY COSTS TO THE CONTRACTOR ARISING FROM COORDINATION WITH UTILITY COMPANY TO RELOCATE UTILITIES SHALL BE CONSIDERED INCIDENTAL TO COST OF THE PROJECT AND NO ADDITIONAL COMPENSATION SHALL BE DUE TO THE CONTRACTOR.
3. CONTRACTOR MUST PROTECT ALL EXISTING SURVEY MONUMENTS AND CONSTRUCTION STAKING. CONTRACTOR SHALL NOTIFY THE GOVERNMENT PRIOR TO DISTURBANCE OR REMOVAL OF ANY PERMANENT MONUMENTS AND COORDINATE RESETTING WITH A LICENSED LAND SURVEYOR.
4. CONTRACTOR MUST RESTORE ALL STREET, ACCESS ROUTE, AND SITE FEATURES IMPACTED BY WORK UNDER CONTRACT PER THE PERFORMANCE WORK STATEMENT (PWS) REQUIREMENTS.
5. CONTRACTOR MUST VERIFY ACCURATE LOCATIONS OF THE LIMITS OF WORK BEFORE THE COMMENCENT OF ANY WORK. RESTORE ALL AREAS AS STIPULATED IN THE CONTRACT DOCUMENTS.
6. THE SAN JOAQUIN RIVER EXPERIENCES VARIATIONS IN FLOW AND RIVER STAGE THAT SHOULD BE EXPECTED DURING THE PROJECT CONSTRUCTION PERIOD. THE CONTRACTOR SHOULD CONSULT RIVER FLOW AND STAGE INFORMATION DURING THE BIDDING, PLANNING, AND EXECUTION OF THE WORK.
7. THE FOLLOWING LINK CAN BE USED TO ACCESS CURRENT FLOW AND STAGE DATA FOR THE SAN JOAQUIN RIVER IN THE PROJECT AREA AT: https://water.weather.gov/ahps/forecasts.php
8. CONTRACTOR OPERATIONS DURING THE CONSTRUCTION PERIOD MAY BE IMPACTED BY EXTREME HIGH OR LOW RIVER LEVELS, FLOODING, DROUGHT, AND/OR OPERATION OF UPSTREAM DAM RELEASES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MONITOR RIVER FLOW CONDITIONS ON A DAILY BASIS AND TO IMPLEMENT PROCEDURES TO PROTECT THE WORK, EQUIPMENT, AND MATERIALS.
9. THE REFERENCES PROVIDED ON THIS SHEET ARE SOLELY FOR THE INFORMATION OF THE CONTRACTOR IN TIMING CONSTRUCTION OPERATIONS TO PREPARE FOR FLOOD EVENTS AND IN MAKING PROVISIONS FOR PROTECTING THE WORK. USACE DOES NOT GUARANTEE THE RELIABILITY OR ACCURACY OF ANY OF THE DATA AND ASSUMES NO RESPONSIBILITY FOR ANY DEDUCTIONS, INTERPRETATIONS, OR CONCLUSIONS WHICH MAY BE DERIVED FROM THE DATA.
10. CONTRACTOR TO PRODUCE AND INSTALL (2) CONSTRUCTION PROJECT SIGNS. SIGNS TO BE LOCATED WITHIN THE SITE BOUNDARY PER DIRECTION OF THE COR. CONTRACTOR TO SUBMIT SHOP DRAWINGS FOR COR APPROVAL BEFORE FABRICATION AND INSTILLATION. BACK OF SIGN TO BE NON-REFLECTIVE. LOCATE PER DIRECTION OF THE COR.
11. CONTRACTOR TO VERIFY ACCURATE LOCATIONS OF EASEMENTS AND RIGHTS OF WAY BEFORE THE COMMENCEMENT OF ANY WORK. CONTRACTOR SHALL RESTORE ALL PROJECT-RELATED EASEMENT AREAS AS STIPULATED IN THE EASEMENT AND CONTRACT DOCUMENTS.
12. CONTRACTOR TO VERIFY SITE CONDITIONS BEFORE THE COMMENCEMENT OF ANY WORK. NOTIFY COR IMMEDIATELY OF ANY DISCREPANCIES FROM THE CONDITIONS SHOWN ON THE PLANS OR DESCRIBED IN THE PWS.
13. ALL WORK TO BE PERFORMED SHALL CONFORM TO ALL APPLICABLE CODES AND ORDINANCES OF GOVERNMENTAL AGENCIES HAVING JURISDICTION OVER THE PROJECT.
14. COORDINATE ALL WORK TO PREVENT CONFLICTS BETWEEN TRADES AND REPORT CONFLICTS OR INCONGRUITIES BETWEEN NEW IMPROVEMENTS AND/OR EXISTING FACILITIES TO THE COR IMMEDIATELY.
15. ALL DEBRIS, RUBBISH, AND/OR OTHER ITEMS SCHEDULED FOR REMOVAL FROM WITHIN THE LIMIT OF WORK MUST BE DISPOSED OF IN A LEGAL MANNER AS CONTRACTOR'S PROPERTY.
16. IN ADDITION TO THESE DRAWINGS, REFER TO THE SPECIFICATIONS AND PERFORMANCE WORK STATEMENT.
17. THE COORDINATE SYSTEM USED IN THIS DRAWING SET IS: CALIFORNIA STATE PLANE COORDINATE SYSTEM ZONE 3, NAD83 (2007), US SURVEY FEET.
18. AERIAL IMAGERY ON PLANS FROM BING MAPS 2021.

RESTORATION OF EXISTING LANDSCAPE AREAS TO REMAIN

1. RESTORE ALL LANDSCAPE AREAS DISTURBED BY CONSTRUCTION ACTIVITIES AS FOLLOWS: DISTURBED LANDSCAPE AREAS SHALL BE WEEDED, CULTIVATED, FINE GRADED FLUSH TO ADJACENT GRADE WITH NO VOIDS, DEPRESSIONS, OR MOUNDS; THE TOP 6" OF SOIL DECOMPACTED, PROVIDED WITH EROSION CONTROL (MUST INCLUDE DRY SEED, DRILL SEED, AND/OR HYDROSEED) AND MAINTAINED THROUGHOUT THE INSTALLATION PERIOD.

SITE PREPARATION NOTES

1. PROTECT ALL SITE ELEMENTS TO REMAIN.
2. PROVIDE FENCING AT LIMIT OF WORK LINE THROUGHOUT THE INSTALLATION PERIOD.
3. ALL MATERIALS SHALL BE DISPOSED OF IN A LEGAL MANNER AS CONTRACTOR'S PROPERTY.
4. VERIFY ALL ITEMS TO BE REMOVED IN THE FIELD WITH THE KO PRIOR TO START OF WORK.

LAYOUT NOTES

1. VERIFY ALL DIMENSIONS IN THE FIELD PRIOR TO BEGINNING CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE CITY REPRESENTATIVE PRIOR TO PROCEEDING.
2. WRITTEN DIMENSIONS ON DRAWINGS SUPERSEDE SCALE DIMENSIONS.
3. ALL DIMENSIONS ARE TO BE MEASURED HORIZONTALLY.
4. VERIFY THE LOCATIONS OF ALL UTILITIES AND UTILITY COVERS. REPORT ANY DISCREPANCIES TO THE KO.
5. THE CONTRACTOR SHALL STAKE ALL LAYOUTS AND FOOTINGS FOR REVIEW BY THE KO BEFORE FINAL CONSTRUCTION.

GRADING NOTES

1. VERIFY ALL GRADES IN THE FIELD BEFORE PROCEEDING WITH WORK. REPORT ANY DISCREPANCIES TO THE COR IMMEDIATELY.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR POSITIVE SURFACE DRAINAGE IN AND AROUND WETLAND AREAS. MAINTENANCE PATHS AROUND WETLAND AREAS SHALL BE FINISHED TO A SMOOTH AND CONTINUOUS GRADE, DRAINING, AND FREE OF STANDING WATER.
3. PROVIDE SMOOTH TRANSITIONS BETWEEN EXISTING AND NEW GRADES IN PLANTING AREAS.
4. THE COR RESERVES THE RIGHT TO MAKE ADJUSTMENTS IN THE FINISHED GRADES AS THE WORK PROGRESSES.
5. ELEVATIONS ARE BASED ON SURVEY DATA UNLESS OTHERWISE NOTED.

PLANTING NOTES

1. CONTRACTOR MUST REVIEW ALL PLANT MATERIAL ON SITE WITH THE KO AND SHALL INSTALL MATERIAL ONLY AFTER OBTAINING APPROVAL FROM THE KO.
2. THE KO RESERVES THE RIGHT TO MAKE SUBSTITUTIONS, ADDITIONS, LAYOUT CHANGES, AND DELETIONS IN THE PLANTING SCHEME AS THE WORK PROGRESSES.
3. ALL NEWLY PLANTED PLANT PITS TO RECEIVE MULCH, SEE PROJECT WORK STATEMENT.

SITE METALWORK NOTES

1. SUBMIT SHOP DRAWINGS FOR ALL METAL WORK FOR KO APPROVAL BEFORE FABRICATING AND INSTALLING..
2. ALL MEMBERS TO BE STRUCTURAL STEEL GALVANIZED SIZE AND TYPE AS INDICATED ON DETAIL DRAWINGS
3. SHOP ASSEMBLY, FULL DEPTH WELDS, TYPE "FILLET WELD" CONTINUOUS, GRIND SMOOTH.
4. HOT DIP GALVANIZE AND POWDER COAT ALL MEMBERS PER SPECIFICATIONS.

ELEVATION DATUM (VERTICAL CONTROL):
NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL):
NAD 83 (2007)
CA SPCS ZONE 5
COMBINED FACTOR (CF): X.XXXXXXXXX

US Army Corps of Engineers®

MARK	DESCRIPTION	DATE

DESIGNED BY: B.J.
DRAWN BY: B.J.
CHECKED BY: T.S.
SUBMITTED BY: B.J.
SIZE: ANSI D
ISSUE DATE: XX/XX/2023
SOLICITATION NO.:
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

SHEET INDEX & NOTES

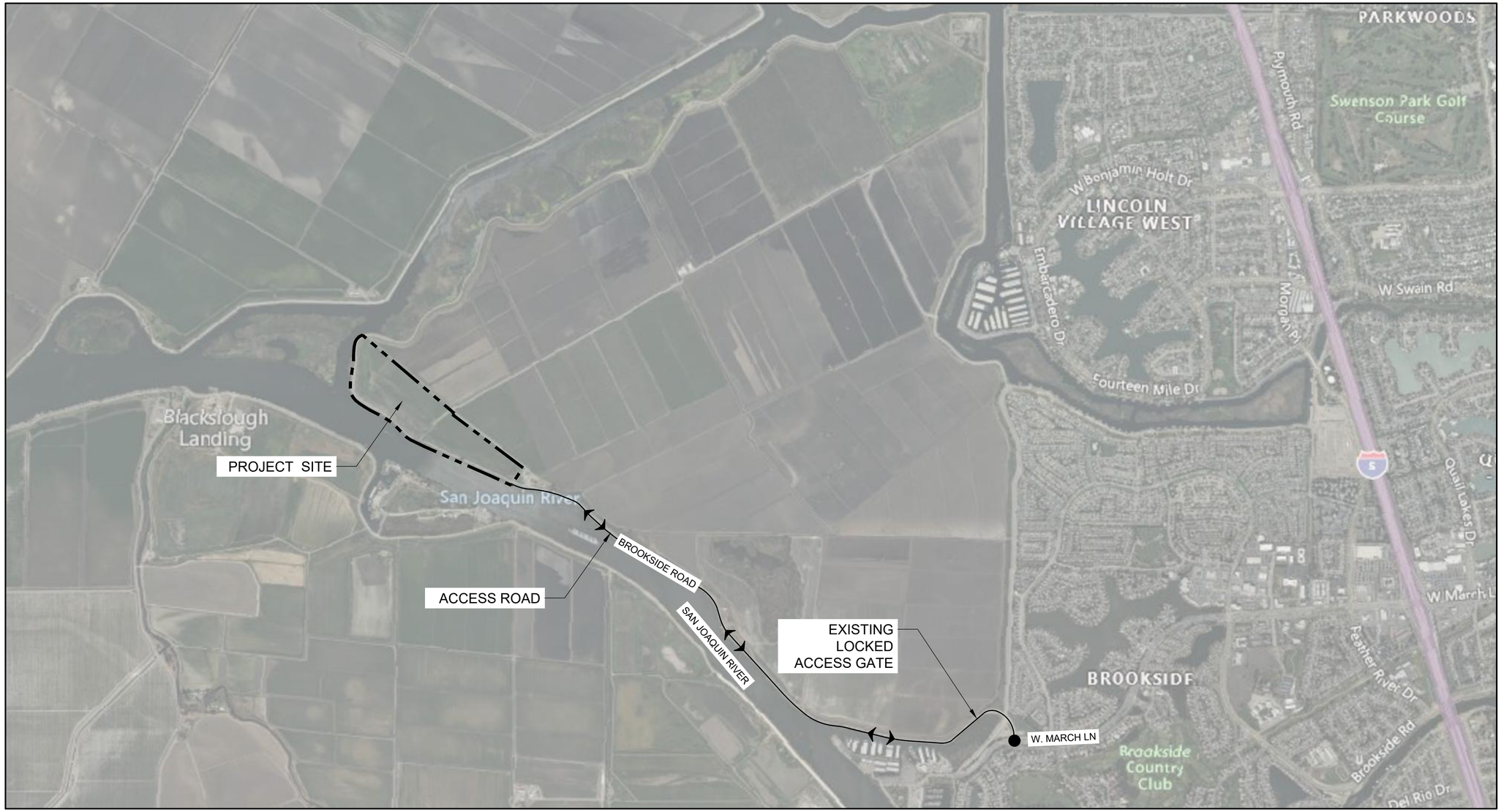
SHEET ID
G-001

%PRODUCTION DATA 1%
%PRODUCTION DATA 2% %PRODUCTION DATA 3% %PRODUCTION DATA 4%

DRAFT 10% SUBMITTAL

NOTES

1. CONTRACTOR'S EXTERNAL HAUL ROUTES AND INGRESS/EGRESS LOCATIONS FOR HAULING MATERIALS, EQUIPMENT DELIVERY, AND ALL LARGE TRANSPORTS SHALL BE LIMITED TO THE ROUTES SHOWN ON THIS SHEET.
2. SUBMIT A TRAFFIC CONTROL PLAN THAT DEFINES INGRESS/EGRESS ROUTES USED TO ACCESS THE SITE. TRAFFIC CONTROL PLAN SHALL INCLUDE CONTRACTOR'S APPROACH TO MEETING THE TRAVEL REQUIREMENTS LISTED BELOW AND SHALL DEMONSTRATE CONFORMANCE WITH ALL REQUIREMENTS IN THE PWS. VERIFY THE LOCATION OF NEW ACCESS ROADS IN THE FILED WITH KO.
3. CONTRACTOR TO MAINTAIN NEW AND EXISTING UNPAVED MAINTENANCE ROUTES TO PROJECT AREA(S).



ELEVATION DATUM (VERTICAL CONTROL): NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL): NAVD 83 (2007)
CA STATE PLANE ZONE 2
COMBINED FACTOR (CF): X.XXXXXXXXX

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U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

ACCESS PLAN AND EXTERNAL HAUL ROUTES

SHEET ID
G-002

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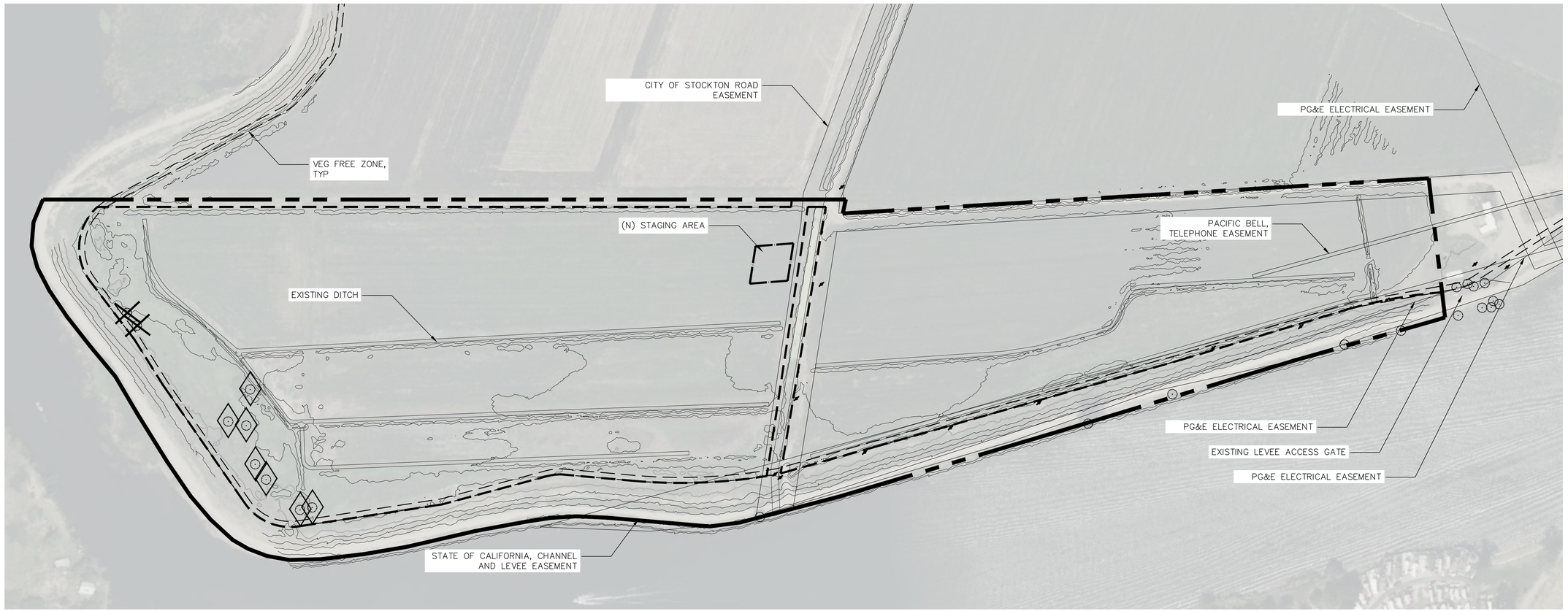
DRAFT 10% SUBMITTAL

LEGEND

- PROPERTY LINE
- LIMIT OF WORK
- STAGING AREA
- (E) UTILITY POLE
- (E) TREE AND/OR STUMP TO BE REMOVED.
- PROTECT (E) TREE TO REMAIN. SEE X/L-X.X.

NOTES

1. PROTECT AND IRRIGATE ALL (E) TREES TO REMAIN.
2. (E) UTILITIES, UTILITY BOXES, AND DITCHES TO REMAIN, UON.
3. FIELD VERIFY ALL ITEMS TO BE REMOVED WITH THE KO
4. STUMP GRIND TO 24" BELOW GRADE. AT STUMP GRINDING LOCATIONS, REMOVE ALL ROOTS 2" DIA OR LARGER TO A DEPTH OF 12" BELOW. BACKFILL HOLES RESULTING FROM STUMP AND ROOT REMOVAL TO BE FLUSH WITH ADJACENT GRADES. COMPACT BACKFILL IN 6" LIFTS TO 85% UON.
5. ANY DAMAGE AS A RESULT OF CONSTRUCTION ACTIVITIES OR STAGING is TO BE RESTORED TO THEIR PREVIOUS CONDITION OR BETTER.



Feet

SCALE: 1" = 150'-0"

1 PLAN: LONGITUDINAL MITIGATION SITE
SCALE: 1" = 150'-0"

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88 GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL): NAD 83 2011 CA SPCS ZONE 5 COMBINED FACTOR (CF): X.XXXXXXXXX

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U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVIER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT- SAN JOAQUIN COUNTY, CA

EXISTING CONDITIONS AND DEMOLITION PLAN

SHEET ID

L-110

DRAFT 10% SUBMITTAL

LINE TABLE					
Line #	Length	START NORTHING	START EASTING	END NORTHING	END EASTING
L1	247.00	2184487.68	6302447.05	2184282.33	6302309.77
L2	1828.05	2184393.37	6302655.56	2185492.41	6301194.79
L3	38.72	2185484.90	6301202.69	2185508.30	6301233.54
L4	2175.34	2185508.30	6301233.54	2186919.69	6299578.22
L5	1880.71	2185589.25	6301107.76	2186809.49	6299676.64
L6	192.89	2186668.18	6299531.08	2186475.61	6299519.98
L7	134.63	2186462.23	6299518.60	2186329.06	6299498.84
L8	392.11	2186329.06	6299498.84	2185938.93	6299459.49
L9	393.54	2185796.31	6299529.82	2185589.28	6299864.50
L10	393.54	2185796.31	6299529.82	2185589.28	6299864.50
L11	293.31	2185589.28	6299864.50	2185463.46	6300129.46
L12	200.99	2185442.02	6300162.55	2185298.48	6300303.25
L15	738.19	2185076.91	6300583.93	2185559.92	6301142.16
L16	407.11	2185528.27	6301179.29	2185266.96	6300867.11
L17	48.79	2185559.92	6301142.16	2185528.27	6301179.29
L18	54.67	2185048.77	6300616.95	2185004.11	6300585.42
L19	62.61	2185045.93	6300634.97	2184988.40	6300610.26
L20	849.91	2184954.84	6300876.44	2184601.42	6301649.38
L21	850.07	2184941.21	6300870.18	2184587.73	6301643.26
L22	479.66	2184587.73	6301643.26	2184395.88	6302082.89
L23	479.53	2184409.63	6302088.89	2184601.42	6301649.38
L25	235.90	2184282.33	6302309.77	2184401.00	6302105.90
L27	108.95	2185225.24	6300854.66	2185155.31	6300771.11
L28	192.71	2185383.52	6301025.05	2185259.82	6300877.28
L29	1801.49	2185457.44	6301158.11	2184374.36	6302597.66
L30	759.19	2184963.69	6300581.40	2185457.44	6301158.11
L31	1385.96	2185382.75	6301091.04	2184549.50	6302198.55
L32	1422.60	2185425.43	6300907.35	2186291.21	6299778.55
L33	184.09	2186313.40	6299765.30	2186495.13	6299735.94
L34	71.47	2186584.34	6299746.55	2186643.62	6299786.47
L35	1091.86	2185311.46	6300774.98	2185986.64	6299916.91
L36	1094.08	2185202.73	6300649.32	2185879.28	6299789.50
L37	23.23	2185576.82	6301079.11	2185553.59	6301079.31
L38	102.68	2185510.36	6301048.21	2185570.74	6300965.16
L39	102.68	2185570.74	6300965.16	2185503.56	6300887.51
L40	102.68	2185503.56	6300887.51	2185443.18	6300970.56
L41	30.99	2185139.13	6300733.09	2185119.24	6300709.32
L42	13.43	2185382.83	6301070.97	2185374.76	6301081.70
L44	89.01	2185763.12	6300037.63	2185833.75	6300091.81
L45	94.64	2185843.27	6300099.11	2185918.36	6300156.70
L46	1169.13	2184907.26	6301044.97	2184427.33	6302111.04
L47	69.42	2184441.04	6302155.31	2184500.33	6302191.41

Curve Table						
Curve #	Length	Radius	START NORTHING	START EASTING	END NORTHING	END EASTING
C1	216.94	150.00	2186809.21	6299670.80	2186668.18	6299531.08
C4	167.60	150.00	2185938.93	6299459.49	2185796.31	6299529.82
C9	358.50	1460.54	2185298.48	6300303.25	2185076.91	6300583.93
C10	358.50	1460.54	2185298.48	6300303.25	2185076.91	6300583.93
C12	252.53	1358.00	2184395.88	6302082.89	2184268.36	6302300.44
C17	13.20	35.00	2185382.75	6301091.04	2185392.47	6301082.22

1 LINE AND CURVE TABLES
SCALE: N/A

ELEVATION DATUM (VERTICAL CONTROL):
NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL):
NAD 83 (2011)
CA SPCS ZONE 5
COMBINED FACTOR (CF): X.XXXXXXXXX

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SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

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EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT: SAN JOAQUIN COUNTY, CA

LAYOUT PLAN

SHEET ID
L-121

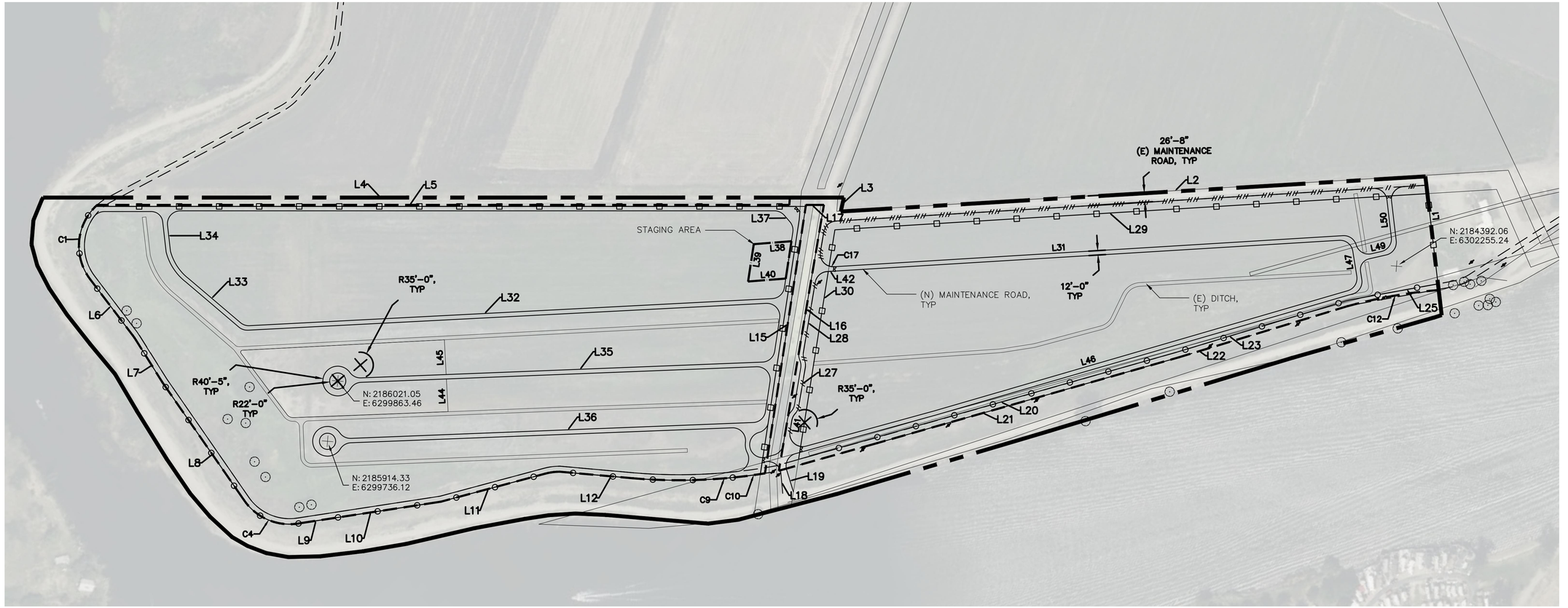
DRAFT 10% SUBMITTAL

LEGEND

- BEAVER FENCE
- DEER FRIENDLY FENCE
- TEMPORARY ROPE FENCE BARRIER

NOTES

1. FINAL LAYOUT TO BE FIELD APPROVED BY KO.
2. SEE SHEET G-001 FOR ADDITIONAL LAYOUT NOTES
3. FIELD ADJUST MAINTENANCE PATHS TO AVOID EXISTING FEATURES TO REMAIN
4. SEE L-121 FOR LINE AND CURVE TABLE



Feet

SCALE: 1" = 150'-0"

1 PLAN: LONGITUDINAL MITIGATION SITE

SCALE: 1" = 150'-0"

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL):
NAD 83 (2011)
CA SPCS ZONE 5,
COMBINED FACTOR (CF): X.XXXXXXXXX

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EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT: SAN JOAQUIN COUNTY, CA

LAYOUT PLAN

SHEET ID
L-120

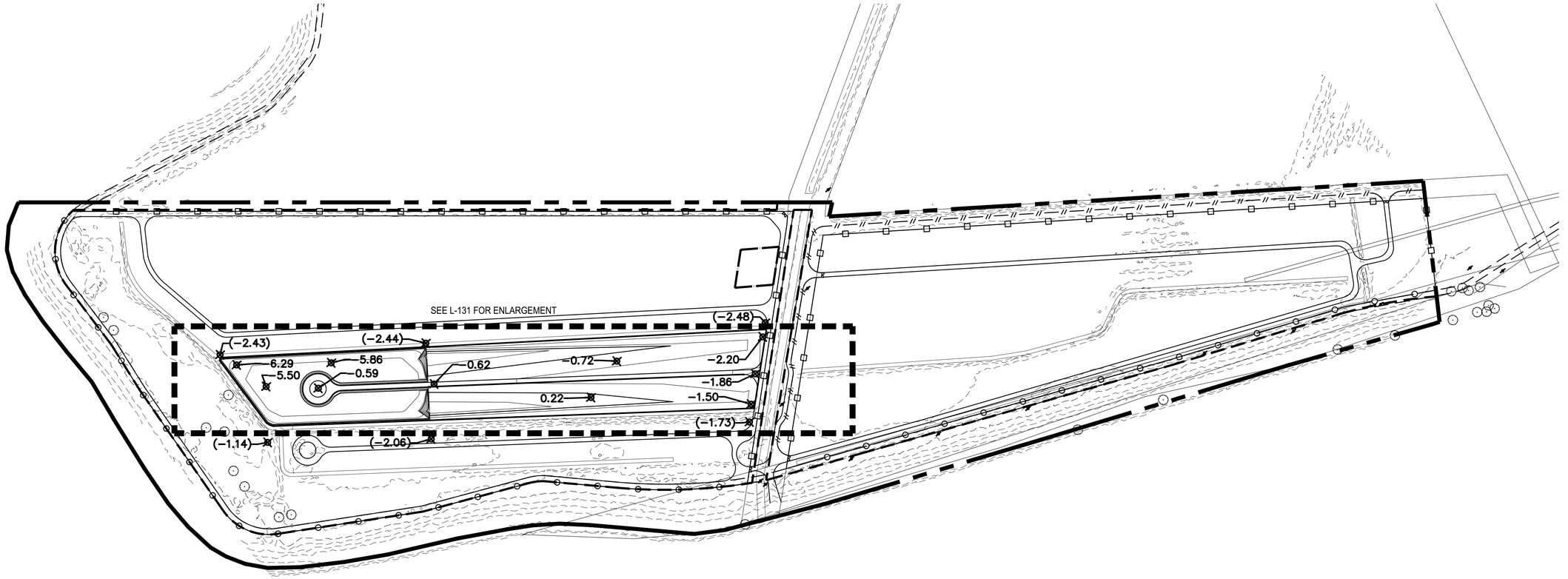
DRAFT 10% SUBMITTAL

LEGEND

+ (0.00)	EXISTING ELEVATION
+ 0.00	PROPOSED ELEVATION
69	PROPOSED CONTOUR
69	EXISTING CONTOUR
	FLUSH
FG	FINISH GRADE @ PLANTING
TS	TOP OF STEP
BC	BOTTOM OF STEP
TC	TOP OF CURB
BC	BOTTOM OF CURB
TW	TOP OF WALL
BW	BOTTOM OF WALL
LP	LOW POINT
	SLOPE
	GRADE BREAK

NOTE

1. ALL EARTHWORK ON SITE TO BE BALANCED, NO IMPORT OR OFF-HAUL REQUIRED.
2. SEE SHT. L-0.0 FOR ADDITIONAL GRADING NOTES.
3. CURRENT SURFACE IS USGS DEM FILE, SURVEY SURFACE EXPECTED SUMMER 2023.



Feet

SCALE: 1" = 150'-0"

1 PLAN: LONGITUDINAL MITIGATION SITE
SCALE: 1" = 150'-0"

ELEVATION DATUM (VERTICAL CONTROL): ELEVATION DATUM (HORIZONTAL CONTROL):
NAVD 88 NAD 83 (2011)
GEOID 12B CA SPCS ZONE 2
COMBINED FACTOR (CF): X.XXXXXXXXX

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EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT: SAN JOAQUIN COUNTY, CA

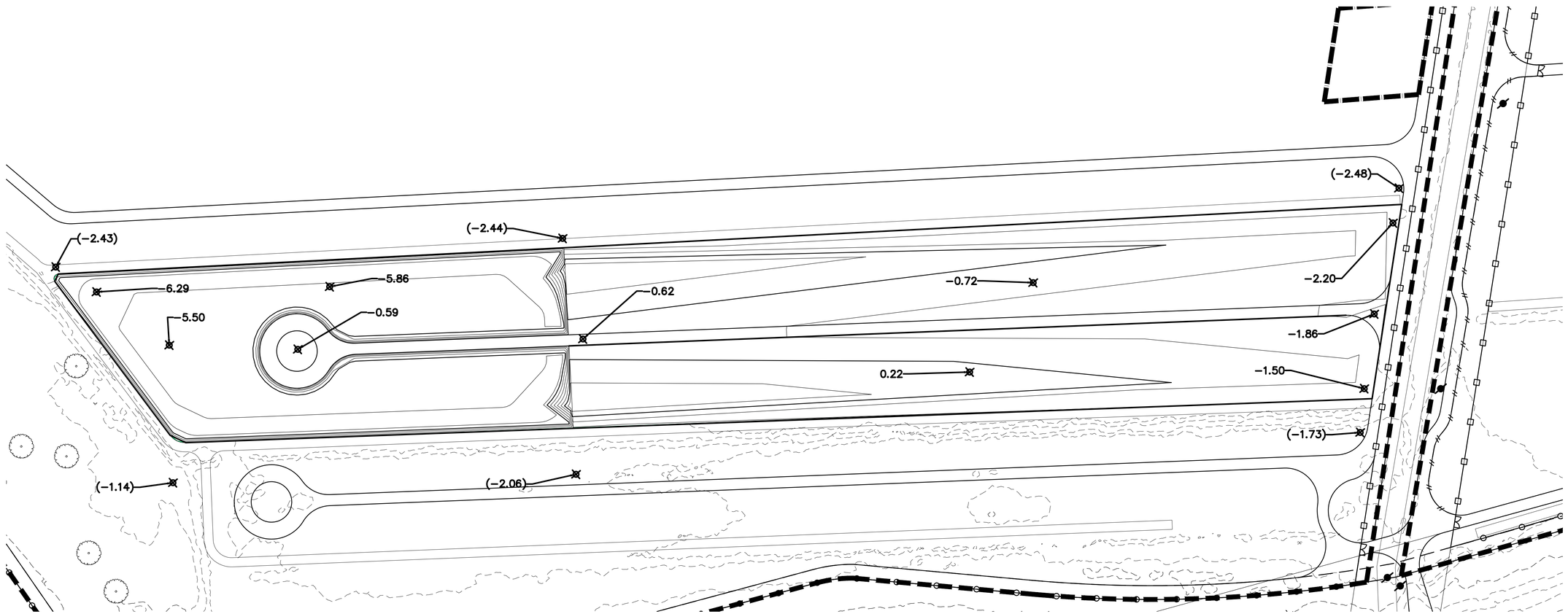
GRADING PLAN

SHEET ID
L-130

DRAFT 10% SUBMITTAL

NOTE

SEE L-131 FOR LEGEND AND NOTES



1 WETLAND ENLARGEMENT
SCALE: 1" = 150'-0"

SCALE: 1" = 60'-0"

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88 GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL): NAD 83 (2011) NAD83 ZONE 5 COMBINED FACTOR (CF): X.XXXXXXXXX

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EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

GRADING PLAN

SHEET ID
L-130

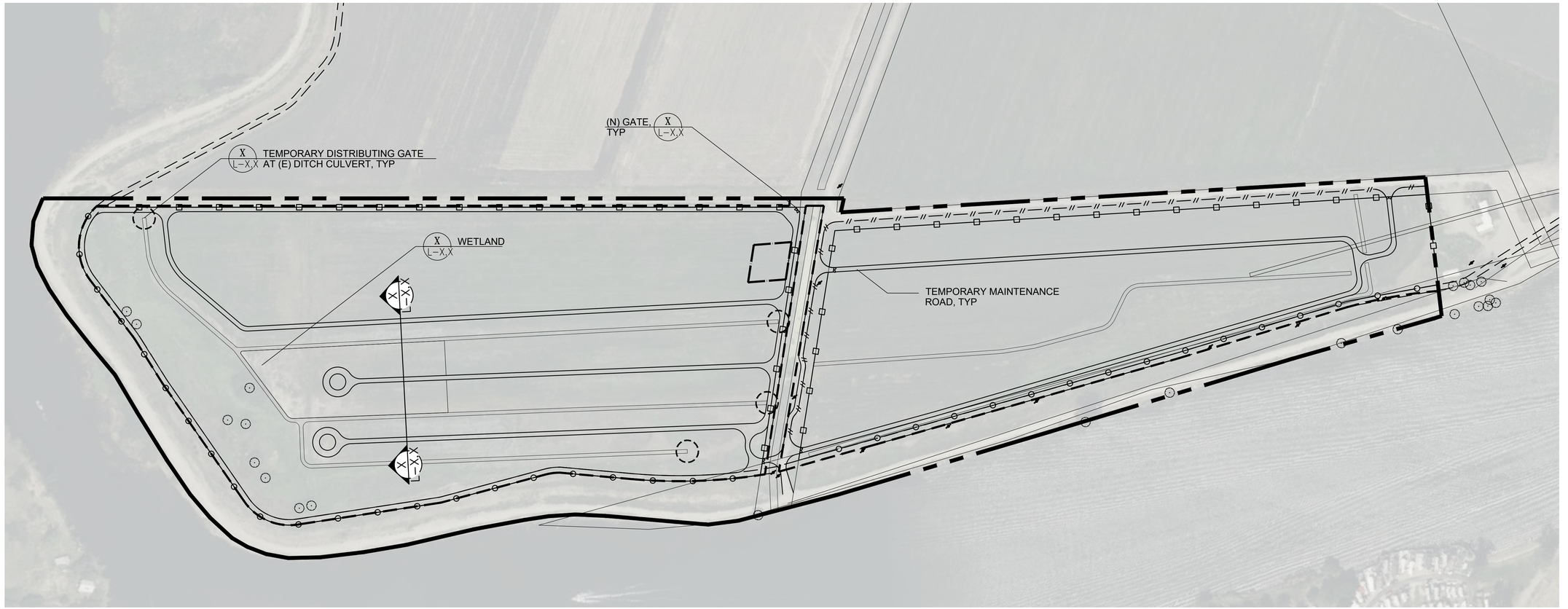
DRAFT 10% SUBMITTAL

NOTES

1. EXACT LOCATION OF ALL SITE FURNISHINGS AND EQUIPMENT TO BE FIELD APPROVED BY THE KO
2. CONTRACTOR TO REPLACE PERIMETER BEAVER FENCE WITH DEER FRIENDLY FENCE AT END OF PLANT ESTABLISHMENT PERIOD

LEGEND

- BEAVER FENCE — X / L–X.X
- DEER FRIENDLY FENCE — X / L–X.X
- TEMPORARY ROPE FENCE BARRIER — X / L–X.X



Feet

SCALE: 1" = 150'-0"

1 PLAN: LONGITUDINAL MITIGATION SITE
SCALE: 1" = 150'-0"

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88 GEOID 12B
ELEVATION DATUM (HORIZONTAL CONTROL): NAD 83 (2011) CA SPCS ZONE 5 COMBINED FACTOR (CF): X.XXXXXXXXX

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EXHIBIT A: LOWER SAN JOAQUIN RIVIER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT: SAN JOAQUIN COUNTY, CA

DETAIL REFERENCE PLAN

SHEET ID
L-140

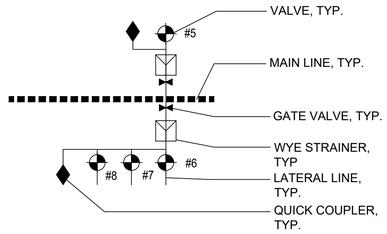
DRAFT 10% SUBMITTAL

LATERAL PIPING SIZE SCHEDULE

GPM	PIPE SIZE (NOMINAL SCH 40 PVC)
8 OR LESS	3/4" Ø
13	1" Ø
23	1 1/4" Ø
32	1 1/2" Ø
53	2" Ø
74	2 1/2" Ø
116 OR MORE	3" Ø

NOTE:
IRRIGATION PIPING DOWNSTREAM OF THE REMOTE CONTROL UNIT SHALL BE SIZED PER THE CHART ABOVE AND NOT INDICATED ON THE PLAN DRAWINGS. REFER TO THE IRRIGATION LEGEND FOR SPRINKLER FLOW RATES (GPM). NO PIPING DOWNSTREAM OF THE REMOTE CONTROL VALVE TO THE SPRINKLER SHALL BE SIZED SMALLER THAN THE SPRINKLER THREADED INLET SIZE.

TYPICAL VALVE DIAGRAM



LATERAL REMOTE CONTROL VALVE SIZING

GPM (MAX)	RCV SIZE
25	1"
60	1 1/2"
90	2"
175	3"

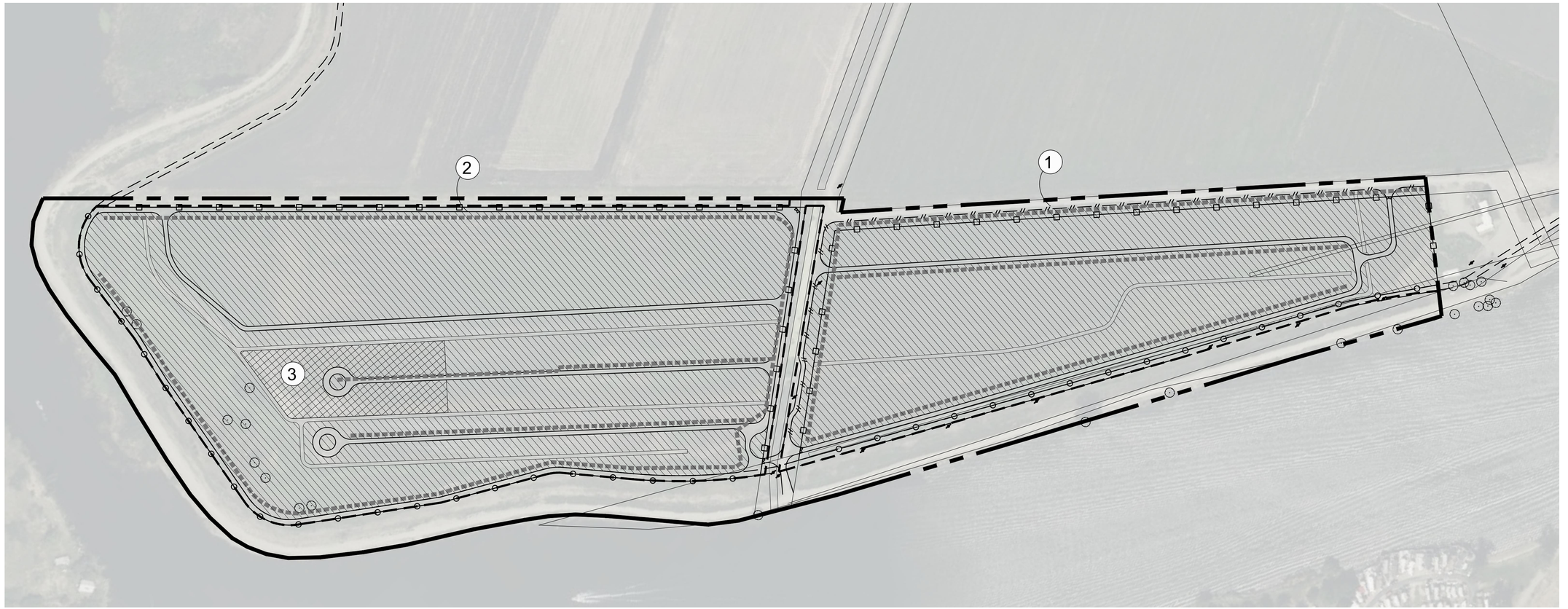
NOTE:
THE LATERAL RCV SIZES ARE BASED ON THE CHART BELOW FOR APPROX LOSS OF 3.5 PSI THROUGH THE REMOTE CONTROL VALVE (GLOBE PATTERN)

LEGEND

- MAINLINE
- WETLAND IRRIGATION
- RIPARIAN IRRIGATION
- (X) FIELD NUMBER

NOTE

1. IRRIGATION SYSTEM SHALL MEET THE PERFORMANCE SPECIFICATIONS REQUIRED, REFER TO PERFORMANCE WORK STATEMENT.
2. AREA WITH PLANTINGS REQUIRING IRRIGATION ARE SHOWN HATCHED.
3. UTILITY INFORMATION PROVIDED IS MEANT AS A GUIDE AND NOT MEANT TO BE A SUBSTITUTE FOR ACCURATE UTILITY LOCATION DATA. CONTRACTOR SHALL BE RESPONSIBLE FOR DAMAGE TO EXISTING INFRASTRUCTURE AS A RESULT OF WORK DONE DURING THE LENGTH OF THE CONTRACT.
4. CONTRACTOR TO PROVIDE TEMPORARY POWER SOURCE FOR THE IRRIGATION SYSTEM.
5. SEE PWS FOR FURTHER INFORMATION CONCERNING THE IRRIGATION SYSTEM. THIS INFORMATION IS PROVIDED FOR THE CONVENIENCE OF THE CONTRACTOR. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL INFORMATION CONCERNING EXISTING IRRIGATION AND UTILITIES.
6. NEW IRRIGATION SYSTEM SHOWN ON PLANS IS DIAGRAMMATIC AND DOES NOT SHOW EXACT LOCATIONS OF NEW FACILITIES. EXCLUDING THE POC, SUPPLY. INSTALL SYSTEM COMPONENTS (MAIN LINES, VALVES, ETC) PARALLEL TO AND AS CLOSELY AS POSSIBLE TO CURBS, HEADERS, OR PAVING EDGES WITHIN PLANTED AREAS, UON.
7. PROVIDE IRRIGATION CROSSOVERS FOR ALL WORK THAT GOES BENEATH OR THROUGH ANY BUILT FEATURES OR PATHS OF TRAVEL (ROADS, SIDEWALKS, WALLS, DITCHES, GUTTERS, AND OTHER BARRIERS), U.O.N. CROSSOVERS TO BE 8" (MIN.) HDPE, BURIED 40-50" BELOW FG/EG, TO INCLUDE MAIN LINE STUB UPS IN #5 PULL BOXES AT BOTH ENDS OF THE CROSSOVER, TO BE ANCHORED TO REINFORCED CONCRETE THRUST BLOCKS (MIN 2 CF) AT TURNS, AND EXTEND A MIN. OF 24" INTO PLANTING AREAS.



Feet

SCALE: 1" = 150'-0"

1 PLAN: LONGITUDINAL MITIGATION SITE
SCALE: 1" = 150'-0"

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL):
NAD 83 (2011)
CA SPCS ZONE 5,
COMBINED FACTOR (CF): X.XXXXXXXXX

US Army Corps of Engineers®

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SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
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EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

IRRIGATION PLAN

SHEET ID
L-150

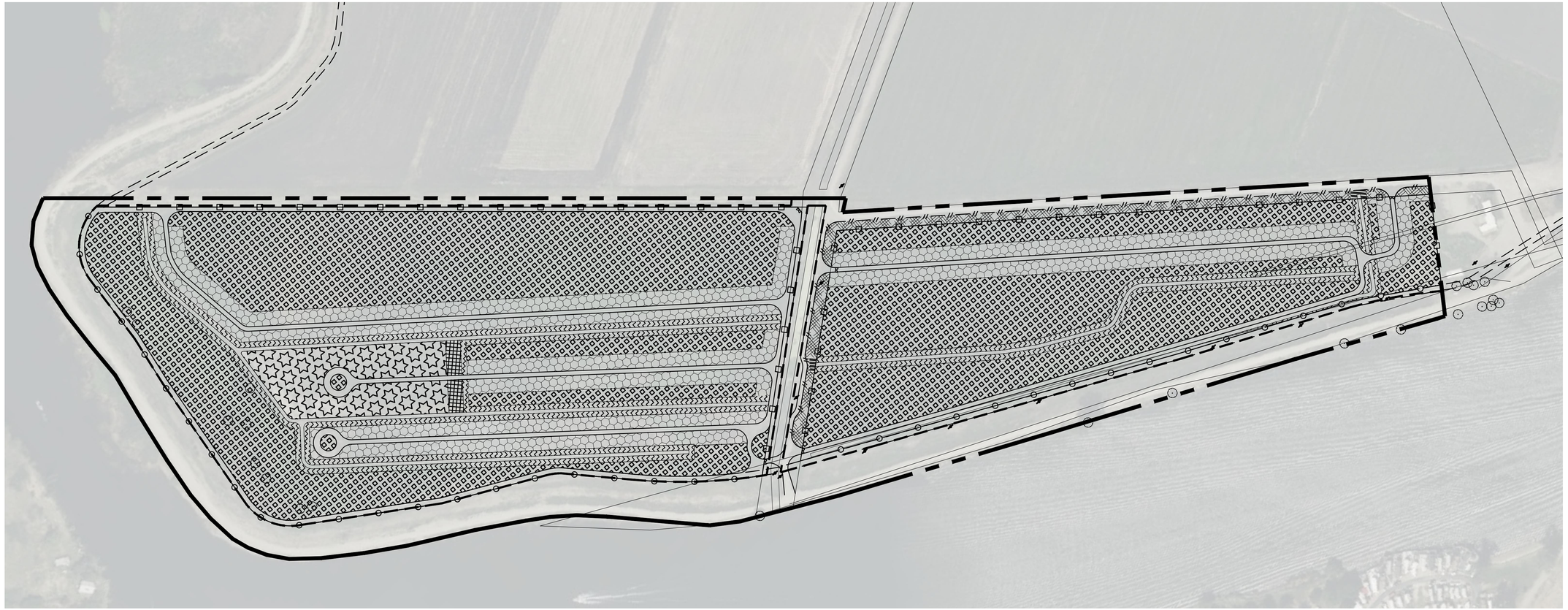
DRAFT 10% SUBMITTAL

LEGEND

- RIPARIAN INTERIOR
- RIPARIAN PERIMITER
- RIPARIAN DITCH PERIMETER
- WETLAND EDGE
- RIPARIAN SCRUB EASEMENT
- RIPARIAN SCRUB, DITCH EDGE
- WETLAND

NOTES

1. SEE L-152 FOR PLANTING SCHEDULE
2. EXACT LOCATION OF PLANTS TO BE FIELD APPROVED BY THE KO.
3. PLANT GROUP BOUNDARIES TO BE MARKED AND STAKED BY CONTRACTOR, IN COORDINATION WITH AND APPROVED BY THE KO.
4. SET BACK CENTER OF PLANTS A MIN OF 2'-0" MIN WHERE ADJACENT TO UNPLANTED AREAS, U.O.N.
5. LAYOUT PLANT SPECIES IN GROUPS OF 3 MIN, 9 MAX. ALTERNATE SPECIES GROUPINGS IN LONGITUDINAL AND LATITUDINAL DIRECTIONS. AT GROUPINGS LARGER THAN 3, GROUP IN FACTORS OF 3.



Feet

SCALE: 1" = 150'-0"

1 PLAN: LONGITUDINAL MITIGATION SITE
SCALE: 1" = 150'-0"

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL):
NAD 83 (2011)
CA SPCS ZONE 5,
COMBINED FACTOR (CF): X.XXXXXXXXX

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SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

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EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

PLANTING PLAN

SHEET ID
L-160

DRAFT 10% SUBMITTAL

				Zone Name	Quantity	Zone Name	Quantity	Zone Name	Quantity	Zone Name	Quantity	Zone Name	Quantity	
	Scientific Name	**Common Name**	**Size/Type**	Riparian Interior		Riparian Perimeter		Riparian Ditch Perimeter		Riparian Scrub (Easement)		Riparian Scrub, Ditch Edge (Easement)		**TOTALS**
Canopy			Acreage	27.170		9.620		4.075		1.186		0.032		42.084
			spacing, feet OC (15'-0" rows)	15		15		5		15		15		
			density, plants/acre	250		250		250		250		250		
	Acer negundo	Box elder	Treepot 4	9%	612	2%	48		-		-		-	660
	Alnus rhombifolia	White alder	Treepot 4	3%	204	2%	48		-		-		-	252
	Cercis occidentalis	Western Redbud	Treepot 4	3%	204	7%	168		-		-		-	372
	Fraxinus latifolia	Oregon ash	Treepot 4	9%	612	8%	192		-		-		-	804
	Juglans californica	S. California Black Walnut	Treepot 4	3%	204	7%	168		-		-		-	372
	Juglans hindsii	N. California Black Walnut	Treepot 4	3%	204	2%	48		-		-		-	252
	Platanus racemosa	Sycamore	Treepot 4	5%	339	8%	192		-		-		-	531
	Populus fremontii	Cottonwood	Treepot 4	5%	339	2%	48		-		-		-	387
	Quercus lobata	Valley oak	Treepot 4	5%	339	2%	48		-		-		-	387
	Salix exigua	Sandbar willow	Treepot 4		-		-	10%	102		-		-	102
	Salix gooddingii	Goodding's willow	Treepot 4	5%	339	10%	240	10%	102		-		-	681
	Salix laevigata	Red willow	Treepot 4		-		-	10%	102		-		-	102
	Salix lasiolepis	Arroyo willow	Treepot 4		-		-	10%	102		-		-	102
	Salix lucida	Shining willow	Treepot 4		-		-	10%	102		-		-	102
			totals	50%		50%		50%		0%		0%		5,106
			spacing, feet OC (15'-0" rows)	6		6		5		6		6		
			density, plants/acre	490		490		490		490		490		
Midstory	*Atriplex lentiformis*	Big Saltbush	Deepot 40	6%	798	6%	282		-	6%	36		-	1,116
	Baccharis pilularis	Coyote brush	Deepot 40	6%	798	6%	282		-	6%	36		-	1,116
	Baccharis salicifolia	Mule fat	Deepot 40	6%	798	6%	282	10%	201	6%	36	10%	3	1,320
	Cephalanthus occidentalis	Buttonbush	Deepot 40	6%	798	6%	282	10%	201	6%	36	10%	3	1,320
	Frangula californica	Coffeeberry	Deepot 40	6%	798	6%	282		-	6%	36		-	1,116
	Rosa californica	Rose	Deepot 40	5%	666	5%	237		-	5%	30		-	933
	Rubus ursinus	Blackberry	Deepot 40	8%	1,065	8%	378	10%	201	8%	45	10%	3	1,692
	Sambucus mexicana	Elderberry	Deepot 40	10%	1,332	10%	471		-	10%	57		-	1,860
	Toxicondendron diversilobum	Poison oak	Deepot 40	2%	267	2%	93		-	2%	12		-	372
Understory	*Artemesia douglassiana*	Mugwort	Deepot 40	10%	1,332	10%	471	24%	480	10%	57	24%	3	2,343
	Carex barbarae	Santa Barbara sedge	Deepot 40	5%	666	5%	237	20%	399	5%	30	20%	3	1,335
	Diplacus aurantiacus	Sticky Monkeyflower	Deepot 40	2%	267	2%	93	10%	201	2%	12	10%	3	576
	Epilobium canum	California Fuchsia	Deepot 40	3%	399	3%	141		-	3%	18		-	558
	Epilobium ciliatum	Northern Willow Herb	Deepot 40	2%	267	2%	93	10%	201	2%	12	10%	3	576
	Euthamia occidentalis	Western Goldenrod	Deepot 40	5%	666	5%	237		-	5%	30		-	933
	Helenium puberulum	Sneezeweed	Deepot 40	2%	267	2%	93		-	2%	12		-	372
	Helianthus californicus	California Sunflower	Deepot 40	2%	267	2%	93		-	2%	12		-	372
	Oenothera hookerii	Evening primrose	Deepot 40	5%	666	5%	237		-	5%	30		-	933
Vines	*Clematis lingustifolia*	Clematis	Deepot 40	3%	399	3%	141	2%	39	3%	18	2%	-	597
	Lonicera hispidula	California Honeysuckle	Deepot 40	3%	399	3%	141	2%	39	3%	18	2%	-	597
	Vitis californica	Grape	Deepot 40	3%	399	3%	141	2%	39	3%	18	2%	-	597
			totals	100%		100%		100%		100%		100%		20,634
														25,740

1 RIPARIAN PLANTING SCHEDULE
SCALE: N/A

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88 GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL): NAD 83 (2007) CA SPCS ZONE 2 COMBINED FACTOR (CF): X.XXXXXXXXX

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EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT: SAN JOAQUIN COUNTY, CA

PLANTING PLAN

SHEET ID
L-160

DRAFT 10% SUBMITTAL

Scientific Name	Common Name	Size/Type	Zone Name	Quantity	Zone Name	Quantity	TOTALS
			Wetland		Wetland Edge		
		Acreage	1.995		0.168		2.163
		spacing, feet OC (6'-0" rows)	6		6		
		density, plants/acre	1210		1210		
Carex aquatilis	Water sedge	Treeband	5%	120		-	120
Baccharis glutinosa	Salt Marsh Baccharis	Deepot 40		-	15%	30	30
Baccharis salicifolia	Mulefat	Deepot 40		-	15%	30	30
Bolboschoenus maritimus	Alkali Bulrush	Treeband	5%	120		-	120
Bolboschoenus robustus	Sturdy bullrush	Treeband	5%	120		-	120
Cyperus eragrostis	Umbrella Sedge	Treeband		-	15%	30	30
Eleocharis macrostachya	Common Spikerush	Treeband	5%	120		-	120
Hydrocotyle umbellata	Marsh pennywort	Treeband	5%	120		-	120
Hydrocotyle verticillata	Whorled marsh pennywort	Treeband	5%	120		-	120
Juncus acuminatus	Sharp-fruited Rush	Treeband	10%	240	5%	9	249
Juncus effusus	Soft rush	Treeband	10%	240	5%	9	249
Juncus balticus	Baltic Rush	Treeband	10%	240	5%	9	249
Juncus patens	Gray Rush	Treeband	10%	240	5%	9	249
Juncus xiphioides	Iris Leaf Rush	Treeband	7%	168		-	168
Sagittaria montevidensis ssp. Calycina	Montevideo arrowhead	Treeband	2%	48		-	48
Sagittaria latifolia	Wappato	Treeband	2%	48		-	48
Sagittaria montevidensis	Montevideo arrowhead	Treeband	2%	48		-	48
Sagittaria sanfordii	Valley arrowhead	Treeband	2%	48		-	48
Schoenoplectus acutus	Hardstem bulrush	Treeband	3%	72		-	72
Schoenoplectus americanus	Chairmaker's Bulrush	Treeband	3%	72		-	72
Schoenoplectus californicus	California bulrush	Treeband	3%	72		-	72
Sparganium erectum	Simplestem bur reed	Treeband	3%	72		-	72
Sparganium eurycarpum	Broadfruit bur reed	Treeband	3%	72		-	72
		totals	100%		65%		2,526
							2,526

1 WETLAND PLANTING SCHEDULE
SCALE: N/A

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88 GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL): NAD 83 (2007) CA SPCS ZONE 2 COMBINED FACTOR (CF): X.XXXXXXXXX

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MARK	DESCRIPTION	DATE

DESIGNED BY: B.J.
DRAWN BY: B.J.
CHECKED BY: T.S.
SUBMITTED BY: B.J.
SIZE: ANSI D
ISSUE DATE: XX/XX/2023
SOLICITATION NO.:
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

PLANTING PLAN

SHEET ID
L-160

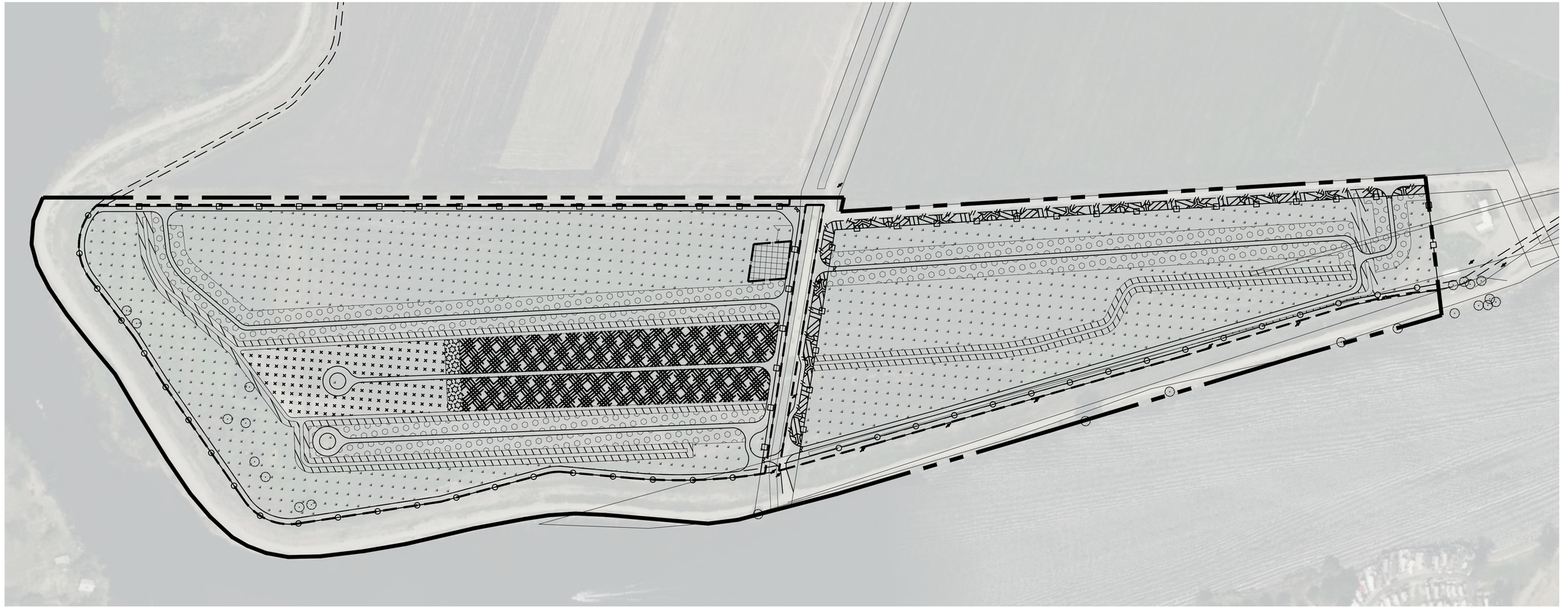
DRAFT 10% SUBMITTAL

LEGEND

- EROSION CONTROL TYPE (2) SEED MIX 5
- EROSION CONTROL TYPE (4) SEED MIX 3
- EROSION CONTROL TYPE (4) SEED MIX 2
- EROSION CONTROL TYPE (4) SEED MIX 3
- EROSION CONTROL TYPE (3) SEED MIX 1
- EROSION CONTROL TYPE (3) SEED MIX 3
- EROSION CONTROL TYPE (2) SEED MIX 4
- EROSION CONTROL TYPE (1) SEED MIX 2
- EROSION CONTROL TYPE (2) SEED MIX 5

NOTES

SEE L-171 FOR EROSION CONTROL LEGEND AND NOTES



Feet

SCALE: 1" = 150'-0"

1 PLAN: LONGITUDINAL MITIGATION SITE

SCALE: 1" = 150'-0"

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL):
NAD 83 (2011)
CA SPCS ZONE 5,
COMBINED FACTOR (CF): X.XXXXXXXXX

US Army Corps of Engineers®

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U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
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SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

EROSION CONTROL PLAN

SHEET ID

L-170

DRAFT 10% SUBMITTAL

EROSION CONTROL TYPE (1)

ITEM	MATERIAL	MATERIAL TYPE	APPLICATION RATE	DEPTH	REMARKS
DRILL SEED	SEED	SEE LEGEND	SEE SEED TABLE		
HYDROMULCH	FIBER	ALTERNATE	2000 LB/ACRE	-	
	TACKIFIER	PSYLLIUM	200 LB/ACRE	-	
COMPOST SOCK	COTTON, JUTE, BURLAP, OR COIR	8" TO 10" DIA			SEE NOTES

EROSION CONTROL TYPE (2)

ITEM	MATERIAL	MATERIAL TYPE	APPLICATION RATE	DEPTH	REMARKS
DECOMPACT	EXISTING GRADE	DECOMPACT		6"-8"	
ROUGHENING	TRACK-WALK				
DRILL SEED	SEED	SEED MIX 6	SEE SEED TABLE		
HYDROMULCH	FIBER	ALTERNATE	2000 LB/ACRE	-	
	TACKIFIER	PSYLLIUM	200 LB/ACRE	-	

EROSION CONTROL TYPE (3)

ITEM	MATERIAL	MATERIAL TYPE	APPLICATION RATE	DEPTH	REMARKS
DECOMPACT	EXISTING GRADE	DECOMPACT		6"-8"	
ROUGHENING	TRACK-WALK				
DRILL SEED	SEED	SEED MIX 2	SEE SEED TABLE		
HYDROMULCH	FIBER	ALTERNATE	2000 LB/ACRE	-	
	TACKIFIER	PSYLLIUM	200 LB/ACRE	-	
COMPOST SOCK	COTTON, JUTE, BURLAP, OR COIR	8" TO 10" DIA			SEE NOTES

EROSION CONTROL TYPE (4)

ITEM	MATERIAL	MATERIAL TYPE	APPLICATION RATE	DEPTH	REMARKS
DRILL SEED	SEED	SEED MIX 2	SEE SEED TABLE		

SEED MIX TYPE (1): RIPARIAN, DITCH PERIMETER

SCIENTIFIC NAME	COMMON NAME	PERCENT GERMINATION (MINIMUM)	POUNDS PURE LIVE SEED PER ACRE (SLOPE MEASUREMENT)
Achillea millefolium	Western Yarrow	56%	0.1
Artemesia douglasiana	Mugwort	33%	0.0
Carex praegracilis	California Field Sedge	86%	0.3
Elymus glaucus	Blue Wild Rye	50%	3.1
Elymus triticoides	Creeping Wildrye	43%	2.8
Epilobium ciliatum	Northern Willow Herb	39%	0.02
Euthamia occidentalis	Western Goldentop - Goldenrod	37%	0.2
Festuca microstachys	Small Fescue	53%	2.0
Grindelia camporum	Gum Plant	46%	0.9
Hordeum brachyantherum	Meadow Barley	60%	4.4
Trifolium wormskioldii	Cows Clover	88%	0.4

SEED MIX TYPE (2): RIPARIAN, INTERIOR

SCIENTIFIC NAME	COMMON NAME	PERCENT GERMINATION (MINIMUM)	POUNDS PURE LIVE SEED PER ACRE (SLOPE MEASUREMENT)
Artemesia douglasiana	Mugwort	33%	0.2
Carex barbarae	Valley Sedge	33%	0.6
Elymus glaucus	Blue Wild Rye	50%	3.1
Elymus triticoides	Creeping Wildrye	43%	2.8
Festuca microstachys	Small Fescue	53%	2.9
Lupinus albifrons	Silver Lupine	XX%	2.4
Lupinus arboreus	Bush Lupine	53%	2.8
Trifolium wormskioldii	Cows Clover	88%	1.3

SEED MIX TYPE (3): RIPARIAN, PERIMETER

SCIENTIFIC NAME	COMMON NAME	PERCENT GERMINATION (MINIMUM)	POUNDS PURE LIVE SEED PER ACRE (SLOPE MEASUREMENT)
Achillea millefolium	Western Yarrow	56%	0.1
Asclepias fascicularis	Narrow Leaf Milkweed	50%	2.3
Asclepias speciosa	Showy Milkweed	50%	2.2
Clarkia purpurea	Purple Clarkia	60%	0.1
Clarkia unguiculata	Elegant Clarkia	40%	0.1
Elymus glaucus	Blue Wild Rye	50%	3.1
Festuca microstachys	Small Fescue	53%	4.1
Lupinus bicolor	Miniature Lupine	56%	1.5
Lupinus formosus	Summer Lupine	51%	3.1
Trifolium wormskioldii	Cows Clover	88%	0.9

SEED MIX TYPE (4): WETLAND

SCIENTIFIC NAME	COMMON NAME	PERCENT GERMINATION (MINIMUM)	POUNDS PURE LIVE SEED PER ACRE (SLOPE MEASUREMENT)
Bolboschoenus maritimus	Alkali Bulrush	70%	2.7
Bolboschoenus robustus	Sturdy bullrush	95%	3.0
Eleocharis macrostachya	Common Spikerush	46%	0.4
Juncus balticus	Artic Rush	40%	0.03
Juncus effusus	Soft Rush	40%	0.02
Juncus patens	Gray Rush	XX%	0.02
Juncus xiphioides	Iris Leaf Rush	40%	0.03
Schoenoplectus acutus	Hardstem bulrush	40%	0.9
Schoenoplectus americanus	Chairmaker's Bulrush	40%	1.2
Schoenoplectus californicus	California bulrush	30%	0.8

SEED MIX TYPE (5): WETLAND EDGE

SCIENTIFIC NAME	COMMON NAME	PERCENT GERMINATION (MINIMUM)	POUNDS PURE LIVE SEED PER ACRE (SLOPE MEASUREMENT)
Carex praegracilis	California Field Sedge	86%	0.3
Erythranthe guttata	Seep Monkey Flower	90%	0.01
Heliotropium curassavicum	Wild Heliotrope	40%	0.5
Lasthenia fremontii	Fremont's goldfields	91%	0.2
Sisyrinchium bellum	Blue-Eyed Grass	50%	1.5
Grindelia camporum	Gum Plant	46%	0.9
Festuca microstachys	Small Fescue	53%	2.0

NOTES

1. FINAL LAYOUT TO BE FIELD APPROVED BY KO.
3. DECOMPACTION OF SOIL SURFACES INVOLVES LOOSENING COMPACTED SOILS BY PULLING SUBSOILING EQUIPMENT IN SUCCESSIVE PASSES IN APPROXIMATELY PERPENDICULAR DIRECTIONS. DECOMPACT TO THE DEPTH AND LOCATIONS INDICATED ON DRAWINGS.
4. DO NOT DECOMPACT SLOPES GREATER THAN 3:1 (HORIZONTAL:VERTICAL). FOR SLOPES GREATER THAN 3:1, SCARIFY TO A DEPTH OF 2", U.O.N
5. INSTALL FIBER ROLLS AT: NEW MAINTENANCE ROADS, THE SITE PERIMETER, THE TOP OF SLOPES, THE TOE OF SLOPES (EXCLUDING DITCHES AND WETLANDS), GRADE BREAKS, THE BORDERS OF PLANTED AREAS, AND AT ALL DISTURBED SOIL AREAS (PER DIRECTION OF THE KO). FOR FIBER ROLLS TO BE PLACED PARALLEL WITH CONTOURS, INSTALL AT EQUAL INTERVALS FOR THE FOLLOWING SLOPE CONDITIONS:
   (A) 10 FEET APART FOR SLOPES GREATER THAN 2:1 (HORIZONTAL:VERTICAL)
   (B) 15 FEET APART FOR SLOPES GRATER THAN 2:1 TO 4:1 (HORIZONTAL:VERTICAL)
   (C) 20 FEET APART FOR SLOPES GREATER THAN 4:1 TO 10:1 (HORIZONTAL:VERTICAL)
   (D) 50 FEET APART FOR SLOPES FLATTER THAN 10:1 (HORIZONTAL:VERTICAL)

ELEVATION DATUM (VERTICAL CONTROL): NAVD 88
GEOID 12B

ELEVATION DATUM (HORIZONTAL CONTROL): NAD 83
NAVD83 2011
CA ZONE 5
COMBINED FACTOR (CF): X.XXXXXXXXX

US Army Corps of Engineers®

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U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

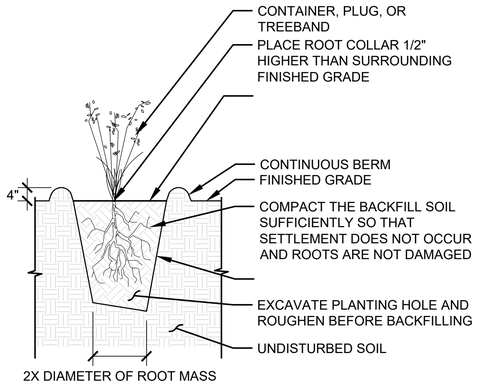
IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVIER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT- SAN JOAQUIN COUNTY, CA

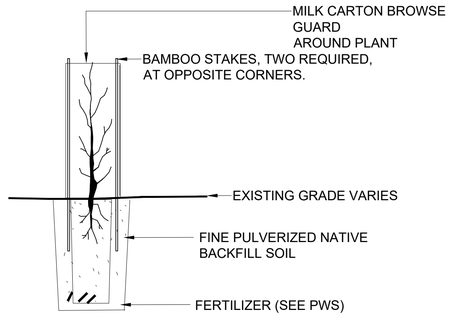
EROSION CONTROL LEGEND

SHEET ID
L-171

DRAFT 10% SUBMITTAL



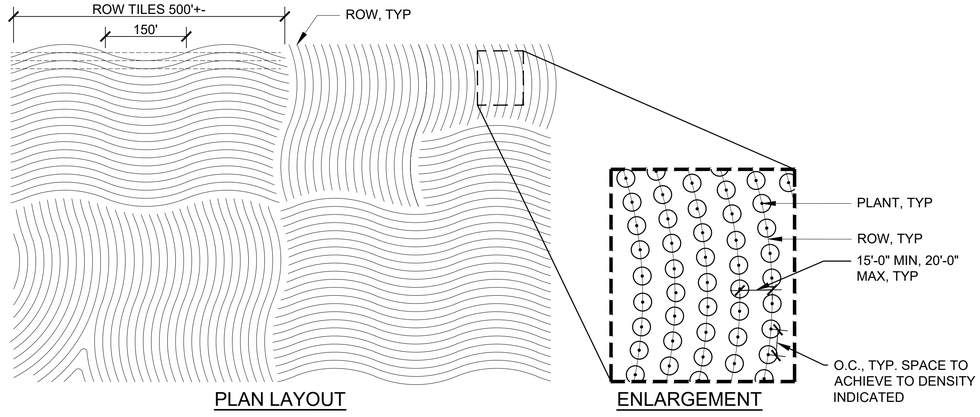
1E CONTAINER PLANTING
SCALE: NTS



NOTES:

1. SET PLANTS ROOT CROWN 1/4" ABOVE EXISTING GRADE.
2. PLANTING STOCK, TREEBAND AND DEEPOT 40
3. PLANTING PIT A MINIMUM OF TWO TIMES DIAMETER OF ROOTBALL. SCARIFY EDGES AND BOTTOM.

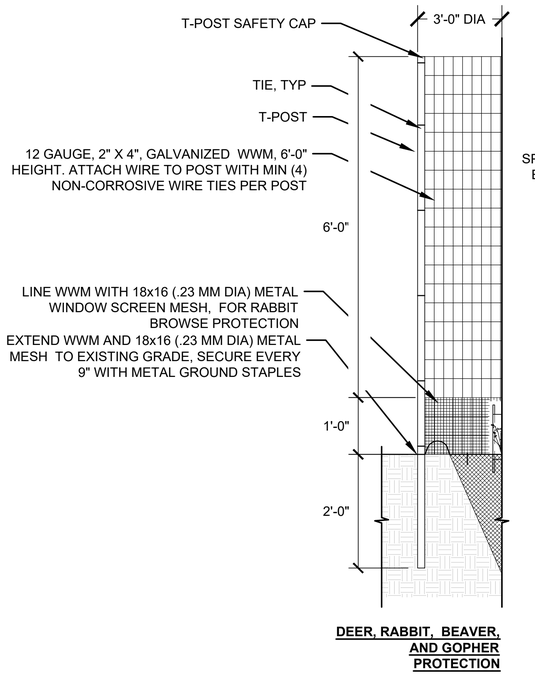
8E MILK CARTON BROWSE GUARD
SCALE: NTS

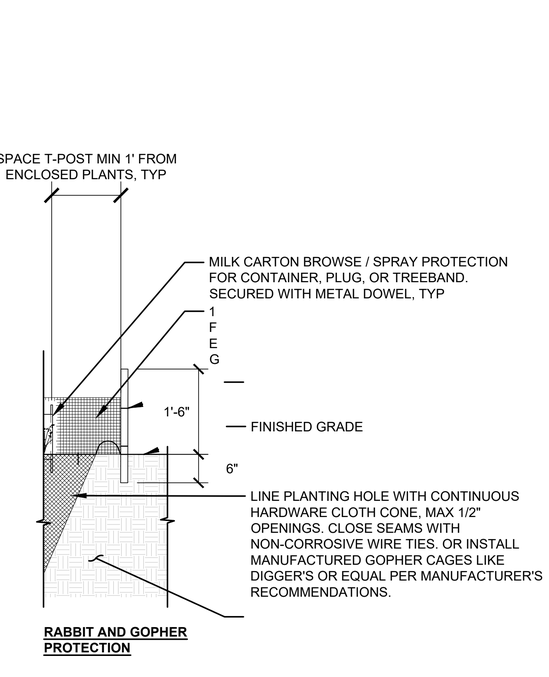


NOTES:

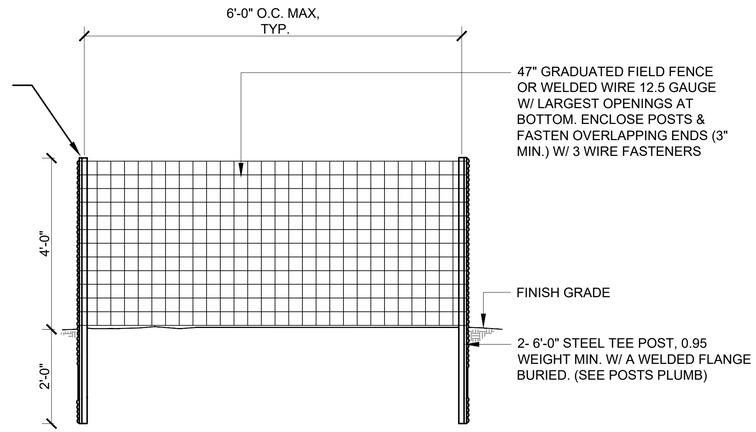
1. LAYOUT THE PLANTS IN CURVILINEAR ROWS. THE CURVES MUST BE SUFFICIENT SO THAT THE LINE OF SIGHT IS BLOCKED AT 150 FEET.
2. IN LARGE UNINTERRUPTED EXPANSES, ROTATE ROW TILES SO THAT THE ROWS DON'T EXTEND BEYOND 500 FEET IN LENGTH.
3. COORDINATE ROW LAYOUT WITH IRRIGATION SYSTEM.
4. EDGE OF PLANT PITS TO BE 24" MIN FROM EDGE OF SITE BOUNDARIES AND MAINTENANCE ROADS. KEEP TREE AND ELDERBERRY PLANT SPECIES A MINIMUM OF 20 FEET AWAY FROM BOUNDARY LINES AND MAINTENANCE ROADS.
5. SEE PLANT SCHEDULE FOR ROW SPACING. PLANTS MUST BE SPACED IN EACH ROW AT A DENSITY TO ACCOMMODATE PLANTS PER ACRE AS INDICATED IN THE SCOPE.
6. FLAG AND LAYOUT PLANT SPECIES IN THE FIELD PRIOR TO INSTILLATION. EXACT LOCATION OF PLANTS TO BE FIELD APPROVED BY KO PRIOR TO INSTILLATION.

1 PLANT LAYOUT - CURVILINEAR ROWS
SCALE: NTS





1A BROWSE GUARD
SCALE: NTS



7A BEAVER FENCE
SCALE: NTS

US Army Corps of Engineers®

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U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

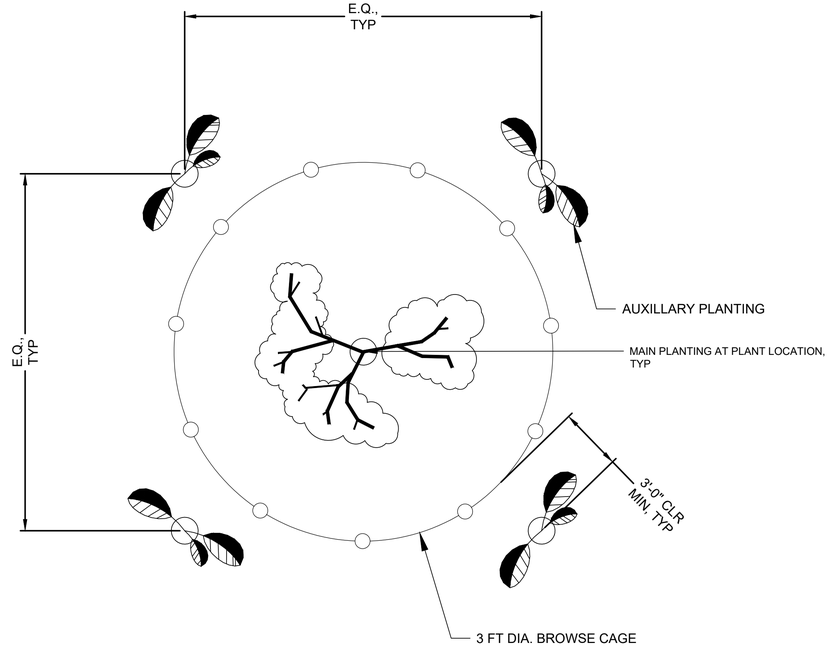
IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT: SAN JOAQUIN COUNTY, CA

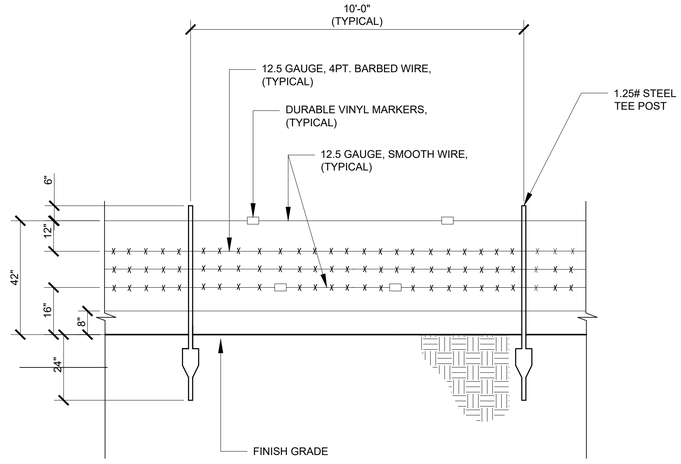
PLANTING AND EROSION CONTROL DETAILS

SHEET ID
L-500

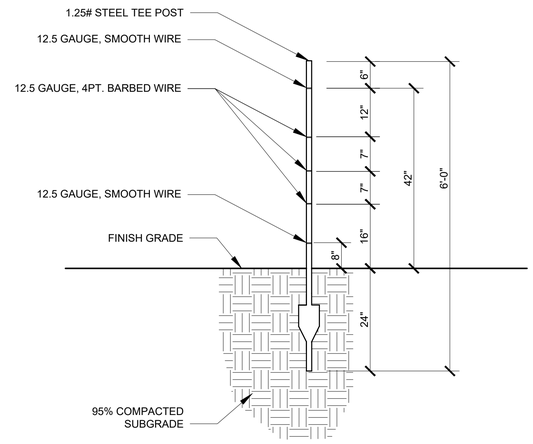
DRAFT 10% SUBMITTAL



B4 AUXILARY PLANTING
SCALE: NTS



ELEVATION

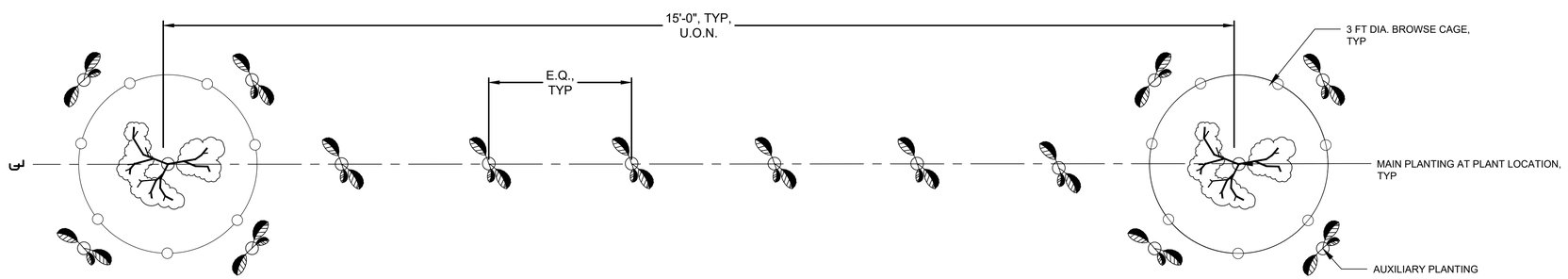


SECTION

NOTE:

MARKERS ARE TO BE MADE FROM WHITE "UNDERSILL" VINYL SIDING. CUT SIDING INTO 3" PIECES AND SNAP PIECES ONTO WIRE FENCING. FOR MARKERS ON SMOOTH FENCING, PREVENT MARKERS FROM SLIDING BY CRIMPING A FERRULE ONO EACH SIDE OF THE MARKER.

3 DEER FRIENDLY LIVESTOCK FENCE
SCALE: NTS



NOTE

FOR MORE INFORMATION, SEE AUXILIARY PLANTING DETAIL

A4 AUXILARY PLANTING AT BANK
SCALE: NTS

US Army Corps of Engineers®

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U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

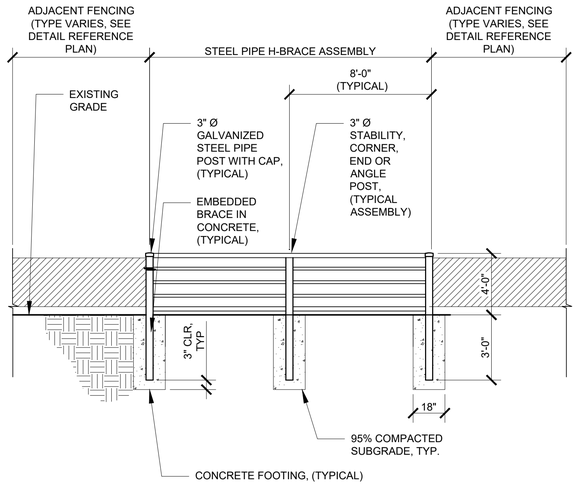
IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
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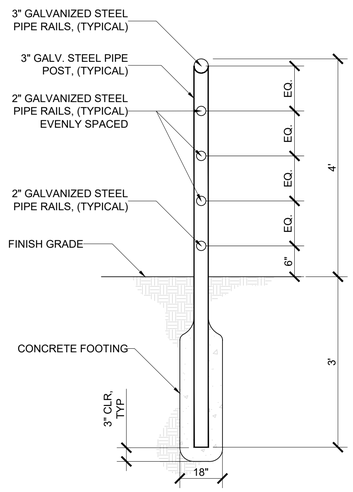
PLANTING AND EROSION CONTROL DETAILS

SHEET ID
L-501

DRAFT 10% SUBMITTAL



ELEVATION



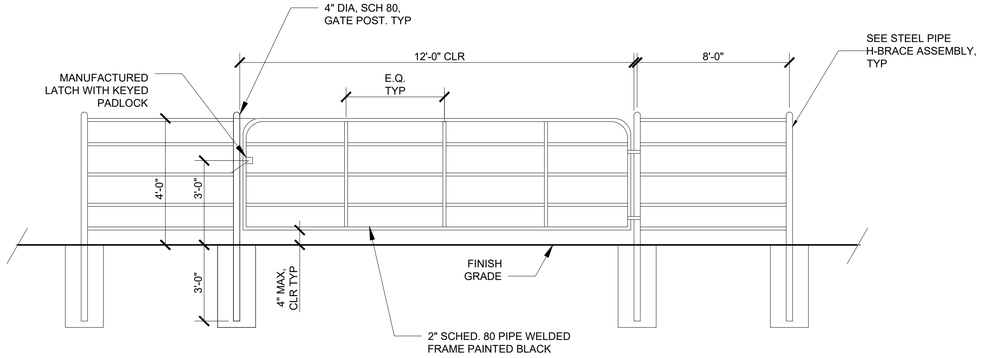
SECTION

NOTES:

1. PROVIDE HOT DIPPED GALVANIZED AND POWDER COATED SIGN POST, HARDWARE, AND ACCESSORIES. POWDER COAT COLOR: FOREST GREEN.
2. GRIND ALL JOINTS TO A SMOOTH FINISH. PREPARE AND FIELD PAINT WELDS AND ALL AREAS REQUIRING TOUCH UPS. COLOR TO MATCH POWDER COAT (PRIME AND PAINT 2 COATS MIN).
3. PROVIDE A STABILITY POST ASSEMBLY EVERY 200', IN CORNERS, IN OFFSET ALIGNMENTS WITH MORE THAN A 10 DEGREE CHANGE OF DIRECTION, AND AT GATE/END LOCATIONS.
4. POST ARE TO HAVE A 1" LEAN AGAINST THE DIRECTION OF FENCE PULL.
5. CAP ALL EXPOSED PIPE ENDS

1 STEEL PIPE H-BRACE ASSEMBLY WITH ADJACENT FENCING

SCALE: NTS

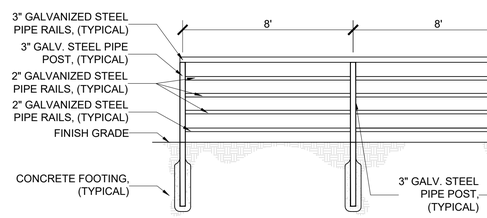


NOTES:

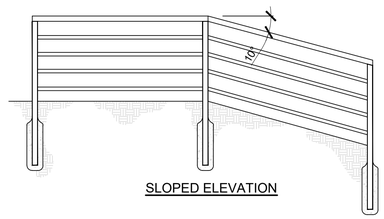
1. PROVIDE HOT DIPPED GALVANIZED AND POWDER COATED SIGN POST, HARDWARE, AND ACCESSORIES. POWDER COAT COLOR: FOREST GREEN.
2. GRIND ALL JOINTS TO A SMOOTH FINISH. PREPARE AND FIELD PAINT WELDS AND ALL AREAS REQUIRING TOUCH UPS. COLOR TO MATCH POWDER COAT (PRIME AND PAINT 2 COATS MIN).
3. PROVIDE A STABILITY POST ASSEMBLY EVERY 200', IN CORNERS, IN OFFSET ALIGNMENTS WITH MORE THAN A 10 DEGREE CHANGE OF DIRECTION, AND AT GATE/END LOCATIONS.
4. FILL GATE HINGE POST AND GATE STRIKE POST WITH CONCRETE.
5. GATE OPENING IS 12 FEET STANDARD, U.O.N.
6. CAP ALL EXPOSED PIPE ENDS.

2 STEEL PIPE LIVESTOCK GATE

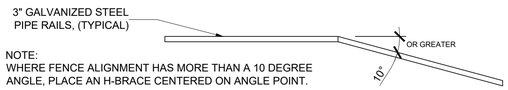
SCALE: NTS



ELEVATION



SLOPED ELEVATION



NOTE:
WHERE FENCE ALIGNMENT HAS MORE THAN A 10 DEGREE ANGLE, PLACE AN H-BRACE CENTERED ON ANGLE POINT.

PLAN VIEW

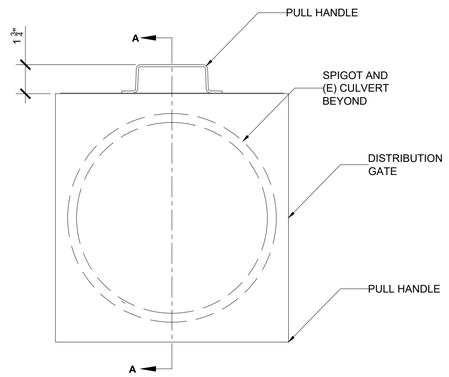
NOTE:
1. WHERE GROUND LEVEL HAS MORE THAN A 10 DEGREE DEFLECTION, PLACE AN H-BRACE CENTERED ON ANGLE POINT.
2. WELD AND GRIND ALL JOINTS, SANDBLAST, PRIME, AND PAINT ALL METAL OLIVE GREEN

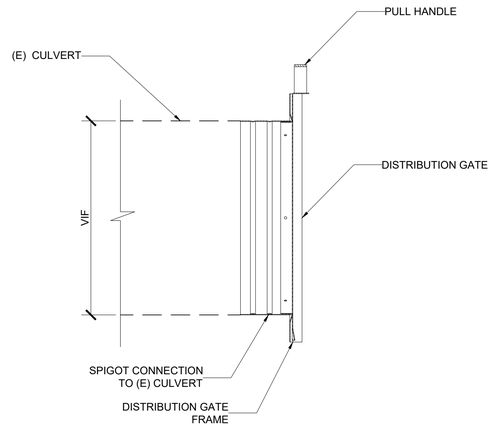
NOTES:

1. WHERE FENCE ALIGNMENT HAS MORE THAN A 10 DEGREE ANGLE, PLACE AN H-BRACE CENTERED ON ANGLE POINT.
2. WHERE GROUND LEVEL HAS MORE THAN A 10 DEGREE DEFLECTION, PLACE AN H-BRACE CENTERED ON ANGLE POINT.
3. GRIND ALL JOINTS TO A SMOOTH FINISH. PREPARE AND FIELD PAINT WELDS AND ALL AREAS REQUIRING TOUCH UPS. COLOR TO MATCH POWDER COAT (PRIME AND PAINT 2 COATS MIN).

3 STEEL PIPE H-BRACE ASSEMBLY AT SLOPES AND DEFLECTIONS

SCALE: NTS





NOTE:

ALL METAL WORK TO BE HOT DIPPED GALVANIZED, SEE PWS

4 DISTRIBUTION GATE AT (E) CULVERT

SCALE: NTS

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DESIGNED BY: B.J.
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CHECKED BY: T.S.
SUBMITTED BY: B.J.
SIZE: ANSI D
ISSUE DATE: XX/XX/2023
SOLICITATION NO.:
CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

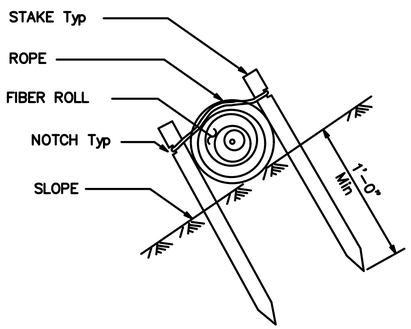
IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

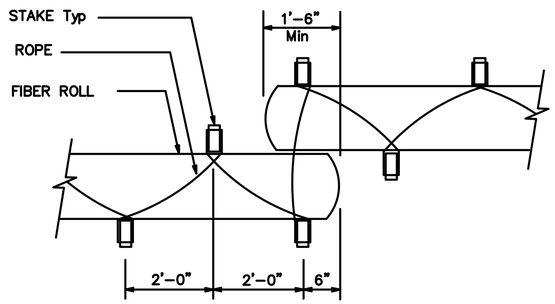
GATES AND H-BRACE DETAILS

SHEET ID
L-502

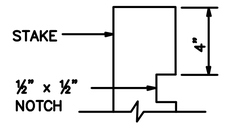
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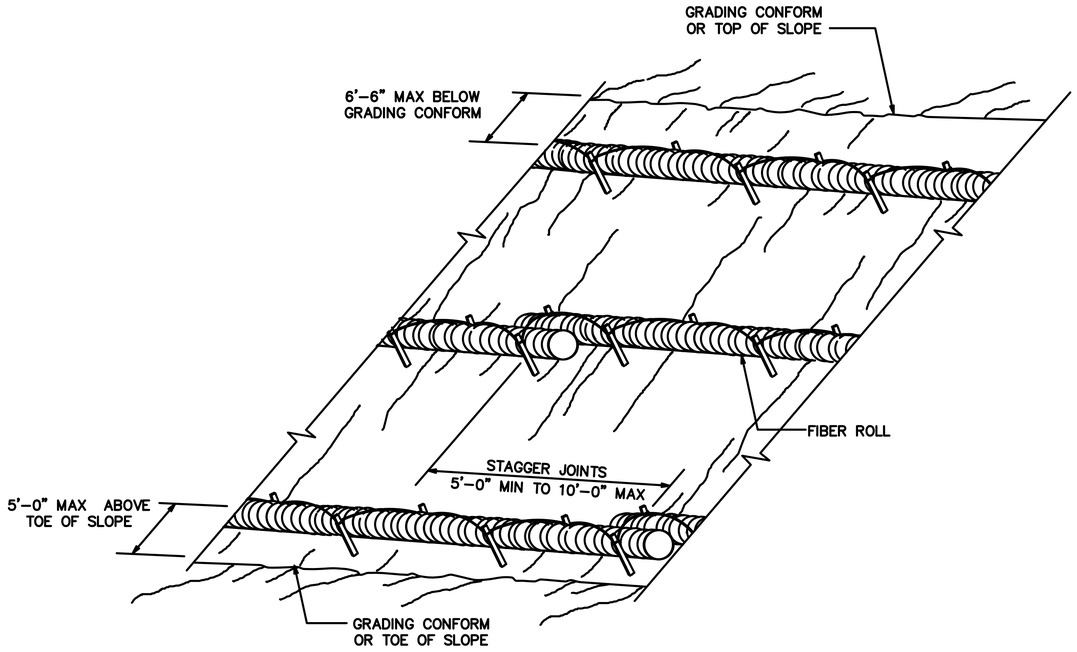
F1 FIBER ROLL SECTION
SCALE: NTS



F5 FIBER ROLL OVERLAP PLAN
SCALE: NTS



F8 FIBER ROLL, STAKE NOTCH ENLARGEMENT
SCALE: NTS

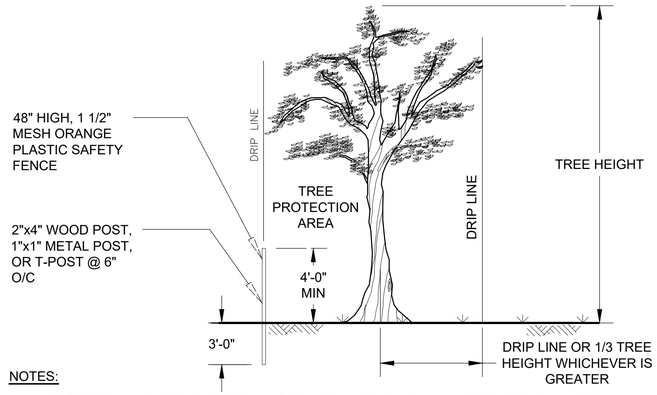


NOTE:

1. INSTALL FIBER ROLLS AT: THE SITE PERIMETER AND THE EDGE OF ALL WORK AREAS; THE TOP OF SLOPES, THE TOE OF SLOPES (EXCLUDING DITCHES), GRADE BREAKS, THE BORDERS OF LANDSCAPE AREAS, AND WITHIN LANDSCAPE AREAS AT EQUAL INTERVALS (PERPENDICULAR TO THE DIRECTION OF SLOPE) FOR THE FOLLOWING SLOPE CONDITIONS, U.O.N:

(A) 10 FEET APART FOR SLOPES GREATER THAN 2:1 (HORIZONTAL:VERTICAL)
(B) 15 FEET APART FOR SLOPES GRATER THAN 2:1 TO 4:1 (HORIZONTAL:VERTICAL)
(C) 20 FEET APART FOR SLOPES GREATER THAN 4:1 TO 10:1 (HORIZONTAL:VERTICAL)
(D) 50 FEET APART FOR SLOPES FLATTER THAN 10:1 (HORIZONTAL:VERTICAL)

5A FIBER ROLLS TYPICAL LAYOUT
SCALE: NTS



NOTES:

1. PROTECT ALL EXISTING TREES WHOSE DRIP LINE IS WITHIN 25 FEET OF EXCAVATION, TRENCHING, GRADING, OR PATHWAY WORK, AGAINST INJURY OR DAMAGE FROM CONSTRUCTION OPERATIONS WITHIN THE LIMITS OF WORK.
2. FOR THOSE TREES NOTED ON DEMOLITION OR TREE REMOVAL PLANS, PROTECT PRIOR TO COMMENCING WORK BY ERECTING A TEMPORARY SAFETY FENCE PER DETAIL ABOVE ON SIDE(S) ADJACENT TO CONSTRUCTION, WITHIN THE LIMITS OF WORK.
3. FOR TREES NOTED ON DEMOLITION OR TREE REMOVAL PLANS, EXCEPT WHEN ON CONCRETE OR ASPHALT PAVEMENT, NO VEHICLES OR MECHANICAL EQUIPMENT LARGER THAN A DITCHWITCH OR BOBCAT CLASS MACHINE ARE PERMITTED ANY CLOSER TO A TREE THAN THE TREE DRIP LINE, WHICHEVER DISTANCE IS GREATER. SHOULD VEHICLES OR EQUIPMENT (OTHER THAN MECHANICAL TRENCHING) BE NECESSARY WITHIN THIS PROXIMITY OF A TREE, USE ROOT PROTECTION MATTING OVER THE AREA TO BE USED BY SUCH VEHICLES OR EQUIPMENT.

1 TYPICAL EXISTING TREE PROTECTION
SCALE: NTS

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ISSUE DATE: XX/XX/2023
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CONTRACT NO.:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN
1325 J STREET
SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT
LONGITUDINAL MITIGATION SITE
WRIGHT TRACT: SAN JOAQUIN COUNTY, CA

FENCE AND SIGN DETAILS

SHEET ID
L-503

DRAFT 10% SUBMITTAL

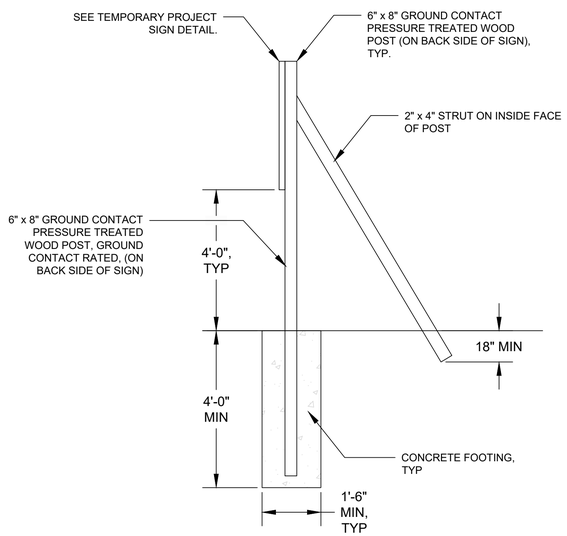


NOTES:

1. A DIGITAL FILE WITH EXACT TEXT AND LOGOS WILL BE PROVIDED BY THE COR AT THE TIME OF FABRICATION.
2. CONTRACTOR TO PROVIDE FINAL TEMPLATE FOR APPROVAL BY THE COR.
3. TEXT FORMAT TO FOLLOW USACE SIGN STANDARDS MANUAL.
4. PROVIDE ANTI-GRAFFITI COATING FOR SIGN GRAPHIC

1 TEMPORARY PROJECT SIGN

SCALE: NTS

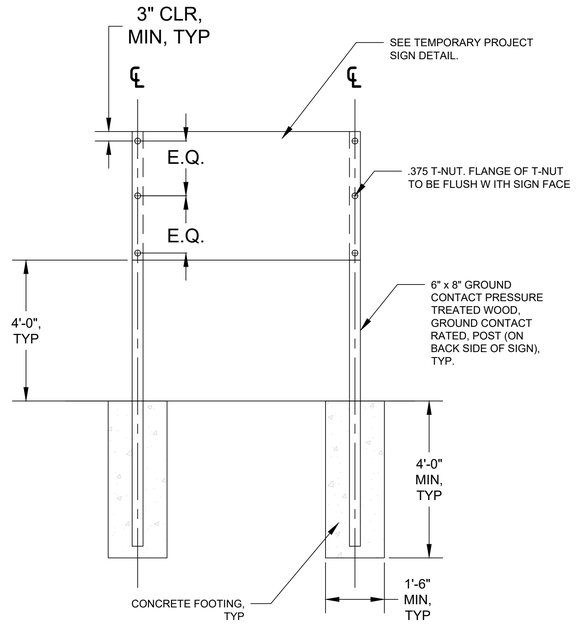


NOTE:

CONTRACTOR TO REMOVE TEMPORARY PROJECT SIGN AT THE END OF CONTRACT

3 PROFILE: TEMPORARY PROJECT SIGN, FLAT AREA

SCALE: NTS

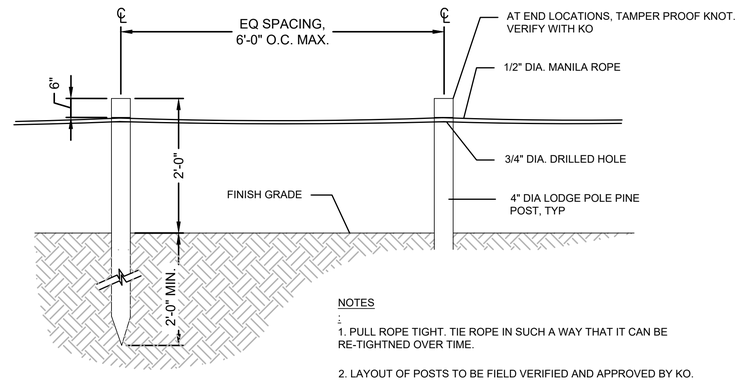


NOTE:

CONTRACTOR TO REMOVE TEMPORARY PROJECT SIGN AT THE END OF CONTRACT

2 SECTION: TEMPORARY PROJECT SIGN, FLAT AREA

SCALE: NTS

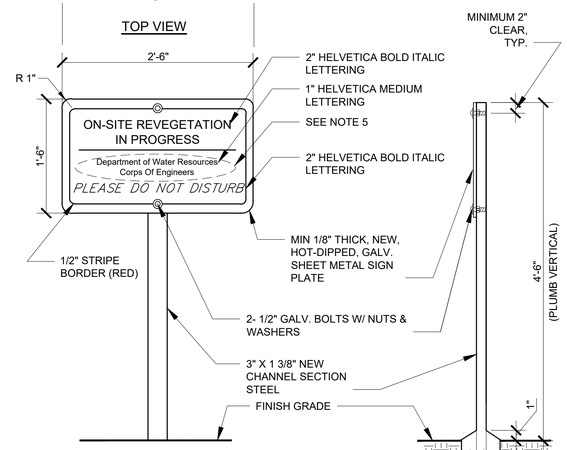


NOTES

1. PULL ROPE TIGHT. TIE ROPE IN SUCH A WAY THAT IT CAN BE RE-TIGHTNED OVER TIME.
2. LAYOUT OF POSTS TO BE FIELD VERIFIED AND APPROVED BY KO.

6E TEMPORARY ROPE FENCE BARRIER

SCALE: NTS



NOTES:

1. PROVIDE HOT DIPPED GALVANIZED AND POWDER COATED SIGN POST, HARDWARE, AND ACCSSORIES. POWDER COAT COLOR: FOREST GREEN. BACK OF SIGN TO BE NON-REFLECTIVE.
2. GRIND ALL JOINTS TO A SMOOTH FINISH. PREPARE AND FIELD PAINT WELDS AND ALL AREAS REQUIRING TOUCH UPS. COLOR TO MATCH POWDER COAT (PRIME AND PAINT 2 COATS MIN).
3. SIGN SHALL BE 1/8" BAKED ENAMEL, SCREEN PRINT IMAGES.
4. IMAGES, LINEWORK, AND TEXT SHALL BE RED WITH A WHITE BACKGROUND.
5. SEE SPECS FOR AGENCY NAMES TO BE IDENTIFIED. NAMES SEEN ON SIGN ABOVE ARE FOR EXAMPLE ONLY.
6. ALL TEXT TO BE MIN 1" IN HEIGHT, U.O.N.
7. ALL EXPOSED BOLT THREADS EXTENDING BEYOND NUT SHALL BE STRIPPED AFTER INSTALLATION.
8. PROVIDE ANTI-GRAFFITI COATING FOR FACE AND BACK OF SIGN

2 ON-SITE REVEGETATION SIGN

SCALE: NTS

US Army Corps of Engineers®

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ISSUE DATE: XX/XX/2023
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CONTRACT NO.:

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DRAWN BY: B.J.
CHECKED BY: T.S.
SUBMITTED BY: B.J.
SIZE: ANSI D

U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT SACRAMENTO, CALIFORNIA

IN-HOUSE DESIGN 1325 J STREET SACRAMENTO, CA 95814

EXHIBIT A, LOWER SAN JOAQUIN RIVER PROJECT LONGITUDINAL MITIGATION SITE WRIGHT TRACT, SAN JOAQUIN COUNTY, CA

FENCE AND SIGN DETAILS

SHEET ID

L-504

DRAFT 10% SUBMITTAL

Appendix D-
Habitat Surveys

ESA

2600 Capitol Avenue
Suite 200
Sacramento, CA 95816
916.564.4500 phone
916.564.4501 fax

esassoc.com

memorandum

date	October 12, 2021
to	Mr. Chris Elias, Executive Director, San Joaquin Area Flood Control Agency
cc	Mr. Omar Al-Hindi, Executive Project Manager, San Joaquin Area Flood Control Agency
from	Kelly Bayne, Senior Biologist, Environmental Science Associates
subject	Preconstruction Swainson's Hawk Nest Tree Surveys within the Access Road to the SEWD Borrow Area and Giant Garter Snake Habitat Assessment and Special-Status Plant Surveys within the Project Site for the Lower San Joaquin River Project – Phase 1, TS_30_L P

Dear Mr. Elias,

An Environmental Science Associates (ESA) qualified biologist conducted biological surveys for the Lower San Joaquin River Project-Phase 1, TS_30_L (Project), located in unincorporated San Joaquin County, California. Proposed activities include transplanting the elderberry (*Sambucus* sp.) shrubs from the project site to a USFWS approved conservation bank or onsite mitigation area, and pruning woody vegetation that overhangs the access road associated with the Stockton East Water District (SEWD) Borrow Area (**Figure 1**).

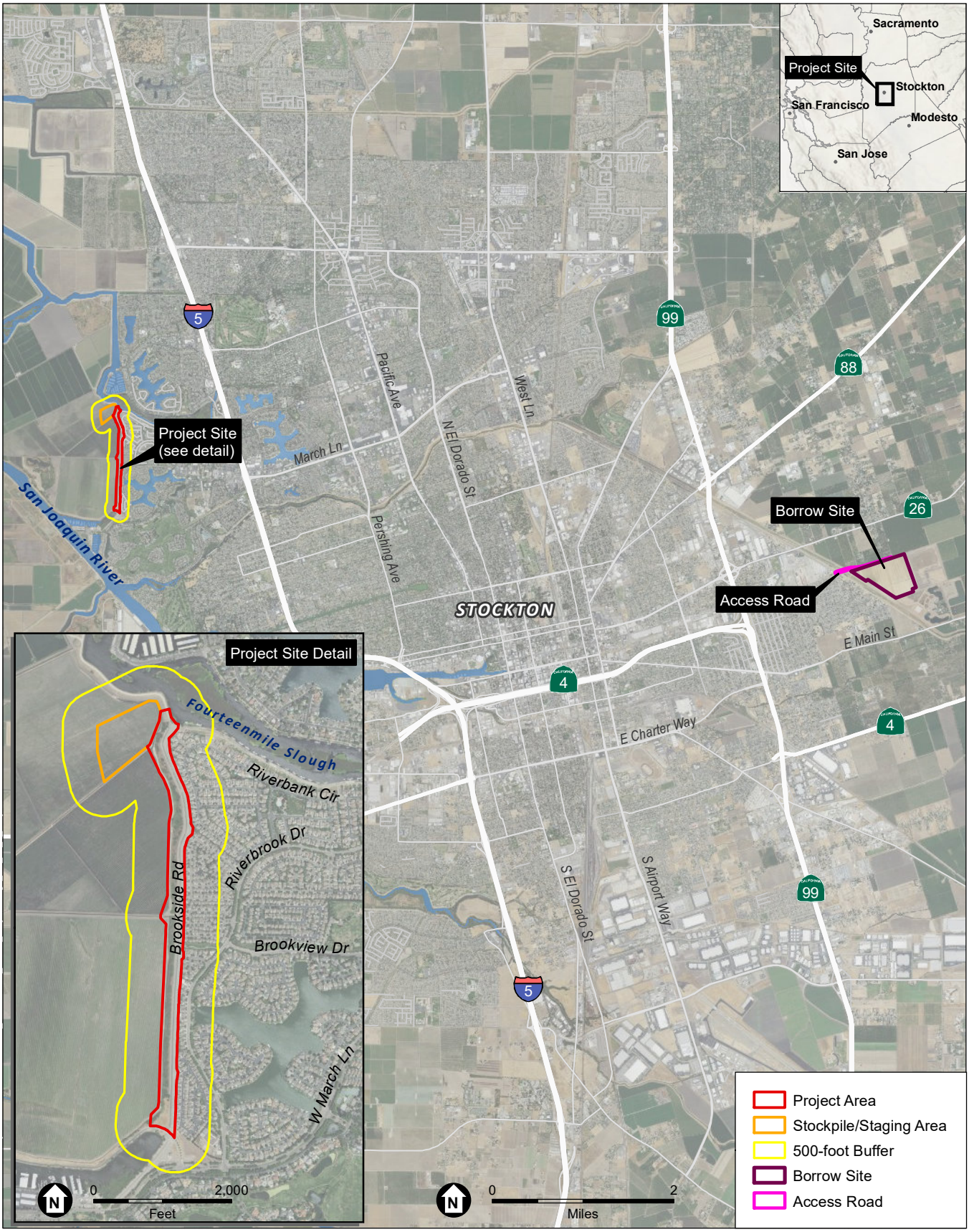
Surveys were conducted consistent with the measures outlined in the Lower San Joaquin River Integrated Interim Feasibility Report/Environmental Impact Statement/Environmental Impact Report (SJAFCA, CVFPB, and USACE 2018; herein referred to as 2018 LSJR FR/EIS/EIR) and the U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO) (USFWS 2016) prepared for the Project.

Biological surveys included:

- A preconstruction survey for suitable Swainson's hawk (*Buteo swainsoni*) nest trees along the access road located just north of the SEWD Borrow Area, in accordance with the mitigation measure on page 5-195 of the 2018 LSJR FR/EIS/EIR and the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP).

- A preconstruction special-status plant survey within the project site for potentially occurring plants, in accordance with the mitigation measure on page 5-197 of the 2018 LSJR FR/EIS/EIR. **Table 1** identifies the 6 plants considered to have potential for occurrence based on Table 5-35 and the discussion in the 2018 LSJR FR/EIS/EIR.

- A habitat assessment for giant garter snake within the project site to determine which avoidance and minimization measures would be applicable to work within the project site, as outlined on page 11 of the USFWS BO.



SOURCE: Esri, 2021; SJAFCA, 2021; ESA, 2021

Lower San Joaquin River Reach TS_30_L Levee Improvement Project

Figure 1
Project Area

ESA

TABLE 1
PLANTS WITH THE POTENTIAL TO OCCUR WITHIN THE PROJECT SITE

Plants	Status	Potential to Occur
Alkali milkvetch *Astragalus tener* var. *tener*	CNPS: 1B.2	**May occur**; 2 accounts – one on project site, the other within 100-500 feet of the project site within Central Stockton. Recorded as extirpated.
Slough thistle *Cirsium crassicaule*	CNPS: 1B.1	**May occur**; 3 on site accounts in RD 17. Chenopod scrub, marshes and swamps (sloughs), riparian scrub.
Big tarplant *Blepharizonia plumosa*	CNPS: 1B.1	**May occur**; Big tarplant occurs in annual grassland on clay to clay-loam soils, usually on slopes and often in burned areas, below 1,500 feet 2 accounts – one on project site, the other within 100-500 feet of the project site at Old Mormon Slough. Recorded as extirpated.
Rose mallow *Hibiscus lasiocarpos*	CNPS: 1B.2	**May occur**; 2 accounts in Delta Front/North Stockton, one in Central Stockton. Native to riparian areas around the Sacramento River in California and can also be found in other states. Grows in moist soil near the river, often in riprap on sides of levees.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	CNPS: 1B.2	**May occur**; 3 accounts in Central Stockton within 100 to 500 feet of project area. Freshwater and brackish marshes and swamps.
Mason's lilaeopsis *Lilaeopsis masonii*	CNPS: 1B.1 State: R	**May occur**; 3 accounts in Delta Front/North Stockton Riparian scrub, brackish or freshwater marshes and swamps.

Source: Information in this table was obtained from Table 5-35 of the 2018 LSJR FR/EIS/EIR

Location

The approximately 51.05-acre project site includes the 36.79-acre project footprint and the 14.27-acre stockpile/staging area. The coordinates of the southern portion of the project site are 37º 58′ 43.80″ North, 121º 22′ 08.47″ West.

The approximately 8.2-acre access road includes a 20-foot buffer around a raised farm road. The farm road occurs to the north of the approximately 115.8-acre SEWD Borrow Area. The coordinates of the western portion of the access road are 37º 58′ 14.69″ North, 121º 13′ 19.98″ West.

Methodology

Prior to conducting the biological surveys, ESA senior biologist Kelly Bayne reviewed California Natural Diversity Database (CNDDB) records of active Swainson's hawk nests within 0.5 miles of the access road and giant garter snake and special-status plant occurrences within 5 miles of the project site.

Ms. Bayne conducted the Swainson's hawk nest tree survey within the access road and a giant garter snake habitat assessment and a special-status plant survey within the project site on August 18, 2021. Representative photographs of the project site and access road are provided in **Attachment 1**.

Ms. Bayne conducted a pedestrian level survey of the access road to look for potentially suitable Swainson's hawk nest trees along the access road and vicinity. Periodic stops were made to scan the area with binoculars. Where feasible, the biologist conducted a windshield level survey for potential Swainson's hawk nests within 0.5 miles of the access road. Ms. Bayne used a spotting scope and binoculars to determine whether remnant raptor nests, which may have been occupied by Swainson's hawk, occur within the trees within 0.5 miles of the project site.

The special-status plant survey was conducted in accordance with CDFW's (2018) *Protocols for Surveying and Evaluating Impacts to Special-Status Native Plant Populations and Natural Communities*. The special-status

plant survey was floristic in nature; specifically, every plant taxon that was observed within the project site was identified to the taxonomic level necessary to determine rarity and listing status. A list of plants observed within the project site is provided in **Attachment 2**.

The habitat assessment for giant garter snake was conducted to determine whether suitable habitat required for the species is present within and in the vicinity of the project site.

Existing Conditions

SEWD Borrow Access Road

The access road is surrounded by orchard trees to the north and south, a levee road followed by an irrigation canal to the west, and by a graded farm road to the east.

The access road consists of a graded levee road comprised of gravel, bare ground, and herbaceous species including wild oat (*Avena fatua*), ripgut grass (*Bromus diandrus*), and soft chess (*Bromus hordeaceus*). Overstory woody vegetation including valley oak (*Quercus lobata*), interior live oak (*Quercus wislizeni*), walnut (*Juglans* sp.), and ornamental trees occurs along both sides of the access road. The trees are approximately 20 to 35 feet tall, with diameters at breast height (DBH) from between 7 inches and 24 inches. The canopies of the overstory woody vegetation overhang several areas of the access road (Photographs 1-4 in Attachment 1).

TS_30_L Project Site

The project site is surrounded by high density residential development to the east, Buckley Cove to the south, Fourteen Mile Slough to the north, and agricultural land to the west. The residential development includes ornamental landscape trees including coast redwood (*Sequoia sempervirens*) and Italian cypress (*Cupressus sempervirens*).

At the time of the August 18, 2021 survey, the southern half of the agricultural land to the west of the project site was fallow and contained scattered weedy species including alfalfa (*Medicago* sp.), wild oat (*Avena fatua*), Johnson grass (*Sorghum halepense*), and Bermuda grass (*Cynodon dactylon*). The northern half of the agricultural land to the west of the project site was planted with rice fields (Photograph 5 in Attachment 1). The rice fields were growing in approximately one foot of standing water at the time of the August 18, 2021.

Habitat types within the project site include riparian woodland, agricultural, irrigation ditch, and developed/disturbed. Developed/disturbed includes the graded levee road and gravel slopes, dirt farm roads, and a graded area comprised of weedy vegetation. The eastern levee slope is completely devoid of vegetation.

Riparian woodland occurs along the western levee slope and includes densely growing vegetation with an overstory canopy comprised of willow (*Salix* sp.), valley oak (*Quercus lobata*), interior live oak (*Quercus wislizeni*), English walnut (*Juglans regia*), northern California black walnut (*Juglans hindsii*), cork oak (*Quercus suber*), pecan (*Carya illinoinensis*), and ailanthus (*Ailanthus altissima*). Understory trees and shrubs include black elderberry (*Sambucus nigra* ssp. *caerulea*), sandbar willow (*Salix exigua* var. *hindiana*), edible fig (*Ficus carica*), giant reed (*Arundo donax*), rose (*Rosa* sp.), Himalayan blackberry (*Rubus armeniacus*), tobacco (*Nicotiana acuminata*), and common buttonbush (*Cephalanthus occidentalis*). Understory herbaceous vegetation includes Johnson grass (*Sorghum halepense*), Bermuda grass (*Cynodon dactylon*), wild oat (*Avena fatua*), radish (*Raphanus sativus*), and soft chess (*Bromus hordeaceus*).

Agricultural land occurs within the northwestern portion of the site and consists of rice fields.

The irrigation ditch extends north to south to the west of the riparian woodland within the project site. The entire length of the irrigation ditch contained standing water at the time of the July 27, 2021 survey. While the northern half of the irrigation ditch still contained ponded water during the August 18, 2021 survey, the southern half only contained saturated soils, but no ponded water was present. Dominant vegetation within or along the banks of the irrigation ditch includes tule (*Schoenoplectus* sp.), barnyard grass (*Echinochloa crus-galli*), broadleaf cattail (*Typha latifolia*), and Johnson grass.

Results and Discussion

Access Road – Swainson's Hawk Survey

No Swainson's hawk occurrences are documented in the CNDDB within 0.5 miles of the access road and no Swainson's hawk nests or raptor nests suitable for Swainson's hawk were observed within 0.5 miles of the access road during the windshield level survey.

Swainson's hawk most often nest in trees ranging in height from 41 to 82 feet. Swainson's hawks typically nest in a solitary tree, bush, small grove, or line of trees in or near riparian habitat. Nest trees include willows (*Salix* spp.), black locusts (*Robinia pseudoacacia*), box elders (*Acer negundo*), junipers (*Juniperus* spp.), oaks (*Quercus* spp.), aspens (e.g., *Populus* spp.), and cottonwoods (*Populus deltoides*) (Bechard, et al. 2010). Swainson's hawks favor nesting near agricultural areas, including irrigated alfalfa fields, wheat fields, and fields planted with row crops (Bechard, et al. 2010, Bradbury 2014).

No active Swainson's hawk nest trees were found and no active or remnant raptor nests were observed along the access road or in the vicinity. A single Swainson's hawk was observed soaring overhead approximately 0.25 mile southeast of the access road. The trees along the access road provide low quality nesting habitat due to their small size (Photographs 1-4 in Attachment 1).

TS_30_L Project Site – Special-Status Plant Survey

No special-status plants were observed within the project site. The survey was conducted during the evident and identifiable period of all special-status plants with potential to occur, except alkali milkvetch which is an annual herb that blooms March through June. Alkali milkvetch typically occurs on alkaline soils in playas, adobe clay valley and foothill grassland, and vernal pools. There are no playas, vernal pools, or alkaline soils in the project site. Due to the marginal habitat present, this species is unlikely to occur in the project site but if present, it would not have been detected due to survey timing outside the blooming window.

TS_30_L Project Site –Giant Garter Snake Habitat Assessment

There are two giant garter snake CNDDB occurrences documented within 5 miles of the project site. One occurrence (351) is from 1880 and is approximately 1.7 miles southeast of the project site. This occurrence states that the record was mapped in a general location in Stockton; however, much of the area has been developed since then. The other occurrence (425) is from 2018 and is approximately 2.5 miles west of the project site. This occurrence states that two individuals were observed foraging within Himalayan blackberries on the waterside bank of the San Joaquin River.

Giant garter snake inhabit agricultural wetlands including irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands in the Central Valley. Giant garter snake are often found within these aquatic features especially when emergent vegetation including cattails and bulrushes are present. Because most of its natural habitat has been lost, giant garter snake also live in rice fields (USFWS 2017). Rice fields provide surface water during the summer when the snakes are active and marsh-like conditions provide the cover,

habitat, and prey required for giant garter snake to survive (Halstead et al. 2010). The active season extends from April 1 to October 1. Giant garter snake inhabit small mammal burrows and other soil crevices above flood elevations during this inactive period (USFWS 2017).

The irrigation ditch along the western edge of the project site provides suitable habitat for giant garter snake due to the presence of ponded water and emergent vegetation. The rice fields to west provide suitable refuge and foraging habitat. The small mammal burrows present on the sides of the irrigation ditches within the project site and on the graded farm road to the west of the project site provide suitable upland habitat.

Discussion

General avoidance and minimization measures outlined in the 2018 LSJR FR/EIS/EIR include the following:

- Install Exclusion fencing along the construction work area perimeter and implement general measures to avoid effect on sensitive natural communities and special-status species, as identified on page 5-126 of the 2018 LSJR FR/EIS/EIR.
- Conduct mandatory contractor/worker awareness training for construction personnel, as identified on page 5-127 of the 2018 LSJR FR/EIS/EIR.
- Retain a biological monitor to monitor all sensitive biological resources, as identified on page 5-127 of the 2018 LSJR FR/EIS/EIR.

The trees along the access road provide low quality nesting habitat for Swainson's hawk and there is no evidence of past raptor nesting in these trees. Therefore, pruning of the overhanging tree limbs for vehicle access is permitted so long as the work occurs outside of the season for all nesting birds including Swainson's hawk (September 16 through January 31). The generally accepted nesting season that encompasses all birds extends from February 1 through September 15. It is recommended that a certified arborist prune the limbs in accordance with ANSI standards. Any work during the nesting season would require surveys be conducted according to the conservation measures identified on page 5-195 of the 2018 LSJR FR/EIS/EIR.

No special-status plants were observed within the project site. The survey was conducted outside the evident and identifiable period alkali milkvetch. An additional survey for alkali milkvetch should be conducted during the evident and identified if work is scheduled to occur in suitable habitat.

The project site provides suitable habitat for giant garter snake. Based on pages 5-192 and 5-193 of the 2018 LSJR FR/EIS/EIR, the following avoidance and minimization measures are required for giant garter snake, one of which prohibits work outside of the active season.

- For each discrete reach affecting snake habitat, construction will be initiated during the snake active period (May 1‑October 1) and prior to September 15, but may continue beyond the active period provided that work is continuous (lapses shall be no greater than 24 hours).
- All construction personnel, including workers and contractors, will participate in a worker environmental awareness training program conducted by a USFWS-approved biologist prior to commencement of construction activities.
- Reach specific monitoring and inspection will be conducted appropriate to the potential for snake presence as indicated by the proximity to and quality of habitat. This will include one or more of the following measures as specified in Appendix A: (a) a pre-work inspection sufficient to detect active snakes before any construction, to occur no sooner than 24 hours prior to initial construction in potential habitat; (b) a morning

inspection before each work day, including the work site, and any parked equipment; (c) an additional second inspection of habitat during construction for each work day; (d) continuous monitoring during all work; and/or (e) a choice of either exclusionary fencing in those reaches where it is possible (i.e., Calaveras River from North Pershing to El Dorado St.; Duck Creek work) or continuous monitoring. Should there be any interruption in work for greater than two weeks, a biologist will survey the project area again no later than 24 hours prior to the restart of work.

- If the USACE elects to use exclusionary fencing in lieu of continuous monitoring, it will be buried at least six inches below the ground to prevent snakes from burrowing and moving under the fence, and will be inspected daily.

- Giant garter snake encountered during construction activities would be allowed to move away from construction activities on their own.

- Movement of heavy equipment to and from the construction site would be restricted to established roadways. Stockpiling of construction materials would be restricted to designated staging areas, which would be located more than 200 feet away from giant garter snake aquatic habitat.

- Giant garter snake habitat within 200 feet of construction activities would be designated as an environmentally sensitive area and delineated with signs and high visibility fencing. Fencing will be inspected and maintained as needed daily until completion of each work section of the project. This area would be avoided by all construction personnel.

- Project-related vehicles will observe a 20-mile-per-hour speed limit within construction areas, except on existing paved roads where they will adhere to the posted speed limits.

- Aquatic habitat for the snake that would be affected by construction will be inspected for the snake, then dewatered and maintained dry and absent of aquatic prey for 5 days before initiation of construction activities. This measure applies primarily to the ditches to be relocated west of the Delta front levee sections. If complete dewatering is not possible, USFWS will be contacted to determine what if any additional measures may be necessary to minimize effects to the snake.

It is recommended that the USACE re-initiate formal consultation with the USFWS and consult with CDFW prior to the elderberry shrub removal/transplantation from the project site scheduled to commence in January 2022.

Please let me know if you have any questions or comments.

Sincerely,



Kelly Bayne
Senior Biologist
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References

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Attachment 1

Photographs of the Project Site and Vicinity including the SEWD Borrow Site



Photograph 1: View east from the east side of the access road of oak trees with overhanging canopies within the SEWD Borrow Site.



Photograph 2: View of the valley oak and Northern California walnut trees overhanging the access road associated with the SEWD Borrow Site.



Photograph 3: View of valley oak and interior live oak along the access road associated with the SEWD Borrow Site.



Photograph 4: View west of access road from the central portion of the access road associated with the SEWD Borrow Site.



Photograph 5: View north of the agricultural field comprised of rice from the central-western side of the project site.



Photograph 6: View north of the dry irrigation ditch within the southern half of the project site. While the irrigation ditch did not contain water during the August 18, 2021 survey, it contained standing water during a July 27, 2021 survey.



Photograph 7: View south of the irrigation ditch comprised of emergent vegetation and disturbed/developed area associated with the dirt farm road from the central portion of the project site.



Photograph 8: View north of the disturbed/developed area associated with the dirt farm road, the irrigation ditch, and the riparian woodland from the central portion of the project site.

Attachment 2

Plants Observed during the July 2021 and August 18, 2021 Surveys

Family	Scientific Name	Common Name	Native/Introduced
Adoxaceae	*Sambucus nigra* ssp. *caerulea*	Blue elderberry	N
Amaranthaceae	*Amaranthus albus*	Tumbleweed	I
Amaranthaceae	*Amaranthus deflexus*	Amaranth, pigweed	I
Amaranthaceae	*Amaranthus retroflexus*	Redroot pigweed	I
Anacardiaceae	*Toxicodendron diversilobum*	Western poison oak	N
Apiaceae	*Foeniculum vulgare*	Fennel	I
Araceae	*Lemna* sp.	Duckweed	N
Asteraceae	*Baccharis pilularis*	Coyote brush	N
Asteraceae	*Helminthotheca echioides*	Bristly ox-tongue	I
Asteraceae	*Heterotheca grandiflora*	Telegraph weed	N
Asteraceae	*Lactuca serriola*	Prickly lettuce	I
Asteraceae	*Senecio vulgaris*	Common groundsel	I
Asteraceae	*Silybum marianum*	Milk thistle	I
Asteraceae	*Sonchus* sp.	Sow thistle	I
Brassicaceae	*Brassica* sp.	Mustard	I
Brassicaceae	*Raphanus sativus*	Radish	I
Chenopodiaceae	*Chenopodium album*	Lamb's quarters	I
Convolvulaceae	*Convolvulus arvensis*	Bindweed, orchard morning-glory	I
Cyperaceae	*Cyperus eragrostis*	Nutsedge	N
Cyperaceae	*Cyperus esculentus*	Nutsedge	N
Cyperaceae	*Eleocharis macrostachya*	Spikerush	N
Cyperaceae	*Schoenoplectus* sp.	Naked-stemmed bulrush	--
Equisetaceae	Equisetum sp.	Horsetail, scouring rush	N
Fagaceae	*Quercus suber*	Cork oak	I
Fagaceae	*Quercus lobata*	Valley oak, roble	N
Fagaceae	*Quercus wislizeni*	Interior live oak	N
Juglandaceae	*Carya illinoinensis*	Pecan	I
Juglandaceae	*Juglans hindsii*	Northern California black walnut	N
Juglandaceae	*Juglans regia*	Persian or English walnut	I
Juncaceae	*Juncus effusus*	Soft or lamp rush	N
Malvaceae	*Malva parviflora*	Cheeseweed, little mallow	I
Moraceae	*Ficus carica*	Edible fig	I
Oleaceae	*Fraxinus latifolia*	Oregon ash	N
Poaceae	*Arundo donax*	Giant reed	I
Poaceae	*Avena fatua*	Wild oat	I
Poaceae	*Avena sativa*	Cultivated oat	I
Poaceae	*Bromus hordeaceus*	Soft chess	I

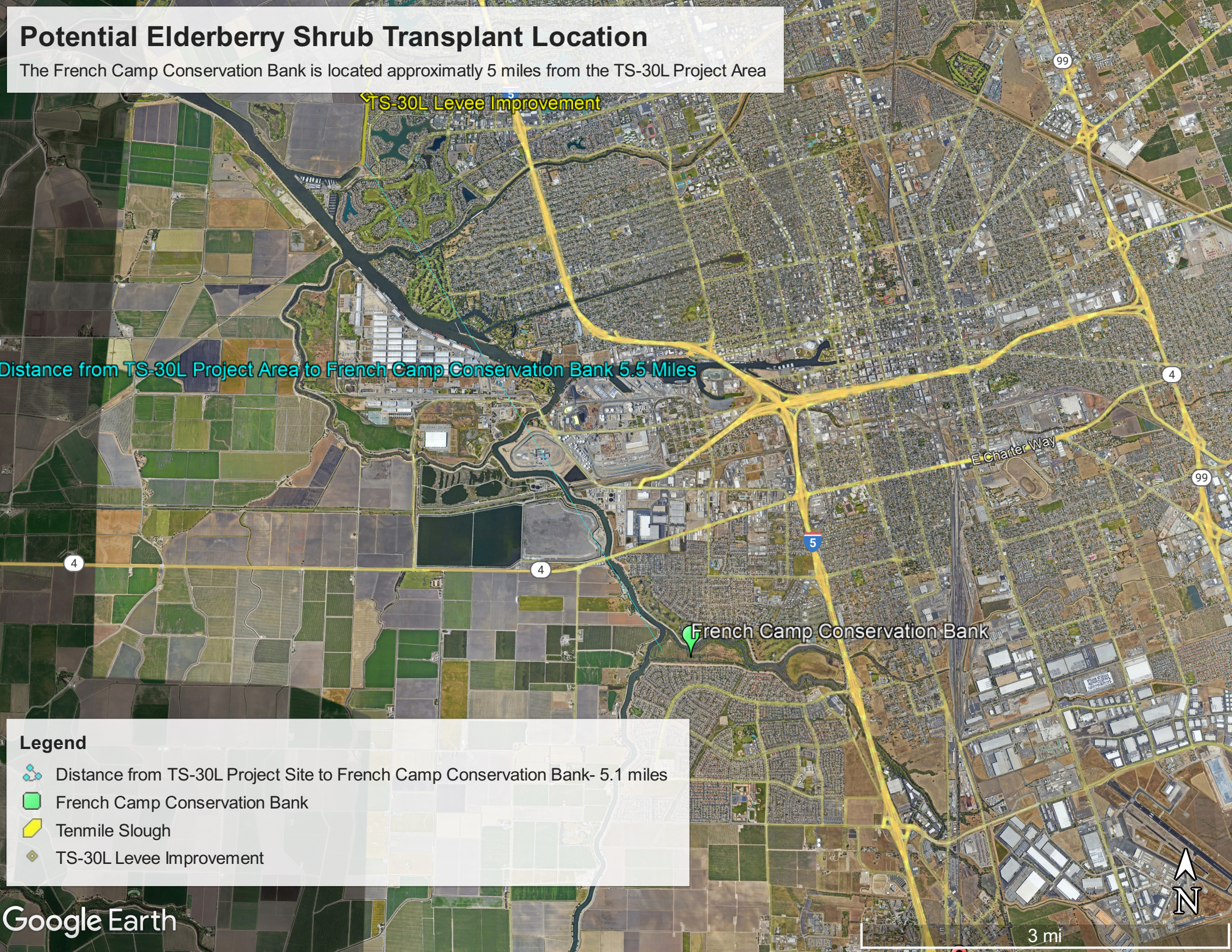
Family	Scientific Name	Common Name	Native/Introduced
Poaceae	*Bromus madritensis*	Brome, chess	I
Poaceae	*Cynodon dactylon*	Bermuda grass	I
Poaceae	*Dactylis glomerata*	Orchard grass	I
Poaceae	*Echinochloa crus-galli*	Barnyard grass	I
Poaceae	*Phalaris aquatica*	Harding grass	I
Poaceae	*Sorghum halepense*	Johnson grass	I
Rosaceae	*Rosa* sp.	Rose	--
Rosaceae	*Rubus armeniacus*	Himalayan blackberry	I
Rubiaceae	*Cephalanthus occidentalis*	California button willow	N
Salicaceae	*Salix exigua*	Willow	N
Salicaceae	*Salix gooddingii*	Goodding's black willow	N
Salicaceae	*Salix lasiolepis*	Arroyo willow	N
Salicaceae	*Salix* sp.	Willow	--
Sapindaceae	*Acer negundo*	Box elder	N
Scrophulariaceae	*Verbascum blattaria*	Moth mullein	I
Simaroubaceae	*Ailanthus altissima*	Tree of heaven	I
Solanaceae	*Nicotiana acuminata*	Tobacco	I
Typhaceae	*Typha latifolia*	Broad-leaved cattail	N

Appendix E- Conservation Banks in the Service Area with Space for Transplants

Includes French Camp Conservation Bank and River Ranch Conservation Bank

Potential Elderberry Shrub Transplant Location

The French Camp Conservation Bank is located approximatly 5 miles from the TS-30L Project Area





Phase III
French Camp Conservation Bank
City of Stockton, CA
October 2011

Exhibit C. Service Area Boundary

SYCAMORE Environmental Consultants, Inc.

Note: VELB range eastern boundary based on 3000' elevation, western boundary based on Central Valley watershed. VELB Range;http://www.fws.gov/pacific/sacramento/images/velb_range.jpg
Basemap: World Physical Map, ESRI Data Resource Center

I0044FCCB_AddtlVELB_ExhibitC_ServiceArea.mxd

From: Darryl Foreman
To: Guerrero, Lorena G CIV USARMY CESPK (USA)
Cc: Darryl Foreman; Johnson, Bradley C CIV USARMY CESPK (USA)
Subject: [Non-DoD Source] Re: EB Transpant to FCCB (10 Elderberry shrubs) - Off March Lane - Stockton TS30L
Date: Thursday, April 6, 2023 1:06:02 PM

Lorena,
Very nice to hear from you today regarding your **10 Elderberry Shrub Transplants** to the French Camp EB Conservation Bank.
I look forward to meeting you on site to firm up the project and provide you with a firm contract cost. Let me know when
you would like to meet on site (most any Thursday works for me) and discuss the Transplant process.

Please Email **(darryl@deltahabitatllc.com)** any mapping you can let me have that I can use to develop a firm cost.

Best Regards
Darryl

Darryl Foreman - 415-309-0646
Delta Habitat LLC / Strata Habitat Foundation

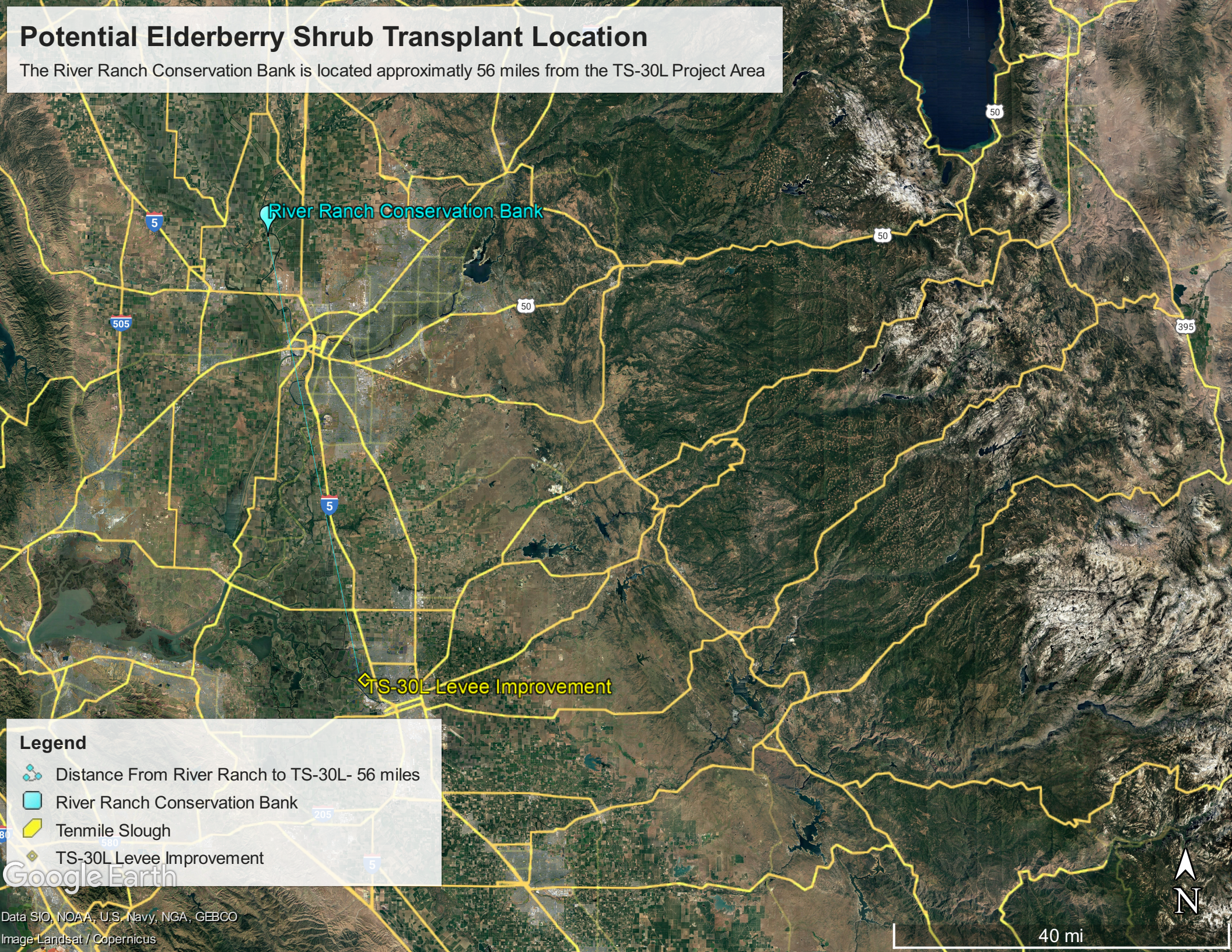
darryl@deltahabitatllc.com

> On Apr 6, 2023, at 10:14 AM, Guerrero, Lorena G CIV USARMY CESPK (USA) <Lorena.G.Guerrero@usace.army.mil> wrote:
>
> Good Morning Mr. Foreman,
>
> We are moving towards construction on one of our projects and have 10 elderberry shrubs which are in need of transplanting. I saw on the web that there may be availability at your bank to accept transplants.
>
> Is there currently any space at the French Camp Conservation Bank?
>
> Thank you,
>
> Lorena G. Guerrero
> Biologist
> Planning Division
> USACE Sacramento District
> 1325 J Street
> Sacramento, CA 95814
> Office: (916) 557-7134

Lorena.G.Guerrero@USACE.ARMY.MIL
Pronouns: she, her, hers

Potential Elderberry Shrub Transplant Location

The River Ranch Conservation Bank is located approximatly 56 miles from the TS-30L Project Area



- Riversidean Alluvial Fan Sage Scrub
- Salmonids
- Salt Marsh Harvest Mouse
- San Bernardino Kangaroo Rat
- San Joaquin Kit Fox
- Santa Ana River Woollystar
- Swainson's Hawk
- Valley Elderberry Longhorn Beetle
- Vernal Pool Creation
- Vernal Pool Preservation
- Waters of the State
- Wetland/Waters of the U.S.

SEARCH BY STATE(S)

- California
- Oregon
- Washington

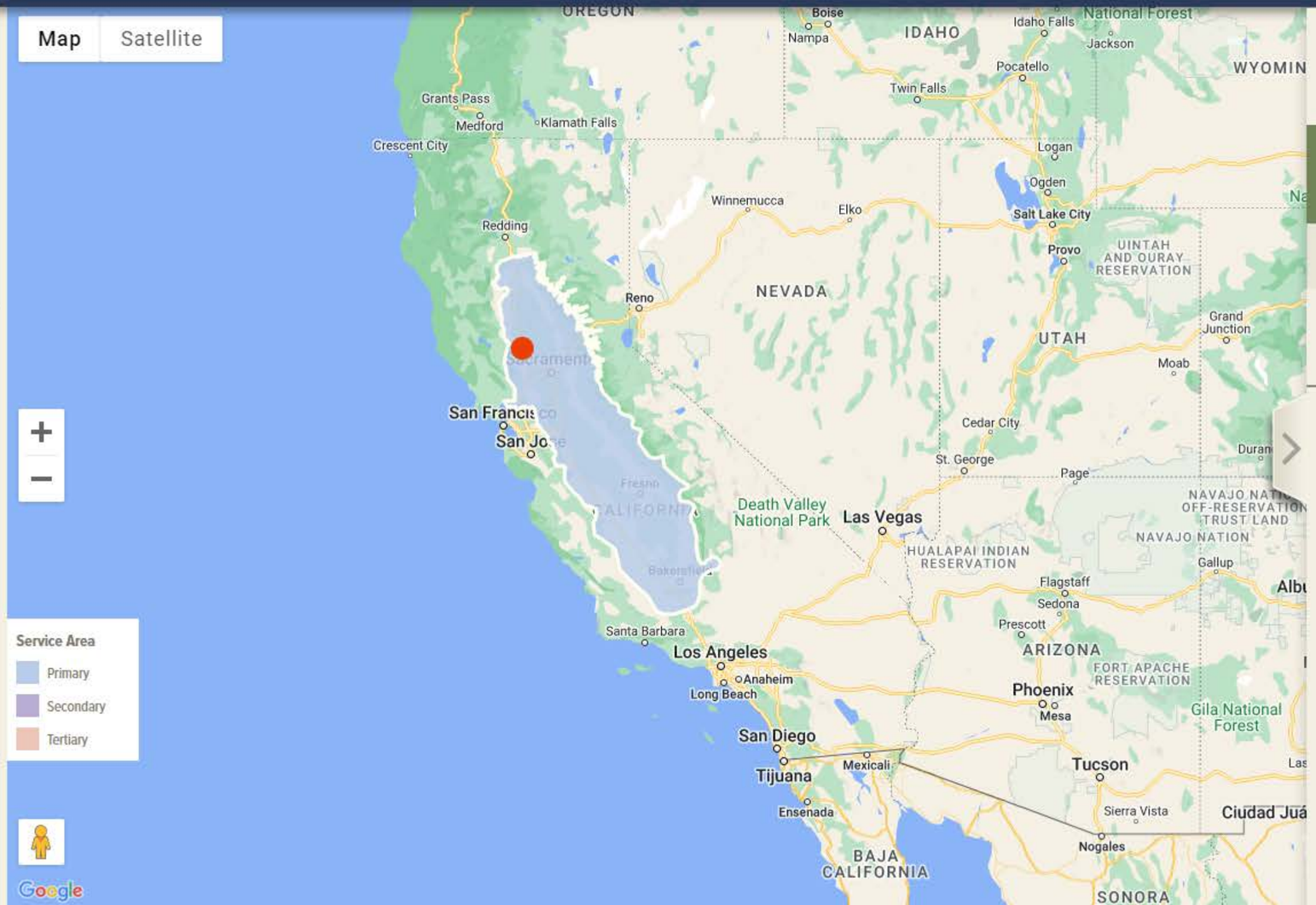
OR SEARCH BY COUNTY

County

OR PHYSICAL ADDRESS

Address, City, State or Zip

See Results >



BANKS AND PRESERVES

Wildlands is continuing to identify new mitigation properties. If you require a habitat type or location not identified on the map, please call us to discuss.

RIVER RANCH VELB CONSERVATION BANK

Valley Elderberry Longhorn Beetle — Service Area

Property Detail >

River Ranch VELB Conservation Bank

From: Julie Maddox
To: Guerrero, Lorena G CIV USARMY CESPK (USA)
Subject: [URL Verdict: Neutral][Non-DoD Source] RE: Checking availability for elderberry shrub transplants
Date: Thursday, April 6, 2023 4:17:44 PM
Attachments: image001.png
image002.png

Hi Lorena,

The Bank is sold-out of VELB credits, but we do have space for incoming elderberry shrub transplants.

Let me know if you have any questions.

Thank you,
Julie Maddox
Wildlands | Director of Sales
6558 Lonetree Blvd. | Rocklin, CA 95765
p: 916.435.3555 | f: 916.435.3556 | d: 916.625.3829

From: Guerrero, Lorena G CIV USARMY CESPK (USA) <Lorena.G.Guerrero@usace.army.mil>
Sent: Thursday, April 6, 2023 10:12 AM
To: Julie Maddox <jmaddox@heronpacific.com>
Subject: Checking availability for elderberry shrub transplants

Good Morning Ms. Maddox,

We are moving towards construction on one of our projects and have 10 elderberry shrubs which are in need of transplanting. I saw on the web that there may be availability at your bank to accept transplants.

Is there currently any space at the River Ranch VELB Conservation Bank?

Thank you,

Lorena G. Guerrero
Biologist
Planning Division
USACE Sacramento District
1325 J Street
Sacramento, CA 95814
Office: (916) 557-7134
Lorena.G.Guerrero@USACE.ARMY.MIL
Pronouns: she, her, hers

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