DRAFT ◦ NOVEMBER 2023

Initial Study/Mitigated Negative Declaration
Hastings Tract Pipe Replacement Project

PREPARED FOR

Reclamation District No. 2060
Hastings Tract
Solano County, CA

PREPARED BY

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Cover photos (counterclockwise from top left): Delta tule pea (*Lathyrus jepsonii*) along Hastings Cut, June 2023; tide gates on Hastings Cut, April 2023; southern end of Hastings Cut, April 2023; Lindsey Slough from Hastings Tract, April 2023.

PROJECT SUMMARY

Hastings Tract Pipe Replacement Project	
Lead agency	Reclamation District No. 2060
Contact person and phone number	Michael N. Kynett, PE Project Engineer MBK Engineers 455 University Avenue, Suite 100 Sacramento, CA 95825 kynett@mbkengineers.com Office: (916) 437-7553 Cell: (916) 799-0641
Project location	Unit 3 Cache Slough and Unit 1 Lindsey Slough levees along Hastings Cut, Hastings Tract, Solano County
Zoning	Agriculture
Description of Project	Relocation of twin 48-inch diameter tide gates along Hastings Cut from the Unit 3 Cache Slough levee at its northeastern end to the Unit 1 Lindsey Slough levee at its southwestern end
Surrounding land uses and setting	The Project Area is surrounded by land on Hastings Tract that is primarily used for agriculture and recreation, and Cache and Lindsey sloughs, which are used for recreation and transportation.
Other public agencies whose approval is required:	• California Department of Water Resources (funding) • California Department of Fish and Wildlife (Lake and Streambed Alteration Agreement) • Central Valley Regional Water Quality Control Board (Clean Water Act Section 401 permit) • U.S. Army Corps of Engineers (Clean Water Act Section 404 permit) • U.S. Army Corps of Engineers (Section 408 permission) • Central Valley Flood Protection Board (Encroachment Permit)

PROPOSED MITIGATED NEGATIVE DECLARATION

Project: Hastings Tract Pipe Replacement Project

Lead Agency: Reclamation District No. 2060

Project Location: Unit 3 Cache Slough and Unit 1 Lindsey Slough levees along Hastings Cut, Hastings Tract, Solano County

Project Description: Reclamation District No. 2060 is planning to relocate twin 48-inch diameter tide gates along Hastings Cut from the Unit 3 Cache Slough levee at its northeastern end to the Unit 1 Lindsey Slough levee at its southwestern end to maintain levee integrity and provide long-term flood protection to Hastings Tract.

Findings: An Initial Study has been prepared to assess the potential effects of the Project on the environment and the significance of those effects. Based on the Initial Study, Reclamation District No. 2060 has determined that the Project, including conservation measures that are part of the Project design, will not have significant effects on the environment. This conclusion is supported by the following findings:

- The Project will have no impact on cultural resources, land use and planning, mineral resources, population and housing, public services, recreation, transportation, tribal cultural resources, and wildfire.
- The Project will result in less-than-significant impacts on aesthetics, agriculture and forestry resources, energy, geology and soils, greenhouse gas emissions, hazards and hazardous materials, hydrology and water quality, noise, and utilities and service systems.
- Mitigation is included to reduce potentially significant impacts to less-than-significant levels for biological resources.

Mandatory Findings of Significance:

- With incorporation of mitigation measures, the Project will not substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory.
- With incorporation of mitigation measures, the Project will not have environmental effects that are individually limited, but cumulatively considerable.
- With incorporation of mitigation measures, the Project will not have environmental effects which would cause substantial adverse effects on human beings, either directly or indirectly.

Proposed Mitigation Measures: Mitigation measures included in the Project to avoid or minimize potential environmental impacts are included in the attached Initial Study, which is hereby incorporated and fully made part of this Mitigated Negative Declaration. Implementation of these mitigation measures will ensure that the potential environmental impacts of the Project are less than significant. Reclamation District No. 2060 has agreed to implement each of the

identified mitigation measures, which will be adopted as part of the Mitigation Monitoring and Reporting Program.

Determination

In accordance with Section 21082.1 of the California Environmental Quality Act (CEQA), Reclamation District No. 2060 has independently reviewed and analyzed the Initial Study and proposed Mitigated Negative Declaration for the Project and finds that the Initial Study and proposed Mitigated Negative Declaration reflects the independent judgment of Reclamation District No. 2060. The lead agency further finds that the Project mitigation measures will be implemented as stated in the Initial Study and Mitigated Negative Declaration. This Mitigated Negative Declaration is filed in accordance with CEQA and the state CEQA guidelines.

I hereby approve this Project:

_____ _____

Reclamation District No. 2060 Date

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1 INTRODUCTION

Reclamation District No. 2060 (District) is planning to relocate twin 48-inch diameter tide gates (pipes) along Hastings Cut from the Unit 3 Cache Slough levee at its northeastern end to the Unit 1 Lindsey Slough levee at its southwestern end (Project). This Initial Study/Mitigated Negative Declaration (IS/MND) has been prepared in compliance with the California Environmental Quality Act (CEQA) to address the potential environmental effects of the Project.

1.1 Project Purpose

The Project has two primary purposes, 1) to improve long-term flood protection of Hastings Tract by replacing aging infrastructure through the levee and 2) to improve water quality and avoid environmental impacts to Cache Slough. The existing pipes provide both drainage and irrigation flow between Hastings Cut and Cache Slough but show signs of significant, irreparable distress in their current configuration. Pipe failure would cause damage to the Unit 3 Cache Slough levee and, depending on water surface elevation, could lead to a levee breach or flooding of the tract. The pipes will be relocated to the Unit 1 Lindsey Slough levee where they will connect Hastings Cut with Lindsey Slough. This relocation will require the removal and/or abandonment of existing features through the Cache Slough levee and the installation of new features through the Lindsey Slough levee.

1.2 Project Location

Hastings Tract is in the Sacramento-San Joaquin River Delta (Delta), approximately 25 miles southwest of Sacramento, in Solano County, California. Hastings Cut runs roughly northeast-southwest through the tract, connecting to Cache Slough to the north and Lindsey Slough to the south via pipes through the tract's perimeter levees (Figure 1-1). Project work will be centered around these pipes as they are relocated from the Cache Slough levee to the Lindsey Slough levee.

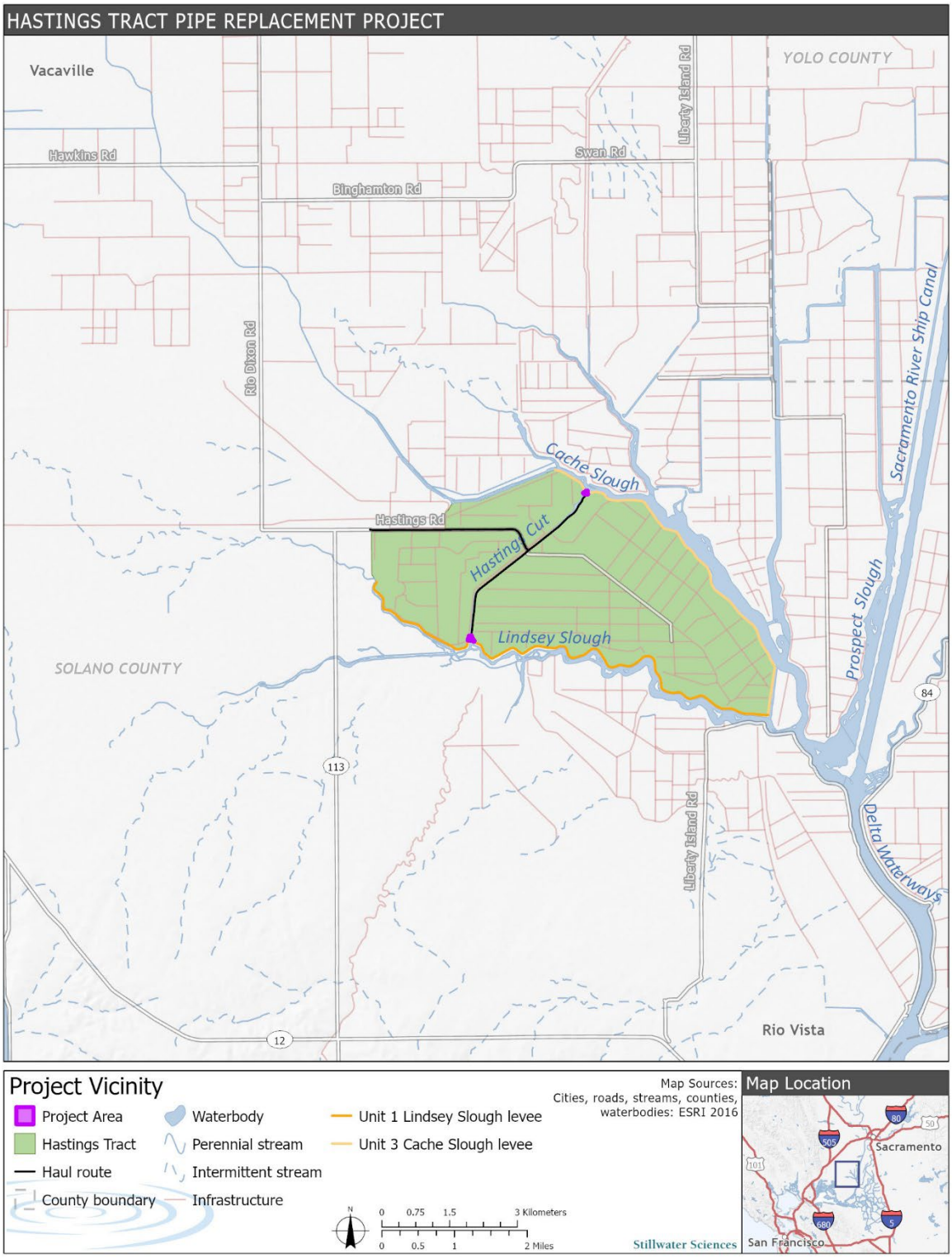

Figure 1-1. Hastings Tract Pipe Replacement Project location and surrounding vicinity.

1.3 Project Area

The Project Area encompasses two distinct sites, the existing pipe location on Cache Slough/Hastings Cut and the proposed new pipe location on Lindsey Slough/Hastings Cut (Figure 1-2). At each location the Project Area includes: (1) the construction footprint, which includes the grading limits and areas enclosed by the cofferdams in Cache Slough, Lindsey Slough, and Hastings Cut; and (2) a staging area (which will be located within the construction footprint along the Cache Slough levee). The Project's haul route follows approximately 5.5 miles along Hastings Cut Road and Hastings Road before joining State Route 113 (Figure 1-1).

1.4 Project Description

1.4.1 Construction

1.4.1.1 Site preparation

Site preparation activities will include stripping, clearing, and grubbing upland vegetation within the construction footprint and staging area. Temporary ramps will also be constructed to connect the staging area to the levee crown road along Hastings Cut.

1.4.1.2 Pipe removal/abandonment on Cache Slough

Cofferdams will be installed in Hastings Cut and Cache Slough to provide a dry work area for pipe removal and abandonment (Figure 1-2). Cofferdams are anticipated to be constructed by driving sheet pile wall. Pumps will be used to dewater the areas enclosed by the cofferdams and will ground-discharge the water or filter it through sediment separation tanks before releasing it into the waterways outside the cofferdams. The levee will then be degraded to at least 6 inches below the existing pipes. Accessible components of the existing pipe structure will be removed and disposed of offsite, and any inaccessible materials will be abandoned and cemented or grouted in place. Excavations will be backfilled with levee embankment fill and reconstructed to its original grade, which varies between approximately 6:1 (horizontal to vertical) near its toe and 3:1 (horizontal to vertical) near its crown. Following its reconstruction, the levee will be seeded with a native seed mix.

1.4.1.3 Pipe installation on Lindsey Slough

Cofferdams will be installed in Hastings Cut and Lindsey Slough (Figure 1-2). Cofferdams are anticipated to be constructed by driving sheet pile wall. The area within the cofferdams will be dewatered, and the levee will be degraded to at least 2.0 feet (ft) below the proposed pipes. The new 48-inch welded-steel gravity pipes and associated appurtenances (e.g., gates, risers, valves) will be installed with headwalls and gate structures at each end. Rock slope protection 2 ft in depth will extend 17 ft and 10 ft from the inlet/outlet structures in Hastings Cut and Lindsey Slough, respectively, to minimize the potential for erosion. The levee surrounding the pipes will be backfilled with levee embankment fill and reconstructed to its original grade, which varies between approximately 6:1 (horizontal to vertical) near its toe and 3:1 (horizontal to vertical) near its crown. Following its reconstruction, the levee will be seeded with a native seed mix.

Figure 1-2a. Hastings Tract Pipe Replacement Project Area, northern portion along Cache Slough (page 1 of 2).

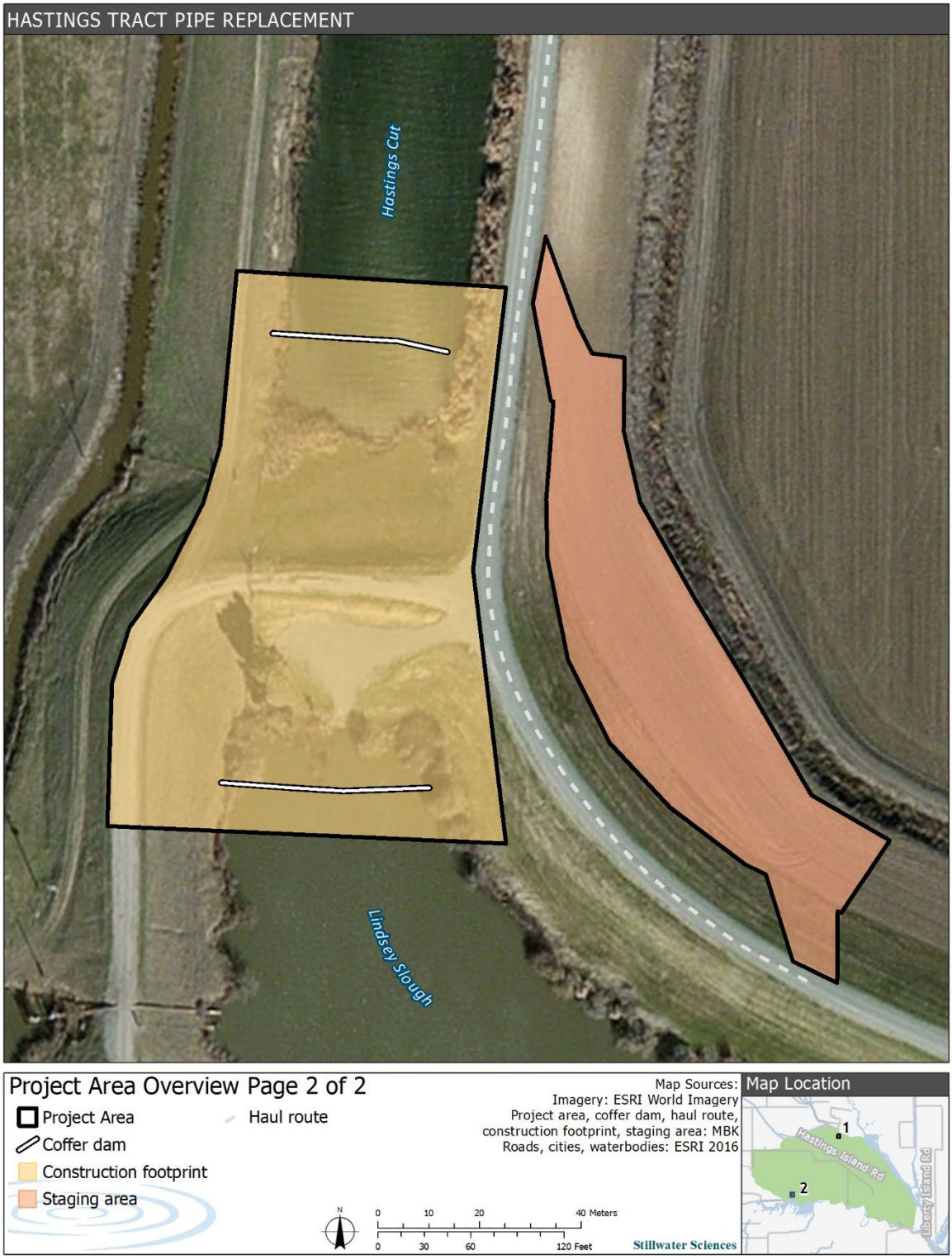

Figure 1-2b. Hastings Tract Pipe Replacement Project Area, southern portion along Lindsey Slough (page 2 of 2).

1.4.2 Staging area

During pipe removal along the Cache Slough levee, equipment, vehicles, and construction materials will be staged on the levee within the construction footprint (Figure 1-2b). During pipe installation along Lindsey Slough, a staging area will be located along the landside levee toe east of the construction footprint (Figure 1-2a). The staging area will be accessed via temporary ramps at its northern and southern ends.

1.4.3 Equipment

Table 1-1 provides a list of expected equipment for use during each phase of Project implementation.

Table 1-1. Equipment list by work phase for the Hastings Tract Pipe Replacement Project.

Work phase	Equipment type	Number	Days
Entire Project Area			
Throughout Project construction	Water truck	1	66
	Front end loader	1	44
	High lift	1	33
	Foreman/super pick-up trucks	2	66
Pipe Removal/Abandonment on Cache Slough			
Site preparation	Dozer	1	1
Cofferdam installation	Excavator	2	5
	Tractor and box grader	3	5
	Dozer	1	5
Levee excavation and pipe removal	Excavator	2	5
	Tractor and box grader	1	5
	Dozer	1	5
	Pump	1	5
Levee replacement	Excavator	1	10
	Tractor and box grader	3	10
	Dozer	1	10
	Compactor	1	10
	Pump	1	10
Pipe Installation on Lindsey Slough			
Site preparation	Dozer	1	1
Cofferdam installation	Excavator	2	5
	Tractor and box grader	3	5
	Dozer	1	5
Levee excavation	Excavator	1	5
	Tractor and box grader	3	5
	Dozer	1	5
	Pump	1	5
Pipe installation	Excavator	2	10
	Pump	1	10
Levee replacement	Excavator	1	10
	Tractor and box grader	3	10
	Dozer	1	10
	Compactor	1	10
	Pump	1	10

1.4.4 Schedule

Project construction is expected to take approximately 66 working days between May and November 2025, with in-water work planned between August and November. A typical workday is assumed to be 8 hours per day, during daylight hours. Work will occur Monday through Saturday with light work (e.g., maintenance of equipment) on Sundays if needed.

1.4.5 Conservation measures

The conservation measures described below will be implemented as part of the Project. The measures are based on standard practices to avoid, minimize, or reduce potential impacts on environmental resources and to comply with existing regulations and/or requirements pertaining to air quality, biological resources, energy, greenhouse gas (GHG) emissions, hazards/hazardous materials, and hydrology/water quality.

CM-1. The following are best management practices (BMPs) that will be implemented during Project construction to prevent, control, and minimize emissions:

a) All construction vehicles will be model year 2010 or newer.
b) All diesel-fueled construction equipment will be in compliance with the California Air Resources Board's (CARB's) In-Use Off-Road Diesel-Fueled Fleets Regulation.
c) All construction equipment will be properly tuned and maintained prior to and for the duration of on-site operation.
d) Diesel-powered construction equipment idling time will be minimized to the extent feasible.
e) An operational water truck will be available at all times. Water will be applied as needed to control dust and to prevent visible emissions violations and off-site dust impacts.
f) On-site dirt piles or stockpiled materials will be covered, and water or soil stabilizers will be employed to reduce wind-blown dust emissions.
g) Traffic speeds on all unpaved surfaces will be limited to 20 miles per hour or less.
h) Ground cover will be re-established in the Project Area as soon as possible after construction.

CM-2. If any special-status wildlife is observed in the Project footprint, activities within the immediate vicinity will cease and the animal will be allowed to move out of the area on its own.

CM-3. Prior to Project construction, a Stormwater Pollution Prevention Plan (SWPPP) will be developed that will include, but not be limited to, the following BMPs to avoid and minimize potential impacts on waters from erosion:

a) Construction will occur only during dry periods. Dry periods are defined as: (1) less than 0.25 inch of precipitation during the preceding 24 hours, and (2) no precipitation falling during active construction.
b) Prior to storm events, all construction activities will cease, and appropriate erosion control measures implemented.
c) Soil, silt, or other organic materials will not be placed, stockpiled, or stored where such materials could pass into surface water or surface water drainage courses during unexpected rain events.
d) All areas disturbed by Project activities will be protected from washout or erosion prior to the onset of the rainy season.

e) All temporarily affected areas will be restored to pre-construction contours and conditions upon completion of construction activities. Any areas with bare ground will be re-seeded with a native seed mix.

f) Prior to initiation of any waterside work, erosion control measures will be utilized throughout all phases of operation where silt and/or earthen fill threaten to enter waters of the U.S and/or state.

CM-4. The Project SWPPP will include, but not be limited to, the following BMPs to avoid and minimize potential effects from hazards and hazardous materials:

a) No potentially hazardous materials will be stored in a location where there is potential to enter any waterway and/or contaminate aquatic resources.

b) All construction materials with the potential to pollute runoff will be handled with care and stored under cover or surrounded by berms during wet weather or when rain is forecast.

c) An effort will be made to store only the amount of a potentially hazardous product necessary to complete the job.

d) Materials, fuels, liquids and lubricants, and equipment supplies stored on site will be stored in a neat, orderly manner, in their appropriate containers, with the original manufacturer's label, and, if possible, in an enclosure.

e) Machinery stored on site will have pans or absorbent mats placed underneath potential leak areas.

f) Any hazardous materials will be stored and labeled according to local, state, and federal regulations.

g) If drums must be stored without overhead cover, they will be stored at a slight angle to reduce corrosion and ponding of rainwater on the lids.

h) Substances will not be mixed with one another unless recommended by the manufacturer.

i) Manufacturer's recommendations for proper use and disposal of a product will be followed.

j) Whenever possible, all of a product will be used before disposal of its container.

k) If surplus product must be disposed of, the manufacturer's or the local and state recommended methods for proper disposal will be followed.

CM-5. The SWPPP developed for the Project will include, but not be limited to, the following measures to prevent, control, and minimize impacts from a spill of a hazardous, toxic, or petroleum substance during construction of the Project:

a) Minor spills are those that can be controlled by on-site personnel. The following actions will occur upon discovery of a minor spill:

- The spread of the spill will be contained.
- If the spill occurs on impermeable surfaces, such as any temporary surfaces installed for pollution prevention during construction, it will be cleaned up using "dry" methods (e.g., absorbent materials, cat litter, rags).
- If the spill occurs in permeable substrate areas, it will be immediately contained by constructing an earthen dike. The contaminated soil will be excavated and properly disposed of.
- If the spill occurs during rain, the impacted area will be covered to avoid runoff, and appropriate cleanup steps will be taken after precipitation has ceased.
- All steps taken to report and contain the spill will be recorded.

b) On-site personnel should not attempt to control major spills until the appropriate and qualified emergency response staff have arrived at the site. Failure to report major spills can result in significant fines and penalties.
   - If a major spill occurs, the Governor's Office of Emergency Services Warning Center will be notified at (800) 852-7550 in addition to local authorities.
   - For spills of federal reportable quantities, the National Response Center will also be notified at (800) 424-8802. The federal reportable spill quantity for petroleum products is any oil spill that: (1) violates applicable water quality standards, (2) causes a film or sheen upon or discoloration of a water surface or adjoining shoreline, or (3) causes a sludge or emulsion to be deposited beneath the surface of the water or adjoining shorelines.
   - A written report will be sent to all notified authorities.

c) Diesel fuel, oil, gasoline, and lubricants are considered petroleum products. These materials will be handled carefully to minimize their exposure to storm water. The risks in using petroleum products will be reduced by following these steps:
   - Waste oil and other petroleum products will not be discharged into the ground or other water bodies.
   - Petroleum products will be stored in tightly sealed containers that are clearly labeled, in a covered area, and in an upland area or within prefabricated spill containment devices, earthen berms, or similar secondary containment features.
   - On-site vehicles will be monitored daily for fluid leaks and receive regular preventative maintenance to reduce the chance of leakage (e.g., check for and fix fuel oil leaks in construction vehicles on a regular basis). Oil, grease, or other fluids will be washed off at designated wash stations prior to entering the Project Area.
   - Bulk fuel or lubricating oil dispensers will have a valve that must be held open to allow the flow of fuel into construction vehicles. During fueling operations, the contractor will have personnel present to detect and contain spills.

d) The following additional spill control and cleanup practices will be followed:
   - Spills will be contained and cleaned up immediately after discovery.
   - Manufacturer's methods for spill cleanup of a material will be followed as described on the material safety data sheets (kept with product containers).
   - Materials and equipment needed for cleanup procedures will be kept readily available on site, either at an equipment storage facility or on the contractor’s trucks. Equipment to be kept on site will include, but not be limited to, brooms, dust pans, shovels, granular absorbents, sand, sawdust, absorbent pads and booms, plastic and metal trash containers, gloves, and goggles.
   - On-site personnel will be made aware of cleanup procedures, the location of spill cleanup equipment, and proper disposal procedures.
   - Toxic, hazardous, or petroleum product spills required to be reported by regulations will be documented and a record of the spills will be kept with Project documents.

If a spill occurs that is reportable to the federal, state, or local agencies, the contractor will be responsible for making and recording the reports.

CM-6. The Project SWPPP will include actions to protect water quality in surrounding waterways during in-water work (e.g., installing cofferdams). These actions will include but not be limited to:

a) Turbidity levels will be monitored during in-water work. If turbidity levels exceed applicable water quality objectives, in-water work will be delayed until adequate turbidity control measures are in place.
b) Sediment booms, silt curtains, or other appropriate turbidity control devices will be installed and maintained. Turbidity control devices will be inspected regularly, and any sediment removed from them shall be disposed of in designated locations.
c) During in-water work, construction equipment will be operated from a barge, an upland berm/levee, or a ground protection mat underlain with filter fabric. The amount of time equipment is stationed, working, or traveling in aquatic habitat will be minimized.

CM-7. The following measures will be implemented to reduce the potential for fire:

a) Smoking will be permitted only in designated smoking areas.
b) Every fuel truck will carry a large fire extinguisher with a minimum rating of 40 B:C.
c) All flammable materials will be removed from equipment parking and storage areas.

1.4.6 Mitigation measures

Mitigation measures have been added to the Project to reduce potential effects on biological resources and water quality to a less than significant level.

MM-1. All contractors and equipment operators will be provided a Worker Environmental Awareness Program training about the environmental resources of the Project Area, including special-status plants, fish, and wildlife species with potential to occur in the Project Area, and required protection measures. Workers will be informed about the presence, life history, and habitat requirements of all special-status species that may be affected by Project activities. Training will also include information on state and federal laws protecting plants, wildlife, fish, nesting birds, cultural resources, and water quality and the consequences of noncompliance with these laws. This training will be conducted prior to construction activities and will be provided to any new staff/contractors added during the Project.

MM-2. The following measures will ensure that adverse effects on special-status plants and Freshwater Marsh, [1] Riparian Forest,[2] Scrub-shrub,[3] and Shaded Riverine Aquatic (SRA)[4] habitats are avoided or minimized:

a) Prior to construction, a targeted special-status plant survey will be conducted, and areas with special-status plants will be flagged or otherwise marked (e.g., staked, fenced) for avoidance, including a 10-ft radius buffer. If work must be conducted within the 10-ft buffer, hand tools will be utilized to the extent possible. A biological monitor will be present during construction activities in areas within a 10-ft buffer of special-status plants to ensure impacts are avoided.

[1] Assembly Bill (AB) 360 defines Freshwater Marsh habitat as tidal and non-tidal areas near levees, either on the waterside or landside where there are seeps or toe ditches. Common plant species include cattails (*Typha* spp.) and common tule (*Schoenoplectus acutus* var. *occidentalis*).
[2] AB 360, which calls for "net long-term habitat improvement" (as defined in Water Code section 12310), defines Riparian Forest habitat as woody vegetation (including isolated trees or shrubs) greater than 20 ft in height that may or may not overhang the water's edge. Often there is a dense, shrubby understory.
[3] AB 360 defines Scrub-shrub habitat as stands of woody vegetation predominantly less than 20 ft in height.
[4] The AB 360 definition for SRA habitat includes areas along the shoreline where Riparian Forest and/or Scrub-shrub overhang the water's edge.

b) Where avoidance of special-status plants is not possible or impacts to Freshwater Marsh, Riparian Forest, or Scrub-shrub habitats occur, a Mitigation and Monitoring Plan will be developed. The plan will describe in detail mitigation for these species and habitat types on Hastings Tract and/or at an off-site mitigation bank. Mitigation site(s) will be approved by the California Department of Fish and Wildlife [CDFW].

MM-3. A preconstruction survey will be conducted within the Project footprint and surrounding 300 ft, within 48 hours of initiation of activities or if activities in an area have lapsed for more than 14 days, focusing on the presence and distribution of special-status wildlife species (including giant garter snake [*Thamnophis gigas*] and northwestern pond turtles [*Actinemys marmorata*]) and active breeding locations (i.e., nests). If an active nest (including northwestern pond turtles) is discovered, the area will be noted, and a no-disturbance buffer will be established and flagged. No-disturbance buffers will be determined by the biologist (and if needed, in consultation with CDFW); recommended buffers are: 500 ft for an active raptor nest (including ground nesting species) and 100 ft for all other active bird or reptile nests.

MM-4. The following measures will be implemented for Project activities conducted between March 1 and September 1 to minimize effects on Swainson's hawk (*Buteo swainsoni*) and other protected raptors:

a) Three pre-construction raptor nest surveys will be conducted within a 0.25-mile buffer of the Project Area by a biologist to identify any active nests in the Project vicinity. One survey will be simultaneously conducted with **MM-3**, no more than seven days prior to the initiation of construction activities.

b) If active nests are found, a no-disturbance buffer of 0.25 mile will be established. If Project-related activities need to be conducted within the no-disturbance buffer a biological monitor will oversee the work while monitoring the nest. Work will be allowed if raptors are not exhibiting agitated behavior such as defensive flights at intruders, getting up from a brooding position, or flying off the nest. The biological monitor will have the authority to stop work if the raptors are exhibiting agitated behavior. If the birds are tolerant of Project activities, consultation with CDFW will commence for the reduction of the no-disturbance buffer.

MM-5. The following measures will be implemented to minimize potential effects on giant garter snake or their habitat.

a) Ground disturbing construction within 200 ft of suitable giant garter snake habitat will be initiated between May 1 and October 1. This is the active period for the snake, lessening the potential for direct mortality. USFWS will be consulted if ground-disturbing work (within 200 ft or suitable giant garter snake habitat) needs to continue beyond October 1.

b) During Project dewatering, potential snake prey (e.g., fish and tadpoles) will be removed to the extent feasible so that snakes are not attracted to the construction footprint.

c) The Project will prohibit use of erosion control materials potentially harmful to giant garter snake, such as mono-filament netting, alternatively, tightly woven fiber netting or similar material will be used to ensure that giant garter snakes do not get trapped or become entangled.

MM-6. Prior to Project activities, a Fish Capture and Relocation Plan will be developed and submitted to the appropriate state and federal wildlife agencies (e.g., CDFW, U.S. Fish and Wildlife Service [USFWS], National Marine Fisheries Service [NMFS]) for review and approval.

The plan will describe the proposed biologist's qualifications, capture methods, capture and relocation work areas, and reporting requirements, including details in the list below.

a) This plan will incorporate the latest USFWS and NMFS guidance relating to the capture and relocation of fish, as applicable.
b) Procedures for decontamination of any equipment used in the capture and relocation of fish will be identified.
c) Prior to the implementation of capture and relocation activities, relocation (or release) sites will be identified by a qualified biologist, based on proximity, access, habitat suitability, and potential to be affected by construction-related disturbance. Suitable habitat for relocation sites will be in the same watershed/subwatershed basin where fish are originally captured. One or more of the following methods will be used to capture protected fish species: electrofishing, dip net, seine, throw net, minnow trap, and hand.
d) Fish relocation will only be led by a qualified biologist. The qualified biologist will have knowledge and experience in fish biology and ecology; fish/habitat relationships; biological monitoring; handling, collecting, and relocating fish; or other relevant experience.
e) Residual surface water associated with the diverted or dewatered habitat will be monitored or sampled for the presence of fish by a qualified biologist as soon as the waters are isolated. If a listed species of fish is observed in the isolated habitat, they will be immediately captured and relocated to the suitable habitat outside of the construction area, but in the same water basin, by the qualified biologist, in accordance with the approved fish capture and relocation plan.
f) The qualified biologist will relocate any stranded covered fish species to an appropriate place, depending on the life stage of the fish and consistent with the approved rescue and relocation plan.
g) The qualified biologist will note the number of individuals observed in the affected area, the number of individuals relocated, the approximate size of individuals, the location of capture and release, any instances of injury or mortality, and the date and time of the collection and relocation. This information will be reported to the appropriate state and/or federal agencies within seven days of completion of the fish capture and relocation effort.

MM-7. The following actions will be implemented during cofferdam installation and removal to avoid and minimize potential impacts to fish and aquatic wildlife:

a) Cofferdam installation will occur in a downstream direction, allowing water to drain (or passive tidal outflow) and fish and wildlife species to leave the area to be enclosed under their own volition.
b) Cofferdams will enclose the minimum area necessary to perform construction activities.
c) If cofferdam installation requires pile driving, vibratory hammers or low/non-impact (i.e., hydraulic) methods will be used. If impact hammers are required, sound dampening or attenuation devices (e.g., cushioning blocks, air bubble curtains) will be utilized. Pile driving will follow criteria outlined in *Technical Guidance for Assessment and Mitigation of Hydroacoustic Effects of Pile Driving on Fish* (Caltrans 2015).
d) Cofferdam footings will be installed to a depth appropriate for impeding the amount of subsurface flow necessary for dewatering the streambed.
e) Fine-meshed block nets or screens with openings no wider than 1/8 inch will be utilized during cofferdam installation to ensure fish and aquatic wildlife do not enter areas to be dewatered. The bottom of the nets or screens will be secured to the channel bed, and the

nets will be checked at least twice daily and cleaned of debris, as necessary, to permit free flow of water.

f) Cofferdams will be removed at the lowest possible tide and in slack water to minimize disturbance. Alteration of the streambed will be minimized, and any imported material that is not part of the Project design will be removed.

MM-8. The following actions will be implemented during dewatering to avoid and minimize potential impacts to fish and aquatic wildlife:

a) Dewatering equipment will be installed to maintain natural flow in waterways adjacent to (i.e., not enclosed by) cofferdams.

b) Dewatering will occur for the minimum amount of time required to perform construction activities in the isolated areas.

c) Dewatering pump intakes will be covered with mesh and checked periodically to prevent potential entrainment of fish or other aquatic species.

2 ENVIRONMENTAL SETTING AND IMPACTS

Each of the following resource sections includes a completed checklist (from Appendix G of the CEQA Guidelines) of environmental factors potentially affected and identifies potential Project impacts by significance level (i.e., no impact, less than significant impact, less than significant impact with mitigation incorporated, and potentially significant impact). The environmental factors checked in Table 2-1 would potentially be affected by this Project; mitigation measures will be implemented to ensure potential impacts are reduced to less than significant levels.

Table 2-1. Summary of environmental factors potentially affected by the Project.

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

2.1 Aesthetics

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Except as provided in Public Resources Code Section 21099, would the Project:				
a) Have a substantial adverse effect on a scenic vista?	❑	❑	❑	✓
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	❑	❑	❑	✓
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings?	❑	❑	✓	❑
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?	❑	❑	❑	✓

2.1.1 Environmental setting

The term "aesthetics" typically refers to the perceived visual character of an area, such as of a scenic view, open space, or architectural facade. The aesthetic value of an area is a measure of its visual character and visual quality combined with viewer response (FHWA 1983). This combination may be affected by the components of a project (e.g., buildings constructed at heights that obstruct views, hillsides cut and graded, open space changed to an urban setting) or by the length or frequency of viewer exposure to a setting. Aesthetic impacts are changes in viewer response because of Project construction and operation.

The levees along the perimeter of Hastings Tract provide scenic views of the Delta, including Cache Slough and Lindsey Slough. Views of the tract interior are largely agricultural and include ruderal vegetation, managed agricultural fields, and small patches of Riparian Forest and Scrub-shrub. Viewers include recreational visitors to Hastings Island Hunting Preserve, the people inhabiting the few residences on the tract, District employees who maintain the tract's infrastructure, and farmers who manage the tract's agricultural fields. People boating in waterways surrounding the tract are not generally able to see the tract's interior because of the existing levees.

2.1.2 Findings

a) Would the Project have a substantial adverse effect on a scenic vista?

Project implementation will not alter the scenic views of Cache Slough or Lindsey Slough from Hastings Tract. Views of the tract interior are not scenic, as described above, and will not change following Project construction. There will be no impact.

b) Would the Project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

No state scenic highways pass through the Project Area, nor is the Project Area visible from any state scenic highways. There will be no impact.

c) In nonurbanized areas, would the Project substantially degrade the existing visual character or quality of public views of the site and its surroundings?

Construction activities will temporarily disrupt the visual character of the Project Area. During Project construction, vegetation within the construction footprint will be removed and portions of the Cache Slough and Lindsey Slough levees will be excavated, which will temporarily degrade the visual quality of the site. Construction equipment may be visible to boaters using the adjacent waterways or the limited number of visitors to or residents of the tract. These impacts will occur for a short period of time (i.e., approximately three months). After Project completion, construction equipment will be removed, and the levee slopes or other disturbed areas will be revegetated with a native seed mix. The Project will therefore not substantially permanently degrade the visual character or aesthetic quality of the Project Area or surrounding areas, and impacts will be less than significant.

d) Would the Project create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

There will be no nighttime construction or creation of a new source of substantial light or glare because of the Project. There will be no impact.

2.2 Agriculture and Forestry Resources

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	❑	❑	✓	❑
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	❑	❑	✓	❑
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220[g]), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104[g])?	❑	❑	❑	✓
d) Result in the loss of forest land or conversion of forest land to non-forest use?	❑	❑	❑	✓
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	❑	❑	❑	✓

2.2.1 Environmental setting

The Project's location in the Sacramento Valley near Cache and Lindsey sloughs has allowed for the development of deep, rich agricultural soil over time. This rich soil and a climate with a lengthy growing season promote extensive agricultural production in Solano County. The county contains approximately 360,000 acres of land in agricultural production, most of which are in active production for fruit and nut crops, vegetable crops, or livestock (Solano County 2008). Much of the approximately 6,400 acres on the interior of Hastings Tract is in agricultural production for field or vegetable crops.

2.2.1.1 Farmland

The California Farmland Mapping and Monitoring Program (FMMP), administered by the State Division of Land Resource Protection, is responsible for producing agricultural resource maps based on soil quality and land use. The FMMP designates land into the following categories: Prime Farmland, Farmland of Statewide Importance, Unique Farmland, Farmland of Local Importance, Grazing Land, Urban or Built-up Land, Other Land, and Water. Descriptions of these categories are detailed in the FMMP (California DOC 2023a).

The majority of Hastings Tract is designated as Prime Farmland or Farmland of Statewide Importance (California DOC 2022). The Project Area includes 1.7 acres of land designated as

Prime Farmland, 0.4 acre of Unique Farmland, and 0.2 acre of Grazing Land. Of the 1.7 acres of Prime Farmland in the Project Area, 0.3 acre is in the staging area.

2.2.2 Findings

a) Would the Project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

The Project Area includes 1.7 acres of land designated as Prime Farmland, 0.4 acre of Unique Farmland, and 0.2 acre of Grazing Land. Although much of the construction footprint is classified as Farmland by the FMMP, these areas are not in agricultural production but comprise levees protecting the adjacent agricultural fields and will be restored to this use following Project construction. The staging area, which includes 0.3 acre designated as Prime Farmland and is regularly used for production of field crops, will be unavailable for agricultural use temporarily during Project construction but will remain available for agricultural use over the long term. The impact will be less than significant.

b) Would the Project conflict with existing zoning for agricultural use, or a Williamson Act contract?

The Project Area is currently zoned for agricultural use and included in a Williamson Act contract. However, the Project's construction footprint only includes the Cache Slough, Lindsey Slough, and Hastings Cut levees and portions of the adjacent waterways, and is not used for agricultural production. The Project's 0.65-acre staging area is regularly cultivated with field crops but is separated from the large agricultural parcels on the interior of the tract by an irrigation ditch. Land use in the Project Area will not change following Project construction, and the footprint of the staging area will remain available for agricultural use. The impact of the Project will be less than significant.

c) Would the Project conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code Section 12220[g]), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104[g])?

The Project Area is not zoned as forest land or timberland. There will be no impact.

d) Would the Project result in the loss of forest land or conversion of forest land to non-forest use?

The Project will not result in the loss of forest land or conversion of forest land to non-forest use. There will be no impact.

e) Would the Project involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

Land use in the Project Area and vicinity will not change following Project construction; therefore, the Project will not involve other changes in the existing environment which could result in conversion of Farmland to non-agricultural use. There will be no impact.

2.3 Air Quality

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	❑	❑	❑	✓
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard?	❑	❑	✓	❑
c) Expose sensitive receptors to substantial pollutant concentrations?	❑	❑	✓	❑
d) Result in other emissions such as those leading to odors adversely affecting a substantial number of people?	❑	❑	❑	✓

2.3.1 Environmental setting

The Project is in the Sacramento Valley Air Basin (SVAB), which includes Butte, Colusa, Glenn, Placer (western), Sacramento, Shasta, Solano (eastern), Sutter, Tehama, Yolo, and Yuba counties, and is administered by the Yolo-Solano Air Quality Management District (YSAQMD). The SVAB is bounded by mountainous areas to the east, west, and north, with an opening to the south into the Delta. The region experiences relatively long summers with generally hot and dry conditions, and short winters with cool, wet conditions. Subtropical high air pressure events can occur year-round and result in the formation of strong atmospheric inversion layers. The combination of these topographical and meteorological factors can prevent the dispersion of pollutants and is particularly conducive to poor air quality.

2.3.1.1 Criteria air pollutants

The federal Clean Air Act of 1970 (Section 6.1) and CARB have established air quality standards for several common pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, sulfates, and hydrogen sulfide (CARB 2023a). Air quality data for some criteria air pollutants in the SVAB are summarized in Table 2-2 for 2017 to 2021.

Table 2-2. Summary air quality statistics for the Sacramento Valley Air Basin, 2017 to 2021.

Year	Pollutant (averaging time)	Maximum concentration	No. of days exceeding federal standards	No. of days exceeding state standards
2017	Ozone (1-hour)	0.121 ppm	n/a	7
	Ozone (8-hour)	0.091 ppm	34	35
	$PM_{2.5}$ (daily)	85.9 µg/m^3	12	n/a
	PM_{10} (daily)	237.7 µg/m^3	6	19
2018	Ozone (1-hour)	0.117 ppm	n/a	11
	Ozone (8-hour)	0.098 ppm	36	42
	$PM_{2.5}$ (daily)	411.7 µg/m^3	24	n/a
	PM_{10} (daily)	454.0 µg/m^3	9	60
2019	Ozone (1-hour)	0.103 ppm	n/a	3
	Ozone (8-hour)	0.082 ppm	12	15
	$PM_{2.5}$ (daily)	41.4 µg/m^3	3	n/a
	PM_{10} (daily)	174.7 µg/m^3	1	45
2020	Ozone (1-hour)	0.137 ppm	n/a	9
	Ozone (8-hour)	0.097 ppm	29	33
	$PM_{2.5}$ (daily)	329.3 µg/m^3	34	n/a
	PM_{10} (daily)	391.3 µg/m^3	10	77
2021	Ozone (1-hour)	0.114 ppm	n/a	13
	Ozone (8-hour)	0.097 ppm	52	56
	$PM_{2.5}$ (daily)	265.7 µg/m^3	26	n/a
	PM_{10} (daily)	218.2 µg/m^3	1	48

Source: CARB (2023b)
n/a = not applicable
$PM_{2.5}$ = respirable particulate matter less than 2.5 microns in diameter
PM_{10} = respirable particulate matter less than 10 microns in diameter
ppm = parts per million
µg/m^3 = micrograms per cubic meter of air

The SVAB does not consistently meet all applicable air quality standards (CARB 2023c). The portion of Solano County within the SVAB is currently designated as nonattainment for state ozone and PM_{10}[5] standards (CARB 2023c) and for federal ozone and $PM_{2.5}$[6] standards (USEPA 2023a). Otherwise, the Project Area is designated as attainment for carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide standards. Therefore, criteria air pollutants and precursors of primary concern for construction activity in the Project Area include ozone precursors (e.g., nitrogen oxides, reactive organic gases) and fugitive/exhaust dust particulate matter (PM_{10} and $PM_{2.5}$).

YSAQMD has established an Air Quality Attainment Plan to aid in the attainment of federal and state ozone standards, largely through emissions reductions (YSAQMD 2019). In accordance with this plan and state and federal air quality standards, YSAQMD has developed emissions thresholds for criteria pollutants to be used in determining the significance of Project-related air quality impacts (YSAQMD 2007). Since YSAQMD emissions thresholds are more stringent than U.S. Environmental Protection Agency (USEPA) thresholds, emissions would be considered

[5] Respirable particulate matter less than 10 microns in diameter
[6] Respirable particulate matter less than 2.5 microns in diameter

significant if they exceeded the local thresholds. Thresholds established by YSAQMD are 10 tons per year of nitrogen oxides, 80 pounds per day of PM_{10}, and 10 tons per year of reactive organic gases. YSAQMD has not established a threshold of significance for $PM_{2.5}$ emissions, so Project emissions of $PM_{2.5}$ would be considered significant if exceeding the USEPA threshold of 100 tons per year (USEPA 2023a).

In addition to thresholds for criteria pollutants, YSAQMD has adopted a threshold of significance for odors. A project is considered to have a significant adverse odor impact if it "generates odorous emissions in such quantities as to cause detriment, nuisance, or annoyance to any considerable number of persons or to the public, or which may endanger the comfort, repose, health, or safety of any such person or the public, or which may cause, or have a natural tendency to cause, injury or damage to business or property."

2.3.1.2 Sensitive receptors

Some individuals have heightened health risks associated with exposure to air pollution, and for some air quality constituents, impacts are determined based on the distance to the closest sensitive receptor. Sensitive receptors include but are not limited to residential areas, schools, and hospitals. The nearest sensitive receptor to the Project Area is the rural residence on the opposite side of Cache Slough from the Project Area, approximately 650 ft away. Other rural residences in the vicinity are greater than 1 mile from the Project Area.

2.3.2 Findings

Project construction details (e.g., duration, timing, equipment use) were analyzed using the California Emissions Estimator Model Version 2022.1.1.14 (CalEEMod) to estimate Project emissions, including exhaust from construction equipment, fugitive dust generated by construction activities, and vehicle travel over unpaved roads. Operational emissions were not analyzed because there will be no change in operations or maintenance activity following Project construction. The CalEEMod data entry and emissions summary sheet is included as Appendix A.

The modeling was based on the emission sources in Table 2-3 below and the construction equipment and phasing in Table 1-1. Additional model assumptions included implementation of air quality BMPs included as part of the Project in conservation measure **CM-1** (e.g., use of an on-site water truck, speed limits on unpaved roads).

Table 2-3. Project quantities used to determine Project emissions.

Emission source	Project quantities
Imported soil fill	1,667 cubic yards
Imported aggregate base	250 cubic yards
Imported rip rap	227 cubic yards
Employee commute trips	6 employee trips/day 20 miles one way

Model results for total anticipated Project emissions of criteria pollutants for which the Project region is designated as non-attainment are shown in Table 2-4 and included in detail in Appendix A.

Table 2-4. Total estimated Project construction emissions of criteria pollutants for which the Project region is designated as non-attainment.

	NO_X (tons/year)	**$PM_{2.5}$ (tons/year)**	**PM_{10} (lbs/day)**	**ROG (tons/year)**
Maximum Project emissions	0.56	0.13	58.2	0.07
Emissions threshold	10	100	80	10

Notes:
lbs = pounds
NO_x = nitrogen oxides
$PM_{2.5}$ = respirable particulate matter (less than 2.5 microns in diameter)
PM_{10} = respirable particulate matter (less than 10 microns in diameter)
ROG = reactive organic gases

a) Would the Project conflict with or obstruct implementation of the applicable air quality plan?

Based on the air quality modeling, Project construction is expected to result in temporary emissions of ozone precursors (i.e., nitrogen oxides and reactive organic gases) that are below YSAQMD standards and therefore do not conflict with emissions reductions goals outlined in the applicable YSAQMD Air Quality Attainment Plan (YSAQMD 2019). Although the applicable air quality plan does not outline specific requirements for mobile emission sources used during Project construction (i.e., equipment, vehicles), the Project will implement BMPs as part of conservation measure **CM-1** (Section 1.4.5) to ensure emissions of ozone precursors are minimized. There will be no change in long-term operational emissions. The Project will therefore not conflict with or obstruct implementation of an applicable air quality plan; there will be no impact.

b) Would the Project result in a cumulatively considerable net increase of any criteria pollutant for which the Project region is non-attainment under an applicable federal or state ambient air quality standard?

The model results summarized in Table 2-4 demonstrate that Project construction emissions are not expected to exceed thresholds for criteria air pollutants for which the SVAB is currently designated as nonattainment (including $PM_{2.5}$, PM_{10}, and ozone precursors [i.e., nitrogen oxides, reactive organic gases]), and implementation of BMPs in **CM-1** (Section 1.4.5) will ensure emissions are minimized. There will be no change in long-term operational emissions because of the Project. Although Project construction will result in some emissions for which the SVAB is not in attainment, the minimal amount and temporary nature of these emissions will not result in a cumulatively considerable net increase of these pollutants. Therefore, the impact will be less than significant.

c) Would the Project expose sensitive receptors to substantial pollutant concentrations?

The nearest sensitive receptor to the Project Area is the rural residence on the opposite side of Cache Slough from the Project Area, approximately 650 ft away. Other rural residences in the vicinity are greater than 1 mile from the Project Area.

The Project will not result in substantial diesel particulate emissions. Maximum exhaust emissions are 1.21 pounds per day PM_{10} and 1.11 pounds per day $PM_{2.5}$, and average exhaust emissions are 0.14 pounds per day PM_{10} and 0.12 pounds per day $PM_{2.5}$ (Appendix A).

Implementation of BMPs included in **CM-1** (Section 1.4.5) will minimize diesel emissions, and Project construction will be temporary, resulting in increased diesel exhaust for approximately 66 days. Therefore, the Project's impact on exposing sensitive receptors to substantial pollutant concentrations will be less than significant.

d) Would the Project result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

Project construction is not expected to result in other emissions, such as those leading to objectionable odors, adversely affecting a substantial number of people. Post-construction, the Project will not result in any change to current operation or maintenance activities that would result in additional emissions. The Project will have no impact.

2.4 Biological Resources

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	❑	✓	❑	❑
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?	❑	✓	❑	❑
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	❑	❑	✓	❑
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	❑	❑	✓	❑
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	❑	❑	❑	✓

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	❑	❑	❑	✓

2.4.1 Environmental setting

Resource evaluations were performed to identify sensitive biological resources or available habitat within or near the Project Area. These evaluations included land cover classification and vegetation mapping, surveys for special-status plants, a habitat assessment for special-status fish and wildlife species, and a delineation of potentially jurisdictional waters/wetlands. Results from these evaluations were used to inform impact analyses and the development of appropriate conservation measures.

2.4.1.1 Special-status species

Special-status plant, fish, and wildlife with the potential to occur within or near the Project Area were identified through a query of the following resources:

- CDFW's California Natural Diversity Database (CNDDB; CDFW 2023a) for the United States Geological Survey (USGS) 7.5-minute quadrangle in which the Project Area is located (Dozier) and the surrounding eight quadrangles (i.e., Allendale, Birds Landing, Denverton, Dixon, Elmira, Liberty Island, Rio Vista, and Saxon),
- USFWS's Information for Planning and Conservation (IPaC) portal (USFWS 2023a),
- National Marine Fisheries Service's (NMFS's) West Coast Region, California Species List Tool (NMFS 2016), and
- California Native Plant Society's online Inventory of Rare and Endangered Vascular Plants of California (CNPS 2023a).

Database query results are presented in Appendix B (for special-status plants) and Appendix C (for special-status fish and wildlife species). The habitat preferences and distributional range of each species from the database queries were compared with existing information and the results of field surveys to determine the potential for each species to occur in the Project Area, resulting in a refined list of species that may be impacted by the Project. If a species' required habitat was lacking from the Project Area or if the Project Area is outside the species' known distribution or elevation range, the species was considered not likely to occur.

Plants

Stillwater Sciences biologists (E. Applequist and C. Bilodeau) conducted special-status plant surveys on April 21 and June 5, 2023. Botanical surveys for special-status plants were comprehensive, conducted during appropriate bloom periods, and followed accepted protocols (USFWS 2000, CDFW 2018).

Three special-status plant species (Delta tule pea [*Lathyrus jepsonii*], Mason's lilaeopsis [*Lilaeopsis masonii*], and Suisun Marsh aster [*Symphyotrichum lentum*]) were documented in and adjacent to the Project Area during 2023 botanical surveys (Table 2-5, Figure 2-1). An additional special-status plant species, Parry's rough tarplant (*Centromadia parryi* subsp. *rudis*), was observed outside of the Project Area along the haul route. A comprehensive list of all plants documented in the Project Area during the botanical surveys is included in Appendix D.

Table 2-5. Special-status plant populations documented in or near the Project Area.

Scientific name	Common name	Status[1] Federal/State/ CRPR	Patch ID	Number of individuals or net patch area	
				Total patch	In Project Area
Centromadia parryi subsp. *rudis*	Parry's rough tarplant	–/–/4.2	CEPA01	170	--
Lathyrus jepsonii var. *jepsonii*	Delta tule pea	–/–/1B.2	LAJE01	20	20
			LAJE02	10	--
			LAJE03	10	--
			LAJE04	25	25
			Total	**65**	**45**
Lilaeopsis masonii	Mason's lilaeopsis	–/CR/1B.1	LIMA01	0.3 ft^2	0.3 ft^2
			LIMA02	127.2 ft^2	10.7 ft^2
			Total	**127.5 ft^2**	**11.0 ft^2**
Symphyotrichum lentum	Suisun Marsh aster	–/–/1B.2	SYLE01	40	20
			SYLE02	10	--
			Total	**50**	**20**

ft^2 = square feet

[1] Status:

State List

CR State Listed as Rare

California Rare Plant Rank (CRPR):

1B Plants rare, threatened, or endangered in California and elsewhere

4 Plants of limited distribution, a watch list

CRPR Threat Rank:

0.1 Seriously threatened in California (high degree and immediacy of threat)

0.2 Fairly threatened in California (moderate degree/immediacy of threat)

Figure 2-1a. Special-status plants in the Project Area, northern portion along Cache Slough (page 1 of 2).

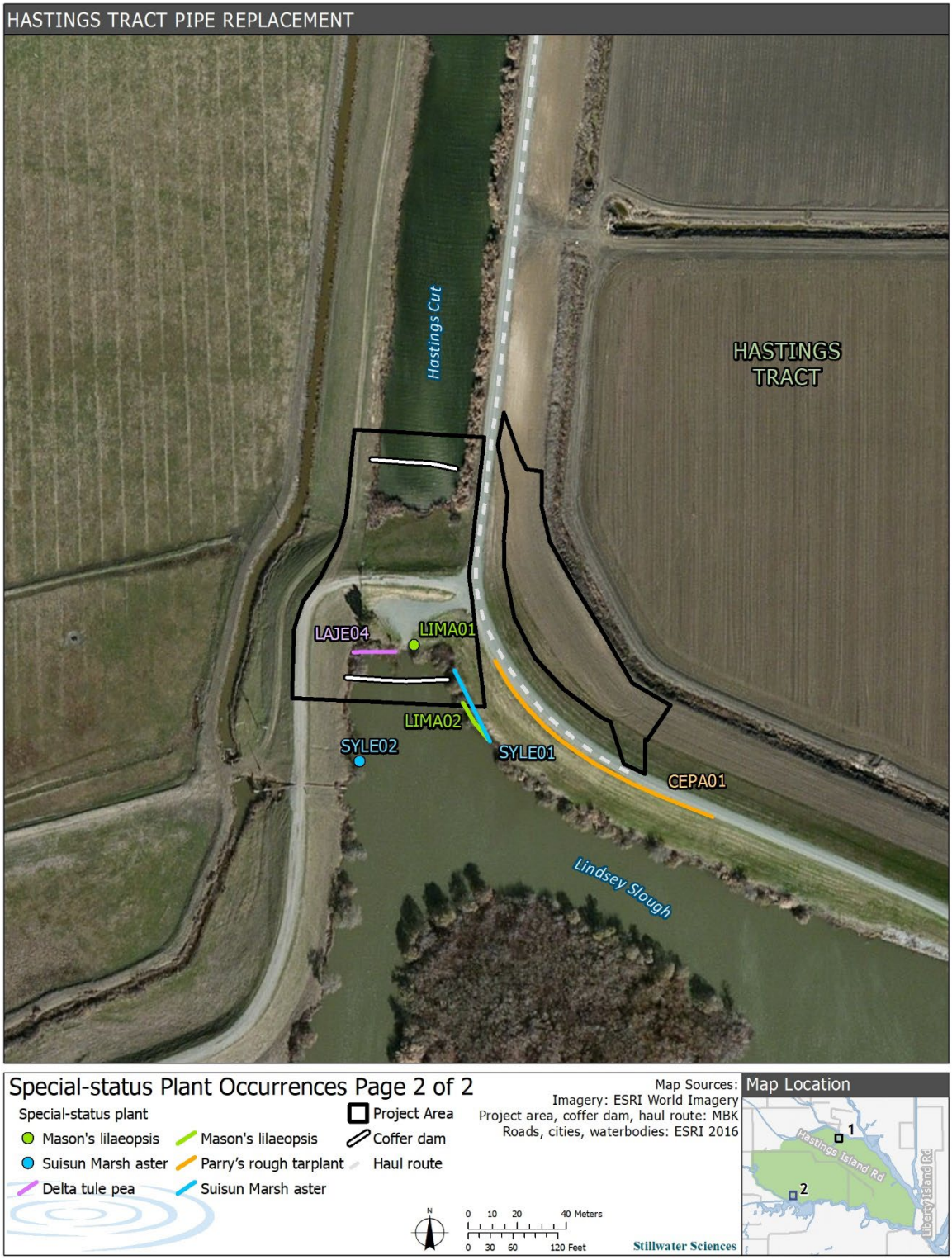

Figure 2-1b. Special-status plants in the Project Area, southern portion along Lindsey Slough (page 2 of 2).

Parry's rough tarplant

A population of 170 Parry's rough tarplant individuals was documented outside of the Project Area, growing adjacent to the haul route near Lindsey Slough (Table 2-5, Figure 2-1).

Parry's rough tarplant is an annual herb in the Asteraceae family and is endemic to California. It has a California Rare Plant Rank (CRPR) of 4.2. It grows in alkaline areas of vernal pools and seeps, and vernally mesic areas of valley and foothill grasslands and roadsides. It occurs at elevations of 0 to 330 ft and blooms from May to October. Populations are threatened by development, habitat alteration, habitat disturbance, grazing, and roadside maintenance (CNPS 2023a).

Delta tule pea

Two patches of Delta tule pea were documented in the Project Area, growing above the mean high water line (i.e., 6.1 ft North American vertical datum 1988) along the waterside toe of the Lindsey Slough levee and the northeastern end of Hastings Cut (Figure 2-1). A total of 45 Delta tule pea plants were documented in the Project Area in these two patches (Table 2-5). Another two patches were documented along Cache Slough and Hastings Cut adjacent to the northern portion of the Project Area. These patches are part of the previously documented occurrences #52 and #53 and (CDFW 2023a).

Delta tule pea is a perennial herb in the Fabaceae family and is endemic to California. It has a CRPR of 1B.2. It grows in brackish and freshwater marshes and swamps at elevations from 0 to 16 ft and blooms from May to July (sometimes to August and September). Most populations are small and are threatened by agriculture, water diversions, and erosion (CNPS 2023a).

Mason's lilaeopsis

The population of Mason's lilaeopsis documented in the Project Area was found in two discrete patches growing in the intertidal zone below the mean high water line along the Lindsey Slough levee (Figure 2-1). The combined gross patch size was 127.5 ft^2, with a total of 11.0 ft^2 in the Project Area (Table 2-5). This population is part of the previously documented occurrence #70 (CDFW 2023a).

Mason's lilaeopsis is a perennial rhizomatous herb in the Apiaceae family and is endemic to California. It is state listed as Rare and has a CRPR of 1B.1. It occurs in freshwater and brackish marshes and swamps, and riparian scrub at elevations ranging from 0 to 32 ft and blooms from April to November (CNPS 2023a). It is threatened by erosion, channel stabilization, development, flood control projects, recreation, agriculture, shading resulting from marsh succession, and competition with non-native water hyacinth (*Eichhornia crassipes*) (CNPS 2023a). Many populations are ephemeral, occupying newly deposited or exposed sediments (CNPS 2023a).

Suisun Marsh aster

The Suisun Marsh aster population documented along the waterside toe of the Lindsey Slough levee at or just above mean higher high water was found across two discrete patches, one of which included 20 plants in the Project Area(Table 2-5, Figure 2-1). This population is part of the previously documented occurrence #28 (CDFW 2023a).

Suisun Marsh aster is a perennial rhizomatous herb in the sunflower (Asteraceae) family that has a CRPR of 1B.2. It is endemic to California, occurring below 10 ft in elevation within the southern Sacramento Valley, the Delta, and eastern San Francisco Bay in Contra Costa, Napa, Sacramento, San Joaquin, Solano, and Yolo counties (CNPS 2023a). Suisun Marsh aster typically occurs in brackish and freshwater marshes and swamps and blooms from May (sometimes as early as April) to November (CNPS 2023a). This species is threatened by habitat alteration and loss as well as erosion, and possibly threatened by herbicide application and competition from non-native plants (CNPS 2023a).

Fish

Database queries identified eight special-status fish species that have the potential to occur in the Project region (Appendix C). Of these, five have a low-to-moderate or moderate potential to occur within the Project Area (Table 2-6) during specific times of year (Table 2-7). The remaining three species have no or low potential to occur in or near the Project Area due to a lack of suitable habitat (aquatic habitat is discussed in detail in Section 2.4.1.2) or because the Project Area is outside of the species' known range.

Table 2-6. Special-status fish with moderate or greater potential to occur in the Project Area.

Common name ***Scientific name***	**Status[1] Federal/ State**	**Likelihood to occur in the Project Area**
Fishes		
North American green sturgeon: southern DPS *Acipenser medirostris*	FT/–	**Moderate.** The Project Area likely contains suitable rearing or migration habitat for juveniles and adults in Lindsey Slough but is lacking suitable spawning habitat. Green sturgeon have been salvaged at the state and federal fish collection facilities every month, indicating they are present in the Bay-Delta year-round (70 FR 17386). In the Sacramento River Delta, juveniles were captured primarily in water from 3–8 ft deep (Radtke 1966). Critical habitat for this species is present in the Project Area (NMFS 2009).
Sacramento splittail *Pogonichthys macrolepidotus*	–/SSC	**Moderate.** The larger Cache-Lindsey Complex contains suitable habitat. Non-reproductive adult splittail are most abundant in moderately shallow, brackish tidal sloughs but can also be found in freshwater areas with tidal or riverine flow (Moyle et al. 2004). Young-of-the-year and yearling splittail are generally most abundant in shallow water (Moyle 2002). Individuals have been periodically caught in Cache Slough near the confluence with Lindsey Slough (at 20mm Survey Station # 716, within 5 miles of the Project Area; CDFW 2023b), and in Lindsey Slough in 2014 (Young et al. 2015).

Common name ***Scientific name***	**Status[1] Federal/ State**	**Likelihood to occur in the Project Area**
Delta smelt *Hypomesus transpacificus*	FT/SE	**Moderate**. Juvenile delta smelt were captured upstream of the Project Area in Barker Slough (at 20 mm Survey Station # 720) in 2019. Additionally, Cache Slough is considered key habitat (Merz et al. 2011) and a potential spawning location (inferred from larval catches [Bennett 2005]) for the species. The species is typically found in shallow water (less than 10 ft deep) (Moyle 2002). Spawning may occur in the Project Area (in Upper Cache Slough and Lindsey Slough); however, spawning activity is limited to February through July (Moyle 2002, Bennett 2005). Critical habitat for delta smelt is present in the Project Area (USFWS 2004).
Longfin smelt, San Francisco Bay-Delta DPS *Spirnichus thaleichthys*	FPE/ST	**Low/Moderate.** Individuals were captured several times in Barker slough and Lindsey slough (at 20mm trawl stations # 720 and # 718, respectively) between 2008 and 2014 (CDFW 2023a,b). In the San Francisco Estuary longfin smelt populations are concentrated in Suisun, San Pablo, and North San Francisco bays, and rarely occur upstream of Rio Vista or Medford Island in the Delta (Moyle 2002).
Steelhead, Central Valley DPS *Oncorhynchus mykiss irideus*	FT/–	**Low/Moderate.** Lindsey Slough is not a migratory pathway for adult or juvenile steelhead but may support non-natal rearing. Critical habitat for this DPS is not present in the Project Area (NMFS 2005).

Notes: DPS = Distinct Population Segment; mm = millimeters

[1] Status

Federal
FT = Listed as threatened under the federal Endangered Species Act
FPE = Federally proposed as endangered

State
SE = Listed as Endangered under the California Endangered Species Act (CESA)
ST = Listed as Threatened under the CESA
SSC = CDFW Species of Special Concern

Table 2-7. Timing of special-status fish species life stages near the Project Area (**bracketed heavy lines** indicate the proposed in-water work period of August through November).

Species ESU/DPS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
North American green sturgeon – Southern DPS												
Adult Migration												
Juvenile Rear/Migration												
Sacramento splittail												
Adult Migration												
Spawning[1]												
Juvenile Rear/Migration												
Delta smelt												
Adult Migration												
Spawning												
Larval/Juvenile Rearing												
Longfin smelt - San Francisco Bay-Delta DPS												
Spawning[2]												
Rearing												
Steelhead – Central Valley DPS												
Adult Migration												
Juvenile Rear/Migration												

[1] Spawning by Sacramento splittail is unlikely to occur within the Project Area, as the species prefers inundated floodplain habitat or nearshore emergent freshwater marsh areas for spawning in low-water years.

[2] Spawning by Longfin smelt occurs in freshwater habitats not found within the Project Area.

Wildlife

Database queries identified 36 special-status wildlife species that have the potential to occur in the Project region (Appendix C). Stillwater Sciences biologist M. Montjoy conducted a wildlife habitat assessment on June 5, 2023, to determine the likelihood for these species to occur in the Project Area. Thirteen species identified by queries have a moderate or high potential to occur within the Project Area (Table 2-8). The remaining 23 species have no or low potential to occur in or near the Project Area due to a lack of suitable habitat or because the Project Area is outside of the species' known range.

Table 2-8. Special-status wildlife with moderate or greater potential to occur in the Project Area.

Common name *Scientific name*	Status[1] Federal/ State	Likelihood to occur in the Project Area
Reptiles		
Northwestern pond turtle *Actinemys marmorata*	FPT/SSC	**Moderate.** The Project Area contains suitable aquatic habitat in Hastings Cut and Lindsey and Cache sloughs. Additionally, the Project Area may be used as upland dispersal between suitable aquatic habitats. A northwestern pond turtle was observed in Barker Slough, less than 1 mile upstream of the Project Area in 2020 (iNaturalist 2023). The Project Area does not contain suitable nesting habitat for the species.
Giant garter snake *Thamnophis gigas*	FT/ST	**Moderate.** The Project Area is within the species' range and contains suitable habitat. There is a documented occurrence of the species from 2017 in Shag Slough, less than five miles from the Project Area (CDFW 2023a). Additionally, there were three snakes observed in 2022 in Shag Slough and one in Duck Slough, all within 5 miles of the Project Area (CDFW 2023a, unprocessed CNDDB data).
Birds		
American white pelican *Pelecanus erythrorhyncos*	–/SSC	**Moderate** (foraging or roosting only). The Project Area is not within the nesting range of the species and does not contain suitable nesting habitat. However, wintering individuals may forage or roost in Lindsey Slough near the Project Area. Individuals have been observed flying above Hastings Tract numerous times between 2000 and 2023 (eBird 2023).
White-tailed kite *Elanus leucurus*	–/SFP	**Moderate.** Suitable foraging and nesting habitat is present around the Project Area.
Northern harrier *Circus hudsonius*	–/SSC	**High.** The Project Area contains suitable foraging habitat for the species. An intact tidal wetland, directly across Lindsey Slough from the Project Area, contains suitable nesting and foraging habitat. Individuals were observed on Hastings Tract adjacent to the Project Area during the biological habitat evaluation and botanical surveys in 2023.
Swainson's hawk *Buteo swainsoni*	–/ST	**High.** Nesting was documented in 2007 and 2009 approximately 0.25 mile from the Project Area on the opposite bank of Lindsey Slough (CDFW 2023a). Individuals were observed on Hastings Tract adjacent to the Project Area in 2023 during the biological habitat evaluation and botanical surveys.
Mountain plover *Charadrius montanus*	FPT/SSC	**Moderate** (non-nesting only). The staging area and fields adjacent to the Project Area contain suitable non-breeding habitat. Additionally, the species was documented within 5 miles of the Project Area several times between 1999 and 2022 (CDFW 2023a, eBird 2023)

Common name *Scientific name*	Status[1] Federal/ State	Likelihood to occur in the Project Area
Western burrowing owl *Athene cunicularia hypugaea*	–/SSC	**Moderate.** Areas adjacent to access roads contain grassland habitats that are suitable for nesting (if suitable burrows are present) and foraging. Additionally, the species has been documented less than 0.25 mile north of the Project Area in 1977 and 2021 (CDFW 2023a, eBird 2023).
Short-eared owl *Asio flammeus*	–/SSC	**Moderate** (non-nesting only). Grizzly Island Wildlife Area (approximately 13 miles southwest of the Project Area) hosts a known breeding population of the species that was first documented in 1987 (CDFW 2023a). The Project Area contains suitable foraging habitat. Individuals were observed near Hastings Road in 2019, approximately 2.5 miles from the Project Area (eBird 2023), but the species is not expected to nest within the Project Area.
Loggerhead shrike *Lanius ludovicianus*	–/SSC	**Moderate.** The Project Area contains suitable nesting and foraging habitat. Individuals were observed on the nearby Peterson Ranch and near Hastings Road in 2019, approximately 2.5 miles from the Project Area (eBird 2023).
Song sparrow ("Modesto" population) *Melospiza melodia*	–/SSC	**Moderate.** The Project Area and vicinity contain a moderate amount of suitable habitat for foraging and nesting. Individuals have been observed approximately 6 miles from the Project Area in 2009 (CDFW 2023a).
Tricolored blackbird *Agelaius tricolor*	–/ST	**Moderate.** Although there is limited suitable nesting habitat in the Project Area, the species is abundant in the Project vicinity with several nearby occurrences (CDFW 2023a, eBird 2020) and may inhabit riparian scrub, agricultural fields, and/or grasslands within or adjacent to the Project Area.
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	–/SSC	**Moderate**. The Project Area is adjacent to suitable foraging and nesting habitat. The species has been documented in similar habitat within 5 miles of the Project Area as recently as 2018 (eBird 2023).

Note: DPS = Distinct Population Segment

[1] Status

Federal	State
FT = Listed as threatened under the federal Endangered Species Act	ST = Listed as Threatened under the California Endangered Species Act
FPT = Federally proposed as threatened	SSC = CDFW Species of Special Concern
	SFP = CDFW Fully Protected species

Other migratory birds

In addition to special-status species, other migratory birds could establish nests in and near the Project Area. There are suitable trees, riparian corridors, and emergent vegetation present within the Project Area along Lindsey and Cache sloughs that could provide nesting habitat for a variety of bird species. Additionally, the ruderal vegetation present in the Project Area could be used by ground nesting bird species. The nesting season for migratory birds is generally February 1 through August 15. Protection of migratory birds, including their active nests (i.e., containing eggs or young), is required by CDFG Code Sections 3503, 3513, and 3800.

2.4.1.2 Habitat types

Stillwater biologists (E. Applequist and C. Bilodeau) mapped the vegetated and non-vegetated habitats in the Project Area on April 21, 2023. Vegetation types were assessed to the extent necessary to determine where there was suitable habitat for special-status wildlife species and to

document sensitive natural communities. Sensitive natural communities with the potential to occur in the Project Area were identified prior to field surveys by querying CNDDB as described in Section 2.4.1.1 (Appendix B). If a sensitive natural community was identified in the field, the location and population boundaries were digitally mapped, and a California Native Plant Society (CNPS) vegetation assessment field data form was completed using the CDFW/CNPS standards and protocols for vegetation sampling and mapping (CDFW 2018). Surveys for blue elderberry (*Sambucus mexicana*) following USFWS (2017) guidelines for assessing habitat for the federally listed valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) were also conducted during vegetation mapping.

Land cover within the construction footprint is largely composed of non-native ruderal herbaceous vegetation with patches of Freshwater Marsh, Riparian Forest, and Scrub-shrub adjacent to the waterways (i.e., Cache Slough, Lindsey Slough, and Hastings Cut). Native Freshwater Marsh, Riparian Forest, and Scrub-shrub stands in the Project Area provide high habitat value for native fish and wildlife species. Three sensitive natural communities—Oregon ash groves (*Fraxinus latifolia* forest and woodland alliance), valley oak riparian forest and woodland (*Quercus lobata* riparian forest and woodland alliance), and California rose briar patches (*Rosa californica* shrubland alliance)—are present within the Project Area and are highlighted individually within the mapped Riparian Forest and Scrub-shrub habitats, as appropriate. Himalayan blackberry (*Rubus armeniacus*) patches were mapped separately from other Scrub-shrub habitat because, although Himalayan blackberry provides foraging opportunities and refugia for some wildlife, it is an invasive, non-native species that often outcompetes native vegetation. No blue elderberry plants were documented in the Project Area. Habitat types in the Project Area are summarized in Table 2-9 and depicted in Figure 2-2.

Table 2-9. Habitat types in the Project Area.

Habitat type		Sensitive natural community?[1]	Acres	Percent of Project Area
Agriculture		no	0.73	19.1
Freshwater Marsh		no	0.07	1.7
Riparian Forest	Oregon ash	yes, S3.2	0.02	0.4
	Valley oak	yes, S3	0.05	1.2
	Other	no	0.08	2.2
	Subtotal		*0.15*	*3.9*
Road		no	0.55	14.4
Ruderal herbaceous vegetation		no	1.66	43.2
Scrub-shrub	California rose	yes, S3	0.01	0.2
	Other native	no	0.18	4.5
	Himalayan blackberry	no	0.01	0.2
	Subtotal		*0.19*	*4.9*
Water		no	0.50	13.0
	Total	**3.85**		**100.0**

[1] Sensitive natural community rankings (CNPS 2023b)
S3 = vulnerable
0.2 = moderately threatened

Figure 2-2a. Habitat types in the Project Area, northern portion along Cache Slough (page 1 of 2).

Figure 2-2b. Habitat types in the Project Area, southern portion along Lindsey Slough (page 2 of 2).

Agriculture
The staging area is regularly used for agricultural production of field crops (e.g., alfalfa [*Medicago sativa*], safflower [*Carthamus tinctorius*]) (Figure 2-2b). This area was not in active cultivation during 2023 botanical surveys but had been recently tilled and was sparsely vegetated with non-native herbaceous species (including escaped crops) such as alfalfa, common groundsel (*Senecio vulgaris*), and henbit (*Lamium amplexicaule*). Depending on crop type, agricultural fields may provide some form of habitat for native birds (e.g., foraging for raptors). A total of 0.73 acre (19.1%) of the Project Area is agriculture (Table 2-9).

Freshwater Marsh
A small patch of Freshwater Marsh including native common tule and non-native paleyellow iris (*Iris pseudacorus*; California Invasive Plant Council [Cal-IPC] Limited rating[7]) is present along the waterside toe of the Lindsey Slough levee, and a narrow band of Freshwater Marsh dominated by non-native giant reed (*Arundo donax*; Cal-IPC High rating) borders the southeastern end of Hastings Cut (Figure 2-2b). Freshwater Marsh habitat can provide nesting, foraging, roosting, and cover for a variety of native wildlife species. A total of 0.07 acre (1.7%) of the Project Area is Freshwater Marsh (Table 2-9).

Riparian Forest
Riparian Forest habitat in the Project Area is dominated by native tree species with an open to moderate canopy in the riparian corridors along Lindsey Slough and Hastings Cut (Figure 2-2). Two sensitive natural communities are mapped within the Riparian Forest habitat type in the Project Area: Oregon ash groves (0.02 acre) and valley oak riparian forest and woodland (0.05 acre) (Table 2-9). Oregon ash (*Fraxinus latifolia*) is the dominant plant species in the Oregon ash groves, and valley oak (*Quercus lobata*) is the dominant plant species in the valley oak riparian forest and woodland type. In other areas, the Riparian Forest habitat type is dominated by white alder (*Alnus rhombifolia*) or red gum (*Eucalyptus camaldulensis*). Native woody species in the understory include California rose (*Rosa californica*) and narrowleaf willow (*Salix exigua*). Herbaceous cover in the understory is moderate and includes the non-native species ripgut grass (*Bromus diandrus*) and bull mallow (*Malva nicaeensis*).

Mature trees in Riparian Forest habitat may provide cover, roosting, foraging, and nesting habitat for raptors, songbirds, and other migratory birds. Where Riparian Forest vegetation overhangs water surfaces in the Project Area, it is classified as SRA habitat because it shades the water column, provides cover and foraging habitat for numerous fish species, and supports the aquatic ecosystem food web. A total of 0.15 acre (3.9%) of the Project Area is Riparian Forest (Table 2-9).

Road
A gravel road traverses the levee crowns throughout the Project Area and provides access to Lindsey Slough and the northeastern end of Hastings Cut (Figure 2-2). Roads cover a total of 0.55 acre (14.4%) of the Project Area (Table 2-9).

[7] Cal-IPC categorizes non-native invasive plants based on an assessment of potential ecological impacts. Species rated "High" have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure, species rated "Moderate" have substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure, and species rated "Limited" are invasive but have minor ecological impacts on a statewide level or not enough available information to justify a higher score (Cal-IPC 2023).

Ruderal Herbaceous Vegetation

The ruderal herbaceous cover type is dominated by non-native herbaceous forb and grass species and is often found in disturbed sites. In the Project Area, ruderal herbaceous vegetation is found on the levee crowns and most of the levee slopes (Figure 2-2). Many species found within this habitat type in the Project Area are rated by Cal-IPC as Limited, Moderate, or High. Dominant plant species include the non-native grasses ripgut grass (Cal-IPC Moderate) and wild oat (*Avena fatua*; Cal-IPC Moderate). Non-native forbs present in this habitat type include bur-chervil (*Anthriscus caucalis*), black mustard (*Brassica nigra*; Cal-IPC Moderate), poison hemlock (*Conium maculatum*; Cal-IPC Moderate), and bristly oxtongue (*Helminthotheca echioides*; Cal-IPC Limited) (Cal-IPC 2023). Ruderal herbaceous areas generally do not provide high-quality wildlife habitat—particularly for special-status species—but may be utilized by some wildlife species for foraging or nesting. A total of 1.66 acres (43.2%) of the Project Area is ruderal herbaceous vegetation (Table 2-9).

Scrub-shrub

Scrub-shrub habitat is dominated by woody species and is often found in mesic soils along riparian corridors. In the Project Area, native Scrub-shrub vegetation is patchily distributed along the waterside toes of the Cache Slough and Lindsey Slough levees. A small patch of one sensitive natural community, California rose briar patches (0.01 acre), is included in the Scrub-shrub habitat type (Table 2-9, Figure 2-2). Within the California rose briar patches, California rose (*Rosa californica*) is the dominant species with a low cover of the native species Mexican rush (*Juncus mexicanus*) in the herbaceous understory. A patch of Scrub-shrub habitat along the northeastern end of Hastings Cut is dominated by a dense thicket of Himalayan blackberry shrubs (0.01 acre). Himalayan blackberry is non-native and highly invasive with a Cal-IPC rating of High, often outcompeting and replacing native vegetation (Cal-IPC 2023). Dominant species in the remaining Scrub-shrub vegetation in the Project Area include arroyo willow (*Salix lasiolepis*), narrowleaf willow, and California rose. Scrub-shrub provides cover, foraging, and nesting habitat for a variety of birds and mammals. Where Scrub-shrub vegetation overhangs water surfaces in the Project Area, it may be classified as SRA habitat, contributing the same habitat functions as SRA created by Riparian Forest vegetation. A total of 0.19 acre (4.9%) of the Project Area is Scrub-shrub habitat (Table 2-9).

Water

The Project Area includes portions of Cache Slough, Lindsey Slough, and Hastings Cut (Figure 2-2). The water surface is largely open in these waterways, but some floating aquatic plant species (common water hyacinth [*Eichhornia crassipes*; Cal-IPC High] and common waterweed [*Elodea canadensis*]) are present in Lindsey Slough. Cache and Lindsey sloughs provide aquatic riverine habitat with gently sloped sand substrates in the shallows along the shorelines. High-quality aquatic fish habitat is present in these areas where overhanging riparian canopy heavily shades the channel margin and instream woody vegetation adds habitat complexity, providing the cover which native fishes—namely juvenile salmonids—require to carry out key behaviors such as foraging, hiding from predators, and sheltering from high water velocity. The nearshore habitat in Cache and Lindsey sloughs is inundated regularly by the tidal cycle, so its usability, extent, and quality vary with tidal stage. Aquatic habitat in Hastings Cut in the Project Area is less suitable for fish and aquatic wildlife species, as it lacks instream complexity and has little overhanging riparian vegetation; additionally, aquatic access to Hastings Cut is limited by the pipes providing the only connection to Cache and Lindsey sloughs. The salinity in aquatic habitats in the Project Area is quite low throughout the year; the salinity at Liberty Island (California Data Exchange Center Station LIB), approximately 5 miles downstream of the Project Area, never exceeded 1 part per thousand in water years 2022 or 2023 (DWR 2023, Lewis 1980).

A total of 0.50 acre (13.0%) of the Project Area is water (Table 2-9), including approximately 200 ft of SRA habitat along Cache and Lindsey sloughs.

2.4.1.3 Waters and wetlands

Stillwater Sciences biologists (K. Rodriguez, E. Applequist, and C. Bilodeau) conducted a preliminary delineation of potentially jurisdictional wetlands in the Project Area on April 20, 2023 (Appendix E). The following resources were queried and referenced to inform the delineation:

- USFWS's National Wetlands Inventory online application, Wetlands Mapper (USFWS 2023b)
- U.S. Department of Agriculture Natural Resources Conservation Service's Soil Survey Geographic Database (USDA NRCS 2023a), and
- Hydric Soils List for Solano County (USDA NRCS 2023b).

The 3.85-acre Project Area contains 0.79 acre of Waters of the United States and no wetlands (Appendix E). The Waters of the United States (associated with Cache Slough, Lindsey Slough, and Hastings Cut) are classified as riverine (tidal) based on the wetland classification standard (FGDC 2013).

2.4.2 Findings

a) Would the Project have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

Special-status plants

Three special-status plant species were documented within the Project Area, including 45 Delta tule pea plants, 11.0 ft^2 of Mason's lilaeopsis, and 20 Suisun Marsh aster plants (Table 2-5, Figure 2-1). Additional patches of these three species and one other special-status species, Parry's rough tarplant, were also documented adjacent to the Project Area. Special-status plants within the Project Area could potentially be directly damaged or destroyed by Project construction activities (e.g., excavation). Mason's lilaeopsis and Suisun Marsh aster in the portion of Lindsey Slough enclosed by the cofferdam could also be indirectly affected by temporary reductions in water availability when the cofferdam is in place in Lindsey Slough.

Where possible, impacts to special-status plants will be avoided using protections in mitigation measure **MM-1** (Section 1.4.6). Per mitigation measure **MM-1**, a targeted special-status plant survey will be conducted prior to Project construction, and any special-status plants that could potentially be damaged or destroyed by Project activities will be flagged for avoidance. A qualified biologist will be present to monitor construction activities within established buffers. Where avoidance is not possible, mitigation measure **MM-1** requires development of a Mitigation and Monitoring Plan in consultation with CDFW to mitigate for any losses of special-status plants, and an Incidental Take Permit (ITP) from CDFW will be pursued, if necessary, for any impact to Mason's lilaeopsis. Impacts to special-status plants will therefore be less than significant with mitigation incorporated including compliance with any ITP requirements.

Special-status fish

Special-status fish (as identified by CDFW's CNDDB, USFWS's IPaC, and NMFS queries) that utilize the tidally connected waterways surrounding the Project Area (Cache Slough and Lindsey Slough; described in Section 2.4.1.2) have the potential to be impacted by in-water Project activities related to cofferdam installation, dewatering, and cofferdam removal (Section 1.4.1). These impacts would likely be limited to the work occurring within Cache Slough and Lindsey Slough; it is unlikely that any special-status fish species would be encountered in Hastings Cut (the current operation of the pipes may allow fish passage into Hastings Cut; however, there is limited habitat and access, reducing the likelihood of special-status fish presence). The tidally connected sloughs (Cache and Lindsey; 0.33 acre of mapped riverine [tidal] habitat in the Project Area) provide suitable aquatic habitat for special-status fish species with potential to be near the Project Area (i.e., North American green sturgeon [*Acipenser medirostris*], Sacramento splittail [*Pogonichthys macrolepidotus*], delta smelt [*Hypomesus transpacificus*], longfin smelt [*Spirnichus thaleichthys*], and steelhead [*Oncorhynchus mykiss irideus*]).

The installation of the cofferdam and subsequent dewatering in the areas of Lindsey and Cache sloughs could result in the crushing or stranding of individual fish, temporary disturbance or degradation of rearing (nursery) and foraging habitat, and underwater disturbance (from noise, sediment, and equipment use) that could cause fish to avoid the Project Area during Project activities. The installation and stabilization of the pipe outflow on Lindsey Slough will lead to a loss of small amounts of marginally suitable foraging habitat for special-status fish. Currently, there is a gravel and reclaimed tile boat ramp at the proposed placement of the outfall structure; the boat ramp does not provide suitable foraging, breeding, rearing, or sheltering habitat for special-status fishes. The loss of marsh or riparian forest (that provides shade and fish cover to the channel margin) is expected to be minimal; additionally, the post-Project conditions should provide suitable conditions for the future recruitment of riparian vegetation.

In-water work will only be conducted in August through November (Section 1.4.4), a period when special-status fish presence in the Project Area is least likely and would be limited to adult or juvenile life stages, which have the ability to flee the vicinity during disturbance. Implementation of conservation measures **CM-3** through **CM-6** would protect water quality in the vicinity during Project activities and reduce the potential for adverse effects on special-status fish species and their habitat. Additionally, the implementation of mitigation measures **MM-6** through **MM-8** (the creation of a Fish Capture and Relocation Plan, requirements for cofferdam installation and removal, and requirements for dewatering activities and pumps) would avoid or minimize adverse effects on special status fishes and their habitat during dewatering, cofferdam installation and removal, and construction. If impacts to or removal of Freshwater Marsh, Riparian Forest, or SRA habitats (suitable fish cover and habitats of value) occurs as part of the Project, mitigation measure **MM-2** would require the development of a Mitigation and Monitoring Plan that would describe on-site or off-site mitigation for these impacts. With implementation of these conservation and mitigation measures, effects on special-status fishes would be less than significant.

Special-status wildlife

Giant garter snake

The waterways and associated uplands of Cache Slough, Lindsey Slough, and Hastings Cut provide suitable foraging and marginally suitable basking or overwintering habitat for giant garter snakes. Project activities near these areas could obstruct giant garter snake movement and feeding activities, fill or crush burrows or crevices potentially used for cover (via use of heavy machinery), and result in the disturbance (via vibration, human presence), displacement, injury, and/or mortality (e.g., vehicle collisions) of individual giant garter snakes. Potential for injury or

mortality of a snake is low because the Project Area contains marginally suitable upland habitat (mostly composed of disturbed areas and existing roadways), and giant garter snakes are sensitive to human activities and will typically flee to avoid people or disturbance.

The loss of foraging habitat (i.e., aquatic habitat) during dewatering, the removal of vegetation (including upland, emergent, or aquatic), and changes to the marginal upland habitat in the Project Area will all be temporary. As such, there will be no significant adverse impacts on general habitat availability for giant garter snakes following the Project.

The implementation of mitigation measure **MM-5** (limiting ground disturbance to the snakes' active season, removal of prey items during dewatering, and restriction of mono-filament netting) will reduce the likelihood that a snake would enter the Project Area for foraging during ground-disturbing activities. Additionally, the implementation of conservation measures (Section 1.4.5) and mitigation measures **CM-1**, **CM-2**, **MM-1**, and **MM-3** (including reduced speed limits, cease work if species is detected, environmental awareness training, and a preconstruction survey) will further minimize the potential for impacts on the species to less-than-significant levels.

Northwestern pond turtle

Northwestern pond turtles that may occur in Cache Slough, Lindsey Slough, or Hastings Cut in or near the Project Area will likely disperse away from areas affected by Project activities. However, turtles that may use uplands in the Project Area could be impacted by Project activities, such as colliding with vehicles or construction equipment. There is no suitable nesting upland habitat for the species in the Project Area, so impacts on nests are not anticipated. Temporary removal or degradation of suitable aquatic or basking habitat would be limited to the smallest amount feasible. Implementation of conservation measures **CM-1** and **CM-2** (including reduced speed limits and ceasing work if species is detected) and mitigation measures **MM-1**, **MM-3**, and **MM-8** (environmental awareness training, preconstruction survey, and the use of screens on dewatering pumps) would reduce impacts on the species to less-than-significant levels.

Special-status and migratory birds

Project-related construction activities and vegetation removal during the nesting season for special-status or migratory birds (generally February 1 through August 15) could lead to direct (e.g., failure or abandonment of an active nest, collision from vehicles or heavy machinery) or indirect impacts (e.g., loss of suitable breeding or foraging habitat) to bird species or their available nesting habitat. Project-related impacts may occur from construction noise (e.g., from heavy equipment, vehicles, generators, or human presence), vibration near ground nests or in nearby trees, or visual disturbance (e.g., increased human or equipment activity near nests).

The Project Area contains suitable habitat for arboreal or riparian nesting special-status species (including Swainson's hawk, white-tailed kite [*Elanus leucurus*], loggerhead shrike [*Lanius ludovicianus*], or yellow-headed blackbird [*Xanthocephalus xanthocephalus*]) in the mature trees found in the Riparian Forest or Scrub-shrub habitats (along Cache and Lindsey sloughs and Hastings Cut) and the dense ruderal herbaceous vegetation in and near the Project Area provides suitable nesting habitat for ground or low-lying vegetation nesting special-status species (including Modesto song sparrow [*Melospiza melodia*], western burrowing owl [*Athene cunicularia hypugaea*], or northern harrier [*Circus hudsonius*]), and migratory birds.

There are a few special-status species that may use the Project Area or vicinity for foraging only, including the American white pelican (*Pelecanus erythrorhyncos*), tricolored blackbird (*Agelaius tricolor*), mountain plover (*Charadrius montanus*), and short-eared owl (*Asio flammeus*). Foraging habitat may be disturbed temporarily during Project construction by the removal of

vegetation. While these actions may lower the quality of foraging habitat for some species, the effects will be temporary, foraging birds can easily disperse away from Project-related disturbances, and the presence of extensive alternative foraging habitat of similar value means the impact on foraging birds and habitat will be less than significant.

Implementation of mitigation and conservation measures **MM-1, MM-3,** and **CM-1** (including environmental awareness training, a preconstruction survey [and applicable no-disturbance buffer for active bird nests], and reduced speed limits on Project roads) will minimize the potential for direct impacts (e.g., injury or mortality, nest failure) to less-than-significant levels. Project activities that include (or require) vegetation removal will be kept to the minimum amount feasible, and any loss of Freshwater Marsh, Riparian Forest, and Scrub-shrub habitats will be mitigated for (see [b] below). If work is being conducted during the nesting season for Swainson's hawks and other raptors (March 1 through September 1), mitigation measure **MM-4** will be implemented, requiring preconstruction raptor nest surveys. If an active nest is discovered, a no-disturbance buffer will be established to limit the potential for nest failure. In addition, general BMPs related to equipment maintenance, erosion control materials, and spill prevention will further reduce the potential for impacts on the species.

b) Would the Project have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

In accordance with the requirements of AB 360 (Section 6.2) and DWR's Delta Flood Protection Program requirement for net long-term aquatic habitat improvement, this discussion is focused on potential impacts to Freshwater Marsh, Riparian Forest, Scrub-shrub, and SRA habitats.

Excavation and replacement of the Cache Slough and Lindsey Slough levees will require removal of no more than 0.07 acre of Freshwater Marsh, 0.15 acre of Riparian Forest (including 0.02 acre of Oregon ash groves [S3.2] and 0.05 acre of valley oak riparian forest and woodland [S3]) , and 0.18 acre of Scrub-shrub vegetation (including 0.01 acre of California rose briar patches [S3]) (Table 2-9), also potentially resulting in a minor loss of SRA habitat in the adjacent waterways. Impacts to these habitat types, including the sensitive natural communities present within them, will be mitigated for on- or off-site via development and implementation of a Mitigation and Monitoring Plan (mitigation measure **MM-1**). Additionally, Project construction will help ensure long-term stability of these habitat types on Hastings Tract, as it will help prevent pipe or levee failure that could result in larger scale habitat losses. Impacts will be less than significant with mitigation incorporated.

c) Would the Project have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

No state or federally protected wetlands are present in the Project Area above the high tide line; however, the Project Area encompasses 0.79 acre of riverine (tidal) Waters of the United States which are federally and state protected. Rock slope protection 2 ft in depth will be placed extending approximately 17 ft and 10 ft from the inlet/outlet structures in Hastings Cut and Lindsey Slough, respectively, to minimize the potential for erosion and protect levee integrity. The Project also includes temporary placement of cofferdams in all three waterways in the Project Area (Cache Slough, Lindsey Slough, and Hastings Cut) but has been designed to minimize adverse impacts to Waters of the United States by limiting the in-water work areas and areas enclosed by cofferdams to include the minimum extent practicable. The cofferdams will not span

the entire widths of Cache or Lindsey Slough and will therefore not inhibit flow or impede navigation. Although the cofferdams in Hastings Cut will temporarily interrupt this managed surface connection between Cache and Lindsey sloughs, their downstream connections (to the Sacramento River and Cache Slough, respectively) will be maintained throughout Project construction. The sloughs' connection via Hastings Cut will be restored following pipe replacement and Project completion. Additionally, the Project's replacement of the pipe between Lindsey Slough and Hastings Cut will reduce the potential for levee failure and adverse impacts to associated waters and wetlands in the Project vicinity. Impacts will therefore be less than significant.

d) Would the Project interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

The Project includes modifications to existing levee and tide control infrastructure (which does not allow fish passage) and will not include construction of any new elements that will block fish or wildlife movement post Project. Existing tide control structures and equipment do not allow fish passage into our out of Hastings Cut or surrounding Lindsey or Cache sloughs. Additionally, the cofferdams will be temporary and no long-term effects to fish movement, migration, or nursery sites are anticipated. Therefore, the Project will not interfere substantially with the movement of any native resident fish or wildlife species. The installation of cofferdams in Lindsey and Cache sloughs (which could be utilized for migration of fish species) will be limited to small inlets and will not block the entirety of the slough. As such, fish passage through Lindsey Slough and Cache Slough will not be impeded. Similarly, Project activities will not impede the use of any fish nursery sites.

e) Would the Project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

The Project will not conflict with any local policies or ordinances protecting biological resources. There will be no impact.

f) Would the Project conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

The Project will not conflict with any provisions of an adopted or approved (local, regional, or state) Habitat Conservation Plan or Natural Community Conservation Plan. The Project does not conflict with the purpose or goals of the Solano Multispecies Habitat Conservation Plan (developed by the Solano County Water Agency in 2012) which promote the conservation of biological diversity and preservation of endangered species (and their habitats), to provide a healthy economic environment (for citizens, agriculture, and industries), and allow for the ongoing maintenance and operation of public and private facilities (Solano County Water Agency 2012).

2.5 Cultural Resources

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?	❑	❑	❑	✓
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	❑	❑	❑	✓
c) Disturb any human remains, including those interred outside of dedicated cemeteries?	❑	❑	❑	✓

2.5.1 Environmental setting

The Natural Investigations Company conducted a cultural and paleontological resources assessment for the Project, which included a search of records for known cultural resources in the Project Area and vicinity, and an intensive pedestrian survey of the Project Area (Natural Investigations Company 2023). Results of the assessment are synthesized in this section. The full report contains confidential information (e.g., Sacred Lands File [SLF] search results) in addition to pre-contact historic, ethnographic, and post-contact historic context of the region and is available to relevant agencies upon request.

2.5.1.1 California Historical Resources Information System search

The Northwest Information Center (NWIC) at Sonoma State University conducted a California Historical Resources Information System (CHRIS) records search to determine whether prehistoric or historic cultural resources were previously recorded in the vicinity of the Project (i.e., within 0.5 mile of the Project Area). The results of the CHRIS search were returned on October 11, 2022. CHRIS records indicate that four prior cultural resource studies have been completed within the Project Area, and seven additional studies have been completed within the 0.5-mile record search radius. CHRIS records indicate that no cultural resources have been previously recorded within the Project Area, but four sites have been previously recorded within the search radius (Natural Investigations Company 2023). All previously recorded cultural resources within 0.5 mile of the Project Area are prehistoric; no historic cultural resources have been previously recorded.

2.5.1.2 Sacred Lands File search and Native American outreach

The Native American Heritage Commission (NAHC) returned the results of a SLF records search on November 28, 2022. The SLF results were negative for Native American resources in the vicinity of the Project (Natural Investigations Company 2023).

The Natural Investigations Company sent Project information letters to all tribal members or organizations affiliated with the region, as provided by NAHC, on November 28, 2022 (Natural Investigations Company 2023). If no response was received, follow-up phone calls were made on

December 13, 2022. To date, no additional information has been received that indicates the potential presence of tribal cultural resources in the Project Area. However, one Tribe has reached out to initiate formal consultation with the District for the Project.

2.5.1.3 Potential for buried archaeological deposits

As supported by CHRIS records, the Project vicinity includes landforms that are sensitive for the presence of buried deposits of cultural resources. The Project Area, however, is in a disturbed context (i.e., fill material used to construct the existing levees), so Project construction would not likely disturb any native soils. Therefore, although the Project vicinity is sensitive for buried deposits of cultural resources, the Project is very unlikely to impact buried cultural resources.

2.5.1.4 Pedestrian survey

On October 27, 2022, Natural Investigations Company archaeologist A. Dang conducted an intensive pedestrian survey of the Project Area (Natural Investigations Company 2023). The survey was conducted along transects spaced no more than 15 meters apart and included transects throughout the Project Area and along the haul route. Transects were carefully examined for cultural material (e.g., flaked stone tools, tool-making debris, fire-affected rock), soil discoloration that might indicate the presence of a cultural midden, soil depressions and features indicative of the former presence of structures or buildings (e.g., postholes, foundations), or historic-era debris (e.g., metal, glass, ceramics).

The field survey identified and documented the Lindsey Slough levee (NIC-2022-HT-01) as a previously unrecorded cultural resource. The Lindsey Slough levee is an earthen levee constructed no later than 1942. However, it does not appear to meet any of the eligibility criteria for inclusion on the National Register of Historic Places (NRHP) or California Register of Historical Resources (CRHR) (e.g., association with significant events or individuals, unique construction or design characteristics).

2.5.2 Findings

a) Would the Project cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?

The Lindsey Slough levee (NIC-2022-HT-01) is the only historical resource identified within the Project Area but is not eligible for inclusion on the NRHP or CRHR. Therefore, the Project will not cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5. The Project will have no impact.

b) Would the Project cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?

The Project vicinity includes landforms that are sensitive for the presence of buried archaeological resources. The vertical extent of the Area of Potential Effects (APE) for the Project, however, is in a disturbed context (i.e., fill material used to construct the existing levees), so Project construction would not likely disturb any native soils. Therefore, although the Project vicinity is sensitive for buried archaeological deposits, they are not expected within the Project's vertical APE. The Project will have no impact.

c) Would the Project disturb any human remains, including those interred outside of dedicated cemeteries?

Records searches, Native American outreach, and an intensive pedestrian survey have not indicated any historic or prehistoric resources, including human remains, within the Project Area. Additionally, the vertical extent of the Project's APE is in a disturbed context (i.e., fill material used to construct the existing levees), so Project construction would not likely disturb any native soils. Therefore, the Project will not disturb any human remains; there will be no impact.

2.6 Energy

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during Project construction or operation?	❑	❑	✓	❑
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	❑	❑	❑	✓

2.6.1 Environmental setting

Energy sources are either renewable (e.g., solar, wind) or nonrenewable (e.g., fossil fuels) and can be combusted to power vehicles and equipment or converted to electricity as a secondary energy source.

In 2021, California consumed more energy than all other states except Texas, but its per capita consumption of 189 million British thermal units (Btu) was the fourth lowest in the nation (USEIA 2023). The California Energy Commission (CEC), established by the Warren-Alquist Act in 1974 (Section 6.2), has been instrumental in limiting California's energy consumption, particularly via energy efficiency standards that are updated every three years in Title 24 (CEC 2023).

The Project will utilize fossil fuels, a nonrenewable energy source, to power construction vehicles and equipment. The fossil fuel consumption will be on a short-term basis during construction and will not persist upon Project completion. No electricity consumption will be associated with the Project.

2.6.2 Findings

a) Would the Project result in a potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during Project construction or operation?

Project construction equipment and vehicles will use fossil fuels for power. BMPs included in conservation measure **CM-1** will ensure construction equipment will be used as efficiently as

feasible (e.g., by limiting idling) (Section 1.4.5). Fossil fuel consumption will be on a short-term basis during construction and will not persist upon Project completion. No electricity consumption will be associated with the Project. The impact will therefore be less than significant.

b) Would the Project conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

The Solano County General Plan includes policies to promote renewable energy use and energy efficiency. In accordance with policy RS.P-54 and implementation program RS.I-48, Project construction will utilize vehicles model year 2010 or newer and diesel-fueled construction equipment in compliance with CARB's In-Use Off-Road Diesel-Fueled Fleets Regulation (conservation measure **CM-1**, Section 1.4.5). Other state and local plans such as California Title 24 Building Energy Efficiency Standards and the Solano County General Plan establish energy efficiency standards for actions (e.g., new building construction, retrofitting existing developments) that are not associated with the Project. As such, the Project will not conflict with or obstruct a state or local plan for renewable energy or energy efficiency. There will be no impact.

2.7 Geology and Soils

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault?	❑	❑	❑	✓
ii) Strong seismic ground shaking?	❑	❑	❑	✓
iii) Seismic-related ground failure, including liquefaction?	❑	❑	❑	✓
iv) Landslides?	❑	❑	❑	✓
b) Result in substantial soil erosion or the loss of topsoil?	❑	❑	✓	❑
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	❑	❑	❑	✓
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or	❑	❑	❑	✓

	Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
	property?				
e)	Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	❑	❑	❑	✓
f)	Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	❑	❑	❑	✓

2.7.1 Environmental setting

The Project Area lies within the Great Valley geomorphic province, which is crossed by few faults; however, it is bordered by the Coast Range province, which contains several active fault zones that predominately exhibit right-lateral, strike-slip motion. The closest active faults[8] designated by the California Geological Survey (CGS) are the Greenville Fault Zone and Green Valley-Concord fault zones, located about 21and 23 miles to the southwest, respectively (CGS 2018, 2022). The closest potentially active fault is the Midland Fault Zone, which runs north-south through the Delta, including along the northern portion of the Project Area near Cache Slough (Unruh and Hitchcock 2009). The most recent displacement along this fault is estimated to be early- to mid-Quaternary (0.7–2.6 million years before present) (CGS 2010).

The Greenville and Green Valley-Concord faults both have estimated slip rates of 1–5 millimeters per year (Bryant and Cluett 2002a,b). The USGS estimates a 16 percent probability of an earthquake of magnitude 6.7 or greater occurring on either of these fault systems by the year 2043 (Aagaard et al. 2016). In general, ground rupture hazards do not affect Solano County. Delta islands are, however, susceptible to liquefaction because of shallow groundwater depths and the presence of sandy-peaty soils with low cohesive strength (CGS 2018, San Joaquin County 1992). Liquefaction or seismically induced waves (i.e., seiches) in Delta channels may damage levees on Delta islands (San Joaquin County 1992).

The northern portion of Hastings Tract (near Cache Slough) is composed of flood-basin deposits, and the southern portion (near Lindsey Slough) is composed of peat and mud of tidal wetlands and waterways. Both deposits accumulated throughout the Holocene (<11,000 years before present) atop sand and eolian deposits from the Pleistocene-age Modesto Formation (Atwater 1982a,b; Helley and Graymer 1997). This process of tidal marshland formation occurred throughout the Delta region until land reclamation began in the late 1800s during Euro-American settlement (Whipple et al. 2012). By the 1930s, draining of marshes and wetlands and extensive levee construction transformed the Delta into an agricultural landscape. These changes in land use allowed for microbial oxidation and depletion of peat, resulting in land-surface subsidence of up to 26 ft below sea level on Delta islands (Drexler et al. 2009).

[8] An "active fault" is defined by the California Geological Survey as a fault having surface displacement within the Holocene epoch, or the past 11,700 years (CGS 2018).

2.7.2 Findings

a) Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map, issued by the State Geologist for the area or based on other substantial evidence of a known fault?

The Project Area is not located within the Alquist-Priolo Earthquake Fault Zone (CGS 2022) or a California Earthquake Hazards Zone (California DOC 2021). The Project will result in no operational or land use change that will cause substantial adverse effects due to potential rupture of an earthquake fault. Therefore, the Project will have no impact.

ii) Strong seismic ground shaking?

The Project Area is not located near active faults and therefore lies in a zone with low potential for strong seismic ground shaking. The Project will not increase the potential for direct or indirect adverse effects related to seismic ground shaking. Therefore, the Project will have no impact.

iii) Seismic-related ground failure, including liquefaction?

The Project Area lies in the Delta, which is potentially susceptible to seismically induced liquefaction that could result in levee failure and flooding. The Project will not increase the potential for direct or indirect adverse effects due to seismic-related ground failure. Therefore, the Project will have no impact.

iv) Landslides?

Except for the levees surrounding the tract, the Project Area has a flat topography and is not susceptible to landslides. The Project will re-construct the levees to their existing grades and will not increase the potential for direct or indirect adverse effects related to landslides. Therefore, the Project will have no impact.

b) Would the Project result in substantial soil erosion or the loss of topsoil?

The Project will remove topsoil during excavation at both sites. Due to the flat topography of the Project Area, removal of this material will not result in substantial potential for erosion. During active construction, there will be a minor and temporary increase in the potential for stormwater-related erosion of surficial soil. To minimize the risk of soil erosion during construction, the Project will implement conservation measure **CM-3** (Section 1.4.5). Construction will only occur during dry periods. Impacts of the Project on soil erosion and loss of topsoil will be less than significant.

c) Would the Project be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

The Project Area is located on Quaternary delta mud and peat deposits which are susceptible to liquefaction. However, because the Project will relocate pipes within levees that will be re-

constructed to their original grade, the Project will not increase susceptibility to hazards associated with unstable geologic units. Therefore, the Project will have no impact.

d) Would the Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?

Soils in the vicinity of the Project are expansive (i.e., peat and organic materials). The Project has, however, been designed to address the potential for expansive soil. Expansive soils will not be used to re-construct the Cache Slough and Lindsey Slough levees. The Project will utilize Soil Type 1 or Type 2 for all embankment fill (MHM 2023). The Project will not increase long-term deformation or risks to life and property compared to existing conditions. Additionally, no residences or structures are located on Hastings Tract in the vicinity of the Project Area. Therefore, the Project will not create substantial direct or indirect risks to life or property by being located on expansive soil; there will be no impact.

e) Would the Project have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

The Project will not utilize septic tanks or alternative wastewater disposal systems. The Project will have no impact.

f) Would the Project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

No unique paleontological resources or geologic features are documented on Hastings Tract. Due to their relatively young age, the Holocene muds and peats that cover much of the tract are generally considered to have low potential for the presence of fossils. None of the geologic units known to contain fossils in the Delta, including the Franciscan, Mehrten, Modesto, or San Pablo formations, have been mapped within the Project Area. Additionally, all Project excavation work will occur in levees composed of imported fill material rather than in naturally deposited soils. The Project will have no impact.

2.8 Greenhouse Gas Emissions

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	❑	❑	✓	❑
b) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	❑	❑	❑	✓

2.8.1 Environmental setting

GHGs can absorb and emit infrared radiation, trapping energy in the atmosphere and causing it to warm. GHGs have impacts that are more global than regional and are different from air pollutants that impact only the general area near where they are released. GHGs can occur naturally or as a direct result of human activities. State law defines GHGs to include the following emissions: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride (Health and Safety Code, § 38505(g)). The most common GHG resulting from human activity is carbon dioxide, followed by methane and nitrous oxide.

California GHG emissions decreased 15% from their 2004 peak to 418.4 million metric tons of carbon dioxide equivalent (CO_2e) in 2019, while statewide per capita emissions decreased by 25% from their peak in 2001 to 2019 (14.0 metric tons per person to 10.5 metric tons per person) (CARB 2021). In 2020, California GHG emissions decreased further to 369.2 million metric tons of CO2e; however, the magnitude of this decrease is likely an anomaly related to impacts of the COVID-19 pandemic (e.g., reduced transportation due to shelter-in-place orders) rather than an accurate indicator of long-term GHG emission trends (CARB 2022). The transportation sector consistently emits more GHG than any other sector, accounting for almost 40% of state GHG emissions in 2019 (CARB 2021).

In January 2008, AB 32 (Section 6.2), the Global Warming Solutions Act of 2006, went into effect. This bill required CARB to develop regulations to address global climate change due to GHG emissions. The act also required a statewide GHG emissions limit, equal to the 1990 level, as a limit to be achieved by December 31, 2020. The 2020 GHG emissions limit was 431 million metric tons of CO_2e, and, as of 2017, statewide GHG emissions were 424 million metric tons of CO_2e (CARB 2019). Signed into law in 2020, AB 1279 expanded upon AB 32 by specifying an emissions limit which further requires California to reduce statewide GHG emissions to 85 percent below 1990s level by 2045.

The YSAQMD has not established a numerical threshold of significance for assessing impacts associated with Project GHG emissions but recommends evaluation of incremental impacts to determine if they may be cumulatively considerable. The YSAQMD and the Solano County Climate Action Plan also provide GHG emission reduction measures and actions that can be implemented to limit potential Project impacts consistent with state and county emissions goals (Solano County 2011).

2.8.2 Findings

a) Would the Project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Project construction is expected to generate only 123 metric tons of CO_2e between May and November 2025, as indicated by the CalEEMod results in Appendix A. The Project will not result in changes to long-term GHG emissions following construction. Therefore, short-term impacts involving the generation of GHG emissions during Project construction will be less than significant.

b) Would the Project conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Emissions associated with Project construction will be temporary and will not inhibit attainment of the statewide GHG emissions limit established by AB 1279, as described in Section 6.2. The YSAQMD has not established quantitative significance thresholds for GHG emissions, but the YSAQMD and the Solano County Climate Action Plan recommend emission reduction measures consistent with long-term state and county emissions goals. Although most recommended measures apply to development projects or ongoing operational (e.g., industrial, commercial) uses rather than construction activities, the Project includes recommended measures where possible to limit GHG emissions and protect GHG storage (i.e., carbon sequestration) during or following construction activities (e.g., reduced idling times in **CM-1** [Section 1.4.5], mitigation for impacts to native vegetation in **MM-2** [Section 1.4.6]). The Project will not result in changes to long-term GHG emissions following construction. The Project will therefore not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions; there will be no impact.

2.9 Hazards and Hazardous Materials

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	❑	❑	✓	❑
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	❑	❑	✓	❑
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	❑	❑	❑	✓
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code § 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	❑	❑	❑	✓
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard or excessive noise for people residing or working in the Project Area?	❑	❑	❑	✓
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	❑	❑	❑	✓

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?	❑	❑	❑	✓

2.9.1 Environmental setting

Land uses surrounding the Project Area are predominantly agricultural, recreational, and open space, along with some residential use. These areas have the potential to contain hazardous substances, particularly petroleum products or pesticides that may have been stored nearby or released into the surrounding environment. Older gas wells and underground storage tanks used to store petroleum products and other hazardous materials may develop leaks that can lead to the contamination of soil or groundwater. A query of the California Department of Toxic Substances Control's database revealed are no known sites in the Project Area with cleanup, permitted, or other hazardous materials statuses (CDTSC 2023).

2.9.2 Findings

a) Would the Project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

The Project has the potential to accidentally spill diesel fuel or other hazardous materials used by construction equipment. To minimize the risk of a hazardous material release during construction, the Project will implement hazardous material BMPs as part of the Project, as outlined in conservation measures **CM-4** and **CM-5** (Section 1.4.5). All fuels and other hazardous materials will be handled and stored according to the manufacturer's specifications. A containment area will be established for construction equipment staging, and the ground will be protected from potential contamination within the containment area. In the event of a spill, crew personnel will stop the spillage at its source, contain the spilled material, and notify Project supervisors and appropriate agency representatives.

The Project will have no potential impacts associated with hazardous material use following Project completion.

Impacts related to the transport, use, or disposal of hazardous materials will be less than significant with compliance with applicable regulations and incorporation of conservation measures **CM-4** and **CM-5**.

b) Would the Project create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

As stated above, implementation of hazardous materials management BMPs outlined in **CM-4** and **CM-5** (Section 1.4.5) will occur during Project implementation; therefore, any impact will be less than significant.

c) Would the Project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

There are no schools located within one-quarter mile of the Project Area. The Project will have no impact.

d) Would the Project be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code § 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

No portion of the Project Area is included on a list of hazardous materials sites (CDTSC 2023). The Project will have no impact.

e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public use airport, would the Project result in a safety hazard or excessive noise for people residing or working in the Project Area?

The Project Area is located along the eastern boundary of the Travis Air Force Base Airport Influence Area covered by the Travis Land Use Compatibility Plan (Solano County 2008). However, the Project Area is approximately 7 miles from Travis Air Force Base's nearest facilities (i.e., runway) where safety hazards and excessive noise would be most likely due to the higher concentration of planes and associated equipment and materials. Project construction workers are therefore not expected to be exposed to safety hazards or excessive noise from operations at Travis Air Force Base or the occasional flight over the Project Area. There are no public-use airports within 2 miles of the Project Area. The Project will have no impact.

f) Would the Project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

In the event of an emergency, residents of Hastings Tract would evacuate the tract via routes that do not cross the Project Area; thus, there will be no disruption to emergency evacuation routes. All roadway traffic supporting the Project will adhere to applicable laws for motor vehicles and with Solano County's Office of Emergency Services. The construction contractor will comply with local fire, police, and medical responders during any emergency. For these reasons, there will be no impact.

g) Would the Project expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?

Hastings Tract has been designated by the California Department of Forestry and Fire Protection (CalFire) as an unzoned local responsibility area[9] with no moderate, high, or very high fire hazard severity zones (CalFire 2022). Accordingly, the Project will not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. In addition, the Project will implement **CM-7** (Section 1.4.5) to reduce the potential for a grass fire. Therefore, the Project will have no impact.

[9] Local responsibility areas are lands on which neither the state nor the federal government has any legal responsibility for providing fire protection.

2.10 Hydrology and Water Quality

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	❑	❑	✓	❑
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the Project may impede sustainable groundwater management of the basin?	❑	❑	❑	✓
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i) result in substantial erosion or siltation on- or off-site;	❑	❑	✓	❑
ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;	❑	❑	❑	✓
(iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	❑	❑	❑	✓
(iv) impede or redirect flood flows?	❑	❑	❑	✓
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to Project inundation?	❑	❑	❑	✓
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	❑	❑	❑	✓

2.10.1 Environmental setting

The Project Area is within the Cache Slough (Hydrologic Unit Code [HUC] 180201630606) and Lindsey Slough (HUC 180201630604) watersheds (USGS 2023). Waterways within the Project Area include a portion of Lindsey Slough to the south and Cache Slough to the north, as well as the adjacent portions of Hastings Cut (Figure 1-1). Hastings Cut connects Lindsey and Cache sloughs at their westernmost ends via pipes through Hastings Tract's perimeter levee. Lindsey Slough flows into Cache Slough at its easternmost end, and Cache Slough flows into the Sacramento River approximately 5 miles east of the Project Area (USACE 2023). Lindsey Slough, Cache Slough, and Hastings Cut are included on the list of Traditional Navigable Waters maintained by the United States Army Corps of Engineers (USACE) Sacramento District (USACE 2023).

The Project Area experiences a Mediterranean climate characterized by hot, dry summers and cool, wet winters. Average annual rainfall in the Project Area between 1991 and 2020 was 16 inches, with the majority typically occurring between October and April (PRISM Climate Group 2023). Water levels in the adjacent waterways fluctuate daily with tidal action and episodically during flood events coinciding with periods of heavy precipitation and runoff. Hastings Tract is currently mapped within Federal Emergency Management Agency's (FEMA's) 100-year floodplain designation (FEMA 2023).

There are no tsunami risks in the Project Area or vicinity according to the State of California's tsunami hazard area map (California DOC 2023b). Earthquakes along any of the active fault zones in the vicinity of the Project (Section 2.7.1), however, could result in seiches in the waterways in the Project Area, and potential effects of a seiche could be compounded by adverse tidal conditions.

Water quality objectives and beneficial uses for surface water and groundwater are in the Water Quality Control Plan for the Central Valley (Basin Plan) (Central Valley RWQCB 2019). The water quality objectives apply to all surface waters in the Sacramento and San Joaquin river basins, including the waterways within the Project Area (i.e., Cache Slough, Lindsey Slough, and Hastings Cut). Existing and potential beneficial uses for the Delta include municipal and domestic supply, agricultural supply (irrigation and stock watering), industrial supply (process and service), recreation (contact and noncontact), freshwater fish habitat (warm and cold), migration (warm and cold), spawning (warm), wildlife habitat, and navigation. In accordance with Section 303(d) of the Clean Water Act, the Delta waterways (northwestern portion), including the waterways in the Project Area, have been classified as *impaired* by the State Water Resources Control Board (SWRCB) (SWRCB 2022). This designation, as specified in the Basin Plan, is assigned to waterbodies where established water quality objectives are not being met or where beneficial uses are not protected. The SWRCB has classified the Delta waterways (northwestern portion) as *impaired* for electrical conductivity, mercury, pesticides (chlorpyrifos, diazinon, dichlorodiphenyltrichloroethane [DDT], and group A pesticides), toxicity, and invasive aquatic species (SWRCB 2022). Classification of a waterbody as *impaired* on the 303(d) list triggers the development of a pollution control plan, called a Total Maximum Daily Load (TMDL). The TMDL for each water body and associated pollutant serves as the means to attain and maintain water quality standards for the *impaired* water body.

2.10.2 Findings

a) Would the Project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?

Ground disturbance during Project construction could temporarily increase the potential for localized erosion and sediment-laden stormwater runoff. The Project will implement a SWPPP with BMPs to minimize the potential for soil erosion and stormwater runoff (conservation measure **CM-3**, Section 1.4.5) and accidental spills of hazardous materials to enter waterways and groundwater (conservation measures **CM-4** and **CM-5**). Additionally, cofferdams will be installed around areas where waterside work occurs below the high tide line, and sediment booms, silt curtains, or other appropriate turbidity control devices will be installed and maintained (**CM-6**) to protect the surrounding waterways from siltation during in-water activities. During in-water work (e.g., installing cofferdam sheet piles), the Project's SWPPP will also include water quality monitoring to ensure turbidity control devices are functioning properly. To reduce erosion upon completion of construction, disturbed areas will be seeded with a native seed

mix (**CM-3**), and the levee crown will be covered with compacted aggregate base placed along its surface to re-create the levee road. The levees surrounding the pipes will be reconstructed to the original grade, which varies between approximately 6:1 (horizontal to vertical) near the toe and 3:1 (horizontal to vertical) near the crown, so the Project will not result in any long-term changes to drainage patterns or erosion. With implementation of conservation measures **CM-3** through **CM-6,** impacts to surface or ground water quality will be less than significant.

b) Would the Project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the Project may impede sustainable groundwater management of the basin?

The Project will not alter existing groundwater pumping rates or natural recharge potential on Hastings Tract. The Project will have no impact.

c) Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

i) result in a substantial erosion or siltation on- or off-site?

Movement of earth and fill material will temporarily disturb soils and alter runoff patterns over a small area during Project construction. Appropriate BMPs included in the Project SWPPP will be implemented to minimize potential temporary impacts on waters from erosion during Project construction (conservation measure **CM-3**, Section 1.4.5). The topography of the Project Area will be returned to existing grades and revegetated following Project construction, and no new impervious surfaces will be created. Therefore, there will be no substantial long-term change in erosion or siltation on- or off-site. The Project will have a less than significant impact.

ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

The Project will not substantially alter drainage patterns following construction. Earth-moving activities during construction have the potential to cause minor alterations to the existing drainage patterns in a manner that would not result in an increased risk of flooding. The Project will have no impact.

iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

The Project will not create or contribute runoff water or provide additional sources of polluted runoff. The Project will have no impact.

iv) impede or redirect flood flows?

Project construction will be completed during late summer and early fall when precipitation in the region and the risk of resulting floods are extremely low, and Project implementation will result in no long-term changes to flood flow patterns. There will be no impact.

d) In flood hazard, tsunami, or seiche zones, would the Project risk release of pollutants due to Project inundation?

The Project Area is not at risk of tsunamis. In the highly unlikely event of a flood or seiche during Project construction (see Section 2.10.1), implementation of hazardous materials BMPs included in the SWPPP (conservation measures **CM-4** and **CM-5**, Section 1.4.5) would minimize the risk of a pollutant release. The Project will not risk release of pollutants following Project construction. The Project will have no impact.

e) Would the Project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

The Project will not conflict with or obstruct the implementation of the Basin Plan (Central Valley RWQCB 2019) or any sustainable groundwater management plan (Solano Collaborative 2021) as it will not chronically lower groundwater levels, reduce groundwater storage, or degrade water quality by increasing concentrations of constituents of concern (nitrate, arsenic, chloride, total dissolved solids, or hexavalent chromium). There will be no impact.

2.11 Land Use and Planning

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Physically divide an established community?	❑	❑	❑	✓
b) Cause a significant environmental impact due to a conflict with any applicable land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	❑	❑	❑	✓

2.11.1 Environmental setting

The land-use designation for Hastings Tract under the Solano County General Plan (Solano County 2008) is Agriculture. The Agriculture designation includes areas for the practice of agriculture as the primary use and allows for secondary uses that support the viability of agriculture. The tract falls within the Elmira and Maine Prairie agricultural region (Solano County 2008) and contains areas of Prime and Unique Farmland (Section 2.2.1).

Hastings Tract is also part of the Delta Primary Zone, as defined by the Delta Protection Act of 1992 (Section 6.2). The Primary Zone includes approximately 500,000 acres of waterways, levees, and farmed lands throughout five counties (DPC 2010). The Land Use and Resource Management Plan for the Primary Zone of the Delta guides planning for the conservation and enhancement of the natural resources of the Delta, while sustaining agriculture and meeting increased recreational demand (DPC 2010).

Hastings Tract is located within the boundary covered by the Delta Plan, a comprehensive, long-term management plan for the Delta and Suisun Marsh mandated by the 2009 Delta Reform Act (Section 6.2) (Delta Stewardship Council 2019). The Delta Plan includes recommendations for achieving the coequal goals of protecting and enhancing the Delta ecosystem and its unique agricultural, cultural, and recreational characteristics, while providing for a more reliable water supply for California. Delta Plan Policy DP P2 reflects these goals by requiring that local land uses be considered when choosing placement of water or flood facilities, or restoring habitats.

2.11.2 Findings

a) Would the Project physically divide an established community?

There are no established communities located on Hastings Tract, and the Project will not change the character or access to any of the residences or farm buildings on the tract; therefore, the Project will have no impact.

b) Would the Project cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

The Project will not result in any long-term changes to land use on Hastings Tract and therefore will not conflict with any goals or policies in the Solano County General Plan (Solano County 2008), the Land Use and Resource Management Plan for the Primary Zone of the Delta (DPC 2010), or the Delta Plan. The Project will have no impact.

2.12 Mineral Resources

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	❑	❑	❑	✓
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	❑	❑	❑	✓

2.12.1 Environmental setting

There are few mineral resources of economic value found in the Delta. Extraction of peat and sand-gravel occurs on some Delta islands. There are no mineral extraction activities currently occurring on Hastings Tract. To date, land on Hastings Tract has not been classified into mineral resource zones, as pursuant to the California Surface Mining and Reclamation Act of 1975 (SMARA; Section 6.2) (Solano County 2008).

2.12.2 Findings

a) Would the Project result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

There are no known mineral resources in the Project Area. The Project will have no impact.

b) Would the Project result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

There are no known mineral resources in the Project Area. The Project will therefore not conflict with a local plan and will have no impact.

2.13 Noise

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project result in:				
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the Project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	❑	❑	✓	❑
b) Generation of excessive groundborne vibration or groundborne noise levels?	❑	❑	❑	✓
c) For a Project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project expose people residing or working in the Project Area to excessive noise levels?	❑	❑	❑	✓

2.13.1 Environmental setting

2.13.1.1 Noise

Noise can be defined as unwanted sound. Pressure waves traveling through air exert a force registered by the human ear as sound, which is measured using monitoring instruments in units of decibels (dB). A whisper is about 30 dB; normal speaking is roughly 60 dB; and a shout is approximately 110 dB (CDC 2022). Long-term exposure to noises exceeding a level of 70 dB can cause negative effects, including hearing loss. Noise levels from localized (i.e., point) sources attenuate with distance at a rate of approximately 6 dB per doubling of distance (FTA 2018). Construction noise levels are often expressed in units of A-weighted decibels (dBA), which

represent the overall noise as adjusted in frequency to approximate typical human hearing sensitivity.

Noise on Hastings Tract is primarily created by boat traffic along adjacent waterways, recreational activities (e.g., hunting), and routine agricultural equipment and vehicles. The noise-sensitive receptor nearest to the Project Area is the rural residence on the opposite side of Cache Slough, approximately 650 ft away. Other rural residences in the vicinity are greater than 1 mile from the Project Area.

Solano County does not currently have a noise ordinance, but the Solano County Code (Section 28.70.10) includes general development standards preventing noise exceeding 65 dBA at any property line.

2.13.1.2 Vibration

Vibrations are periodic oscillations of a medium, including groundborne vibrations caused by machinery or construction equipment. Groundborne noise is produced by the vibration of other objects, such as room surfaces, resulting from groundborne vibrations. Vibrations are typically measured by their root mean squared velocity expressed as vibration decibels (VdB). Vibrations begin to be perceptible at approximately 65 VdB, become distinctly perceptible around 75 VdB, and become bothersome around 85 VdB (FTA 2018).

Existing vibration levels are relatively low near the Project Area. Vibrations in the vicinity are primarily produced by vehicular traffic, including routine agricultural and maintenance vehicles and equipment.

The Solano County Code (Section 28.70.10) prohibits offensive vibrations that are detectable beyond any property line.

2.13.2 Findings

a) Would the Project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the Project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

Typical construction equipment noise levels for the Project are estimated to be between 77 and 85 dBA, 50 ft from the source (Table 2-8). Expected noise levels were also calculated at 650 ft from the equipment (i.e., the distance to the nearest noise-sensitive receptor) (FTA 2018). The expected noise levels of Project construction equipment 650 ft from the source would be no greater than 59 dBA (Table 2-8), and up to four pieces of the loudest construction equipment (i.e., dozer, excavator, grader) could be run simultaneously without exceeding noise levels of 65 dBA.

Table 2-10. Expected construction equipment noise levels and usage.

Equipment	Acoustical usage factor (%)[1]	Expected noise level (dBA) from 50 ft	Expected noise level (dBA) from 650 ft
Compactor	20	82	53
Dozer	40	85	59
Excavator	40	85	59
Grader	40	85	59
Loader	40	80	54
Pump	50	77	52
Truck	40	84	58

Source: FHWA (2017)
dBA = A-weighted decibels
ft = feet
[1] Percentage of time equipment generates noise at the maximum level

As indicated in Table 2-8, noise levels during Project construction are expected to be below the Solano County Code development standard of 65 dB at the nearest residence. Additionally, there will be no long-term increase in noise generation following Project construction. Therefore, the Project will not result in generation of a substantial increase in ambient noise levels in excess of local standards; the impact will be less than significant.

b) Would the Project result in generation of excessive groundborne vibration or groundborne noise levels?

Vibration levels for heavy equipment and loaded haul trucks to be used during Project construction are not expected to exceed 87 VdB, 25 ft from the source, or 65 VdB, 135 ft from the source (FTA 2018), so groundborne vibration resulting from Project construction activities is not anticipated to be detectable at surrounding land uses, including the nearest sensitive receptor. No long-term increase in groundborne vibration generation will occur following Project construction. For these reasons, the Project will not result in generation of excessive groundborne vibration. There will be no impact.

c) For a Project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project expose people residing or working in the Project Area to excessive noise levels?

The Project Area is located along the eastern boundary of the Travis Air Force Base Airport Influence Area covered by the Travis Land Use Compatibility Plan (Solano County 2008). However, the Project Area is approximately 7 miles from Travis Air Force Base's nearest facilities (i.e., runway) where excessive noise would be most likely due to the higher concentration of planes and associated equipment. This noise would be imperceptible from a distance of 7 miles, and flights over the Project Area would be infrequent and brief in duration. Project construction workers will therefore not be exposed to excessive noise from operations at Travis Air Force Base. The Project will have no impact.

2.14 Population and Housing

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	❑	❑	❑	✓
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	❑	❑	❑	✓

2.14.1 Environmental setting

The Project Area is in a rural area of Solano County with low population density. Land surrounding the Project Area is primarily agricultural with a few domestic residences, including in the southeastern portion of Hastings Tract.

2.14.2 Findings

a) Would the Project induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

Although the Project improves infrastructure along Hastings Cut, it does not include any elements that would induce population growth. There will be no impact.

b) Would the Project displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

The Project will not displace any existing housing or necessitate the construction of replacement housing elsewhere. There will be no impact.

2.15 Public Services

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
a) Would the Project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	❑	❑	❑	✓
Fire protection?	❑	❑	❑	✓
Police protection?	❑	❑	❑	✓
Schools?	❑	❑	❑	✓
Parks?	❑	❑	❑	✓
Other public facilities?	❑	❑	❑	✓

2.15.1 Environmental setting

Hastings Tract is managed primarily for agriculture and private recreation (i.e., at Hastings Island Hunting Preserve). There are no government facilities, public resources, or services on the tract.

2.15.2 Findings

a) Would the Project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

Fire protection?
Police protection?
Schools?
Parks?
Other public facilities?

The Project will not affect fire protection services, police protection services, schools, parks, or other public facilities. None of these services have facilities on Hastings Tract, and access routes will be maintained to allow fire and police protection services to reach the residents and structures on Hastings Tract. There will be no impact.

2.16 Recreation

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
a) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	❑	❑	❑	✓
b) Does the Project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	❑	❑	❑	✓

2.16.1 Environmental setting

The Delta waterways surrounding Hastings Tract are a recreational resource for boating, fishing, wildlife viewing, and hunting. Lindsey Slough can be accessed via a boat ramp located within the Project Area; however, public access to the boat ramp is limited by locked gates along Hastings Cut Road.

On the interior of Hastings Tract, the privately owned Hastings Island Hunting Preserve includes approximately 4,700 acres that are maintained for recreational upland bird (e.g., ring-necked pheasant [*Phasianus colchicus*], chukar [*Alectoris chukar*]) hunting.

2.16.2 Findings

a) Would the Project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

The Project will not alter the use of existing neighborhood or regional parks or of the private hunting preserve on Hastings Tract. There will be no impact.

b) Does the Project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

The Project does not require construction or expansion of recreational facilities which might have an adverse physical effect on the environment. There will be no impact.

2.17 Transportation

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
Would the Project:				
a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?	❑	❑	❑	✓
b) Conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?	❑	❑	❑	✓
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	❑	❑	❑	✓
d) Result in inadequate emergency access?	❑	❑	❑	✓

2.17.1 Environmental setting

The Project Area is accessible from State Route 113, Hastings Road, and Hastings Cut Road. Construction workers commuting to the Project Area, and Project haul trucks, will drive along approximately 5.5 miles of Hastings Road and Hastings Cut Road before joining State Route 113. The Project will temporarily increase traffic in the Project vicinity during construction but will not result in long-term changes to any traffic or transportation circulation system.

Hastings Tract has roads along existing levee crowns. The roads on levees in the Project Area that need to be excavated will be restored following Project construction.

2.17.2 Findings

a) Would the Project conflict with a program, plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?

The Project will not conflict with a program plan, ordinance, or policy addressing the circulation system, including transit roadway, bicycle, and pedestrian facilities. There will be no impact.

b) Would the Project conflict or be inconsistent with CEQA Guidelines § 15064.3, subdivision (b)?

Automobile vehicle miles traveled are not expected to change due to the Project since there will be no detours during construction or change to any transportation system. There will be no impact.

c) Would the Project substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

The Project will not affect the design or use of roads in the vicinity. There will be no impact.

d) Would the Project result in inadequate emergency access?

Emergency services will continue to have access to Hastings Tract via Hastings Road and Hastings Cut Road throughout Project construction. Project personnel, including haul truck drivers and equipment operators, will comply with local fire, police, and medical responders during any emergency. There will be no impact.

2.18 Tribal Cultural Resources

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

2.18.1 Environmental setting

2.18.1.1 Ethnographic overview

The Project Area is located within the ethnographic territory of the Southern Wintun or Patwin, who are members of the widespread Penutian language family (Johnson 1978). Patwin are the southernmost division of Wintuan groups. They occupied the southwest portion of the Sacramento Valley, from the lower hills of the eastern North Coast Ranges to the Sacramento River, and from Princeton south to San Pablo and Suisun bays. Patwin are comprised of numerous different tribal groups with separate dialects, but anthropologists usually separate Patwin into two primary subdivisions: Hill Patwin and River Patwin. Hill Patwin occupied the lower, eastern slopes of the southern North Coast Range, and River Patwin occupied the west side

of the lower Sacramento River below the mouth of the Feather River and the lower reaches of Cache Creek and Putah Creek in the Sacramento Valley.

Patwin were organized into tribelets, which were usually composed of a principal village and a few satellite settlements (Kroeber 1932). Tribelets were small, autonomous, and sometimes bounded by the limits of a small drainage. Patwin subsistence relied on hunting, fishing, and gathering a wide variety of plant resources that were located within their territory, including acorns, blackberries, elderberries, grapes, tule, honey, salt (acquired from burning salt grass), and tobacco. Patwin also manufactured a variety of utilitarian and luxury items like baskets, stone tools, shell beads, and clothing.

River Patwin villages were estimated to average about 500 persons at Euroamerican contact (Cook 1976), which occurred by at least 1800 (Johnson 1978), and the Sacramento River Valley had an overall population density of approximately 3.35 persons per square mile. The influx of European and Spanish explorers and settlers during the 1830s and 1840s rapidly changed Patwin demography, as local Native American populations were used as labor on large land grants known as ranchos. Ranchos in the Project Area include Suisun and Tolenas (Beck and Haase 1974). The 1848 discovery of gold in the western Sierra Nevada foothills and the ensuing Gold Rush led to a flood of non-indigenous peoples into Patwin territory. The latter half of the nineteenth and early twentieth century witnessed ongoing and growing immigration of Euroamericans into the Project region, which was accompanied by regional cultural and economic changes highlighted by agricultural development of the Project Area.

2.18.1.2 Sacred Lands File search and Native American outreach

The NAHC returned the results of a SLF records search on November 28, 2022. The SLF results were negative for Native American resources in the vicinity of the Project (Natural Investigations Company 2023).

The Natural Investigations Company sent Project information letters to all tribal members or organizations affiliated with the region, as provided by NAHC, on November 28, 2022 (Natural Investigations Company 2023). If no response was received, follow-up phone calls were made on December 13, 2022. To date, no additional information has been received that indicates the potential presence of tribal cultural resources in the Project Area. However, one Tribe has reached out to initiate formal consultation with the District for the Project.

2.18.2 Findings

a) Would the Project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code § 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code § 5020.1(k), or?

Native American outreach, SLF records, and the Natural Investigations Company survey indicate that there are no tribal cultural resources listed or eligible for listing in the CRHR

or in a local register of historical resources within or near the Project Area (Natural Investigations Company 2023). The Project will have no impact.

ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code § 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code § 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

Native American outreach, SLF records, and the Natural Investigations Company survey indicate that there are no significant tribal cultural resources within or near the Project Area (Natural Investigations Company 2023). The Project will have no impact.

2.19 Utilities and Service Systems

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

2.19.1 Environmental setting

There are no public wastewater treatment facilities, stormwater drainage facilities, or other public utilities or service systems located on Hastings Tract. Wastewater is managed by private septic systems. Solid waste can be disposed of at landfills and recycling facilities in nearby cities (e.g.,

Vacaville, Dixon). Pacific Gas and Electric Company (PG&E) provides electricity to Hastings Tract via local distribution lines.

The California State Legislature passed the Integrated Waste Management Act of 1989 (AB 939; Section 6.2) to minimize the disposal of solid wastes. AB 939 established the California Integrated Waste Management Board (CIWMB) and required diversion of 25 percent of solid waste by 1995 and 50 percent by 2000. CIWMB's responsibilities transferred to the California Department of Resources Recycling and Recovery in 2010, and AB 341 (Section 6.2) was enacted in 2011, updating the statewide goal to 75 percent reduction by 2020. The Solano County Integrated Waste Management Plan outlines the ways in which Solano County will meet these goals (Solano County 2023).

2.19.2 Findings

a) Would the Project require or result in the relocation or construction of new or expanded water, wastewater treatment, or stormwater drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?

The Project will not affect any existing, or require construction of any new, utility infrastructure, including that relating to wastewater, electricity, natural gas, or telecommunications. There will be no impact.

b) Would the Project have sufficient water supplies available to serve the Project and reasonably foreseeable future development during normal, dry, and multiple dry years?

The Project will not create a need for an increased water supply following construction. During construction, water trucks may source water from Cache Slough, Lindsey Slough, and/or Hastings Cut. Based on the relatively small amount of water needed temporarily during construction, there will be sufficient water supplies available for these needs. There will be no impact.

c) Would the Project result in a determination by the wastewater treatment provider which serves or may serve the Project that it has adequate capacity to serve the Project's projected demand in addition to the provider's existing commitments?

The Project will not generate wastewater or require the use of a wastewater treatment facility. There will be no impact.

d) Would the Project generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?

To the extent possible, reusable portions of the existing pipes in the Cache Slough levee will be relocated to the Lindsey Slough levee, and fill removed during the levee excavation will be used as backfill during levee replacement. Any existing pipe features that can remain in their current location without negatively impacting the surrounding environment will be abandoned in place. Any remaining materials not suitable for use in Project construction, including plant material or any trash generated during construction activities, will be recycled if possible, or disposed of at an off-site waste facility (likely Hay Road landfill). Because the Project will reuse or recycle materials where feasible and will only generate solid waste over the short term during Project

construction, the Project will not generate solid waste in excess of state or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals. The impact will be less than significant.

e) Would the Project comply with federal, state, and local management and reduction statutes and regulations related to solid waste?

As indicated in (d) above, the Project will comply with federal, state, and local management and reduction statutes and regulations related to solid waste by reusing or recycling materials when possible. There will be no impact.

2.20 Wildfire

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

2.20.1 Environmental setting

Within Solano County, the highest wildfire risk is in the western portion of the county where foothill or mountain areas have potentially large fuel loads. The Project Area, however, has generally flat topography and primarily includes agricultural land surrounded by waterways. The Project Area is in an unzoned state responsibility area and does not contain lands classified as moderate, high, or very high fire hazard severity zones (CalFire 2022).

2.20.2 Findings

a) If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the Project substantially impair an adopted emergency response plan or emergency evacuation plan?

The Project Area is not located in or near a state responsibility area or on land classified as a very high fire hazard severity zone. There will be no impact.

b) If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the Project due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose Project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?

The Project is not located in or near a state responsibility area or on land classified as a very high fire hazard severity zone. The Project does not include any components that will exacerbate wildfire risk. There will be no impact.

c) If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the Project require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines, or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?

The Project is not located in or near a state responsibility area or on land classified as a very high fire hazard severity zone and does not require the installation of associated infrastructure. There will be no impact.

d) If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the Project expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?

The Project is not located in or near a state responsibility area or on land classified as a very high fire hazard severity zone. The topography in the Project Area is generally flat, and Project implementation will not result in increased runoff or slope instability. There will be no impact.

2.21 Mandatory Findings of Significance

Issues	Potentially significant impact	Less than significant with mitigation incorporated	Less than significant impact	No impact
a) Does the Project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	❑	✓	❑	❑
b) Does the Project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a Project are considerable when viewed in connection with the effects of past Projects, the effects of other current Projects, and the effects of probable future Projects.)	❑	✓	❑	❑
c) Does the Project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	❑	✓	❑	❑

a) Does the Project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

As discussed in Sections 2.4 and 2.10, the Project has the potential to impact special-status plant, fish, and wildlife species as well as their habitats within the Project Area. Impacts on these resources will be limited to a less than significant level with the incorporation of mitigation measures **MM-1** through **MM-8**.

Therefore, the Project will not substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory. Potential impacts on biological and cultural resources will be less than significant with incorporation of the mitigation measures described above.

b) Does the Project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a Project are considerable when viewed in connection with the effects of past Projects, the effects of other current Projects, and the effects of probable future Projects.)

The Project has been determined to have no impact on cultural resources, land use and planning, mineral resources, population and housing, public services, recreation, transportation, tribal cultural resources, and wildfire. As such, there is no potential for cumulatively considerable impacts on these resources.

The Project has been determined to have the potential for less-than-significant impacts to aesthetics, agriculture, air quality, energy, geology and soils, GHG emissions, hazards and hazardous materials, hydrology and water quality, noise, and utilities and service systems temporarily during construction. There are no other construction projects planned for 2025 on Hastings Tract that also have the potential to contribute to impacts to these resources. Additionally, the Project does not exceed the air quality and GHG thresholds that were determined by YSAQMD in consideration of the potential for cumulative effects attributable to emissions from multiple projects occurring simultaneously. The potential for cumulatively considerable hydrology and water quality impacts would be minimized by implementation of a SWPPP during construction (**CM-3** through **CM-6**); any nearby projects with the potential to impact surrounding waterways would also implement a SWPPP, as required by Clean Water Act Section 402. For these reasons, the Project will not have a cumulatively considerable impact on aesthetics, air quality, energy, geology and soils, GHG emissions, hazards and hazardous materials, hydrology and water quality, noise, or utilities and service systems.

The Project will result in a minor loss of Freshwater Marsh, Riparian Forest, and Scrub-shrub habitats, as defined by AB 360 (Section 6.2). This loss will be mitigated such that there is a net increase in these habitat types. A Mitigation and Monitoring Plan will be developed in consultation with CDFW who oversees compliance with the AB 360 program, which was established to protect these components of the Delta ecosystem. The net increase in these habitats will not result in adverse impacts that will be cumulatively considerable.

In addition, and as described in (a) above, implementation of mitigation measures (**MM-1** through **MM-8**) during construction (e.g., preconstruction surveys) will prevent impacts to biological resources that have the potential to be cumulatively considerable.

For the reasons described above, the Project will not have environmental effects that are individually limited but cumulatively considerable; cumulative effects will be less than significant with mitigation.

c) Does the Project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

As discussed in this IS/MND, the Project, including conservation measures that are incorporated into its design, will have no impact or a less-than-significant impact on aesthetics, agriculture, air quality, energy, geology and soils, GHG emissions, hazards or hazardous materials, hydrology and water quality, land use and planning, mineral resources, noise, population and housing, public services, recreation, transportation, utilities and services, and wildfire. In addition, and as described in (a) above, implementation of mitigation measures during construction will limit impacts to water quality that have the potential to adversely affect human beings. As such, the

Project's environmental effects will not cause substantial adverse effects on humans, either directly or indirectly; impacts will be less than significant with mitigation.

3 DETERMINATION

On the basis of this evaluation:

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

4 LIST OF PREPARERS

The table below lists the preparers of this IS/MND and participants in the related planning, data gathering, and analytical tasks.

Name	Title	Affiliation	Project role
Tina Anderson	Senior Project Manager	MBK Engineers	Project management and support
Mike Kynett	Supervising Engineer	MBK Engineers	Engineering, Project design
Catlin Ames	Fish Biologist	Stillwater Sciences	Environmental analysis (biological resources—fish)
Emily Applequist	Terrestrial Ecologist	Stillwater Sciences	Environmental analysis, document preparation
Carina Bilodeau	Botanist	Stillwater Sciences	Environmental analysis (biological resources—plants)
Holly Burger	Senior Wildlife Biologist	Stillwater Sciences	Environmental analysis oversight
Megan Keever	Senior Botanist	Stillwater Sciences	Environmental analysis oversight (biological resources—plants)
AJ Keith	Senior Aquatic Ecologist	Stillwater Sciences	Environmental analysis oversight (biological resources—fish)
Marissa Montjoy	Biologist	Stillwater Sciences	Environmental analysis, document preparation
Joey Verdian	Geologist	Stillwater Sciences	Environmental analysis, document preparation
Cooper Walton	Biologist	Stillwater Sciences	Environmental analysis (biological resources—wildlife)
Andrew Dang, BA	Archaeologist	Natural Investigations Company	Cultural resources, tribal cultural resources
John Nadolski, MA	Archaeologist	Natural Investigations Company	Cultural resources, tribal cultural resources

5 CONSULTATION AND COORDINATION

The Draft IS/MND was circulated to agencies, individuals, and/or organizations known to have a special interest in the proposed Project and was made available to the public for a 30-day review period. The public was notified as follows:

a) A Notice of Intent (NOI) to adopt an MND was posted for publication in a local newspaper and filed with the Solano County Clerk.

b) The proposed IS/MND, NOI, and Notice of Completion (NOC) were electronically submitted to the State Clearinghouse for distribution.

c) The proposed IS/MND was distributed electronically by the State Clearinghouse to interested parties.

d) Copies of the proposed IS/MND were made available for public review at MBK Engineers offices in Sacramento.

6 COMPLIANCE WITH FEDERAL AND STATE ENVIRONMENTAL LAWS AND REGULATIONS

6.1 Federal

Clean Air Act. Section 176(c) of this act prohibits federal action or support of activities that do not conform to a State Implementation Plan. The Project is not expected to violate any air quality standard, increase air quality violations in the Project region, exceed the USEPA's general conformity *de minimis* threshold, or hinder the attainment of air quality objectives in the local air basin. The Project will have no adverse effect on the future air quality of the Project Area and is compliant with this act.

Clean Water Act (Sections 401 and 404). Section 404 of this act requires that a permit be obtained from USACE for fill of waters of the U.S., including wetlands, prior to Project implementation. In compliance with Section 401 of the Act, a water quality certification or a waiver of water quality certification needs to be obtained from the Central Valley RWQCB. Section 404 and 401 permits will be secured prior to Project implementation, in compliance with this act.

Endangered Species Act. The Endangered Species Act (ESA) prohibits unauthorized take of species listed or proposed for listing as threatened or endangered. The ESA also ensures that the actions of federal agencies do not jeopardize the continued existence of threatened and endangered species. The mitigation measures incorporated into the Project will ensure compliance with the ESA.

Migratory Bird Treaty Act. Protection of migratory birds, their occupied nests, and their eggs is required by the Migratory Bird Treaty Act (MBTA) (16 USC 703 et seq.), Title 50 Code of Federal Regulations (part 10), and CDFG Code Sections 3503 and 3513. The full list of the species protected under the MBTA appears in Title 50, Section 10.13, of the Code of Federal Regulations (50 CFR 10.13) and includes federally and state-listed migratory birds as well as other non-listed migratory birds. Mitigation measures incorporated into the Project will ensure compliance with the MBTA.

Rivers and Harbors Act (Sections 10 and 14 [codified in Section 408]). The Rivers and Harbors Act prohibits the unauthorized obstruction of any navigable water of the United States. All features below mean high water are subject to Section 10 of the Rivers and Harbors Act, which requires authorization for the construction of any structure in or over navigable waters. Lindsey Slough, Cache Slough, and Hastings Cut are considered navigable waters by USACE. Section 14 of the Rivers and Harbors Act (codified in and commonly referred to as Section 408) regulates permanent or temporary modifications to USACE public works projects, including levees. If it is determined that the Project may impact navigable waters or a USACE levee, then Section 10 and/or Section 408 permits will be secured, as necessary, prior to Project implementation.

6.2 State

Assembly Bills 32 and 1279. AB 32 required CARB to develop regulations to address global climate change due to GHG emissions. The bill also required attainment of a statewide GHG emissions limit, equal to the 1990 level, by December 31, 2020. As of 2019, statewide GHG emissions (418.4 million metric tons of CO_2e) (CARB 2021) were below the 2020 GHG

emissions limit (431 million metric tons of CO_2e) (CARB 2018). Signed into law in 2022, AB 1279 expanded upon AB 32 by specifying an emissions limit which further requires California to reduce statewide GHG emissions to 85 percent below 1990s level by 2045. Emissions associated with Project construction will be temporary and will not inhibit attainment of the statewide GHG emissions limits established by these bills.

Assembly Bill 52. AB 52 provides a method for incorporation of Native American tribal knowledge into the CEQA review process via formal consultation. In compliance with AB 52, tribal members or organizations, provided by the NAHC, were contacted for information on the potential for indigenous resources in or near the Project Area. Results of tribal outreach efforts undertaken in support of the Project gave no indication that tribal cultural resources are present within the Project Area.

Assembly Bill 341. AB 341 established regulations requiring commercial business and multi-family residences to implement recycling programs. AB 341 also updated the statewide goal from AB 939 (see Integrated Waste Management Act below) from a 50 percent reduction in solid waste disposal to a 75 percent reduction by 2020. The Project will reuse or recycle materials where feasible and will only generate solid waste over the short term during Project construction so will not impair the attainment of solid waste reduction goals.

Assembly Bill 360. AB 360 established provisions, including mitigation requirements, for the protection of fish and wildlife habitat in the Delta (i.e., Freshwater Marsh, Scrub-shrub, Riparian Forest, and SRA habitats). Mitigation measures incorporated into the Project (**MM-1**) will ensure compliance with AB 360.

California Environmental Quality Act. This Initial Study/Mitigated Negative Declaration has been prepared to comply with CEQA.

California Endangered Species Act. Generally, CDFW administers the state laws providing protection of fish and wildlife resources, including the CESA. The CESA parallels the ESA and was written to protect state endangered and threatened species. Mitigation measures incorporated into the Project will ensure compliance with CESA.

Delta Protection Act. The Delta Protection Act was established in recognition of the increasing threats to the resources of the Primary Zone of the Delta from urban and suburban encroachment which have the potential to impact agriculture, wildlife habitat, and recreational uses. Pursuant to the Delta Protection Act, the Land Use and Resource Management Plan for the Primary Zone of the Delta was completed and adopted by the Delta Protection Commission in 1995 (updated in 2002). The Project will not result in urban or suburban encroachment and is, therefore, in compliance with this act.

Delta Reform Act. The Delta Reform Act created the Delta Stewardship Council to oversee the management of water and environmental resources in the Delta through the development and implementation of the Delta Plan. If it is determined that the Project is a covered action, a consistency determination will be obtained from the Delta Stewardship Council.

Fish and Game Code Section 1600 et seq. California Fish and Game Code Section 1600 et seq. gives authority to CDFW to regulate activities that would interfere with the natural flow of, or substantially alter the channel, bed, or bank of a lake, river, or stream. Because the Project includes work on the waterside levee below the hinge point or waterside crest, the District is required to notify CDFW. If CDFW determines that the Project will have potential adverse

effects on fish and wildlife resources, they will issue a Lake and Streambed Alteration Agreement that includes conditions to protect these resources. The Project will therefore comply with this Fish and Game Code section.

Fish and Game Code Sections 86, 3503, and 3513. California Fish and Game Code Section 86 defines take as hunting, pursuing, catching, capturing, or killing, or attempting to hunt, pursue, catch, capture, or kill. Under Fish and Game Code Section 3503 it is unlawful to take, possess, or needlessly destroy the nests or eggs of any bird, except as otherwise provided. Fish and Game Code Section 3503.5 protects all birds-of-prey (raptors) and their eggs and nests, and under Section 3513 it is unlawful to take or possess any migratory non-game bird designated under the MBTA. Mitigation measures incorporated into the Project will ensure compliance with these Fish and Game Code sections.

Fish and Game Code Sections 3511, 4700, 5050, and 5515. California Fish and Game Code Sections 3511, 4700, 5050, and 5515 designated rare fish and wildlife species as Fully Protected in California. This designation provides additional protection to these species from unauthorized take or possession. Mitigation measures incorporated into the Project will ensure compliance with these sections.

Integrated Waste Management Act (AB 939). The Integrated Waste Management Act made California cities and counties responsible for enacting plans to divert 25 percent of solid waste by 1995 and 50 percent by 2000. The Project will reuse or recycle materials where feasible and will only generate solid waste over the short term during Project construction so will not impair the attainment of solid waste reduction goals.

Native Plant Protection Act. The NPPA directed CDFW to preserve, protect, and enhance native plants. It gave CDFW the authority to designate native plants as endangered or rare and require that landowners who have been notified of state-listed species on their property, and who wish to destroy those plants and their habitat, to provide CDFW with notice to salvage the plants no less than 10 days before destruction occurs. Many of the species designated under the NPPA were subsumed by CESA, but there is a subset of species, subspecies, and varieties of plants that were not and are protected as rare under the NPPA. Mitigation measures incorporated into the Project, which include NPPA rare plants that may be impacted, will ensure compliance with NPPA.

Porter-Cologne Water Quality Control Act. The Porter-Cologne Water Quality Control Act was established to protect water quality and beneficial uses of water in California. This act requires that National Pollutant Discharge Elimination System (NPDES) and Waste Discharge Requirement (WDR) permits for point and nonpoint source discharges, respectively, be obtained from the RWQCB to protect water quality in surface waters, groundwater, and wetlands. If it is determined that the Project may impact waters of the United States, then NPDES and WDR permits will be secured prior to Project implementation, in compliance with this act.

Surface Mining and Reclamation Act. SMARA includes policies for the regulation of surface mining operations to balance production of state mineral resources with minimization of adverse environmental impacts associated with these activities. In support of these goals, state lands are classified into mineral resource zones based on known or inferred mineral resources. No land on Hastings Tract has been classified into mineral resource zones, so the Project will not conflict with the policies in this act.

Warren-Alquist Act. The Warren-Alquist Act established the California Energy Commission, the state's primary energy policy and planning agency. The California Energy Commission works to advance state energy policy, encourage energy efficiency, and develop renewable energy. The Project will only utilize fossil fuels on a short-term basis during construction activities and will include BMPs for energy conservation (e.g., limiting idling time, properly maintaining equipment).

Williamson Act (also known as the California Land Conservation Act). The Williamson Act allows for the formation of contracts between local governments and private landowners to restrict use of specific parcels to agricultural or related open space land uses. The Project Area is covered by a Williamson Act contract, and land use in the Project Area will not change over the long term following Project construction.

7 REFERENCES

Aagaard, B. T., J. L. Blair, J. Boatwright, S. H. Garcia, R. A. Harris, A. J. Michael, D. P. Schwartz, and J. S. DiLeo. 2016. Earthquake outlook for the San Francisco Bay region 2014–2043 (ver. 1.1, August 2016): U.S. Geological Survey Fact Sheet 2016–3020. Available at: http://dx.doi.org/10.3133/fs20163020.

Atwater, B. F. 1982a. Geologic maps of the Sacramento-San Joaquin Delta, California. Miscellaneous field studies map MF-1401. Bouldin Island quadrangle. Scale 1:24,000. Available at: https://ngmdb.usgs.gov/Prodesc/proddesc_7126.htm.

Atwater, B. F. 1982b. Geologic Maps of the Sacramento-San Joaquin Delta, California. Report to accompany Map MF-1401. Available at: https://pubs.usgs.gov/mf/1401/report.pdf.

Beck, W. A., and Y. D. Haase. 1974. Historical atlas of California, 1st edition. University of Oklahoma Press, Norman, Oklahoma.

Bennett, W. A. 2005. Critical assessment of the delta smelt population in the San Francisco Estuary, California. San Francisco Estuary and Watershed Science [online serial] Volume 3. Available at: http://repositories.cdlib.org/jmie/sfews/vol3/iss2/art1/.

Bryant, W. A., and S. E. Cluett, compilers. 2002a. Fault number 53b, Greenville fault zone, Marsh Creek-Greenville section. Quaternary fault and fold database of the United States: U.S. Geological Survey website. Available at: https://earthquake.usgs.gov/static/lfs/nshm/qfaults/Reports/53b.pdf.

Bryant, W. A., and S. E. Cluett, compilers. 2002b. Fault number 37, Green Valley fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, Available at: https://earthquake.usgs.gov/cfusion/qfault/show_report_AB_archive.cfm?fault_id=37&section_id=.

CalFire (California Department of Forestry and Fire Protection). 2022. California Fire Hazard Severity Zones (FHSZ). Available at: https://www.arcgis.com/home/item.html?id=31219c833eb54598ba83d09fa0adb346.

California DOC (Department of Conservation). 2021. EQ Zapp: California earthquake hazards zone application. Available at: https://www.conservation.ca.gov/cgs/geohazards/eq-zapp..

California DOC. 2022. California important farmland finder. California Department of Conservation, Division of Land Resources Protection, Farmland Mapping and Monitoring Program. Available at: https://maps.conservation.ca.gov/DLRP/CIFF/.

California DOC. 2023a. Important farmland categories. Available at: https://www.conservation.ca.gov/dlrp/fmmp/Pages/Important-Farmland-Categories.aspx.

California DOC. 2023b. California tsunami maps. Available at: https://www.conservation.ca.gov/cgs/tsunami/maps.

Cal-IPC (California Invasive Plant Council). 2023. California Invasive Plant Inventory. Online database. https://www.cal-ipc.org/plants/inventory [Accessed August 2023]. Prepared by California Invasive Plant Council, Berkeley, California. .

Caltrans (California Department of Transportation). 2015. Technical Guidance Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Report No. CTHWANP-RT-15-306.01.01.

CARB (California Air Resources Board). 2018. AB 32 Scoping Plan. Available at: https://ww3.arb.ca.gov/cc/scopingplan/scopingplan.htm.

CARB. 2019. California greenhouse gas emission inventory: 2000–2017, 2019 edition. Available at: https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2016/ghg_inventory_trends_00-16.pdf?_ga=2.41074274.1903261348.1588278400-1589787952.1543448564.

CARB. 2021. California greenhouse gas emissions for 2000 to 2019. Trends of Emissions and Other Indicators. Sacramento, California.

CARB. 2022. California greenhouse gas emissions for 2000 to 2020. Trends of Emissions and other indicators. Sacramento, California.

CARB. 2023a. Air quality standards. Available at: https://ww2.arb.ca.gov/resources/background-air-quality-standards.

CARB. 2023b. State area designations describing summary statistics for pollutants. Available at: https://www.arb.ca.gov/adam/trends/trends1.php.

CARB. 2023c. Summaries of historical area designations for state standards. Available at: https://ww2.arb.ca.gov/our-work/programs/state-and-federal-area-designations/state-area-designations/summary-tables.

CDC (Centers for Disease Control and Prevention). 2022. What noises cause hearing loss? Available at: https://www.cdc.gov/nceh/hearing_loss/what_noises_cause_hearing_loss.html.

CDFW (California Department of Fish and Wildlife). 2018. Protocols for surveying and evaluating impacts to special status native plant populations and sensitive natural communities. California Natural Resources Agency, Sacramento, California. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18959&inline.

CDFW. 2023a. California Natural Diversity Database (CNDDB), Rarefind version 5. CDFW, Sacramento, California. Available at: https://www.wildlife.ca.gov/data/cnddb/maps-and-data.

CDFW. 2023b. List of California Sensitive Natural Communities. Vegetation Classification and Mapping Program, California Department of Fish and Game, Sacramento, California. Available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153609&inline.

CDTSC (California Department of Toxic Substances Control). 2023. EnviroStor online map viewer database. http://www.envirostor.dtsc.ca.gov/ [Accessed July 2023].

CEC (California Energy Commission). 2021. California Energy Commission: about. Website. https://www.energy.ca.gov/about [Accessed July 2021].

Central Valley RWQCB (Regional Water Quality Control Board). 2019. The Water Quality Control Plan (Basin Plan) for the Central Valley Region. Fifth edition.

CGS (California Geological Survey). 2010. Fault activity map of California. Compilation and interpretation by C. W. Jennings and W. A. Bryant with assistance from G. Saucedo.t: https://maps.conservation.ca.gov/cgs/fam/App/ [Accessed August 2023].

CGS. 2018. Special Publication 42. Earthquake fault zones: A guide for government agencies, property owners/developers, and geoscience practitioners for assessing fault rupture hazards in California.at: https://www.conservation.ca.gov/cgs/Documents/Publications/Special-Publications/SP_042.pdf [Accessed August 2023].

CGS. 2022. MapService of the Alquist-Priolo Fault Zones defined under the Alquist-Priolo Earthquake Fault Zoning Act.at: https://gis.conservation.ca.gov/portal/home/item.html?id=c280aad6034449e085023ef4f8d7e2ad [Accessed August 2023].

CNPS (California Native Plant Society). 2023a. Inventory of rare and endangered plants of California (online edition, v8-03 0.39). Rare Plant Program, California Native Plant Society, Sacramento, California. [Accessed April and July 2023].

CNPS. 2023b. A Manual of California Vegetation, Online Edition. California Native Plant Society, Sacramento, CA. Available at: http://www.cnps.org/cnps/vegetation/ [Accessed April 2023].

Cook, S. F. 1976. The Population of the California Indians, 1769–1970. University of California Press, Berkeley, California.

Delta Stewardship Council. 2019. Delta Plan. Available at: https://deltacouncil.ca.gov/delta-plan/.

DPC (Delta Protection Commission). 2010. Land Use and Resource Management Plan. Available at: http://delta.ca.gov/wp-content/uploads/2016/10/Land-Use-and-Resource-Management-Plan-2.25.10_.pdf.

Drexler, J. Z, C. S. de Fontaine, and T. A. Brown. 2009. Peat accretion histories during the past 6000 years in marshes of the Sacramento-San Joaquin Delta, California, USA. Estuaries and Coasts 32: 871–892.

DWR (California Department of Water Resources. 2023. Electrical conductivity data from Liberty Island station (Station ID: LIB). California Data Exchange Center, DWR, Sacrament, California. Available at: http://cdec.water.ca.gov [Accessed September 2023].

eBird. 2023. An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [Accessed: February 2023].

FEMA (Federal Emergency Management Agency). 2023. FEMA Flood Map Service Center.at: https://msc.fema.gov/portal/home.

FGDC (Federal Geographic Data Committee). 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C.

FHWA (Federal Highway Administration). 1983. Visual impact assessment for highway projects. Washington, D.C.

FHWA. 2017. Construction noise handbook. Construction equipment noise levels and ranges. Available at: https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm.

FTA (Federal Transit Administration). 2018. Transit noise and vibration impact assessment manual. FTA Report No. 0123. Prepared by John A. Volpe National Transportation Systems Center. September.

Helley, E. J., and R. W. Graymer. 1997. Quaternary geology of Contra Costa County, and surrounding parts of Alameda, Marin, Sonoma, Solano, Sacramento, and San Joaquin Counties, California: A digital database. U.S. Geological Survey Open-File Report 97-98. Available at: http://pubs.usgs.gov/of/1997/of97-098/.

iNaturalist. 2023. Available from https://www.inaturalist.org. Accessed June 2023.

Johnson, P. J. 1978. Patwin. Pages 385–415 *in* California: Handbook of North American Indians, Volume 8. Smithsonian Institute. Plenum Press, New York.

Kroeber, A. L. 1932. The Patwin and their neighbors. University of California Publications in Archaeology and Ethnology 29: 253–423.

Lewis, E.L. 1980. The Practical Salinity Scale 1978 and its antecedents. IEEE Journal of Oceanic Engineering OE-5(1).

Merz J. E., Hamilton S., Bergman P. S, Cavallo B. 2011. Spatial perspective for delta smelt: a summary of contemporary survey data. Calif Fish Game 97:164–189.

MHM. 2023. Solano County, California Reclamation District No. 2060 Hastings Tract - Pipe Replacement Project. Volume 2. May.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press, Berkeley.

Moyle P. B., R. D. Baxter, T. Sommer, T. C. Foin, and S. A. Matern. 2004. Biology and population dynamics of Sacramento splittail (*Pogonichthys macrolepidotus*) in the San Francisco Estuary: A review. San Francisco Estuary and Watershed Science [online serial] 2: Article 3.

Natural Investigations Company. 2023. Cultural resources assessment for the Reclamation District No. 2060: Hastings Tract Deferred Maintenance Program Pipe Replacement Project, Solano County, California. Prepared by Natural Investigations Company, Sacramento, California.

NMFS (National Marine Fisheries Service). 2009. Final biological and conference opinion on the long-term operations of the Central Valley Project and State Water Project. National Marine Fisheries Service, Southwest Region. Long Beach, California.

NMFS. 2016. National Marine Fisheries Service's West Coast Region California Species List Tools http://www.westcoast.fisheries.noaa.gov/maps_data/california_species_list_tools.html [Accessed April 2023].

PRISM Climate Group. 2023. Time Series Values for Individual Locations. PRISM Climate Group, Oregon State University, Corvallis, OR. Available at: http://prism.oregonstate.edu/explorer/.

Radtke, L. D. 1966. Distribution of smelt, juvenile sturgeon, and starry flounder in the Sacramento-San Joaquin Delta with observations on food of sturgeon. California Fish and Game Bulletin 136: 115–126.

San Joaquin County. 1992. San Joaquin County General Plan 2010. Section III.A Seismic and Geological Hazards. Available at: https://www.sjgov.org/commdev/cgi-bin/cdyn.exe/handouts-planning_GP-V3-III-A?grp=handouts-planning&obj=GP-V3-III-A [Accessed August 2023].

Solano Collaborative (City of Vacaville Groundwater Sustainability Agency [GSA], Northern Delta GSA, Sacramento County GSA, Solano GSA, Solano Irrigation District GSA). 2021. Solano Subbasin Groundwater Sustainability Plan.

Solano County. 2008. Solano County General Plan. Available at: https://www.solanocounty.com/depts/rm/planning/general_plan.asp [Accessed July 2023].

Solano County. 2011. Solano County Climate Action Plan. Prepared by AECOM. June.

Solano County. 2023. Countywide Integrated Waste Management Plan. Available at: https://www.solanocounty.com/depts/rm/planning/solano_county_recycling/ciwmp_planning_documents.asp.

Solano County Water Agency. 2012. Solano Multispecies Habitat Conservation Plan. Available at: https://www.scwa2.com/solano-multispecies-habitat-conservation-plan/.

SWRCB (State Water Resources Control Board). 2022. CA 2020–2022 Integrated Report. Available at: https://gispublic.waterboards.ca.gov/portal/home/item.html?id=6cca2a3a1815465599201266373cbb7b.

Unruh, J. R., and C. S. Hitchcock. 2009. Characterization of potential seismic sources in the Sacramento-San Joaquin Delta, California. Prepared by Fugro William Lettis & Associates, Inc. Walnut Creek, California for U.S. Geological Survey, National Earthquake Hazards Reduction Program. Available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/dd_jardins/DDJ-142_Unruh.pdf.

USACE (U.S. Army Corps of Engineers). 2023. Navigable waterways in the Sacramento District. Available at: https://www.spk.usace.army.mil/Missions/Regulatory/Jurisdiction/Navigable-Waters-of-the-US/.

USDA NRCS (U.S. Department of Agriculture Natural Resources Conservation Service). 2023a. Web soil survey. Online database. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

USDA NRCS. 2023b. Hydric soils lists for Solano County, California soil survey area. Available at: https://www.nrcs.usda.gov/publications/query-by-ssa.html.

USEIA (U. S. Energy Information Administration). 2023. Rankings: Total Energy Consumed per Capita, 2021 (million Btu). Available at: https://www.eia.gov/state/rankings/?sid=US [Accessed July 2023].

USEPA (U.S. Environmental Protection Agency). 2023. Nonattainment Areas for Criteria Pollutants (Green Book). Available at: https://www.epa.gov/green-book [Accessed July 2023].

USFWS. 2000. Guidelines for conducting and reporting botanical inventories for federally listed, proposed and candidate plants.

USFWS. 2004. Formal Programmatic Consultation on the Issuance of Section 10 and 404 Permits for Projects with Relatively Small Effects on the delta smelt (*Hypomesus transpacificus*) and its Critical Habitat. Service File Number: 1-1-04-F-0345. Sacramento Fish and Wildlife Office, Sacramento, California.

USFWS. 2017. Framework for assessing impacts to the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). U.S. Fish and Wildlife Service, Sacramento, California.

USFWS. 2023a. Information for Planning and Consultation (IPaC): online project planning tool. https://ecos.fws.gov/ipac/ [Accessed April 2023].

USFWS. 2023b. National Wetlands Inventory (NWI) wetlands and riparian polygon data. Geospatial wetlands data. USFWS, Arlington, Virginia. http://www.fws.gov/wetlands/.

USGS (U.S. Geological Survey). 2023. Hydrologic units from the watershed boundary dataset. Available at: https://gispublic.waterboards.ca.gov/portal/home/item.html?id=b6c1bab9acc148e7ac726e33c43402ee.

Whipple, A. A., R. M. Grossinger, D. Rankin, B. Stanford, and R. A. Askevold. 2012. Sacramento-San Joaquin Delta historical ecology investigation: exploring pattern and process. A report of SFEI-ASC's Historical Ecology Program, Publication #672. Prepared by San Francisco Estuary Institute-Aquatic Science Center, Richmond, California for California Department of Fish and Game and Ecosystem Restoration Program. Available at: http://www.sfei.org/DeltaHEStudy.

Young, Y. J., Martin Perales, K., Durand, J. R., Moyle, P. B. 2015. Fish Distribution in the Cache Slough Complex of the Sacramento-San Joaquin Delta during Drought. IEP Newsletter Volume 28, Number 3, 2015.

YSAQMD (Yolo-Solano Air Quality Management District). 2007. Handbook for assessing and mitigating air quality impacts.

YSAQMD. 2019. Air Quality Attainment Plan. Triennial Assessment and Plan Update.

Appendices

Appendix A

California Emissions Estimator Model Data Entry and Emissions Summary Sheets

Hastings Tract Pipe Replacement Custom Report

Table of Contents

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Hastings Tract Pipe Replacement
Construction Start Date	5/1/2025
Lead Agency	Reclamation District No. 2060
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	5.70
Precipitation (days)	2.20
Location	38.26382088718836, -121.77209240190933
County	Solano-Sacramento
City	Unincorporated
Air District	Yolo/Solano AQMD
Air Basin	Sacramento Valley
TAZ	878
EDFZ	4
Electric Utility	Pacific Gas & Electric Company
Gas Utility	Pacific Gas & Electric
App Version	2022.1.1.18

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description

User Defined Linear	0.25	Mile	4.00	0.00	0.00	—	—	Tide gates through island perimeter levees

1.3. User-Selected Emission Reduction Measures by Emissions Sector

No measures selected

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	3.71	3.10	27.2	27.4	0.06	1.21	57.0	58.2	1.11	6.82	7.93	—	6,812	6,812	0.23	0.27	3.34	6,903
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.43	0.36	3.07	3.19	0.01	0.14	4.86	5.00	0.12	0.61	0.74	—	737	737	0.03	0.02	0.10	743
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.08	0.07	0.56	0.58	< 0.005	0.02	0.89	0.91	0.02	0.11	0.13	—	122	122	< 0.005	< 0.005	0.02	123
Exceeds (Daily Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Threshold	—	—	—	—	—	—	—	80.0	—	—	—	—	—	—	—	—	—	—
Unmit.	—	—	—	—	—	Yes	—	No	—	—	—	—	—	—	—	—	—	—
Exceeds (Average Daily)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Threshol	—	—	—	—	—	—	—	80.0	—	—	—	—	—	—	—	—	—	—
Unmit.	—	—	—	—	—	Yes	—	No	—	—	—	—	—	—	—	—	—	—
Exceeds (Annual)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Threshol d	—	10.0	10.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	—	No	No	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	3.71	3.10	27.2	27.4	0.06	1.21	57.0	58.2	1.11	6.82	7.93	—	6,812	6,812	0.23	0.27	3.34	6,903
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.43	0.36	3.07	3.19	0.01	0.14	4.86	5.00	0.12	0.61	0.74	—	737	737	0.03	0.02	0.10	743
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.08	0.07	0.56	0.58	< 0.005	0.02	0.89	0.91	0.02	0.11	0.13	—	122	122	< 0.005	< 0.005	0.02	123

3. Construction Emissions Details

3.1. Site preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.85	1.55	12.9	12.6	0.03	0.55	—	0.55	0.51	—	0.51	—	3,054	3,054	0.12	0.02	—	3,065
Dust From Material Movement	—	—	—	—	—	—	2.56	2.56	—	1.31	1.31	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.10	0.03	< 0.005	< 0.005	7.42	7.42	< 0.005	0.74	0.74	—	70.8	70.8	< 0.005	0.01	0.14	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.07	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	16.7	16.7	< 0.005	< 0.005	—	16.8
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.04	0.04	< 0.005	< 0.005	< 0.005	—	0.39	0.39	< 0.005	< 0.005	< 0.005	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.77	2.77	< 0.005	< 0.005	—	2.78
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	0.06	0.06	< 0.005	< 0.005	< 0.005	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.40	0.00	0.00	10.7	10.7	0.00	1.08	1.08	—	91.6	91.6	< 0.005	< 0.005	0.35	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	0.46	0.46	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	0.08	0.08	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—

3.3. Levee replacement (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.63	3.05	25.4	26.6	0.05	1.18	—	1.18	1.08	—	1.08	—	5,273	5,273	0.21	0.04	—	5,291

Dust From Material Movement	—	—	—	—	—	—	3.18	3.18	—	1.38	1.38	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.10	0.03	< 0.005	< 0.005	7.42	7.42	< 0.005	0.74	0.74	—	70.8	70.8	< 0.005	0.01	0.14	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.20	0.17	1.39	1.46	< 0.005	0.06	—	0.06	0.06	—	0.06	—	289	289	0.01	< 0.005	—	290
Dust From Material Movement	—	—	—	—	—	—	0.17	0.17	—	0.08	0.08	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	0.40	0.40	< 0.005	0.04	0.04	—	3.88	3.88	< 0.005	< 0.005	< 0.005	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.25	0.27	< 0.005	0.01	—	0.01	0.01	—	0.01	—	47.8	47.8	< 0.005	< 0.005	—	48.0
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.07	0.07	< 0.005	0.01	0.01	—	0.64	0.64	< 0.005	< 0.005	< 0.005	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.40	0.00	0.00	10.7	10.7	0.00	1.08	1.08	—	91.6	91.6	< 0.005	< 0.005	0.35	—
Vendor	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	0.00	0.00	—
Hauling	0.05	0.03	1.62	0.38	0.01	0.03	35.7	35.7	0.03	3.62	3.65	—	1,377	1,377	0.01	0.22	2.85	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	0.58	0.58	0.00	0.06	0.06	—	4.62	4.62	< 0.005	< 0.005	0.01	—
Vendor	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	0.00	0.00	—
Hauling	< 0.005	< 0.005	0.09	0.02	< 0.005	< 0.005	1.94	1.94	< 0.005	0.20	0.20	—	75.5	75.5	< 0.005	0.01	0.07	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.11	0.11	0.00	0.01	0.01	—	0.77	0.77	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	< 0.005	< 0.005	0.02	< 0.005	< 0.005	< 0.005	0.35	0.35	< 0.005	0.04	0.04	—	12.5	12.5	< 0.005	< 0.005	0.01	—

3.5. Levee excavation at Lindsey Slough (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.59	3.01	25.2	26.4	0.05	1.17	—	1.17	1.08	—	1.08	—	5,239	5,239	0.21	0.04	—	5,256
Dust From Material Movement	—	—	—	—	—	—	3.18	3.18	—	1.38	1.38	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.10	0.03	< 0.005	< 0.005	7.42	7.42	< 0.005	0.74	0.74	—	70.8	70.8	< 0.005	0.01	0.14	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.05	0.04	0.35	0.36	< 0.005	0.02	—	0.02	0.01	—	0.01	—	71.8	71.8	< 0.005	< 0.005	—	72.0
Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.10	0.10	< 0.005	0.01	0.01	—	0.97	0.97	< 0.005	< 0.005	< 0.005	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.9	11.9	< 0.005	< 0.005	—	11.9
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	< 0.005	—	0.16	0.16	< 0.005	< 0.005	< 0.005	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.40	0.00	0.00	10.7	10.7	0.00	1.08	1.08	—	91.6	91.6	< 0.005	< 0.005	0.35	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.15	0.15	0.00	0.01	0.01	—	1.16	1.16	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—

Hauling	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	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.03	0.03	0.00	< 0.005	< 0.005	—	0.19	0.19	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—

3.7. Levee excavation and pipe removal (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.84	2.38	19.9	20.1	0.04	0.85	—	0.85	0.79	—	0.79	—	4,243	4,243	0.17	0.03	—	4,258
Dust From Material Movement	—	—	—	—	—	—	2.76	2.76	—	1.34	1.34	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.10	0.03	< 0.005	< 0.005	7.42	7.42	< 0.005	0.74	0.74	—	70.8	70.8	< 0.005	0.01	0.14	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.04	0.03	0.27	0.28	< 0.005	0.01	—	0.01	0.01	—	0.01	—	58.1	58.1	< 0.005	< 0.005	—	58.3
Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.02	0.02	—	—	—	—	—	—	—

Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.10	0.10	< 0.005	0.01	0.01	—	0.97	0.97	< 0.005	< 0.005	< 0.005	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.05	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	9.62	9.62	< 0.005	< 0.005	—	9.66
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	< 0.005	—	0.16	0.16	< 0.005	< 0.005	< 0.005	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.40	0.00	0.00	10.7	10.7	0.00	1.08	1.08	—	91.6	91.6	< 0.005	< 0.005	0.35	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.15	0.15	0.00	0.01	0.01	—	1.16	1.16	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.03	0.03	0.00	< 0.005	< 0.005	—	0.19	0.19	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—

3.9. Cofferdam installation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.41	2.86	24.2	26.1	0.05	1.12	—	1.12	1.03	—	1.03	—	5,135	5,135	0.21	0.04	—	5,153
Dust From Material Movement	—	—	—	—	—	—	3.18	3.18	—	1.38	1.38	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.10	0.03	< 0.005	< 0.005	7.42	7.42	< 0.005	0.74	0.74	—	70.8	70.8	< 0.005	0.01	0.14	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.09	0.08	0.66	0.72	< 0.005	0.03	—	0.03	0.03	—	0.03	—	141	141	0.01	< 0.005	—	141
Dust From Material Movement	—	—	—	—	—	—	0.09	0.09	—	0.04	0.04	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.20	0.20	< 0.005	0.02	0.02	—	1.94	1.94	< 0.005	< 0.005	< 0.005	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.12	0.13	< 0.005	0.01	—	0.01	0.01	—	0.01	—	23.3	23.3	< 0.005	< 0.005	—	23.4

Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.04	0.04	< 0.005	< 0.005	< 0.005	—	0.32	0.32	< 0.005	< 0.005	< 0.005	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.40	0.00	0.00	10.7	10.7	0.00	1.08	1.08	—	91.6	91.6	< 0.005	< 0.005	0.35	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	0.29	0.29	0.00	0.03	0.03	—	2.31	2.31	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	0.38	0.38	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—

3.11. Pipe installation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.27	1.06	7.77	8.92	0.02	0.29	—	0.29	0.26	—	0.26	—	2,297	2,297	0.09	0.02	—	2,305
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	0.10	0.03	< 0.005	< 0.005	7.42	7.42	< 0.005	0.74	0.74	—	70.8	70.8	< 0.005	0.01	0.14	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.21	0.24	< 0.005	0.01	—	0.01	0.01	—	0.01	—	62.9	62.9	< 0.005	< 0.005	—	63.1
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.20	0.20	< 0.005	0.02	0.02	—	1.94	1.94	< 0.005	< 0.005	< 0.005	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.04	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	10.4	10.4	< 0.005	< 0.005	—	10.5
Dust From Material Movement	—	—	—	—	—	—	0.00	0.00	—	0.00	0.00	—	—	—	—	—	—	—
Onsite truck	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.04	0.04	< 0.005	< 0.005	< 0.005	—	0.32	0.32	< 0.005	< 0.005	< 0.005	—
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.40	0.00	0.00	10.7	10.7	0.00	1.08	1.08	—	91.6	91.6	< 0.005	< 0.005	0.35	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	0.29	0.29	0.00	0.03	0.03	—	2.31	2.31	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	0.38	0.38	< 0.005	< 0.005	< 0.005	—
Vendor	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	0.00	0.00	—
Hauling	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	0.00	0.00	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site preparation	Linear, Grubbing & Land Clearing	5/7/2025	5/8/2025	6.00	2.00	site preparation at Cache and Lindsey sloughs
Levee replacement	Linear, Grading & Excavation	8/19/2025	9/11/2025	6.00	20.0	levee replacement at Cache and Lindsey sloughs
Levee excavation at Lindsey Slough	Linear, Grading & Excavation	9/12/2025	9/17/2025	6.00	5.00	levee excavation at Lindsey Slough

Levee excavation and pipe removal	Linear, Grading & Excavation	8/13/2025	8/17/2025	6.00	5.00	levee excavation at Cache Slough
Cofferdam installation	Linear, Grading & Excavation	8/1/2025	8/12/2025	5.00	10.0	cofferdam installations at Cache and Lindsey sloughs and Hastings Cut
Pipe installation	Linear, Drainage, Utilities, & Sub-Grade	9/18/2025	9/28/2025	6.00	10.0	Pipe installation at Lindsey slough

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site preparation	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Site preparation	Rubber Tired Loaders	Diesel	Average	1.00	5.50	150	0.36
Site preparation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Levee replacement	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Levee replacement	Graders	Diesel	Average	3.00	8.00	148	0.41
Levee replacement	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Levee replacement	Plate Compactors	Diesel	Average	1.00	8.00	8.00	0.43
Levee replacement	Pumps	Diesel	Average	1.00	24.0	11.0	0.74
Levee replacement	Aerial Lifts	Diesel	Average	1.00	5.00	46.0	0.31
Levee replacement	Rubber Tired Loaders	Diesel	Average	1.00	5.50	150	0.36
Levee replacement	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Levee excavation at Lindsey Slough	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Levee excavation at Lindsey Slough	Graders	Diesel	Average	3.00	8.00	148	0.41
Levee excavation at Lindsey Slough	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40

Levee excavation at Lindsey Slough	Pumps	Diesel	Average	1.00	24.0	11.0	0.74
Levee excavation at Lindsey Slough	Aerial Lifts	Diesel	Average	1.00	5.00	46.0	0.31
Levee excavation at Lindsey Slough	Rubber Tired Loaders	Diesel	Average	1.00	5.50	150	0.36
Levee excavation at Lindsey Slough	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Levee excavation and pipe removal	Excavators	Diesel	Average	2.00	8.00	36.0	0.38
Levee excavation and pipe removal	Graders	Diesel	Average	1.00	8.00	148	0.41
Levee excavation and pipe removal	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Levee excavation and pipe removal	Pumps	Diesel	Average	1.00	24.0	11.0	0.74
Levee excavation and pipe removal	Aerial Lifts	Diesel	Average	1.00	5.00	46.0	0.31
Levee excavation and pipe removal	Rubber Tired Loaders	Diesel	Average	1.00	5.50	150	0.36
Levee excavation and pipe removal	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Cofferdam installation	Excavators	Diesel	Average	2.00	8.00	36.0	0.38
Cofferdam installation	Graders	Diesel	Average	3.00	8.00	148	0.41
Cofferdam installation	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Cofferdam installation	Aerial Lifts	Diesel	Average	1.00	5.00	46.0	0.31
Cofferdam installation	Rubber Tired Loaders	Diesel	Average	1.00	5.50	150	0.36
Cofferdam installation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38
Pipe installation	Excavators	Diesel	Average	2.00	8.00	36.0	0.38
Pipe installation	Pumps	Diesel	Average	1.00	24.0	11.0	0.74
Pipe installation	Aerial Lifts	Diesel	Average	1.00	5.00	46.0	0.31
Pipe installation	Rubber Tired Loaders	Diesel	Average	1.00	5.50	150	0.36

Pipe installation	Off-Highway Trucks	Diesel	Average	1.00	8.00	376	0.38

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Levee replacement	—	—	—	—
Levee replacement	Worker	6.00	20.0	LDA,LDT1,LDT2
Levee replacement	Vendor	0.00	8.40	HHDT,MHDT
Levee replacement	Hauling	20.0	20.0	HHDT
Levee replacement	Onsite truck	2.00	10.0	HHDT
Pipe installation	—	—	—	—
Pipe installation	Worker	6.00	20.0	LDA,LDT1,LDT2
Pipe installation	Vendor	0.00	8.40	HHDT,MHDT
Pipe installation	Hauling	0.00	20.0	HHDT
Pipe installation	Onsite truck	2.00	10.0	HHDT
Levee excavation at Lindsey Slough	—	—	—	—
Levee excavation at Lindsey Slough	Worker	6.00	20.0	LDA,LDT1,LDT2
Levee excavation at Lindsey Slough	Vendor	0.00	8.40	HHDT,MHDT
Levee excavation at Lindsey Slough	Hauling	0.00	20.0	HHDT
Levee excavation at Lindsey Slough	Onsite truck	2.00	10.0	HHDT
Site preparation	—	—	—	—
Site preparation	Worker	6.00	20.0	LDA,LDT1,LDT2
Site preparation	Vendor	0.00	8.40	HHDT,MHDT
Site preparation	Hauling	0.00	20.0	HHDT
Site preparation	Onsite truck	2.00	10.0	HHDT
Levee excavation and pipe removal	—	—	—	—

Levee excavation and pipe removal	Worker	6.00	20.0	LDA,LDT1,LDT2
Levee excavation and pipe removal	Vendor	0.00	8.40	HHDT,MHDT
Levee excavation and pipe removal	Hauling	0.00	20.0	HHDT
Levee excavation and pipe removal	Onsite truck	2.00	10.0	HHDT
Cofferdam installation	—	—	—	—
Cofferdam installation	Worker	6.00	20.0	LDA,LDT1,LDT2
Cofferdam installation	Vendor	0.00	8.40	HHDT,MHDT
Cofferdam installation	Hauling	0.00	20.0	HHDT
Cofferdam installation	Onsite truck	2.00	10.0	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Control Strategies Applied	PM10 Reduction	PM2.5 Reduction
Water unpaved roads twice daily	55%	55%
Limit vehicle speeds on unpaved roads to 25 mph	44%	44%

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (Cubic Yards)	Material Exported (Cubic Yards)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site preparation	—	—	4.00	0.00	—
Levee replacement	2,150	—	4.00	0.00	—
Levee excavation at Lindsey Slough	—	—	4.00	0.00	—
Levee excavation and pipe removal	—	—	4.00	0.00	—
Cofferdam installation	—	—	4.00	0.00	—

Pipe installation	—	—	4.00	0.00	—

5.6.2. Construction Earthmoving Control Strategies

Control Strategies Applied	Frequency (per day)	PM10 Reduction	PM2.5 Reduction
Water Exposed Area	2	61%	61%

Appendix B

Database Query Results for Special-status Plant Species and Sensitive Natural Communities in the Hastings Tract Pipe Replacement Project Region

Table B-1. Special-status plant species documented in the Project region.

Scientific name	Common name	Status[1] CRPR/State/ Federal	Query source	Blooming period	Elevation range (feet)	Habitat associations	Potential to occur in the Project Area
Astragalus tener var. *ferrisiae*	Ferris' milk-vetch	1B.1/–/–	CNPS, CNDDB	April–May	5–245	Meadows and seeps and valley and foothill grassland	Yes; suitable habitat may be present
Astragalus tener var. *tener*	alkali milk-vetch	1B.2/–/–	CNPS, CNDDB	March–June	5–195	Alkaline areas in playas, valley and foothill grassland, vernal pools	No; suitable habitat not present
Atriplex cordulata var. *cordulata*	heartscale	1B.2/–/–	CNPS, CNDDB,	April–October	0–1,835	Sometimes alkaline areas in chenopod scrub, meadows and seeps, and valley and foothill grassland	Yes; suitable habitat may be present
Atriplex coronata var. *coronata*	crownscale	4.2/–/–	CNPS	March–October	5–1,935	Alkaline and often clay areas in chenopod scrub, valley and foothill grassland, and vernal pools	No; suitable habitat not present
Atriplex depressa	brittlescale	1B.2/–/–	CNPS, CNDDB	April–October	5–1,050	Alkaline and clay areas in chenopod scrub, meadows and seeps, playas, valley and foothill grassland, and vernal pools	No; suitable habitat not present
Atriplex persistens	vernal pool smallscale	1B.2/–/–	CNPS, CNDDB	June–October	35–375	Vernal pools	No; suitable habitat not present
Centromadia parryi subsp. *parryi*	pappose tarplant	1B.2/–/–	CNPS, CNDDB	May–November	0–1,380	Often alkaline areas in chaparral, coastal prairie, marshes and swamps, meadows and seeps, and valley and foothill grassland	Yes; suitable habitat may be present
Centromadia parryi subsp. *rudis*	Parry's rough tarplant	4.2/–/–	CNPS	May–October	0–330	Alkaline and vernally mesic areas and sometimes roadsides in seeps, valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Chloropyron molle subsp. *hispidum*	hispid salty bird's-beak	1B.1/–/–	CNPS, CNDDB	June–September	5–510	Alkaline areas in meadows and seeps, playas, and valley and foothill grassland	No; suitable habitat not present
Chloropyron molle subsp. *molle*	soft salty bird's-beak	1B.2/CR/FE	CNPS, CNDDB	June–November	0–10	Marshes and swamps	Yes; suitable habitat may be present

Scientific name	Common name	Status[1] CRPR/State/ Federal	Query source	Blooming period	Elevation range (feet)	Habitat associations	Potential to occur in the Project Area
Cicuta maculata var. *bolanderi*	Bolander's water-hemlock	2B.1/–/–	CNPS, CNDDB	July–September	0–655	Marshes and swamps	Yes; suitable habitat may be present
Cirsium hydrophilum var. *hydrophilum*	Suisun thistle	1B.1/–/FE	CNPS, CNDDB	June–September	0–5	Marshes and swamps	Yes; suitable habitat may be present
Delphinium recurvatum	recurved larkspur	1B.2/–/–	CNPS, CNDDB	March–June	10–2,590	Alkaline areas in chenopod scrub, cismontane woodland, and valley and foothill grassland	No; suitable habitat not present
Downingia pusilla	dwarf downingia	2B.2/–/–	CNPS, CNDDB	March–May	5–1,460	Valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Eleocharis parvula	small spikerush	4.3/–/–	CNPS	(April) June–August (September)	5–9,910	Marshes and swamps	Yes; suitable habitat may be present
Eryngium jepsonii	Jepson's coyote-thistle	1B.2/–/–	CNPS, CNDDB	April–August	10–985	Clay areas in valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Extriplex joaquinana	San Joaquin spearscale	1B.2/–/–	CNPS, CNDDB	April–October	5–2,740	Alkaline areas in chenopod scrub, meadows and seeps, playas, and valley and foothill grassland	No; suitable habitat not present
Fritillaria agrestis	stinkbells	4.2/–/–	CNPS	March–June	35–5,100	Clay, sometimes serpentinite areas in chaparral, cismontane woodland, pinyon and juniper woodland, and valley and foothill grassland	Yes; suitable habitat may be present
Fritillaria liliacea	fragrant fritillary	1B.2/–/–	CNPS, CNDDB	February–April	10–1,345	Often serpentinite areas in cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland	Yes; suitable habitat may be present
Fritillaria pluriflora	adobe-lily	1B.2/–/–	CNPS, CNDDB	February–April	195–2,315	Often adobe areas in chaparral, cismontane woodland, and valley and foothill grassland	Yes; suitable habitat may be present
Gratiola heterosepala	Boggs Lake hedge-hyssop	1B.2/CE/–	CNPS, CNDDB	April–August	35–7,790	Clay areas in marshes and swamps, and vernal pools	Yes; suitable habitat may be present
Hesperevax caulescens	hogwallow starfish	4.2/–/–	CNPS	March–June	0–1,655	Sometimes alkaline areas in valley and foothill grassland, vernal pools	Yes; suitable habitat may be present

Scientific name	Common name	Status[1] CRPR/State/ Federal	Query source	Blooming period	Elevation range (feet)	Habitat associations	Potential to occur in the Project Area
Hibiscus lasiocarpos var. *occidentalis*	woolly rose-mallow	1B.2/–/–	CNPS, CNDDB	June–September	0–395	Marshes and swamps	Yes; suitable habitat may be present
Isocoma arguta	Carquinez goldenbush	1B.1/–/–	CNPS, CNDDB	August–December	5–65	Valley and foothill grassland	Yes; suitable habitat may be present
Lasthenia chrysantha	alkali-sink goldfields	1B.1/–/–	CNPS, CNDDB	February–April	0–655	Alkaline areas in vernal pools	No; suitable habitat not present
Lasthenia conjugens	Contra Costa goldfields	1B.1/–/FE	CNPS, CNDDB	March–June	0–1,540	Mesic areas in cismontane woodland, playas, valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Lasthenia ferrisiae	Ferris' goldfields	4.2/–/–	CNPS	February–May	65–2,295	Vernal pools	No; suitable habitat not present
Lasthenia glabrata subsp. *coulteri*	Coulter's goldfields	1B.1/–/–	CNPS, CNDDB	February–June	5–4,005	Marshes and swamps, playas, and vernal pools	Yes; suitable habitat may be present
Lathyrus jepsonii var. *jepsonii*	Delta tule pea	1B.2/–/–	CNPS, CNDDB	May–July (August–September)	0–15	Marshes and swamps	Yes; suitable habitat may be present
Legenere limosa	legenere	1B.1/–/–	CNPS, CNDDB	April–June	5–2,885	Vernal pools	No; suitable habitat not present
Lepidium latipes var. *heckardii*	Heckard's pepper-grass	1B.2/–/–	CNPS, CNDDB	March–May	5–655	Valley and foothill grassland	Yes; suitable habitat may be present
Lessingia hololeuca	woolly-headed lessingia	3/–/–	CNPS	June–October	50–1,000	Clay and serpentinite areas in broadleafed upland forest, coastal scrub, lower montane coniferous forest, and valley and foothill grassland	No; suitable habitat not present
Lilaeopsis masonii	Mason's lilaeopsis	1B.1/CR/–	CNPS, CNDDB	April–November	0–35	Marshes and swamps, and riparian scrub	Yes; suitable habitat may be present
Limosella australis	Delta mudwort	2B.1/–/–	CNPS, CNDDB	May–August	0–10	Usually streambanks in marshes and swamps, and riparian scrub	Yes; suitable habitat may be present

Scientific name	Common name	Status[1] CRPR/State/ Federal	Query source	Blooming period	Elevation range (feet)	Habitat associations	Potential to occur in the Project Area
Meesia triquetra	three-ranked hump moss	4.2/–/–	CNPS	July	4,265–9,690	Bogs and fens, meadows and seeps, subalpine coniferous forest, and upper montane coniferous forest	No; suitable habitat not present
Microseris paludosa	marsh microseris	1B.2/–/–	CNPS, CNDDB	April–June (July)	15–1,165	Cismontane woodland, closed-cone coniferous forest, coastal scrub, and valley and foothill grassland	Yes; suitable habitat may be present
Myosurus minimus subsp. *apus*	little mousetail	3.1/–/–	CNPS	March–June	65–2,100	Valley and foothill grassland, and vernal pools	No; suitable habitat not present
Navarretia leucocephala subsp. *bakeri*	Baker's navarretia	1B.1/–/–	CNPS, CNDDB	April–July	15–5,710	Mesic areas in cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Neostapfia colusana	Colusa grass	1B.1/CE/FT	CNPS, CNDDB, USFWS	May–August	15–655	Vernal pools	No; suitable habitat not present
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	1B.1/CE/FT	CNPS, CNDDB	April–September	35–2,475	Vernal pools	No; suitable habitat not present
Perideridia gairdneri subsp. *gairdneri*	Gairdner's yampah	4.2/–/–	CNPS	June–October	0–2,000	Vernally mesic areas in broadleafed upland forest, chaparral, coastal prairie, valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Plagiobothrys hystriculus	bearded popcornflower	1B.1/–/–	CNPS, CNDDB	April–May	0–900	Valley and foothill grassland, vernal pools	Yes; suitable habitat may be present
Puccinellia simplex	California alkali grass	1B.2/–/–	CNPS, CNDDB	March–May	5–3,050	Alkaline areas, flats, lake margins, and vernally mesic areas in chenopod scrub, meadows and seeps, valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Sagittaria sanfordii	Sanford's arrowhead	1B.2/–/–	CNPS, CNDDB	May–October(November)	0–2,135	Marshes and swamps	Yes; suitable habitat may be present

Scientific name	Common name	Status[1] CRPR/State/ Federal	Query source	Blooming period	Elevation range (feet)	Habitat associations	Potential to occur in the Project Area
Sidalcea keckii	Keck's checkerbloom	1B.1/–/FE	CNPS, CNDDB, USFWS	April–May(June)	245–2,135	Clay and serpentinite areas in cismontane woodland, and valley and foothill grassland	No; suitable habitat not present
Spergularia macrotheca var. *longistyla*	long-styled sand-spurrey	1B.2/–/–	CNPS	February–May	0–835	Alkaline areas in marshes and swamps, and meadows and seeps	No; suitable habitat not present
Symphyotrichum lentum	Suisun Marsh aster	1B.2/–/–	CNPS, CNDDB	(April)May–November	0–10	Marshes and swamps	Yes; suitable habitat may be present
Trifolium amoenum	two-fork clover	1B.1/–/FE	CNPS, CNDDB	April–June	15–1,360	Coastal bluff scrub, and valley and foothill grassland	Yes; suitable habitat may be present
Trifolium hydrophilum	saline clover	1B.2/–/–	CNPS, CNDDB	April–June	0–985	Marshes and swamps, valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present
Tuctoria mucronata	Crampton's tuctoria or Solano grass	1B.1/CE/FE	CNPS, CNDDB, USFWS	April–August	15–35	Valley and foothill grassland, and vernal pools	Yes; suitable habitat may be present

[1] Status:

Federal

FE Federally listed as endangered
FT Federally listed as threatened
– No federal status

State

CE State listed as endangered
CR State listed as rare
– No state status

California Rare Plant Rank (CRPR)

1A Plants presumed extirpated in California and rare or extinct elsewhere
1B Plants rare, threatened, or endangered in California and elsewhere
2B Plants rare, threatened, or endangered in California, but more common elsewhere
3 More information needed about this plant, a review list
4 Plants of limited distribution, a watch list

CRPR Threat Ranks:

0.1 Seriously threatened in California (high degree/immediacy of threat)
0.2 Fairly threatened in California (moderate degree/immediacy of threat)
0.3 Not very threatened in California (low degree/immediacy of threats or no current threats known)

Table B-2. CNDDB query results for sensitive natural communities previously documented in the Project region.

Natural community (Holland 1986)	Status[1]	Distribution[2]	Habitat description[2]	Potential Sensitive Vegetation Alliances[3]	Potential to occur in the Project Area
Coastal and Valley Freshwater Marsh	S2.1	Remnant stands are most extensive in the upper portion of the Sacramento-San Joaquin River Delta, in river oxbows and other areas on the floodplain. Occurs occasionally along the coast, in coastal valleys near river mouths, and around the margins of lakes and springs	Quiet sites (lacking significant current) permanently flooded by fresh water (rather than brackish, alkaline, or variable)	• *Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus* • *Deschampsia cespitosa – Hordeum brachyantherum – Danthonia californica* • *Hydrocotyle* (*ranunculoides, umbellata*) • *Isoetes* (*bolanderi, echinospora, howellii, nuttallii, occidentalis*) • *Nuphar lutea* • *Schoenoplectus americanus* • *Scirpus microcarpus*	Yes, species and structure may be present
Coastal Brackish Marsh	S2.1	Usually at the interior edges of coastal bays and estuaries or in coastal lagoons. Adjacent to several Salt Marshes. Most extensively developed around Suisun Bay at the mouth of the Sacramento-San Joaquin Delta.	Brackish from freshwater input. Salinity may vary considerably and may increase at high tide or during seasons of low freshwater runoff or both.	• *Bolboschoenus maritimus* • *Carex lyngbyei* • *Carex obnupta – Oenanthe sarmentosa – Scirpus microcarpus* • *Grindelia* (*stricta*) • *Ruppia* (*cirrhosa, maritima*) • *Stuckenia* (*pectinata*) – *Potamogeton* spp.	Yes, species and structure may be present
Northern Claypan Vernal Pool	S1.1	Primarily on old alluvial terraces on the east side of the Great Valley from Tulare or Fresno County north to Shasta County	Old, circum-neutral to alkaline, Fe-Si cemented hardpan soils.	• *Centromadia* (*pungens*) • *Cressa truxillensis – Distichlis spicata* • *Eryngium aristulatum* • *Lasthenia fremontii – Distichlis spicata*	None, species and structure not present
Valley Needlegrass Grassland	S3.1	Formerly extensive around the Sacramento, San Joaquin, and Salinas Valleys, as well as the Los Angeles Basin, but now much reduced.	Usually on fine-textured (often clay) soils, moist or even waterlogged during winter, but very dry in summer.	• *Nassella* spp. – *Melica* spp.	None, species and structure not present

[1] S1 Critically Imperiled: At very high risk of extinction due to extreme rarity, very steep declines, or other factors
S2 Imperiled: At high risk of extinction or elimination due to very restricted range, very few populations, steep declines, or other factors
0.1 Very threatened

[2] Source: Holland (1986)

[3] Source: CNPS 2023b

Appendix C

Database Query Results for Special-status Fish and Wildlife Species in the Hastings Tract Pipe Replacement Project Region

Table C-1. Special-status fish and wildlife species with potential to occur within the Hastings Project Area.

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Invertebrates					
Conservancy fairy shrimp *Branchinecta conservatio*	USFWS, CDFW	FE/–	Vernal pools in the Central Valley from Tehama County to Merced County. A single population in the interior Coast Ranges near Santa Barbara	Large, deep vernal pools in annual grasslands	None; the Project Area does not contain suitable or critical habitat (USFWS 2006)
Vernal pool fairy shrimp *Branchinecta lynchi*	USFWS, CDFW	FT/–	Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County; isolated populations also in Riverside County	Vernal pools; also found in sandstone rock outcrop pools	None; the Project Area does not contain suitable or critical habitat (USFWS 2006)
Vernal pool tadpole shrimp *Lepidurus packardi*	USFWS, CDFW	FE/–	Shasta County south to Merced County	Vernal pools and ephemeral stock ponds	None; the Project Area does not contain suitable or critical habitat (USFWS 2006)
Western bumble bee *Bombus occidentalis*	CDFW	–/SCE	Throughout California and adjacent states	Uses flowering plants in meadows and forested openings; abandoned rodent burrows are used for nest and hibernation sites for queens	Low; species has experienced a significant decline in population and the predicted mean occupancy of the species in the western United States dropped by 93% (Graves et al. 2020); an occurrence of the species was documented in 1972, near Creed, approximately three miles from the Project Area (CDFW 2023b)
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	USFWS, CDFW	FT/–	Streamside habitats throughout the Central Valley; below 915 m (3,000 ft)	Riparian and oak savanna habitats with host plant *Sambucus* sp. (blue elderberry)	None; the Project Area does not contain blue elderberry (*Sambucus mexicana*), the primary host plant for the species; critical habitat is not present in the Project Area (USFWS 1980b)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Delta green ground beetle *Elaphrus viridus*	USFWS, CDFW	FT/–	Only known to occur in Solano County	Grassland habitat interspersed with vernal pools	Low; the Project Area does not contain high-quality habitat; the closest documented occurrences of the species were recorded between 1999 and 2002, approximately 4 miles west of the Project Area (CDFW 2023b); critical habitat for this species is not present in the Project Area (USFWS 1980a)
Monarch butterfly *Danaus plexippus*	USFWS	FC (CA over-wintering population) /–	Historical overwintering groves are typically between 1.5 miles of the California Coast or SF Bay	Overwintering groves are typically stands of blue gum eucalyptus (Eucalyptus globulus), Monterey pine (Pinus radiata) and Monterey cypress (Cupressus macrocarpa)	None; the Project Area is outside of the species' overwintering range
Fish					
North American green sturgeon: southern DPS *Acipenser medirostris*	NMFS, CDFW	FT/–	San Francisco, San Pablo, Suisun, and Humboldt bays; Sacramento-San Joaquin Delta, Sacramento and Klamath rivers	Spawns in pools of large freshwater river mainstems with cool water and cobble, clean sand, or bedrock; in San Francisco Bay adults tend to utilize water depths less than 10 m (33 ft) to swim near the surface or forage along the sea floor	Moderate; the Project Area likely contains suitable rearing or migration habitat for juveniles and adults in Lindsey Slough but is lacking suitable spawning habitat; green sturgeon have been salvaged at the state and federal fish collection facilities every month, indicating they are present in the Bay-Delta year-round (70 FR 17386); in the Sacramento River Delta, juveniles were captured primarily in water from 3–8 ft deep (Radtke 1966); critical habitat for this species is present in the Project Area (NMFS 2009)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Sacramento splittail *Pogonichthys macrolepidotus*	CDFW	–/SSC	Lower portions of the Napa, Petaluma, Sacramento and San Joaquin rivers; Sacramento-San Joaquin Delta including Suisun Bay, Suisun Marsh	Low-elevation mainstem rivers and estuaries with low to moderate salinity (0–18 ppt); shallow, flooded vegetated habitat for spawning and foraging	Moderate; the larger Cache-Lindsey Complex contains suitable habitat; non-reproductive adult splittail are most abundant in moderately shallow, brackish tidal sloughs but can also be found in freshwater areas with tidal or riverine flow (Moyle et al. 2004); young-of-the-year and yearling splittail are generally most abundant in shallow water (Moyle 2002); individuals have been periodically caught in Cache Slough near the confluence with Lindsey Slough (at 20mm Survey Station # 716, within 5 miles of the Project Area (CDFW 2023a), and in Lindsey Slough in 2014 (Young et al. 2015)
Delta smelt *Hypomesus transpacificus*	USFWS, CDFW	FT/SE	Found only in the Sacramento-San Joaquin Estuary, including the lower reaches of Sacramento and Napa rivers; the Delta including Suisun Bay, Goodyear, Suisun, Cutoff, First Mallard, and Montezuma sloughs	Estuarine or brackish waters up to 18 parts per thousand (ppt); spawn in shallow brackish water upstream of the mixing zone (zone of saltwater-freshwater interface) where salinity is around 2 ppt	Moderate; juvenile delta smelt were captured upstream of the Project Area in Barker Slough (at 20mm Survey Station # 720) in 2019; additionally, Cache Slough is considered key habitat (Merz et al. 2011) and a potential spawning location (inferred from larval catches [Bennett 2005]) for the species; the species is typically found in shallow water (less than 10 ft deep) (Moyle 2002); spawning may occur in the Project Area (in Upper Cache Slough and Lindsey Slough), with spawning activity limited to February through July (Moyle 2002, Bennett 2005); critical habitat for Delta smelt is present in the Project Area (USFWS 2004)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Longfin smelt, San Francisco Bay-Delta DPS *Spirnichus thaleichthys*	CDFW	FPE/ST	San Francisco estuary from Rio Vista or Medford Island in the Delta as far downstream as South Bay; concentrated in Suisun, San Pablo, and North San Francisco bays; historical populations in Humboldt Bay, Eel River estuary, and Klamath River estuary	Adults in large bays, estuaries, and nearshore coastal areas; migrate into freshwater rivers to spawn; salinities of 15–30 ppt	Low/Moderate; individuals were captured several times in Barker slough and Lindsey slough (at 20mm trawl stations # 720 and # 718, respectively) between 2008 and 2014 (CDFW 2023a,b); in the San Francisco Estuary, longfin smelt populations are concentrated in Suisun, San Pablo, and North San Francisco bays, and rarely occur upstream of Rio Vista or Medford Island in the Delta (Moyle 2002)
Chinook salmon, central Valley spring-run ESU *Oncorhynchus tshawytscha*	NMFS	FT/ST	Sacramento River and its tributaries (Deer, Mill, Antelope, Battle, Beegum, Butte, and Big Chico creeks and the Feather and Yuba rivers)	Low- to mid-elevation rivers and streams with cold water, clean gravel of appropriate size for spawning and adequate rearing habitat; typically rear in freshwater for one or more years before migrating to the ocean	Low; Lindsey Slough does not constitute typical rearing habitat, nor is it a migratory pathway for adults or juveniles; juveniles have been caught in Lindsey Slough at very low densities (CDFW 2023a, Young et al. 2015) though it is not possible to assign these individuals to a particular ESU; critical habitat for this ESU is not present in the Project Area (NMFS 2005)
Chinook salmon, Sacramento River winter-run ESU *Oncorhynchus tshawytscha*	NMFS	FE/SE	Sacramento River and its tributaries; Sacramento-San Joaquin Delta; San Francisco, San Pablo and Suisun bays	Mainstem river reaches with cool water and available spawning gravel; rear five to ten months in the river and estuary; migrate to the ocean to feed and grow until sexually mature	Low; Lindsey Slough does not constitute typical rearing habitat, nor is it a migratory pathway for adults or juveniles; juveniles have been caught in Lindsey Slough at very low densities (CDFW 2023a, Young et al. 2015) though it is not possible to assign these individuals to a particular ESU; critical habitat for this ESU is not present in the Project Area (NMFS 2005)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Steelhead, central California coast DPS *Oncorhynchus mykiss irideus*	NMFS	FT/–	Coastal California streams from the Russian River, south to Aptos Creek, San Francisco, San Pablo, and Suisun bays; the drainages of San Francisco, San Pablo, and Suisun bays eastward to Chipps Island at the confluence of the Sacramento and San Joaquin rivers; excludes the Sacramento San Joaquin Delta	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat; typically rear in fresh water for one or more years before migrating to the ocean	None; individuals occurring upstream of the Sacramento-San Joaquin River confluence are not considered to be CCC DPS steelhead; the Project Area is outside of the range for this DPS; critical habitat for this DPS is not present in the Project Area (NMFS 2005)
Steelhead, Central Valley DPS *Oncorhynchus mykiss irideus*	NMFS, CDFW	FT/–	Sacramento and San Joaquin rivers and their tributaries	Rivers and streams with cold water, clean gravel of appropriate size for spawning, and suitable rearing habitat; typically rear in freshwater for one or more years before migrating to the ocean	Low/moderate; Lindsey Slough is not a migratory pathway for adult or juvenile steelhead but may support non-natal rearing; critical habitat for this DPS is not present in the Project Area (NMFS 2005)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Amphibians					
California tiger salamander, central California DPS *Ambystoma californiense*	USFWS, CDFW	FT/ST	Very fragmented; along the coast from Sonoma County to Santa Barbara County, in the Central Valley and Sierra foothills from Sacramento County to Tulare County	Grassland, oak savannah, or edges of woodland that provide subterranean refuge (typically mammal burrows); breeds in nearby temporary ponds, vernal pools, or slow-moving parts of streams	Low; unlikely that adult California tiger salamanders would be within the Project Area, as the Project Area does not contain suitable breeding habitat for the species (e.g., ponds, vernal pools) and is outside of the maximum dispersal distance from the nearest occurrence (1.30 miles; Orloff 2007); the nearest documented occurrence is from 2014 in vernal pools near the entrance of Hastings Island Road (this road portion is paved and elevated) (CDFW 2023b); there is marginally suitable breeding habitat in fields to the north/northwest of the Project Area, though they are scattered in agriculture or grazing fields that appear to be routinely managed; critical habitat for this species is not present in the Project Area (USFWS 2005)
Foothill yellow-legged frog Northwest/North Coast clade *Rana boylii*	CDFW	–/SSC	From the Oregon border along the coast to the Transverse Ranges, and south along the western side of the Sierra Nevada Mountains to Kern County; a possible isolated population in Baja California	Shallow tributaries and mainstems of perennial streams and rivers, typically associated with cobble or boulder substrate	None; the Project Area does not contain suitable breeding or non-breeding habitat; the nearest occurrence of the species, documented in 1912, is approximately 14 miles northwest of the Project Area (CDFW 2023b)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Reptiles					
Northwestern pond turtle *Actinemys marmorata*	iNaturalist	FPT/SSC	From the Oregon border along the coast ranges to the Mexican border, and west of the crest of the Cascades and Sierras	Permanent, slow-moving fresh or brackish water with available basking sites and adjacent open habitats or forest for nesting	Moderate; the Project Area contains suitable aquatic habitat in Hastings Cut and Lindsey and Cache sloughs; the Project Area may also be used as upland dispersal between suitable aquatic habitats; a northwestern pond turtle was observed in Barker Slough, less than 1 mile upstream of the Project Area, in 2020 (iNaturalist 2023); the Project Area does not contain suitable upland nesting habitat for the species
Giant garter snake *Thamnophis gigas*	USFWS	FT/ST	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno	Sloughs, canals, low-gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter	Moderate; the Project Area is within the species' range and contains suitable habitat; there is a documented occurrence of the species from 2017 in Shag Slough, less than five miles from the Project Area (CDFW 2023b); additionally, three snakes were observed in 2022 in Shag Slough and one in Duck Slough, all within five miles of the Project Area (CDFW 2023b, unprocessed CNDDB data)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Birds					
American white pelican *Pelecanus erythrorhyncos*	eBird	–/SSC	Breeds on lakes in the Klamath Basin, winters along the Pacific coast from Sonoma County south to Baja California and in the Central Valley	Salt ponds, large lakes, and estuaries; loafs on open water during the day; roosts along water's edge at night	Moderate (foraging or roosting only); the Project Area is not within the breeding range of the species and does not contain suitable nesting habitat; wintering individuals may forage or roost in Lindsey Slough near the Project Area; individuals have been observed flying above Hastings Tract numerous times between 2000–2023 (eBird 2023)
White-tailed kite *Elanus leucurus*	CDFW	–/SFP	Year-round resident; found in nearly all lowlands of California west of the Sierra Nevada mountains and the southeast deserts	Lowland grasslands and wetlands with open areas; nests in trees near open foraging area	Moderate; suitable foraging and nesting habitat is present around the Project Area
Bald eagle *Haliaeetus leucocephalus*	USFWS	FD, BGEPA/SE, SFP	Permanent resident and uncommon winter migrant, found nesting primarily in Butte, Lake, Lassen, Modoc, Plumas, Shasta, Siskiyou, and Trinity counties	Large bodies of water or rivers with abundant fish, uses snags or other perches; nests in advanced-successional conifer forest near open water.	Low (foraging only); the Project Area does not contain typical nesting habitat; however, individuals may forage in nearby sloughs, the Yolo Bypass, or the Sacramento River
Northern harrier *Circus hudsonius*	eBird	–/SSC	Year-round resident; scattered throughout California; in the northwest, nests largely within coastal lowlands from Del Norte County south to Bodega Head in Sonoma County, inland to Napa **County**	Nests, forages, and roosts in wetlands or along rivers or lakes, but also in grasslands, meadows, or grain fields	High; the Project Area contains suitable foraging habitat for the species; an intact tidal wetland, directly across Lindsey Slough from the Project Area, contains suitable nesting and foraging habitat; individuals were observed within the Project Area during the biological habitat evaluation and botanical surveys in 2023

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Swainson's hawk *Buteo swainsoni*	CDFW, eBird	–/ST	Summer resident; breeds in lower Sacramento and San Joaquin valleys, the Klamath Basin, and Butte Valley; highest nesting densities occur near Davis and Woodland, Yolo County	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures, and grain fields	High; nesting was documented in 2007 and 2009 approximately 0.25 mile from the Project Area on the opposite bank of Lindsey Slough (CDFW 2023b); individuals were observed within the Project Area in 2023 during the biological habitat evaluation and botanical surveys
Golden eagle *Aquila chrysaetos*	USFWS	BGEPA/SFP	Uncommon permanent resident and migrant throughout California, except center of Central Valley	Open woodlands and oak savannahs, grasslands, chaparral, sagebrush flats; nests on steep cliffs or medium to tall trees	Low (foraging only); the Project Area does not contain suitable nesting habitat (cliffs or tall suitable nest trees); however, the species could forage in the open grassland habitat near the Project Area
American peregrine falcon *Falco peregrinus anatum*	CDFW	FD/SD, SFP	Most of California during migrations and in winter; nests primarily in the Coast Ranges, northern Sierra Nevada Mountains, and other mountainous areas of northern California	Wetlands, woodlands, cities, agricultural lands, and coastal area with cliffs (and rarely broken-top, predominant trees) for nesting; often forages near water	Low (foraging only); the Project Area does not contain suitable nesting habitat (cliffs); however, individuals may forage in the wetlands, agricultural lands, or grasslands around the Project Area
Yellow rail *Coturnicops noveboracensis*	CDFW	–/SSC	Extremely rare	Marshes	None/low; the closest documented occurrence was recorded in 2004 in Grizzly Island Wildlife Area, approximately 13 miles southwest of the Project Area (CDFW 2023b)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
California black rail *Laterallus jamaicenis coturniculus*	CDFW	–/ST, SFP	Northern San Francisco Bay area (primarily San Pablo and Suisun bays) and Sacramento-San Joaquin Delta	Large tidally-influenced marshes with saline to brackish water, typically with a high proportion of pickleweed (*Salicornia virginica*); also can be associated with bulrush (*Schoenoplectus* spp.), cattail (*Typha* spp.), or rushes (*Juncus* spp.); peripheral vegetation at and above mean high higher water necessary to protect nesting birds during extremely high tides	Low; several occurrences have been documented in tidal marshes across Lindsey Slough, between 0.5–1.0 mile from the Project Area, as recently as 2015 (CDFW 2023b); however, the Project Area contains only a small amount of intact tidal marsh suggesting that it does not constitute high quality nesting habitat, and no occurrences have been documented on Hastings Tract (CDFW 2023b)
California Ridgway's rail *Rallus obsoletus obsoletus*	CDFW	FE/SE, SFP	Predominantly in the marshes of the San Francisco estuary: South San Francisco Bay, North San Francisco Bay, San Pablo Bay, and sporadically throughout the Suisun Marsh area east to Browns Island	Salt and brackish water marshes, typically dominated by pickleweed (*Salicornia virginica*) and Pacific cordgrass (*Spartina foliosa*)	None; the Project Area is outside the species' range
Mountain plover *Charadrius montanus*	CDFW	FPT/SSC	Winter visitor; found in the Central Valley south of Yuba County, along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego counties; parts of Imperial, Riverside, Kern, and Los Angeles counties	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grain fields	Moderate (non-nesting only); the staging area in the Project Area and fields adjacent to the Project Area contain suitable non-breeding habitat; the species was documented within 5 miles of the Project Area several times between 1999 and 2022 (CDFW 2023b, eBird 2023)

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Western yellow-billed cuckoo *Coccyzus americanus*	CDFW	FT/SE	Breeds in limited portions of the Sacramento River and the South Fork Kern River; small populations may nest in Butte, Yuba, Sutter, San Bernardino, Riverside, Inyo, Los Angeles, and Imperial counties	Summer resident of valley foothill and desert riparian habitats; nests in open woodland with clearings and low, dense, scrubby vegetation	Low; the species' distribution is highly restricted and outside of the Project Area; the Project Area does not contain suitable nesting habitat
Western burrowing owl *Athene cunicularia hypugaea*	CDFW	–/SSC	Year-round resident throughout much of the state; Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast	Level, open, dry, heavily grazed or low- stature grassland or desert vegetation with available burrows	Moderate; areas adjacent to Project access roads contain grassland habitats that are suitable for nesting (if suitable burrows are present) and foraging; additionally, the species has been documented less than 0.25 mile north of the Project Area in 1977 and 2021 (CDFW 2023b, eBird 2023)
Short-eared owl *Asio flammeus*	CDFW, eBird	–/SSC	Year-round resident in certain areas; breeding in California episodic and a widespread winter migrant, found primarily in the Central Valley, in the western Sierra Nevada foothills, and along the coastline	Salt or freshwater marshlands, ungrazed grasslands, old pastures, and irrigated alfalfa or grain fields. Eat small mammals	Moderate (non-breeding only); Grizzly Island Wildlife Area (approximately 13 miles southwest of the Project Area) hosts a known breeding population of the species, first documented in 1987 (CDFW 2023b); the Project Area contains suitable foraging habitat; individuals were observed near Hastings Road in 2019, approximately 2.5 miles from the Project Area (eBird 2023), but the species is not expected to nest within the Project Area

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Loggerhead shrike *Lanius ludovicianus*	eBird	–/SSC	Year-round resident in most of California except for the forested coastal slope and the high elevations of the Sierra Nevada, southern Cascade, and Transverse Ranges	Open shrubland or woodlands with short vegetation and and/or bare ground for hunting; some tall shrubs, trees, fences, or power lines for perching; typically nest in isolated trees or large shrubs	Moderate; the Project Area contains suitable nesting and foraging habitat; individuals were observed on the nearby Peterson Ranch and near Hastings Road in 2019, approximately 2.5 miles from the Project Area (eBird 2023)
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	CDFW	–/SSC	San Francisco Bay region	Brackish marsh, riparian woodland/swamp, freshwater marsh, and salt marsh often near upland habitats	None; the Project Area is outside the subspecies' range
Grasshopper sparrow *Ammodramus savannarum*	CDFW	–/SSC	Summer resident; nests in Mendocino, Trinity, and Tehama counties south, west of the Cascade–Sierra Nevada axis and southeastern deserts, to San Diego County	Typically found in moderately open grasslands with scattered shrubs	Low; the Project Area is outside the species' breeding range; however, agricultural fields adjacent to the Project Area could support foraging; the closest occurrence of the species was recorded in 2017, approximately 6 miles northwest of the Project Area (CDFW 2023b)
Song sparrow ("Modesto" population) *Melospiza melodia*	CDFW	–/SSC	Year-round resident; north-central portion of the Central Valley	Emergent freshwater marshes, riparian willow thickets, and riparian forests	Moderate; the Project Area and the Project vicinity contain a moderate amount of suitable habitat for foraging and nesting; individuals have been observed approximately 6 miles from the Project Area in 2009 (CDFW 2023b)
Suisun song sparrow *Melospiza melodia maxillaris*	CDFW	–/SSC	Resident of Suisun Bay	Brackish-water marshes	None; the Project Area is outside the subspecies range

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Tricolored blackbird *Agelaius tricolor*	CDFW	–/ST	Permanent resident, but makes extensive migrations both in breeding season and winter; common locally throughout Central Valley and in coastal areas from Sonoma County south	Feeds in grasslands and agriculture fields; nesting habitat components include open accessible water, a protected nesting substrate (including flooded or thorny vegetation), and a suitable nearby foraging space with adequate insect prey	Moderate; although there is limited suitable nesting habitat in the Project Area, the species is abundant in the Project vicinity with several nearby occurrences (CDFW 2023b, eBird 2023) and may inhabit riparian scrub, agricultural fields, and/or grasslands within or adjacent to the Project Area
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	CDFW	–/SSC	Primarily a migrant and summer resident, though small numbers remain in winter; Central Valley, northeastern California, central and southern coasts, and southern deserts	Breeds almost entirely in open marshes with relatively deep water and tall emergent vegetation, such as bulrush (*Schoenoplectus* spp.) or cattails (*Typha* spp.); nests are typically in moderately dense vegetation; forage within wetlands and surrounding grasslands and croplands	Moderate; the Project Area is adjacent to suitable foraging and nesting habitat; the species has been documented in similar habitat within 5 miles of the Project Area as recently as 2018 (eBird 2023)
Mammals					
Salt marsh harvest mouse *Reithrodontomys raviventris*	CDFW	FE/SE, SFP	San Pablo, Suisun, and San Francisco bays in Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo counties	Tidal salt marshes; depend on dense cover, preferring pickleweed (*Salicornia pacifica*) and saltgrass	None; the Project Area is outside the species' range
Suisun shrew *Sorex ornatus sinuosus*	CDFW	–/SSC	Along the north shore of San Pablo and Suisun bays, from Tubbs Island/Sonoma Creek in Sonoma County east to Grizzly Island in Solano County	Areas of low, dense vegetation, in salt and brackish marshes	None; the Project Area is outside the species' range

Common name Scientific name	Query Sources	Status[a] Federal/ State	Distribution in California	Habitat Association	Likelihood to Occur in Project Area
Western red bat *Lasiurus blossevillii*	CDFW	–/SSC	Near the Pacific Coast, Central Valley, and the Sierra Nevada	Riparian forests, woodlands near streams, fields and orchards	Low; the Project Area contains scattered trees along Hastings Cut and Lindsey Slough that may be suitable for roosting; however, Hastings Tract does not contain true forest or woodland; the closest documented occurrence, recorded in 1999, is approximately 12 miles east of the Project Area (CDFW 2023b)
American badger *Taxidea taxus*	CDFW	–/SSC	Throughout the state except in the humid coastal forests of Del Norte County and the northwest portion of Humboldt County	Shrubland, open grasslands, fields, and alpine meadows with friable soils	Low; while levee shoulders within the Project Area may contain suitable denning habitat, the closest documented occurrence, recorded in 2016, is approximately 13 miles northwest of the Project Area (CDFW 2023b)

[a] Status codes:

Federal
FE = Listed as endangered under the federal Endangered Species Act
FT = Listed as threatened under the federal Endangered Species Act
FPT = Federally proposed as threatened
FC = Federal candidate species
FD = Federally delisted
BGEPA = Federally protected under the Bald and Golden Eagle Protection Act

State
SE = Listed as Endangered under the California Endangered Species Act
ST = Listed as Threatened under the California Endangered Species Act
SCE = State Candidate Endangered
SD = State Delisted
SSC = CDFW Species of Special Concern
SFP = CDFW Fully Protected species

References

Bennett, W. A. 2005. Critical assessment of the delta smelt population in the San Francisco Estuary, California. San Francisco Estuary and Watershed Science [online serial] Volume 3. Available at: http://repositories.cdlib.org/jmie/sfews/vol3/iss2/art1/.

CDFW. 2023a. 20 mm Trawl Fish Distribution Map. Website. https://www.dfg.ca.gov/delta/data/20mm/CPUE_map.asp. Prepared by California Department of Fish and Wildlife, Sacramento, California. [Accessed December 2022]

CDFW. 2023b. California Natural Diversity Database (CNDDB) – Rarefind Version 5. Internet Application. California Department of Fish and Wildlife, Sacramento, California.

eBird. 2023. An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Available: http://www.ebird.org. [Accessed: February 2023].

Graves, T. A., Janousek, W. M., Gaulke, S. M., Nicholas, A. C., Keinath, D. A., Bell, C. M., Cannings, S., Hatfield, R. G., Heron, J. M., Koch, J. B., Loffland, H. L., Richardson, L. L., Rohde, A. T., Rykken, J., Strange, J. P., Tronstad, L. M., and Sheffield, C. S. 2020. Western bumble bee: declines in the continental United States and range-wide information gaps. Ecosphere 11: e03141. 10.1002/ecs2.3141.

iNaturalist. 2023. Available from https://www.inaturalist.org. Accessed June 2023.

Merz J. E., Hamilton S., Bergman P. S, Cavallo B. 2011. Spatial perspective for delta smelt: a summary of contemporary survey data. Calif Fish Game 97:164–189.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press, Berkeley.

Moyle P. B., R. D. Baxter, T. Sommer, T. C. Foin, and S. A. Matern. 2004. Biology and population dynamics of Sacramento splittail (*Pogonichthys macrolepidotus*) in the San Francisco Estuary: A review. San Francisco Estuary and Watershed Science [online serial] 2: Article 3.

NMFS (National Marine Fisheries Service). 2005. Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California. Federal Register 70: 52,488–52,627.

NMFS. 2009. Endangered and threatened wildlife and plants: final rulemaking to designate critical habitat for the threatened southern distinct population segment of North American green sturgeon. Federal Register 74: 52,300–52,351.

Orloff, S. 2007. Migratory movements of California tiger salamander in upland habitat – a five-year study. Prepared for Bailey Estates LLC.

Radtke, L. D. 1966. Distribution of smelt, juvenile sturgeon, and starry flounder in the Sacramento-San Joaquin Delta with observations on food of sturgeon. California Fish and Game Bulletin 136: 115–126.

USFWS (United States Fish and Wildlife Service). 1980a. Endangered and Threatened Wildlife and Plants; Listing the Delta Green Ground Beetle as a Threatened Species With Critical Habitat. Federal Register 48: 52807–52810.

USFWS 1980b. Endangered and Threatened Wildlife and Plants; Listing the Valley Elderberry Longhorn Beetle as a Threatened Species With Critical Habitat. Federal Register 48: 52803–52807.

USFWS. 2004. Formal Programmatic Consultation on the Issuance of Section 10 and 404 Permits for Projects with Relatively Small Effects on the delta smelt (*Hypomesus transpacificus*) and its Critical Habitat. Service File Number: 1-1-04-F-0345. Sacramento Fish and Wildlife Office, Sacramento, California.

USFWS. 2005. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California Tiger Salamander, Central Population: Final Rule. Federal Register 70: 49380-49458

USFWS 2006. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for Four Vernal Pool Crustaceans and Eleven Vernal Pool Plants. Federal Register 71: 7118–7311.

Young, Y. J., Martin Perales, K., Durand, J. R., Moyle, P. B. 2015. Fish Distribution in the Cache Slough Complex of the Sacramento-San Joaquin Delta during Drought. IEP Newsletter Volume 28, Number 3, 2015.

Appendix D

Comprehensive List of Plant Species Documented during Special-status Plant Surveys for the Hastings Tract Pipe Replacement Project

Table D-1. Comprehensive list of plant species documented during special-status plant surveys for the Hastings Tract Pipe Replacement Project

Scientific name[1]	Common name	Family	Native?	Cal-IPC rating[2]
Achyrachaena mollis	blow wives	Asteraceae	Yes	–
Alnus rhombifolia	white alder	Betulaceae	Yes	–
Ambrosia psilostachya	western ragweed	Asteraceae	Yes	–
Anthriscus caucalis	bur-chervil	Apiaceae	No	–
Apocynum cannabinum	hemp dogbane	Apocynaceae	Yes	–
Arundo donax	giant reed	Poaceae	No	High
Avena fatua	wild oat	Poaceae	No	Moderate
Brassica nigra	black mustard	Brassicaceae	No	Moderate
Bromus diandrus	ripgut grass	Poaceae	No	Moderate
Bromus hordeaceus	soft chess	Poaceae	No	Limited
Bromus madritensis	foxtail chess	Poaceae	No	–
Capsella bursa-pastoris	shepherd's purse	Brassicaceae	No	–
Carduus pycnocephalus subsp. *pycnocephalus*	Italian thistle	Asteraceae	No	Moderate
Carex pellita	woolly sedge	Cyperaceae	Yes	–
Carex barbarae	whiteroot	Cyperaceae	Yes	–
Centaurea melitensis	tocalote	Asteraceae	No	Moderate
Centaurea solstitialis	yellow star-thistle	Asteraceae	No	High
Centromadia parryi* subsp. *rudis	**Parry's rough tarplant**	**Asteraceae**	**Yes**	**–**
Ceratophyllum demersum	coon's tail	Ceratophyllaceae	Yes	–
Cirsium vulgare	bull thistle	Asteraceae	No	Moderate
Conium maculatum	poison hemlock	Apiaceae	No	Moderate
Convolvulus arvensis	bindweed	Convolvulaceae	No	–
Cornus sericea	American dogwood	Cornaceae	Yes	–
Croton setiger	doveweed	Euphorbiaceae	Yes	–
Distichlis spicata	salt grass	Poaceae	Yes	–
Eichhornia crassipes	common water hyacinth	Pontederiaceae	No	High
Elodea canadensis	common waterweed	Hydrocharitaceae	Yes	–
Elymus ponticus	tall wheat grass	Poaceae	No	–
Elymus triticoides	beardless wild rye	Poaceae	Yes	–
Epilobium brachycarpum	tall annual willowherb	Onagraceae	Yes	–
Epipactis gigantea	stream orchid	Orchidaceae	Yes	–
Equisetum hyemale subsp. *affine*	common scouring rush	Equisetaceae	Yes	–
Erigeron canadensis	horseweed	Asteraceae	Yes	–
Erodium cicutarium	redstem filaree	Geraniaceae	No	Limited
Erodium moschatum	greenstem filaree	Geraniaceae	No	–
Eucalyptus camaldulensis	red gum	Myrtaceae	No	Limited

Scientific name[1]	Common name	Family	Native?	Cal-IPC rating[2]
Euthamia occidentalis	western goldenrod	Asteraceae	Yes	–
Festuca microstachys	desert fescue	Poaceae	Yes	–
Festuca myuros	rattail sixweeks grass	Poaceae	No	Moderate
Festuca perennis	rye grass	Poaceae	No	Moderate
Foeniculum vulgare	fennel	Apiaceae	No	Moderate
Frankenia salina	alkali heath	Frankeniaceae	Yes	–
Fraxinus latifolia	Oregon ash	Oleaceae	Yes	–
Geranium dissectum	cutleaf geranium	Geraniaceae	No	Limited
Helminthotheca echioides	bristly ox-tongue	Asteraceae	No	Limited
Hordeum marinum subsp. *gussoneanum*	Mediterranean barley	Poaceae	No	Moderate
Hordeum murinum	wall barley	Poaceae	No	Moderate
Hydrocotyle verticillata	whorled marshpennywort	Araliaceae	Yes	–
Iris pseudacorus	paleyellow iris	Iridaceae	No	Limited
Isolepis cernua	low bulrush	Cyperaceae	Yes	–
Juncus mexicanus	Mexican rush	Juncaceae	Yes	–
Lactuca serriola	prickly lettuce	Asteraceae	No	–
Lamium amplexicaule	henbit	Lamiaceae	No	–
Lathyrus jepsonii* var. *jepsonii	**Delta tule pea**	**Fabaceae**	**Native**	**–**
Lepidium latifolium	perennial pepperweed	Brassicaceae	No	High
Lepidium nitidum	shining pepperweed	Brassicaceae	Yes	–
Lilaeopsis masonii	**Mason's lilaeopsis**	**Apiaceae**	**Native**	**–**
Lotus corniculatus	bird's-foot trefoil	Fabaceae	No	–
Malva nicaeensis	bull mallow	Malvaceae	No	–
Malvella leprosa	alkali-mallow	Malvaceae	Yes	–
Matricaria discoidea	pineapple weed	Asteraceae	Yes	–
Medicago polymorpha	California burclover	Fabaceae	No	Limited
Medicago sativa	alfalfa	Fabaceae	No	–
Melilotus albus	white sweetclover	Fabaceae	No	–
Melilotus indicus	sourclover	Fabaceae	No	–
Parapholis incurva	curved sicklegrass	Poaceae	No	–
Paspalum dilatatum	dallis grass	Poaceae	No	–
Phalaris aquatica	harding grass	Poaceae	No	Moderate
Phyla nodiflora	turkey tangle fogfruit	Verbenaceae	Yes	–
Plantago lanceolata	English plantain	Plantaginaceae	No	Limited
Plantago major	common plantain	Plantaginaceae	No	–
Poa annua	annual blue grass	Poaceae	No	–
Polygonum aviculare	knotweed	Polygonaceae	No	–

Scientific name[1]	Common name	Family	Native?	Cal-IPC rating[2]
Pseudognaphalium luteoalbum	Jersey cudweed	Asteraceae	No	–
Psilocarphus tenellus	slender woolly-marbles	Asteraceae	Yes	–
Quercus lobata	valley oak	Fagaceae	Yes	–
Rosa californica	California rose	Rosaceae	Yes	–
Rubus armeniacus	Himalayan blackberry	Rosaceae	No	High
Rubus ursinus	California blackberry	Rosaceae	Yes	–
Rumex crispus	curly dock	Polygonaceae	No	Limited
Salix exigua	narrowleaf willow	Salicaceae	Yes	–
Salix lasiolepis	arroyo willow	Salicaceae	Yes	–
Schoenoplectus acutus var. *occidentalis*	common tule	Cyperaceae	Yes	–
Schoenoplectus californicus	southern bulrush	Cyperaceae	Yes	–
Senecio vulgaris	common groundsel	Asteraceae	No	–
Silybum marianum	blessed milkthistle	Asteraceae	No	Limited
Sonchus asper subsp. *asper*	prickly sow thistle	Asteraceae	No	–
Sonchus oleraceus	common sow thistle	Asteraceae	No	–
Stipa miliacea var. *miliacea*	smilo grass	Poaceae	No	Limited
Symphyotrichum lentum	**Suisun Marsh aster**	**Asteraceae**	**Native**	**–**
Trifolium fragiferum	strawberry clover	Fabaceae	No	–
Triticum aestivum	common wheat	Poaceae	No	–
Typha angustifolia	narrow-leaved cattail	Typhaceae	Yes or No	–
Verbena lasiostachys	western vervain	Verbenaceae	Yes	–
Vicia sativa subsp. *sativa*	spring vetch	Fabaceae	No	–
Zeltnera muehlenbergii	Monterey centaury	Gentianaceae	Yes	–

[1] Special status species are denoted in bold font.

[2] Cal-IPC ratings (Cal-IPC 2023)

High Species having severe ecological impacts on physical processes, plant and animal communities, and vegetation structure.

Moderate Species having substantial and apparent—but generally not severe—ecological impacts on physical processes, plant and animal communities, and vegetation structure.

Limited Species having minor ecological impacts on a statewide level or for which there is not enough information to justify a higher score.

Appendix E

Preliminary Wetland Delineation for Hastings Tract Pipe Replacement Project

DRAFT ◦ NOVEMBER 2023

Preliminary Wetland Delineation for the Hastings Tract Pipe Replacement Project, Solano County, California

PREPARED FOR

Reclamation District No. 2060
Hastings Tract
Solano County, CA

PREPARED BY

Stillwater Sciences
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Davis, CA 95618

Stillwater Sciences

Stillwater Sciences. 2023. Preliminary Wetland Delineation for Hastings Tract Pipe Replacement Project, California. Prepared by Stillwater Sciences, Davis, California for Reclamation District 2060, Solano County, California.

Cover photos, clockwise from upper left: boat ramp leading into Lindsey Slough, emergent vegetation in Lindsey Slough, pipe infrastructure in Hastings Cut, Hastings Cut from the Lindsey Slough levee (April 2023).

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1 INTRODUCTION

1.1 Project Background

Reclamation District No. 2060 (District) is planning to relocate twin 48-inch diameter tide gates (pipes) along Hastings Cut from the Unit 3 Cache Slough levee at its northeastern end to the Unit 1 Lindsey Slough levee at its southwestern end (Project). The Project has two primary purposes, 1) to improve long-term flood protection of Hastings Tract by replacing aging infrastructure through the levee and 2) to improve water quality and avoid environmental impacts to Cache Slough. The existing pipes provide both drainage and irrigation flow between Hastings Cut and Cache Slough but show signs of significant, irreparable distress in their current configuration. Pipe failure would cause damage to the Unit 3 Cache Slough levee and, depending on water surface elevation, could lead to a levee breach or flooding of the tract. The pipes will be relocated to the Unit 1 Lindsey Slough levee where they will connect Hastings Cut with Lindsey Slough. This relocation will require the removal and/or abandonment of existing features through the Cache Slough levee and the installation of new features through the Lindsey Slough levee.

1.2 Project Location

Hastings Tract is in the Sacramento-San Joaquin River Delta (Delta), approximately 25 miles southwest of Sacramento, in Solano County, California (Figure 1). Hastings Cut runs roughly northeast-southwest through the tract, connecting to Cache Slough to the north and Lindsey Slough to the south via tide gates through the tract's perimeter levees. Project work will be centered around these pipes as they are relocated from the Cache Slough levee to the Lindsey Slough levee.

1.3 Project Area

The Project Area encompasses two distinct sites, the existing pipe location on Cache Slough/Hastings Cut and the proposed new pipe location on Lindsey Slough/Hastings Cut (Figure 2). At each location the Project Area includes: (1) the construction footprint, which includes the grading limits and areas enclosed by the cofferdams in Cache Slough, Lindsey Slough, and Hastings Cut; and (2) a staging area (which will be located within the construction footprint along the Cache Slough levee). The Project's haul route follows approximately 5.5 miles along Hastings Cut Road and Hastings Road before joining State Route 113 (Figure 1).

1.4 Purpose of the Wetland Delineation

The purpose of this wetland delineation is to assess the water and wetland resources in the Project Area and delineate the boundaries of any Waters of the United States (WOUS), including wetlands, potentially subject to the jurisdiction of the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act (CWA) and/or Section 10 of the Rivers and Harbors Act. The waters and wetland delineation in this report is considered preliminary until verified by the Regulatory Branch of the USACE, Sacramento District.

The Project Manager may be contacted at:
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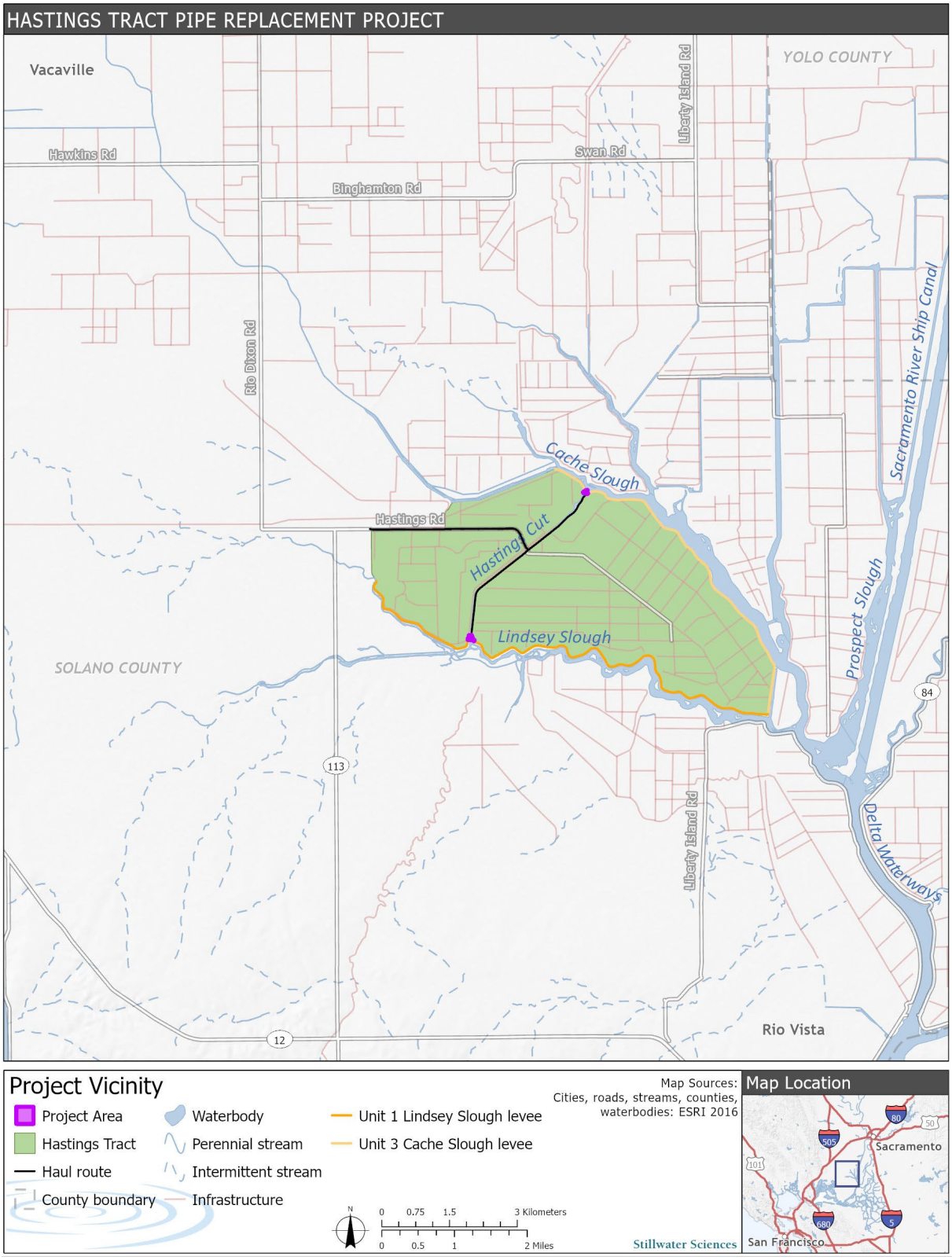

Figure 1. Hastings Tract Pipe Replacement Project location and surrounding vicinity.

Figure 2a. Project Area for the Hastings Tract Pipe Replacement Project, page 1 of 2.

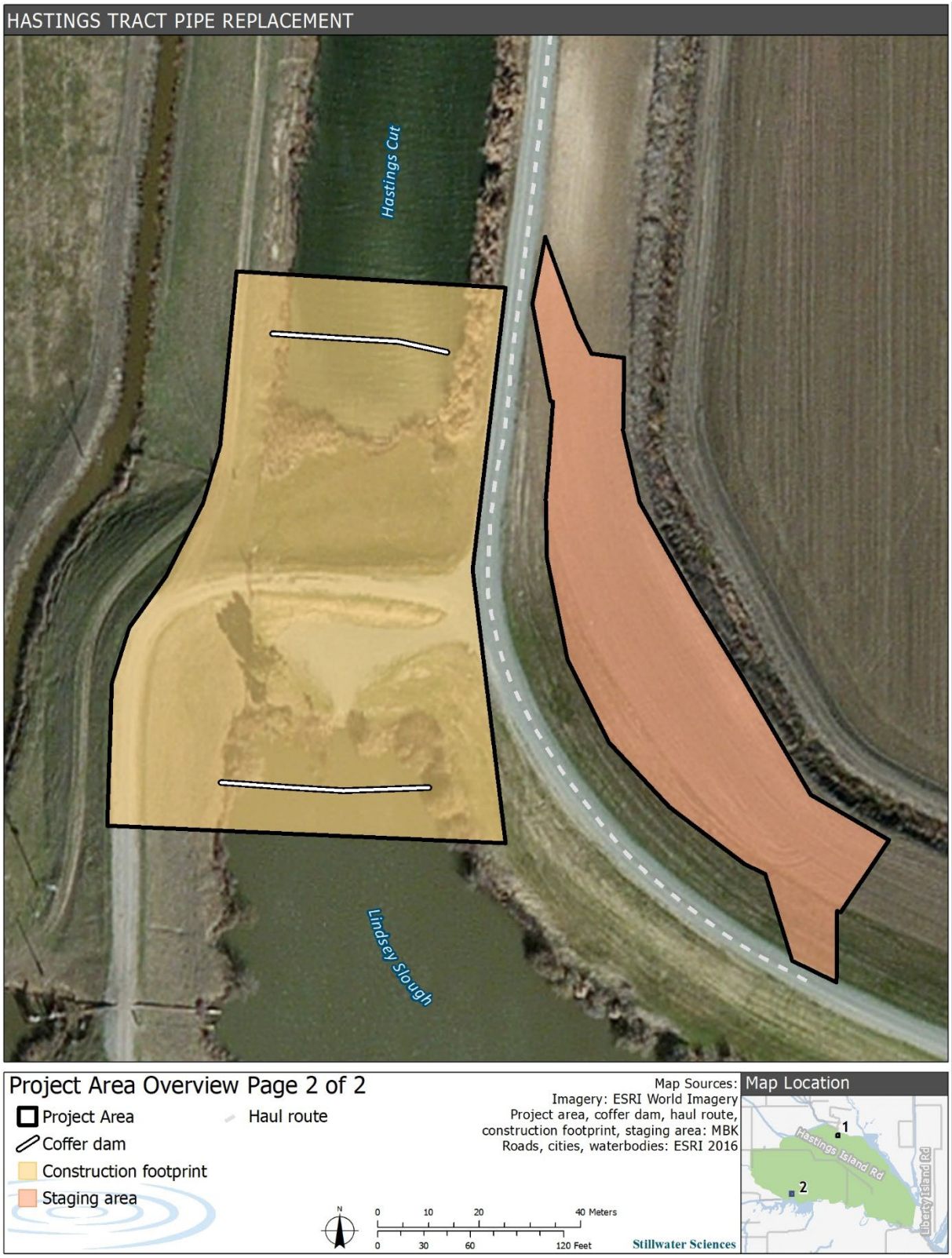

Figure 2b. Project Area for the Hastings Tract Pipe Replacement Project, page 2 of 2.

2 METHODS

2.1 Existing Conditions

Prior to the delineation of jurisdictional waters and wetlands, available data on hydrology, soil, precipitation, and vegetation were evaluated for the Project Area and nearby vicinity. Information on potential water and wetland features was obtained from the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) online application, Wetlands Mapper (USFWS 2023). Soil data for the Project Area were downloaded from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO) (NRCS 2023a) and the Hydric Soils List for Solano County (NRCS 2023b) were referenced to determine if any mapped soil units located in the Project Area are considered hydric. Precipitation and climate records from a nearby weather station in Vacaville, California (NRCS 2023c) and light detection and ranging (LiDAR) topographic data for the Project Area (OCM Partners 2023) were also reviewed.

2.2 Field Delineation

USACE has jurisdiction over WOUS, including wetlands, pursuant to Section 404 of the CWA and Section 10 of the Rivers and Harbors Act. Section 404 of the CWA applies to all WOUS, including wetlands, which are defined in the 33 Code of Federal Regulations (CFR) 328.3 and 40 CFR 120.2. Additionally, per Section 10 of the Rivers and Harbors Act, the USACE has jurisdiction over all waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide (i.e., traditionally navigable waters [TNWs]) as defined in 33 CFR 328.3 and 40 CFR 120.2.

The delineation was conducted on April 20, 2023, by Stillwater Sciences (K. Rodriguez, E. Applequist, C. Bilodeau). Vegetation communities in the Project Area were mapped in the field concurrent with the wetland delineation. Vegetation types were characterized according to the online *Manual of California Vegetation* (CNPS 2023) and digitized post-field into a Geographic Information System (GIS) shapefile. All plant species were identified following the taxonomy of *Jepson eFlora* (Jepson Flora Project 2023).

2.2.1 Waters delineation

Delineations of WOUS were conducted following the methods presented in *National Ordinary High Water Mark Field Delineation Manual for Rivers and Streams: Interim Version* (USACE 2022a) and the *Interim Draft Rapid Ordinary High Water Mark (OHWM) Field Identification Data Sheet* (USACE 2022b). During the field delineation, the extent of non-wetland waters was delineated by either the location of the ordinary high-water mark (OHWM) for non-tidal waters, or the mean high water (MHW) and high tide line (HTL) for tidal waters. The OHWM is the signature of the active channel and is indicated by physical characteristics such as: a clear, natural line impressed on the bank; shelving; changes in sediment characteristics; changes in vegetation characteristics; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3, USACE 2022a, 2022b). The MHW and HTL were calculated based on local tidal datums and verified in the field. Field indicators for MHW are based on OHWM characteristics; the HTL is indicated by physical characteristics such as water stains, sediment deposits, and changes in vegetation characteristics (33 CFR 328.3).

The extent of water features was delineated in the field by mapping the OHWM or MHW and HTL at representative cross-sections or transects within each feature. At each transect, the delineation team took photographs and measured the width of the channel at the OHWM or MHW and HTL. The OHWM or MHW and HTL were mapped with a sub-meter Global Positioning System (GPS) unit (Trimble Geo 7x). These data were subsequently post-processed, corrected, and incorporated into a GIS shapefile. MHW and HTL indicator point data taken in the field were extrapolated using LiDAR topographic data (OCM Partners 2023). Finally, all mapped water features were classified according to the *Classification of Wetlands and Deepwater Habitats of the United States* (FGDC 2013) and reviewed for connectivity to or classification as a TNW based on topography, satellite imagery, and other maps of the watershed.

2.2.2 Wetland delineation

The delineation of potentially jurisdictional wetlands within the Project Area was conducted in accordance with the *Corps of Engineers Wetlands Delineation Manual* (1987 Manual) (USACE 1987) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (Arid West Supplement) (USACE 2008). The 1987 Manual and Arid West Supplement provide technical guidelines and methods for the three-parameter approach to determining the location and boundaries of potential jurisdictional wetlands. This approach requires that an area must support positive indicators of hydrophytic vegetation, hydric soils, and wetland hydrology to be considered a potential jurisdictional wetland under Section 404 of the CWA. Connectivity of delineated wetlands to other waters and tributaries was evaluated in accordance with 33 CFR 328.3 and 40 CFR 120.2.

Any potential wetlands above the OHWM or HTL were sampled and assessed for positive indicators of hydrophytic vegetation, hydric soils, and wetland hydrology. If a sample point met all three parameters for a wetland, then a paired sample point was placed across the anticipated transition zone (the area in which a change from wetland to non-wetland conditions occurs) to delineate the wetland-upland boundary. If the sample point did not meet any of the three parameters, then the point was considered an upland location and a paired point was not sampled. At each sample point, a soil core was taken and the following information was recorded using the USACE (2008) data forms:

1. **Vegetation:** Dominant plant species for each stratum (i.e., tree, sapling/shrub, herb, woody vine) were identified by scientific name (genus and species) following the taxonomy of *Jepson eFlora* (Jepson Flora Project 2023). Absolute percent cover and dominance were determined using the 50/20 rule outlined in the Arid West Region Supplement, and the wetland indicator status (obligate [OBL], facultative wetland [FACW], facultative [FAC], facultative upland [FACU], and upland [UPL]) defined for the Arid West Region in the *National Wetland Plant List* (USACE 2020). Plant species not listed (NL) in the *National Wetland Plant List* were considered UPL species. A dominance test was performed to determine if the sample point exhibited hydrophytic vegetation. If the dominance test was not conclusive and wetland hydrology and hydric soils were present, then the prevalence index was calculated.
2. **Soils:** Moistened soil matrix descriptions were recorded for each sampling point using the following: depth of the sample, color (as defined in Munsell soil color charts [Munsell Color 2000]), and texture. When present, redoximorphic features were described by type (e.g., concentration, depletion, reduced matrix) and location (i.e., pore lining or matrix). Hydric soil presence was evaluated using the Arid West Region Supplement indicators, such as depleted matrix (F3). In addition, mapped soil units (described in Section 3.1.2) were considered, and the Hydric Soils List (NRCS 2023b) was consulted.

3. **Hydrology:** At each sample point, presence and depth of surface water, groundwater, and soil saturation were recorded in addition to any primary (e.g., surface soil cracks) or secondary (e.g., drainage patterns) indicators of wetland hydrology that were observed.

The locations of any sample points and wetland borders were recorded using a sub-meter GPS unit (Trimble Geo 7x) in the field and subsequently post-processed, corrected, and incorporated into a GIS shapefile. Photographs were taken at all sample points to show representative site characteristics. Wetland boundaries were extrapolated between sample points using average elevation break and photographic interpretation. Mapped wetlands were classified according to the *Classification of Wetlands and Deepwater Habitats of the United States* (FGDC 2013) based on the vegetation composition and structure at the sample points.

3 RESULTS

3.1 Existing Conditions

3.1.1 Hydrology

The Project Area is within the Cache Slough (Hydrologic Unit Code [HUC] 180201630606) and Lindsey Slough (HUC 180201630604) watersheds (USGS 2023). Waterways within the Project Area include a portion of Lindsey Slough to the south and Cache Slough to the north, as well as the adjacent portions of Hastings Cut (Figure 2). Hastings Cut connects Lindsey and Cache sloughs at their westernmost ends via pipes through Hastings Tract's perimeter levee. Lindsey Slough flows into Cache Slough at its easternmost end (Figure 1), and Cache Slough flows into the Sacramento River approximately 5 miles east of the Project Area (USACE 2023). Lindsey Slough, Cache Slough, and Hastings Cut are included on the list of TNWs maintained by the USACE Sacramento District (USACE 2023).

The USFWS NWI *Wetlands Mapper* online application, shows multiple wetland and water types within and adjacent to the Project Area including Riverine, Freshwater Forested/Shrub Wetland, and Palustrine Farmed (i.e., wetlands where the soil surface has been mechanically or physically altered for production of crops) (Figure 3) (USFWS 2023).

Figure 3a. National Wetlands Inventory map of the Hastings Tract Pipe Replacement Project Area, page 1 of 2 (Source: USFWS 2023).

Figure 3b. National Wetlands Inventory map of the Hastings Tract Pipe Replacement Project Area, page 2 of 2 (Source: USFWS 2023).

3.1.2 Soil units

A custom soil resource report for the Project Area was downloaded from SSURGO (NRCS 2023a; Appendix A). The Hydric Soils Lists for Solano County (NRCS 2023b) were also referenced to determine if any mapped soil units located in the Project Area are hydric soils. There are two mapped soil units in the Project Area, both of which are considered hydric by the NRCS (Table 1, Figure 4).

Table 1. Soil units in the Project Area for the Hastings Tract Pipe Replacement Project.

Soil unit	Soil unit setting	Existing drainage class	Landform	Typical horizons	Hydric components	Hydric criteria[1]	Acreage in Project Area
Clear Lake clay, 0 to 2 percent slopes, MLRA 17	Elevation: 10 to 260 feet Mean annual precipitation: 15 to 23 inches Mean annual air temperature: 57 to 61 ºF Frost-free period: 260 to 290 days	Clear Lake and similar soils: (85%) poorly drained	Basin floors	Clay	Clear Lake, Sacramento, Omni	2[2], 3[3]	1.2
Sacramento clay, 0 to 2 percent slopes, MLRA 16	Elevation: -10 to 20 feet Mean annual precipitation: 13 to 17 inches Mean annual air temperature: 60 to 62 ºF Frost-free period: 250 to 300 days	Sacramento and similar soils (85%) poorly drained	Basin floors	Clay, stratified loam to clay loam to clay	Sacramento, Clear Lake, Egbert, Ryde	2, 3	2.0

Notes: ºF = degrees Fahrenheit; MLRA = Major Land Resource Area

[1] Source: NRCS (2023b)

[2] Map unit components in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, or Andic, Cumulic, Pachic, or Vitrandic subgroups that:

- [a] Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
- [b] Show evidence that the soil meets the definition of a hydric soil.

[3] Map unit components that are frequently ponded for long duration or very long duration during the growing season that:

- [a] Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
- [b] Show evidence that the soil meets the definition of a hydric soil.

Figure 4a. Soil units in the Hastings Tract Pipe Replacement Project Area, page 1 of 2.

Figure 4b. Soil units in the Hastings Tract Pipe Replacement Project Area, page 2 of 2.

3.1.3 Precipitation

Appendix B includes the NRCS Climate Analysis for Wetlands Table (WETS Table) for the National Weather Service Vacaville Nut Tree Airport station, approximately 12 miles southeast of the Project Area, for the period of record from 1998 to 2023 (NRCS 2023c). The average mean temperature at the Nut Tree Airport is 62.2 degrees Fahrenheit (°F), the highest average maximum temperatures occur in July (94.7 °F), and the lowest average minimum temperatures occur in December (37.8 °F). The average yearly precipitation (i.e., rainfall) is approximately 21.66 inches. Based on daily minimum temperature values in the period of record, the average growing season is 337 days (January 20 to December 23; 50% probability, 28 °F); as such, the date of the field delineation (April 20, 2023) was within the growing season.

Data available from the nearby Vacaville Nut Tree Airport station indicate that the total cumulative rainfall from January 2023 through March 2023 (the months prior to the delineation) was 24.18 inches, which is higher than the average cumulative rainfall for these months (11.52 inches) based on the 25-year climatic normal (NRCS 2023c). However, weather conditions during the field delineation and the preceding days were dry (0.09 inch of rainfall in April through April 20) (NRCS 2023c). Weather conditions were therefore unlikely to have influenced the delineation results; waters features were evident as described in Section 3.2 and Appendices C and D.

3.1.4 Vegetation and land cover types

The Project Area consists of agricultural vegetation in the staging area and annual brome grasslands and riparian vegetation in the construction footprint. Agricultural areas are periodically planted with field crops and regularly disced, and grasslands on the levee slopes are maintained by regular mowing. The Project Area includes 0.30 acre of native vegetated habitat and 2.50 acres of non-native vegetated habitat, with a total of 2.80 acres of vegetated habitat. Vegetation and land cover types are summarized in Table 2, presented in Figure 5, and described in subsequent sections. Small areas of three sensitive natural communities were documented in the Project Area (Table 2).

Table 2. Vegetation and land cover types in the Hastings Tract Pipe Replacement Project Area.

Vegetation type[a]	Land cover/ habitat type[b]	Sensitive natural community?[c]	Total	Percent of Project Area
–	Agricultural	no	0.73	19.1%
Hardstem and California bulrush marshes *Schoenoplectus* (*acutus, californicus*) herbaceous alliance	Freshwater Marsh	no	0.02	0.4%
Giant reed marshes *Arundo donax* herbaceous semi-natural alliance		no	0.05	1.3%
California rose briar patches *Rosa californica* shrubland alliance	Scrub-shrub (native)	yes, S3	0.01	0.2%
Sandbar willow thickets *Salix exigua* shrubland alliance		no	0.18	4.5%
Himalayan blackberry riparian scrub *Rubus armeniacus* shrubland semi-natural alliance	Scrub-shrub (Himalayan blackberry)	no	0.01	0.2%
Eucalyptus groves *Eucalyptus* spp. woodland semi-natural alliance	Riparian Forest	no	0.04	1.1%
Oregon ash groves *Fraxinus latifolia* forest and woodland alliance		yes, S3.2	0.02	0.4%
Valley oak riparian forest and woodland *Quercus lobata* riparian forest and woodland alliance		yes, S3	0.05	1.2%
White alder groves *Alnus rhombifolia* forest and woodland alliance		no	0.04	1.1%
Annual brome grasslands *Bromus* [*diandrus, hordeaceus*] herbaceous semi-natural alliance	Ruderal herbaceous	no	1.66	43.2%
Total Vegetated			**2.80**	**75%**
Road			0.55	13.0%
Water			0.50	11.8%
Grand Total			**3.85**	**100%**

[a] *Manual of California Vegetation* (CNPS 2023)
[b] Stillwater Sciences and MBK Engineers (2023)
[c] Sensitive natural community rankings (CNPS 2023)
S3 = vulnerable
0.2 = moderately threatened

Figure 5a. Vegetation and land cover types in the Hastings Tract Pipe Replacement Project Area, page 1 of 2.

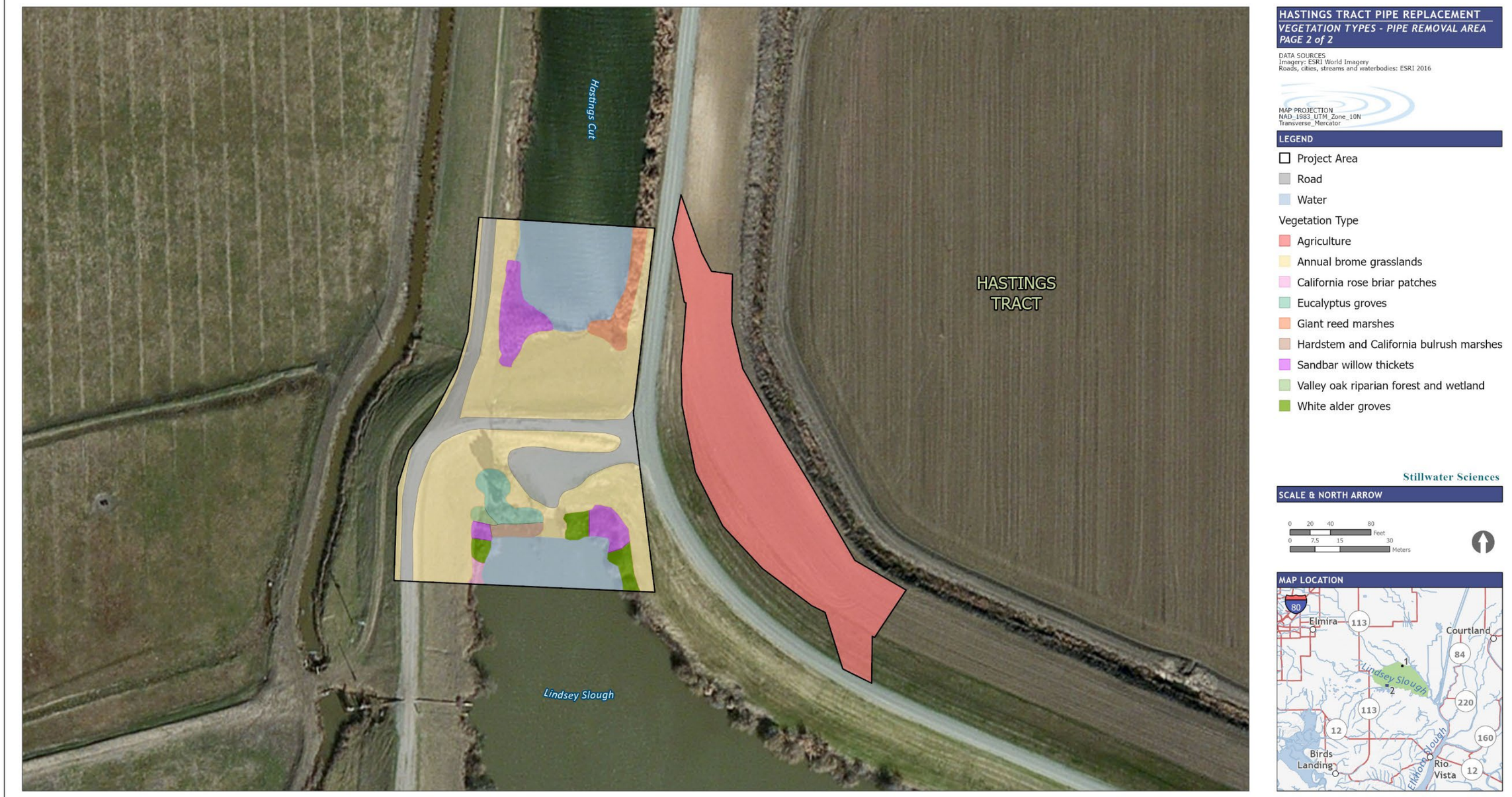

Figure 5b. Vegetation and land cover types in the Hastings Tract Pipe Replacement Project Area, page 2 of 2.

3.1.4.1 Hardstem and California bulrush marshes

In the Project Area, hardstem and California bulrush marshes (*Schoenoplectus* [*acutus, californicus*] herbaceous alliance) are dominated by the native species common tule (*Schoenoplectus acutus* var. *occidentalis*) and southern bulrush (*Schoenoplectus californicus*). The non-native species paleyellow iris (*Iris pseudacorus*) is present in low cover. A total of 0.02 acre (0.4%) of the Project Area is hardstem and California bulrush marshes (Figure 5b, Table 2).

3.1.4.2 Giant reed marshes

In the Project Area, giant reed marshes (*Arundo donax* herbaceous semi-natural alliance) are dominated by the non-native grass giant reed (*Arundo donax*) with a low cover of poison hemlock (*Conium maculatum*) and black mustard (*Brassica nigra*). A total of 0.05 acre (1.3%) of the Project Area is giant reed marshes (Figure 5b, Table 2).

3.1.4.3 California rose briar patches

In the Project Area, California rose briar patches (*Rosa californica* shrubland alliance) are dominated by California rose (*Rosa californica*) with low or moderate cover of Mexican rush (*Juncus mexicanus*) and perennial pepperweed (*Lepidium latifolium*). A total of 0.01 acre (0.2%) of the Project Area is California rose briar patches, which have a sensitive natural community rank of S3 (vulnerable) (CNPS 2023) (Figure 5b, Table 2).

3.1.4.4 Sandbar willow thickets

In the Project Area, sandbar willow thickets (*Salix exigua* shrubland alliance) are dominated by the native species narrowleaf willow (*Salix exigua*). The herbaceous layer is sparse and consists of the non-native species black mustard and ripgut grass (*Bromus diandrus*). A total of 0.18 acre (4.5%) of the Project Area is sandbar willow thickets (Figure 5, Table 2).

3.1.4.5 Himalayan blackberry riparian scrub

In the Project Area, Himalayan blackberry riparian scrub (*Rubus armeniacus* shrubland semi-natural alliance) is dominated by the non-native species Himalayan blackberry (*Rubus armeniacus*) with a low cover of narrowleaf willow. A total of 0.01 acre (0.2%) of the Project Area is Himalayan blackberry riparian scrub (Figure 5a, Table 2).

3.1.4.6 Eucalyptus groves

In the Project Area, Eucalyptus groves (*Eucalyptus* spp. woodland semi-natural alliance) are dominated by the non-native tree red gum (*Eucalyptus camaldulensis*). The understory consists of primarily herbaceous species, including ripgut grass, perennial pepperweed, and bull mallow (*Malva nicaeensis*). A total of 0.04 acre (1.1%) of the Project Area is eucalyptus groves (Figure 5b, Table 2).

3.1.4.7 Oregon ash groves

In the Project Area, Oregon ash groves (*Fraxinus latifolia* forest and woodland alliance) are dominated by the native species Oregon ash (*Fraxinus latifolia*). The shrub layer has moderate cover and includes the native species California rose and narrowleaf willow. The herbaceous layer has high cover and includes the native species Delta tule pea (*Lathyrus jepsonii* var.

jepsonii; California Rare Plant Rank [CRPR] 1B.2[1]) and the non-native species Italian thistle (*Carduus pycnocephalus* subsp. *pycnocephalus*). A total of 0.02 acre (0.4%) of the Project Area is Oregon ash groves, which have a sensitive natural community rank of S3.2 (vulnerable, moderately threatened) (CNPS 2023) (Figure 5a, Table 2).

3.1.4.8 Valley oak riparian forest and woodland

In the Project Area, valley oak riparian forest and woodland (*Quercus lobata* riparian forest and woodland alliance) is dominated by the native tree valley oak (*Quercus lobata*). The understory consists of herbaceous species, including wild oat (*Avena fatua*), ripgut grass, and rye grass (*Festuca perennis*). A total of 0.05 acre (1.2%) of the Project Area is valley oak riparian forest and woodland, which has a sensitive natural community rank of S3 (CNPS 2023) (Figure 5, Table 2).

3.1.4.9 White alder groves

In the Project Area, white alder groves (*Alnus rhombifolia* forest and woodland alliance) are dominated by the native tree white alder (*Alnus rhombifolia*). The shrub layer has moderate cover and includes the native shrub California rose, and the herbaceous layer has moderate cover and includes ripgut grass and Mexican rush. A total of 0.04 acre (1.1%) of the Project Area is white alder groves (Figure 5b, Table 2).

3.1.4.10 Annual brome grasslands

In the Project Area, annual brome grasslands (*Bromus* [*diandrus, hordeaceus*] herbaceous semi-natural alliance) are dominated by non-native grasses including ripgut grass, soft chess (*Bromus hordeaceus*), and wild oat, and includes frequent cover of non-native forbs including black mustard, yellow star-thistle (*Centaurea solstitialis*), poison hemlock, and rye grass. Native forbs are present at low cover and include pineapple weed (*Matricaria discoidea*). A total of 1.66 acres (43.2%) of the Project Area is annual brome grasslands (Figure 5, Table 2).

3.2 Preliminary Waters of the United States

A total of 0.79 acres of waters within Lindsey Slough, Cache Slough, and Hastings Cut were delineated within the Project Area and are considered preliminary WOUS (Table 3, Figure 6). Other areas in the vicinity of the Project Area (e.g., extent of riparian vegetation) may fall under the regulatory purview of California state agencies such as the State Water Resources Control Board and/or California Department of Fish and Wildlife under the Porter-Cologne Water Quality Control Act and the California Fish and Game Code (Section 1600 et seq.), respectively. Additional information regarding preliminary WOUS within the Project Area follows.

[1] CRPR 1B.2 includes plants rare, threatened, or endangered in California and elsewhere and fairly threatened in California (moderate degree/immediacy of threat).

Table 3. Preliminary Waters of the United States delineated for the Hastings Tract Pipe Replacement Project.

Water feature		Acres in the Project Area		
		Below MHW	**Between MHW and HTL**	**Total**
Riverine (tidal)	Cache Slough	0.02	0.01	**0.03**
	Hastings Cut (north)	0.15	0.01	**0.17**
	Lindsey Slough	0.22	0.07	**0.30**
	Hastings Cut (south)	0.27	0.02	**0.30**
Grand Total		***0.67***	***0.12***	***0.79***

Notes: MHW = mean high water
HTL = high tide line

3.2.1 Riverine

Three riverine features present within the Project Area are expected to be considered jurisdictional WOUS by the USACE: Cache Slough, Lindsey Slough, and Hastings Cut (Table 3, Figure 6). All three waterways are included on the list of TNWs maintained by the USACE Sacramento District (USACE 2023).

One transect was surveyed on the right bank of Cache Slough, two transects were surveyed on the left bank of Lindsey Slough, and two transects were surveyed across Hastings Cut to measure and characterize WOUS within the Project Area (Figure 6). MHW and HTL indicators (33 CFR 328.3, USACE 2022a, 2022b) included break in bank slope, change in vegetation type, and presence of organic litter (Appendix C). Waters delineation data sheets are included in Appendix C, and representative photos are included in Appendix D.

Cache Slough, Lindsey Slough, and Hastings Cut are classified as riverine (tidal) based on the wetland classification standard (FGDC 2013, adapted from Cowardin et al. 1979). Cache Slough, which is connected to the Sacramento River and tidally influenced (Section 3.1.1), occupies 0.03 acre (0.02 acre below MHW and 0.01 acre between MHW and HTL) within the Project Area (Table 3). Lindsey Slough is tidally influenced through its downstream connection to Cache Slough and occupies 0.30 acre (0.22 acre below MHW and 0.07 acre between MHW and HTL) within the Project Area. Hastings Cut is connected to Cache and Lindsey sloughs via twin 48-inch diameter pipes that dampen tidal influence within the waterway. Hastings Cut occupies 0.46 acre (0.43 acre below MHW and 0.04 acre between MHW and HTL) within the Project Area.

3.2.2 Wetland

No potentially jurisdictional wetlands are present within the Project Area. Freshwater marsh vegetation (e.g., common tule) within the Project Area is largely located below the HTL, and although some areas with hydrophytic vegetation above the HTL pass the FAC-neutral test (secondary indicator of wetland hydrology), no additional indicators of wetland hydrology were observed above the HTL.

Waters	Area
Cache Slough	
Riverine (tidal), below MHW	0.02
Riverine (tidal), between HTL and MHW	0.01
Lindsey Slough	
Riverine (tidal), below MHW	0.22
Riverine (tidal), between HTL and MHW	0.07
Hastings Cut	
Riverine (tidal), below MHW	0.43
Riverine (tidal), between HTL and MHW	0.04
Total	**0.79**

Figure 6a. Preliminary Waters of the United States in the Hastings Tract Pipe Replacement Project Area, page 1 of 2.

Figure 6b. Preliminary Waters of the United States in the Hastings Tract Pipe Replacement Project Area, page 2 of 2.

4 REFERENCES

CNPS (California Native Plant Society). 2023. A Manual of California Vegetation, Online Edition. California Native Plant Society, Sacramento, CA. Available at: http://www.cnps.org/cnps/vegetation/.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. U.S. Fish and Wildlife Service, Washington, D.C.

FGDC (Federal Geographic Data Committee). 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C.

Jepson Flora Project, editors. 2023. Jepson eFlora. Available at: http://ucjeps.berkeley.edu/eflora/.

NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service). 2023a. Web soil survey. Online database. Natural Resource Conservation Service. Available at: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

NRCS. 2023b. Hydric soils lists for Solano County, California soil survey area. Available at: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1316620.html.

NRCS. 2023c. National Water and Climate Center. National Weather Service Cooperative Observer Program. Agricultural Applied Climate Information System (AgACIS) climate data and WETS summary report. Data from Marysville Yuba County Airport and Sacramento International Airport. Available at: https://www.wcc.nrcs.usda.gov/climate/navigate_wets.html and http://agacis.rcc-acis.org/.

OCM Partners. 2023. 2017 CA DWR Lidar: Sacramento Delta, CA from 2010-06-15 to 2010-08-15. NOAA National Centers for Environmental Information. Available at: https://www.fisheries.noaa.gov/inport/item/65524

Stillwater Sciences and MBK Engineers. 2023. Draft Initial Study/Mitigated Negative Declaration for the Hastings Tract Pipe Replacement Project. Prepared by Stillwater Sciences, Davis, California and MBK Engineers, Sacramento, California for Reclamation District No. 2060, Solano County, California.

USACE (U.S. Army Corps of Engineers). 1987. Corps of Engineers wetlands delineation manual. Technical Report Y-87-1. USACE, Environmental Laboratory, Waterways Experiment Station, Vicksburg, Mississippi.

USACE. 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region. Version 2.0. Final Report ERDC/EL TR-08-28. Wetlands Regulatory Assistance Program, USACE, Engineer Research and Development Center, Environmental Laboratory, Vicksburg, Mississippi.

USACE. 2020. National Wetland Plant List, version 3.5. Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center, Hanover, New Hampshire. Available at: http://wetland-plants.usace.army.mil/.

USACE. 2022a. National Ordinary High Water Mark Field Delineation Manual for Rivers and Streams. Interim Version ERDC/CRREL TR-22-26. Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center, Hanover, New Hampshire.

USACE. 2022b. Interim Draft Rapid Ordinary High Water Mark (OHWM) Identification Data Sheet. ENG FORM 6250. Cold Regions Research and Engineering Laboratory, U.S. Army Engineer Research and Development Center, Hanover, New Hampshire.

USACE. 2023. Navigable Waterways in the Sacramento District website. Available at: https://www.spk.usace.army.mil/Missions/Regulatory/Jurisdiction/Navigable-Waters-of-the-US/.

USFWS (U.S. Fish and Wildlife Service). 2023. National Wetlands Inventory (NWI) wetlands and riparian polygon data. Geospatial wetlands data. USFWS, Arlington, Virginia. Available at: http://www.fws.gov/wetlands/.

USGS (U.S. Geological Survey). 2023. Hydrologic units from the watershed boundary dataset. Available at: https://gispublic.waterboards.ca.gov/portal/home/item.html?id=b6c1bab9acc148e7ac726e33c43402ee.

Appendices

Appendix A

Soil Resource Reports and Hydric Soils List

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Solano County, California

Hastings Tract Pipe Replacement: Cache Slough Construction Footprint

August 29, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:773 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Solano County, California
Survey Area Data: Version 17, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 23, 2022—Apr 24, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CeA	Clear Lake clay, 0 to 2 percent slopes, MLRA 17	1.2	87.9%
W	Water	0.2	12.1%
Totals for Area of Interest		**1.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Solano County, California

CeA—Clear Lake clay, 0 to 2 percent slopes, MLRA 17

Map Unit Setting

National map unit symbol: 2vbt0
Elevation: 10 to 260 feet
Mean annual precipitation: 15 to 23 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 290 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Clear lake and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Clear Lake

Setting

Landform: Basin floors
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Basin alluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

Ag - 0 to 13 inches: clay
Bssg1 - 13 to 19 inches: clay
Bssg2 - 19 to 45 inches: clay
Bkss - 45 to 60 inches: clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 48 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 4 percent
Maximum salinity: Nonsaline to moderately saline (1.0 to 15.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: C/D
Ecological site: R017XY901CA - Clayey Basin Group
Hydric soil rating: Yes

Minor Components

Capay
Percent of map unit: 5 percent
Hydric soil rating: No

Omni
Percent of map unit: 4 percent
Landform: Basin floors
Hydric soil rating: Yes

Sacramento
Percent of map unit: 4 percent
Landform: Basin floors
Hydric soil rating: Yes

Unnamed
Percent of map unit: 2 percent
Hydric soil rating: No

W—Water

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

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The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:664 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 30 60 120 180

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

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Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Solano County, California
Survey Area Data: Version 17, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 23, 2022—Apr 24, 2022

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Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Sd	Sacramento clay, 0 to 2 percent slopes, MLRA 16	1.2	71.9%
W	Water	0.5	28.1%
Totals for Area of Interest		**1.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Solano County, California

Sd—Sacramento clay, 0 to 2 percent slopes, MLRA 16

Map Unit Setting

National map unit symbol: 2w8bd
Elevation: -10 to 20 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 250 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Sacramento and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sacramento

Setting

Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Basin alluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

Ap - 0 to 15 inches: clay
A1 - 15 to 24 inches: clay
A2 - 24 to 27 inches: clay
C - 27 to 60 inches: stratified loam to clay loam to clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.04 to 0.20 in/hr)
Depth to water table: About 0 to 35 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 2 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to slightly saline (0.2 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: R017XY901CA - Clayey Basin Group

Hydric soil rating: Yes

Minor Components

Clear lake

Percent of map unit: 5 percent
Landform: Basin floors
Hydric soil rating: Yes

Egbert

Percent of map unit: 5 percent
Landform: Basin floors
Hydric soil rating: Yes

Sacramento

Percent of map unit: 3 percent
Landform: Basin floors
Hydric soil rating: Yes

Ryde

Percent of map unit: 2 percent
Landform: Basin floors
Hydric soil rating: Yes

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

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Custom Soil Resource Report for Solano County, California

Hastings Tract Pipe Replacement: Staging Area

August 29, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

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Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Sd	Sacramento clay, 0 to 2 percent slopes, MLRA 16	0.7	100.0%
Totals for Area of Interest		**0.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Solano County, California

Sd—Sacramento clay, 0 to 2 percent slopes, MLRA 16

Map Unit Setting

National map unit symbol: 2w8bd
Elevation: -10 to 20 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 60 to 62 degrees F
Frost-free period: 250 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Sacramento and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sacramento

Setting

Landform: Basin floors
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Basin alluvium derived from igneous, metamorphic and sedimentary rock

Typical profile

Ap - 0 to 15 inches: clay
A1 - 15 to 24 inches: clay
A2 - 24 to 27 inches: clay
C - 27 to 60 inches: stratified loam to clay loam to clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.04 to 0.20 in/hr)
Depth to water table: About 0 to 35 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 2 percent
Gypsum, maximum content: 1 percent
Maximum salinity: Nonsaline to slightly saline (0.2 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: High (about 9.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: R017XY901CA - Clayey Basin Group

Hydric soil rating: Yes

Minor Components

Clear lake

Percent of map unit: 5 percent
Landform: Basin floors
Hydric soil rating: Yes

Egbert

Percent of map unit: 5 percent
Landform: Basin floors
Hydric soil rating: Yes

Sacramento

Percent of map unit: 3 percent
Landform: Basin floors
Hydric soil rating: Yes

Ryde

Percent of map unit: 2 percent
Landform: Basin floors
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Soil Data Access (SDA) Hydric Soils List

An SDA-populated select list is used to pick a state and SSA which enables creation of a "Hydric Soils Report" based upon those selections. The data is not static; it hits Soil Data Access Live. To reset the table hit F5 on the keyboard. Once a survey is selected and table appears, if a new survey is selected it will append to the table at the bottom. For more information about the table,

California

selected stateId = CA

Solano County, California

selected SSA areasymbol = CA095

State_Sym	Area_Symbol	Area_Name	mukey	Mapunit_SYM	Mapunit_Name	Comp_Name_phase	muacres	Comp_RV_Pct	majcompflag	Comp_Acres	Comp_Landform	microfeature	Hydric_Rating	hydric_criteria
CA	CA095	Solano County, California	816871	123n	Coombs gravelly loam, 2 to 5 percent slopes	Clear Lake	1	3	No	0.0	alluvial fans	null	Yes	2
CA	CA095	Solano County, California	456057	An	Alviso silty clay loam	Alviso	1857	85	Yes	1578.5	tidal flats	null	Yes	2
CA	CA095	Solano County, California	456057	An	Alviso silty clay loam	Reyes	1857	8	No	148.6	tidal flats	null	Yes	2, 4
CA	CA095	Solano County, California	456057	An	Alviso silty clay loam	Tamba	1857	7	No	130.0	tidal flats	null	Yes	2, 4
CA	CA095	Solano County, California	456058	AoA	Antioch-San Ysidro complex, 0 to 2 percent slopes	Pescadaro	21356	7	No	1494.9	basin floors	null	Yes	3
CA	CA095	Solano County, California	456065	Cc	Capay clay, 0 percent slopes, MLRA 17	Clear Lake	38135	5	No	1906.8	basin floors	null	Yes	2
CA	CA095	Solano County, California	456065	Cc	Capay clay, 0 percent slopes, MLRA 17	Omni	38135	5	No	1906.8	basin floors	null	Yes	2
CA	CA095	Solano County, California	456065	Cc	Capay clay, 0 percent slopes, MLRA 17	Pescadaro	38135	5	No	1906.8	basin floors	null	Yes	3
CA	CA095	Solano County, California	456066	CeA	Clear Lake clay, 0 to 2 percent slopes, MLRA 17	Clear Lake	15513	85	Yes	13186.1	basin floors	null	Yes	2, 3
CA	CA095	Solano County, California	456066	CeA	Clear Lake clay, 0 to 2 percent slopes, MLRA 17	Sacramento	15513	4	No	620.5	basin floors	null	Yes	2
CA	CA095	Solano County, California	456066	CeA	Clear Lake clay, 0 to 2 percent slopes, MLRA 17	Omni	15513	4	No	620.5	basin floors	null	Yes	2
CA	CA095	Solano County, California	456067	CeB	Clear Lake clay, drained, 2 to 5 percent slopes, MLRA 15	Clear Lake, drained	1033	85	Yes	878.1	drainageways	null	Yes	2

CA	CA095	Solano County, California	456068	ClA	Clear Lake clay, saline, drained, 0 to 2 percent slopes, MLRA 14	Clear Lake, drained, saline	394	85	Yes	334.9	basin floors	null	Yes	2, 3
CA	CA095	Solano County, California	456068	ClA	Clear Lake clay, saline, drained, 0 to 2 percent slopes, MLRA 14	Alviso	394	5	No	19.7	tidal flats	null	Yes	2
CA	CA095	Solano County, California	456069	Cm	Columbia fine sandy loam	Valdez	1212	5	No	60.6	alluvial fans	null	Yes	2
CA	CA095	Solano County, California	456069	Cm	Columbia fine sandy loam	Ryde	1212	5	No	60.6	marshes	null	Yes	2, 4
CA	CA095	Solano County, California	456084	Eb	Egbert silty clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Egbert	4746	85	Yes	4034.1	flood plains	null	Yes	2, 4
CA	CA095	Solano County, California	456084	Eb	Egbert silty clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Scribner	4746	4	No	189.8	flood plains	null	Yes	2, 4
CA	CA095	Solano County, California	456084	Eb	Egbert silty clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Willows	4746	3	No	142.4	valley floors	null	Yes	2
CA	CA095	Solano County, California	456085	Ec	Egbert silty clay loam, partially drained, 0 to 2 percent slopes, occasionally flooded, MLRA 16	Egbert	1263	85	Yes	1073.6	flood plains	null	Yes	2, 4
CA	CA095	Solano County, California	456085	Ec	Egbert silty clay loam, partially drained, 0 to 2 percent slopes, occasionally flooded, MLRA 16	Sacramento	1263	10	No	126.3	flood plains	null	Yes	2, 4
CA	CA095	Solano County, California	456090	Ja	Joice muck, MLRA 16	Joice	13034	85	Yes	11078.9	tidal marshes	null	Yes	1, 3, 4
CA	CA095	Solano County, California	456090	Ja	Joice muck, MLRA 16	Tamba	13034	6	No	782.0	tidal marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456090	Ja	Joice muck, MLRA 16	Suisun	13034	6	No	782.0	tidal marshes	null	Yes	1, 3, 4
CA	CA095	Solano County, California	456090	Ja	Joice muck, MLRA 16	Reyes	13034	3	No	391.0	tidal flats	null	Yes	2, 3, 4

CA	CA095	Solano County, California	456091	Jb	Joice muck, clayey subsoil, 0 to 2 percent slopes, MLRA 16	Joice, clayey subsoil	1247	85	Yes	1060.0	marshes	null	Yes	1, 3, 4
CA	CA095	Solano County, California	456091	Jb	Joice muck, clayey subsoil, 0 to 2 percent slopes, MLRA 16	Joice	1247	8	No	99.8	tidal marshes	null	Yes	1, 3, 4
CA	CA095	Solano County, California	456091	Jb	Joice muck, clayey subsoil, 0 to 2 percent slopes, MLRA 16	Suisun	1247	7	No	87.3	tidal marshes	null	Yes	1, 3, 4
CA	CA095	Solano County, California	456142	Ld	Lang silt loam	Valdez	1	5	No	0.1	alluvial fans	null	Yes	2
CA	CA095	Solano County, California	456142	Ld	Lang silt loam	Unnamed	1	3	No	0.0	alluvial fans	null	Yes	2
CA	CA095	Solano County, California	456092	Ma	Made land	Valdez	2504	5	No	125.2	alluvial fans	null	Yes	2
CA	CA095	Solano County, California	456143	Mfy	Marvin silty clay loam	Capay	5	5	No	0.3	rims	null	Yes	4
CA	CA095	Solano County, California	456100	Om	Omni clay loam	Omni	907	85	Yes	771.0	basin floors	null	Yes	2
CA	CA095	Solano County, California	456100	Om	Omni clay loam	Clear Lake	907	5	No	45.4	basin floors	null	Yes	2
CA	CA095	Solano County, California	456101	On	Omni silty clay	Omni	3266	85	Yes	2776.1	basin floors	null	Yes	2
CA	CA095	Solano County, California	456101	On	Omni silty clay	Willows	3266	5	No	163.3	basin floors	null	Yes	2
CA	CA095	Solano County, California	456101	On	Omni silty clay	Egbert	3266	5	No	163.3	basin floors	null	Yes	2
CA	CA095	Solano County, California	456101	On	Omni silty clay	Sacramento	3266	5	No	163.3	basin floors	null	Yes	2
CA	CA095	Solano County, California	456102	Pc	Pescadero silty clay loam, 0 percent slopes, MLRA 17	Willows	6797	7	No	475.8	basin floors	null	Yes	2
CA	CA095	Solano County, California	456103	Pe	Pescadero clay, 0 percent slopes, MLRA 17	Pescadero	1048	85	Yes	890.8	basin floors, fan remnants	null	Yes	3
CA	CA095	Solano County, California	456105	Rd	Reyes silty clay loam	Reyes	1616	85	Yes	1373.6	tidal marshes	null	Yes	2
CA	CA095	Solano County,	456105	Rd	Reyes silty clay loam	Clear Lake	1616	5	No	80.8	alluvial fans	null	Yes	2

		California												
CA	CA095	Solano County, California	456105	Rd	Reyes silty clay loam	Reyes, saline	1616	3	No	48.5	tidal marshes	null	Yes	2
CA	CA095	Solano County, California	456105	Rd	Reyes silty clay loam	Reyes, overwashed	1616	2	No	32.3	tidal marshes	null	Yes	2
CA	CA095	Solano County, California	456106	Re	Reyes silty clay	Reyes	14891	85	Yes	12657.4	tidal marshes	null	Yes	2, 3
CA	CA095	Solano County, California	456106	Re	Reyes silty clay	Tamba	14891	8	No	1191.3	tidal marshes	null	Yes	3, 4
CA	CA095	Solano County, California	456106	Re	Reyes silty clay	Valdez	14891	7	No	1042.4	tidal marshes	null	Yes	2
CA	CA095	Solano County, California	456110	Rw	Riverwash	Riverwash	707	95	Yes	671.7	channels	null	Yes	4
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Ryde	6206	85	Yes	5275.1	deltas	null	Yes	2
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Peltier	6206	2	No	124.1	deltas	null	Yes	2
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Kingile	6206	2	No	124.1	deltas	null	Yes	1, 2
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Egbert	6206	2	No	124.1	deltas	null	Yes	2, 4
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Sacramento	6206	2	No	124.1	flood plains	null	Yes	2
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Scribner	6206	2	No	124.1	deltas	null	Yes	2, 4
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Rindge	6206	2	No	124.1	deltas	null	Yes	1, 2
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2	Guard	6206	2	No	124.1	deltas	null	Yes	2

					percent slopes, MLRA 16									
CA	CA095	Solano County, California	456111	Ry	Ryde clay loam, partially drained, 0 to 2 percent slopes, MLRA 16	Itano	6206	1	No	62.1	deltas	null	Yes	2
CA	CA095	Solano County, California	456150	SP	Reyes silty clay loam, salt ponds	Reyes, salt ponds	2887	100	Yes	2887.0	tidal marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456112	Sa	Sacramento silty clay loam, 0 to 2 percent slopes, MLRA 16	Sacramento	3855	85	Yes	3276.8	basin floors	null	Yes	2, 3
CA	CA095	Solano County, California	456112	Sa	Sacramento silty clay loam, 0 to 2 percent slopes, MLRA 16	Sacramento	3855	8	No	308.4	basin floors	null	Yes	2
CA	CA095	Solano County, California	456112	Sa	Sacramento silty clay loam, 0 to 2 percent slopes, MLRA 16	Egbert	3855	7	No	269.9	basin floors	null	Yes	2
CA	CA095	Solano County, California	456113	Sc	Sacramento silty clay loam, occasionally flooded	Sacramento	728	85	Yes	618.8	basin floors	null	Yes	2
CA	CA095	Solano County, California	456113	Sc	Sacramento silty clay loam, occasionally flooded	Egbert	728	14	No	101.9	basin floors	null	Yes	2
CA	CA095	Solano County, California	456114	Sd	Sacramento clay, 0 to 2 percent slopes, MLRA 16	Sacramento	7210	85	Yes	6128.5	basin floors	null	Yes	2, 3
CA	CA095	Solano County, California	456114	Sd	Sacramento clay, 0 to 2 percent slopes, MLRA 16	Clear Lake	7210	5	No	360.5	basin floors	null	Yes	2
CA	CA095	Solano County, California	456114	Sd	Sacramento clay, 0 to 2 percent slopes, MLRA 16	Egbert	7210	5	No	360.5	basin floors	null	Yes	2
CA	CA095	Solano County, California	456114	Sd	Sacramento clay, 0 to 2 percent slopes, MLRA 16	Sacramento	7210	3	No	216.3	basin floors	null	Yes	2
CA	CA095	Solano County, California	456114	Sd	Sacramento clay, 0 to 2 percent slopes, MLRA 16	Ryde	7210	2	No	144.2	basin floors	null	Yes	2, 4
CA	CA095	Solano County, California	456119	Sk	Solano-Pescadero complex	Pescadero	1882	44	Yes	828.1	terraces	null	Yes	3
CA	CA095	Solano County, California	456121	Sp	Suisun peaty muck, MLRA 16	Suisun	5040	85	Yes	4284.0	tidal marshes	null	Yes	1, 3, 4
CA	CA095	Solano County,	456121	Sp	Suisun peaty muck, MLRA	Joice	5040	8	No	403.2	tidal marshes	null	Yes	1, 3, 4

		California			16									
CA	CA095	Solano County, California	456121	Sp	Suisun peaty muck, MLRA 16	Tamba	5040	7	No	352.8	tidal marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456124	St	Sycamore silty clay loam, saline	Alviso	2282	8	No	182.6	alluvial fans	null	Yes	2
CA	CA095	Solano County, California	456125	Su	Sycamore complex ,occasionally flooded	Sacramento	2461	5	No	123.1	basin floors	null	Yes	2
CA	CA095	Solano County, California	456125	Su	Sycamore complex ,occasionally flooded	Egbert	2461	5	No	123.1	basin floors	null	Yes	2
CA	CA095	Solano County, California	456126	Ta	Tamba mucky clay, MLRA 16	Tamba	14573	85	Yes	12387.1	tidal marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456126	Ta	Tamba mucky clay, MLRA 16	Joice	14573	5	No	728.7	tidal marshes	null	Yes	1, 3, 4
CA	CA095	Solano County, California	456126	Ta	Tamba mucky clay, MLRA 16	Suisun	14573	5	No	728.7	tidal marshes	null	Yes	1, 3, 4
CA	CA095	Solano County, California	456126	Ta	Tamba mucky clay, MLRA 16	Reyes	14573	5	No	728.7	tidal marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456127	Td	Tidal marsh	Tidal marsh	2588	86	Yes	2225.7	tidal flats	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456127	Td	Tidal marsh	Unnamed	2588	14	No	362.3	tidal flats	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456132	Va	Valdez silt loam, drained, 0 to 2 percent slopes, MLRA 16	Valdez	5003	85	Yes	4252.6	flood plains	null	Yes	2
CA	CA095	Solano County, California	456132	Va	Valdez silt loam, drained, 0 to 2 percent slopes, MLRA 16	Sacramento	5003	1	No	50.0	flood plains	null	Yes	2
CA	CA095	Solano County, California	456132	Va	Valdez silt loam, drained, 0 to 2 percent slopes, MLRA 16	Laugenour	5003	1	No	50.0	flood plains	null	Yes	2
CA	CA095	Solano County, California	456132	Va	Valdez silt loam, drained, 0 to 2 percent slopes, MLRA 16	Sycamore	5003	1	No	50.0	flood plains	null	Yes	2
CA	CA095	Solano County, California	456132	Va	Valdez silt loam, drained, 0 to 2 percent slopes, MLRA 16	Maria	5003	1	No	50.0	flood plains	null	Yes	2
CA	CA095	Solano County, California	456133	Vc	Valdez silty clay loam	Valdez	56	85	Yes	47.6	alluvial fans	null	Yes	2

CA	CA095	Solano County, California	456133	Vc	Valdez silty clay loam	Reyes	56	10	No	5.6	marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456134	Vd	Valdez silty clay loam, strongly saline, 0 to 2 percent slopes, MLRA 16	Valdez, strongly saline	1587	90	Yes	1428.3	marshes	null	Yes	2
CA	CA095	Solano County, California	456134	Vd	Valdez silty clay loam, strongly saline, 0 to 2 percent slopes, MLRA 16	Reyes	1587	10	No	158.7	tidal flats	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456135	Ve	Valdez silty clay loam, clay substratum, MLRA 16	Valdez, clay substratum	6936	85	Yes	5895.6	deltas	null	Yes	2
CA	CA095	Solano County, California	456135	Ve	Valdez silty clay loam, clay substratum, MLRA 16	Reyes	6936	8	No	554.9	tidal marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456135	Ve	Valdez silty clay loam, clay substratum, MLRA 16	Tamba	6936	7	No	485.5	tidal marshes	null	Yes	2, 3, 4
CA	CA095	Solano County, California	456136	Wc	Willows clay, 0 percent slopes, MLRA 17	Willows	2227	85	Yes	1893.0	basin floors	null	Yes	3
CA	CA095	Solano County, California	456136	Wc	Willows clay, 0 percent slopes, MLRA 17	Sacramento	2227	3	No	66.8	alluvial fans	null	Yes	2

Report Metadata: Back to top

- **Area_Symbol:** A symbol that uniquely identifies a single occurrence of a particular type of area (e.g. Dane Co., Wisconsin is WI025).
- **Area_Name:** The name given to the specified geographic area.
- **mukey:** A non-connotative string of characters used to uniquely identify a record in the Mapunit table.
- **Mapunit_SYM:** The symbol used to uniquely identify the soil mapunit in the soil survey.
- **Mapunit_Name:** Correlated name of the mapunit (recommended name or field name for surveys in progress).
- **Comp_Name_phase:** Component name - Name assigned to a component based on its range of properties. Local Phase - Phase criterion to be used at a local level, in conjunction with "component name" to help identify a soil component.
- **muacres:** The number of acres of a particular mapunit.
- **Comp_RV_Pct:** The percentage of the component of the mapunit.
- **majcompflag:** Indicates whether or not a component is a major component in the mapunit.
- **Comp_Acres:** The number of acres of a particular component in a mapunit. ((muacres*comppct_r)/100)
- **Comp_Landform:** A word or group of words used to name a feature on the earth's surface, expressed in the plural form. Column Physical
- **Hydric_Rating:** A yes/no field that indicates whether or not a map unit component is classified as a "hydric soil". If rated as hydric, the specific criteria met are listed in the Component Hydric Criteria table.
- **Hydric_criteria:** Criterion code for the soil characteristic(s) and/or feature(s) that cause the map unit component to be classified as a "hydric soil." These codes are the paragraph numbers in the hydric soil criteria publication.

Criteria:

1. All Histels except Folistels and Histosols except Folists; or
2. Map unit components in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, or Andic, Cumulic, Pachic, or Vitrandic subgroups that:
    a. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
    b. Show evidence that the soil meets the definition of a hydric soil;
3. Map unit components that are frequently ponded for long duration or very long duration during the growing season that:
    a. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or

b. Show evidence that the soil meets the definition of a hydric soil; or

4. Map unit components that are frequently flooded for long duration or very long duration during the growing season that:
   a. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
   b. Show evidence that the soils meet the definition of a hydric soil.

Appendix B

WETS Table

WETS Table

WETS Station: VACAVILLE/ NUT TREE AP ASOS, CA								
Requested years: 1971 - 2023								
Month	Avg Max Temp	Avg Min Temp	Avg Mean Temp	Avg Precip	30% chance precip less than	30% chance precip more than	Avg number days precip 0.10 or more	Avg Snowfall
Jan	57.9	38.0	47.9	4.25	1.28	5.03	6	-
Feb	62.5	40.2	51.4	3.96	1.65	4.55	6	-
Mar	67.1	43.7	55.4	3.31	0.88	3.87	6	-
Apr	72.5	46.3	59.4	1.20	0.37	1.37	2	-
May	80.5	51.7	66.1	0.66	0.00	0.62	2	-
Jun	89.4	57.4	73.4	0.13	0.00	0.09	0	-
Jul	94.7	59.8	77.2	0.01	0.00	0.00	0	-
Aug	93.6	58.9	76.3	0.02	0.00	0.00	0	-
Sep	89.8	56.3	73.1	0.11	0.00	0.09	0	-
Oct	79.3	49.7	64.5	0.94	0.27	0.89	2	-
Nov	66.1	42.1	54.1	2.12	1.23	2.58	4	-
Dec	57.4	37.8	47.6	4.96	1.55	5.90	7	-
Annual:					13.99	25.14		
Average	75.9	48.5	62.2	-	-	-	-	-
Total	-	-	-	21.66			36	-

GROWING SEASON DATES			
Years with missing data:	24 deg = 29	28 deg = 29	32 deg = 29
Years with no occurrence:	24 deg = 22	28 deg = 4	32 deg = 0
Data years used:	24 deg = 24	28 deg = 24	32 deg = 24
Probability	24 F or higher	28 F or higher	32 F or higher
50 percent *	No occurrence	1/20 to 12/23: 337 days	2/16 to 11/30: 287 days
70 percent *	No occurrence	1/10 to 1/3: 358 days	2/8 to 12/9: 304 days
* Percent chance of the growing season occurring between the Beginning and Ending dates.			

STATS TABLE - total precipitation (inches)													
Yr	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annl
1998				M1.10	3.50	0.04	0.00		0.34	M0.65	4.89	1.01	11.53
1999	1.88	7.36	3.37	1.70	0.04	0.05	T	T	0.08	0.43	1.90	0.27	17.08
2000	5.78	10.76	2.17	1.33	1.18	0.22	0.00	T	0.03	3.02	0.85	0.75	26.09
2001	3.26	6.63	1.97	0.90	0.00	0.09	0.00	0.00	0.19	0.52	5.17	9.76	28.49
2002	M2.96	0.95	2.22	0.06	0.96	0.00	0.00	0.00	0.00	0.00	4.07	12.75	23.97
2003	2.49	2.01	2.99	2.50	0.84	0.00	T	0.37	MT	0.00	1.81	7.29	20.30
2004	3.54	7.42	1.25	0.12	0.00	0.00	0.00	0.00	0.23	2.81	3.14	7.17	25.68
2005	4.55	4.67	4.30	0.96	1.86	0.44	0.00	0.00	0.00	0.14	1.72	15.29	33.93

2006	3.57	3.55	7.72	4.07	1.33	0.00	0.00	0.00	0.00	0.06	2.09	3.18	25.57
2007	0.07	4.36	0.09	1.67	0.39	0.00	0.09	0.00	0.14	1.69	M0.65	M2.52	11.67
2008	M9.01	2.87	M0.03	M0.05	0.00	M0.00	M0.00	M0.00	0.00	0.66	M2.25	M2.65	17.52
2009	M1.23	M6.85	2.09	0.89	0.88	0.00	0.00	M0.00	0.04	M4.47	0.51	M2.08	19.04
2010	M7.47	M3.53	1.56	3.31	0.70	M0.00	0.00	0.00	0.01	M1.87	2.50	6.28	27.23
2011	1.94	4.74	9.01	0.13	1.46	1.54	0.00	0.00	0.01	1.09	1.55	0.33	21.80
2012	4.80	1.27	7.37	2.27	T	0.04	0.00	0.00	0.00	1.13	4.69	8.40	29.97
2013	0.78	0.22	0.56	0.59	0.28	0.10	0.00	0.00	0.24	0.00	0.63	0.60	4.00
2014	0.15	6.94	1.11	1.48	0.00	0.00	0.04	T	0.47	0.80	1.96	9.87	22.82
2015	0.01	2.70	0.10	1.23	0.00	0.04	T	T	0.04	0.78	1.21	2.38	8.49
2016	8.44	0.57	7.04	0.84	0.44	0.00	0.00	0.00	0.00	3.15	1.59	5.03	27.10
2017	16.68	12.79	4.12	3.36	0.03	0.42	0.00	0.01	T	0.14	2.03	0.04	39.62
2018	4.83	0.34	6.44	M1.65	T	0.00	0.00	0.00	0.00	0.06	3.68	M0.93	17.93
2019	7.53	M7.83	5.46	0.18	2.88	0.00	0.00	0.00	0.03	0.00	1.50	8.78	34.19
2020	1.32	0.00	M0.02	MT	T	0.00	0.00	T	0.00	0.00	0.85	1.46	3.65
2021	2.83	0.68	0.87	M0.02	0.00	0.00	0.00	0.00	0.05	M0.08	0.27	M1.90	6.70
2022	0.54	T	0.72	0.62	M0.22	0.22	T	0.00	0.78	0.00	1.48	7.99	12.57
2023	10.60	3.41	10.17	0.09	M0.28								24.55

Notes: Data missing in any month have an "M" flag. A "T" indicates a trace of precipitation.

Data missing for all days in a month or year is blank.

Creation date: 2023-05-30

Appendix C

Rapid Ordinary High Water Mark Data Sheets

U.S. Army Corps of Engineers (USACE)

INTERIM DRAFT RAPID ORDINARY HIGH WATER MARK (OHWM) FIELD IDENTIFICATION DATA SHEET

The proponent agency is Headquarters USACE CECW-CO-R.

Form Approved -
OMB No. 0710-0025
Expires: 01-31-2025

AGENCY DISCLOSURE NOTICE

The public reporting burden for this collection of information, 0710-OHWM, is estimated to average 30 **minutes** per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

Project ID #: Hastings Tract Pipe	Site Name: T1- Lindsey Slough	Date and Time: 4/20/23 9:00
Location (lat/long): 38.26307, -121.77151	Investigator(s): Karley Rodriguez,EmilyApplequist,CarinaBilodeau	

Step 1 Site overview from remote and online resources

Check boxes for online resources used to evaluate site:

- [ ] gage data
- [ ] LiDAR
- [ ] geologic maps
- [ ] climatic data
- [x] satellite imagery
- [ ] land use maps
- [x] aerial photos
- [x] topographic maps
- [x] Other: NWI

Describe land use and flow conditions from online resources. Were there any recent extreme events (floods or drought)?

Delta - agriculture in area, recreational use (hunting), levees bound Lindsey slough on all sides (within Project Area). High flows in preceding winter

Step 2 Site conditions during field assessment. First look for changes in channel shape, depositional and erosional features, and changes in vegetation and sediment type, size, density, and distribution. Make note of natural or man-made disturbances that would affect flow and channel form, such as bridges, riprap, landslides, rockfalls etc.

Levees, boat ramp with placed "rocks"

Step 3 Check the boxes next to the indicators used to identify the location of the OHWM.

OHWM is at a transition point, therefore some indicators that are used to determine location may be just below and above the OHWM. From the drop-down menu next to each indicator, select the appropriate location of the indicator by selecting either just below `b', at `x', or just above `a' the OHWM.

Go to page 2 to describe overall rationale for location of OHWM, write any additional observations, and to attach a photo log.

Geomorphic indicators

- [x] **Break in slope:** x
  - [x] *on the bank:* x
  - [ ] *undercut bank:*
  - [ ] *valley bottom:*
  - [ ] Other: _____
- [ ] **Shelving:**
  - [ ] *shelf at top of bank:*
  - [ ] *natural levee:*
  - [ ] *man-made berms or levees:*
  - [ ] *other berms:* _____
- [ ] **Channel bar:**
  - [ ] *shelving (berms) on bar:*
  - [ ] *unvegetated:*
  - [ ] *vegetation transition (go to veg. indicators)*
  - [ ] *sediment transition (go to sed. indicators)*
  - [ ] *upper limit of deposition on bar:*
- [ ] **Instream bedforms and other bedload transport evidence:**
  - [ ] *deposition bedload indicators (e.g., imbricated clasts, gravel sheets, etc.)*
  - [ ] *bedforms (e.g., pools, riffles, steps, etc.):*
- [ ] *erosional bedload indicators (e.g., obstacle marks, scour, smoothing, etc.)*
- [ ] **Secondary channels:**

Sediment indicators

- [ ] **Soil development:**
- [x] **Changes in character of soil:** x
- [ ] **Mudcracks:**
- [ ] **Changes in particle-sized distribution:**
  - [ ] *transition from* _____ to _____
  - [ ] *upper limit of sand-sized particles*
  - [ ] *silt deposits:*

Vegetation Indicators

- [x] **Change in vegetation type and/or density:** x

  Check the appropriate boxes and select the general vegetation change *(e.g., graminoids to woody shrubs).* ***Describe the vegetation transition looking from the middle of the channel, up the banks, and into the floodplain.***

  - [ ] *vegetation absent to:*
  - [ ] *moss to:*
  - [x] *forbs to:* woody shrubs
  - [ ] *graminoids to:*
  - [x] *woody shrubs to:* graminoids
  - [ ] *deciduous trees to:*
  - [ ] *coniferous trees to:*
- [ ] **Vegetation matted down and/or bent:**
- [ ] **Exposed roots below intact soil layer:**

Ancillary indicators

- [x] **Wracking/presence of organic litter:** x
- [ ] **Presence of large wood:**
- [ ] **Leaf litter disturbed or washed away:**
- [ ] **Water staining:**
- [ ] **Weathered clasts or bedrock:**

Other observed indicators? Describe:

Break in slope, on the bank at MHW
Changes in character of soil at MHW (wet)
Change in vegetation type and/or density: forbs to: woody shrub at MHW, woody shrubs to: graminoids & forbs at HTL
Wracking/presence of organic litter: MHW and HTL

Project ID #: Hastings Tract Pipe

Step 4 Is additional information needed to support this determination? ☐ Yes ☒ No If yes, describe and attach information to datasheet:

Step 5 Describe rationale for location of OHWM

HTL - change in vegetation composition from wetter species and emergent vegetation to more upland grasses; wracking visible on boat launch to east of transect. Rosa californica, Schoenoplectus acutus, Carex sp. to Bromus diandrus, Festuca perennis, Lepidium latifolium, Hordeum murinum.

MHW - change in vegetation composition from Schoenoplectus acutus to Rosa californica; break in slope/ small bank feature

Additional observations or notes

Attach a photo log of the site. Use the table below, or attach separately.

Photo log attached? ☐ Yes ☒ No If no, explain why not: See Appendix D to Preliminary Wetland Delineation

List photographs and include descriptions in the table below.

Number photographs in the order that they are taken. Attach photographs and include annotations of features.

Photo Number	Photograph description

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 1 Site overview from remote and online resources **Complete Step 1 prior to site visit.**

Online Resources: Identify what information is available for the site. Check boxes on datasheet next to the resources used to assess this site.

a. gage data
b. aerial photos
c. satellite imagery
d. LiDAR
e. topographic maps
f. geologic maps
g. land use maps
h. climatic data (precipitation and temperature)

Landscape context: Use the online resources to put the site in the context of the surrounding landscape.

a. **Note on the datasheet under Step 1:**
   i. Overall land use and change if known
   ii. Recent extreme events if known (e.g., flood, drought, landslides, debris flows, wildfires)
b. Consider the following to inform weighting of evidence observed during field visit.
   i. What physical characteristics are likely to be observed in specific environments?
   ii. Was there a recent flood or drought? Are you expecting to see recently formed or obscured indicators?
   iii. How will land use affect specific stream characteristics? How natural is the hydrologic regime? How stable has the landscape been over the last year, decade, century?

Step 2 Site conditions during the field assessment (assemble evidence)

a. Identify the assessment area.
b. Walk up and down the assessment area noting all the potential OHWM indicators.
c. Note broad trends in channel shape, vegetation, and sediment characteristics.
   i. Is this a single thread or multi-thread system? Is this a stream-wetland complex?
   ii. Are there any secondary and/or floodplain channels?
   iii. Are there obvious man-made alterations to the system?
   iv. Are there man-made (e.g., bridges, dams, culverts) or natural structures (e.g., bedrock outcrops, Large Wood jams) that will influence or control flow?
d. Look for signs of recurring fluvial action.
   i. Where does the flow converge on the landscape?
   ii. Are there signs of fluvial action (sediment sorting, bedforms, etc.) at the convergence zone?
e. Look for indicators on both banks. If the opposite bank is not accessible, then look across the channel at the bank.
f. **In Step 2 of the datasheet** describe any adjacent land use or flow conditions that may influence interpretation of each line of evidence.
   i. What land use and flow conditions may be affecting your ability to observe indicators at the site?
   ii. What recent extreme events may have caused changes to the site and affected your ability to observe indicators?

Step 3a List evidence

Assemble evidence by checking the boxes next to each line of evidence:

a. If needed, use a separate scratch datasheet to check boxes next to possible indicators, or check boxes of possible indicators in pencil and use pen for final decision.
b. If using fillable form, then follow the instructions for filling in the fillable form.

Context is important when assembling evidence. For instance, pool development may be an indicator of interest on the bed of a dry stream, but may not be a useful indicator to take note of in a flowing stream. On the other hand, if the pool is found in a secondary channel adjacent to the main channel, it could provide a line of evidence for a minimum elevation of high flows. Therefore, consider the site context when deciding which indicators provide evidence for identifying the OHWM. Explain reasoning in Step 5.

Questions to consider while making observations and listing evidence at a site:

Geomorphic indicators	**Sediment and soil indicators**	**Vegetation Indicators**	**Ancillary indicators**
Where are the breaks in slope?	Where does evidence of soil formation appear?	Where are the significant transitions in vegetation species, density, and age?	Is there organic litter present?
Are there identifiable banks?		Is there vegetation growing on the channel bed?	
Is there an easily identifiable top of bank?	Are there mudcracks present?	If no, how long does it take for the non-tolerant vegetation to establish relative to how often flows occur in the channel?	Is there any leaf litter disturbed or washed away?
Are the banks actively eroding?			
Are the banks undercut?	Is there evidence of sediment sorting by grain size?	Where are the significant transitions in vegetation?	Is there large wood deposition?
Are the banks armored?			
Is the channel confined by the surrounding hillslopes?		Is the vegetation tolerant of flowing water?	Is there evidence of water staining?
Are there natural or man-made berms and levees?		Has any vegetation been flattened by flowing water?	
Are there fluvial terraces?			
Are there channel bars?			

Are the following features of fluvial transport present?

Evidence of erosion: obstacle marks, scour, armoring
Bedforms; riffles, pools, steps, knickpoints/headcuts
Evidence of deposition: imbricated clasts, gravel sheets, etc.

In some cases, it may be helpful to explain why an indicator was NOT at the OHWM elevation, but found above or below. It can also be useful to note if specific indicators (e.g., vegetation) are NOT present. For instance, note if the site has no clear vegetation zonation.

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 3b Weight each line of evidence and weigh body of evidence

Weight each indicator by considering its importance based upon:

***Landscape context from Step 1 can help determine the relevance, strength, and reliability of the indicators observed in the field.**

a. Relevance:

i. Is this indicator left by low, high, or extreme flows?

Tips on how to assess the indicator relative to type of flow:

Consider the elevation of the indicator relative to the channel bed. What is the current flow level based on season or nearby gages? Consider the elevation of the indicator relative to the current flow. If the stream is currently at baseflow and indicator is adjacent to that, then it is likely a low flow indicator. The difference between high and extreme flow indicators can sometimes be difficult to determine.

***Information in Chapter 2 of the OHWM field manual provides information on specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.**

ii. Did recent extreme events and/or land use affect this indicator?

1. Recent floods may have left many extreme flow indicators, or temporarily altered channel form. Other resources will likely be needed to support any OHWM identification at this site. Field evidence of the OHWM may have to wait for the site to recover from the recent flood.
2. Droughts may cause field evidence of OHWM to be obscured, because there has been an extended time since the last high flow event. There can be overgrowth of vegetation or deposition of material from surrounding landscape that can obscure indicators.
3. Both man-made (e.g., dams, construction, mining activities, urbanization, agriculture, grazing) and natural (e.g., fires, floods, debris flows, beaver dams) disturbances can all alter how indicators are expected to appear at a site. Chapter 6 and Chapter 7 of the OHWM field manual provides specific case-studies that can help in interpreting evidence at these sites.

b. Strength:

i. Is this indicator persistent across the landscape?

1. Look up and downstream and across the channel to see if you see the same indicator at multiple locations.
2. Does the indicator occur at the same elevation as other indicators?

c. Reliability:

i. Is this indicator persistent on the landscape over time? Will this indicator still persist across seasons?

1. This can be difficult to determine for some indicators and may be specific to climatic region (in terms of persistence of vegetation) and history of land use or other natural disturbances.
2. Chapter 2, Chapter 6, and Chapter 7 of the OHWM field manual describes each indicator in detail and provides examples of areas where indicators are difficult to interpret.

d. Weigh body of evidence:

i. Combine weights: integrate the weighted line of evidence (relevance, strength, reliability) of each indicator.

ii. For each of the observed indicators, which are more heavily weighted? Where do high value indicators co-occur along the stream reach? Do they co-occur at a similar elevation along the banks relative to water surface (or channel bed if there is no water).

iii. On datasheet, select the indicators used to identify the OHWM. Information in Chapter 2 of the OHWM field manual provides descriptions of specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.

e. Take photographs of indicators and attach a log using either page 2 of datasheet or another method of logging photos.

i. Annotate photos with descriptions of indicators.

Step 4 Is additional information needed? Are other resources needed to support the lines of evidence observed in the field?

a. If additional resources are needed, then repeat steps 3a and 3b for the resources selected in Step 1 of assembling, weighting, and weighing evidence collected from online resources. Chapter 5 of the OHWM field manual provides information on using online resources.

b. Any data collected from online tools have strengths and weaknesses. Make sure these are clear when determining relevance, strength, and reliability of the remotely collected data. Clearly describe why other resources were needed to support the lines of evidence observed in the field, as well as the relevance, strength, and reliability of the supporting data and/or resources.

c. Attach any remote data and data analysis to the datasheet.

Step 5 Describe rationale for location of OHWM:

a. Why do the combination of indicators represent the OHWM?

b. If there are multiple possibilities for the OHWM, explain why there are two (or more) possibilities. Include any relevant discussion on why specific indicators were not included in the final decision.

c. If needed, add additional site notes on page 2 of the datasheet under Step 5.

U.S. Army Corps of Engineers (USACE)

INTERIM DRAFT RAPID ORDINARY HIGH WATER MARK (OHWM) FIELD IDENTIFICATION DATA SHEET

The proponent agency is Headquarters USACE CECW-CO-R.

Form Approved -
OMB No. 0710-0025
Expires: 01-31-2025

AGENCY DISCLOSURE NOTICE

The public reporting burden for this collection of information, 0710-OHWM, is estimated to average 30 **minutes** per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

Project ID #: Hastings Tract Pipe	Site Name: T2-Lindsey Slough	Date and Time: 4/20/23 10:37
Location (lat/long): 38.26288, -121.77170	Investigator(s): KarleyRodriguez, EmilyApplequist,CarinaBilodeau	

Step 1 Site overview from remote and online resources

Check boxes for online resources used to evaluate site:

- [ ] gage data
- [ ] LiDAR
- [ ] geologic maps
- [ ] climatic data
- [x] satellite imagery
- [ ] land use maps
- [x] aerial photos
- [x] topographic maps
- [x] Other: NWI

Describe land use and flow conditions from online resources. Were there any recent extreme events (floods or drought)?

Delta- agriculture in area, recreation use (hunting), levees bound Lindsey Slough on all sides w/in Project Area. High flows in preceding winter.

Step 2 Site conditions during field assessment. First look for changes in channel shape, depositional and erosional features, and changes in vegetation and sediment type, size, density, and distribution. Make note of natural or man-made disturbances that would affect flow and channel form, such as bridges, riprap, landslides, rockfalls etc.

Levee, change in slope is very steep at water edge; pipe nearby

Step 3 Check the boxes next to the indicators used to identify the location of the OHWM.

OHWM is at a transition point, therefore some indicators that are used to determine location may be just below and above the OHWM. From the drop-down menu next to each indicator, select the appropriate location of the indicator by selecting either just below `b', at `x', or just above `a' the OHWM.

Go to page 2 to describe overall rationale for location of OHWM, write any additional observations, and to attach a photo log.

Geomorphic indicators

- [x] **Break in slope:** x
  - [x] *on the bank:* x
  - [ ] *undercut bank:*
  - [ ] *valley bottom:*
  - [ ] Other: _____
- [ ] **Shelving:**
  - [ ] *shelf at top of bank:*
  - [ ] *natural levee:*
  - [ ] *man-made berms or levees:*
  - [ ] *other berms:* _____
- [ ] **Channel bar:**
  - [ ] *shelving (berms) on bar:*
  - [ ] *unvegetated:*
  - [ ] *vegetation transition (go to veg. indicators)*
  - [ ] *sediment transition (go to sed. indicators)*
  - [ ] *upper limit of deposition on bar:*
- [ ] **Instream bedforms and other bedload transport evidence:**
  - [ ] *deposition bedload indicators (e.g., imbricated clasts, gravel sheets, etc.)*
  - [ ] *bedforms (e.g., pools, riffles, steps, etc.):*
- [ ] *erosional bedload indicators (e.g., obstacle marks, scour, smoothing, etc.)*
- [ ] **Secondary channels:**

Sediment indicators

- [ ] **Soil development:**
- [ ] **Changes in character of soil:**
- [ ] **Mudcracks:**
- [ ] **Changes in particle-sized distribution:**
  - [ ] *transition from* _____ to _____
  - [ ] *upper limit of sand-sized particles*
  - [ ] *silt deposits:*

Vegetation Indicators

- [x] **Change in vegetation type and/or density:**

  Check the appropriate boxes and select the general vegetation change *(e.g., graminoids to woody shrubs).* ***Describe the vegetation transition looking from the middle of the channel, up the banks, and into the floodplain.***

  - [x] *vegetation absent to:* woody shrubs
  - [ ] *moss to:*
  - [ ] *forbs to:*
  - [ ] *graminoids to:*
  - [x] *woody shrubs to:* graminoids
  - [ ] *deciduous trees to:*
  - [ ] *coniferous trees to:*
- [ ] **Vegetation matted down and/or bent:**
- [ ] **Exposed roots below intact soil layer:**

Ancillary indicators

- [x] **Wracking/presence of organic litter:** x
- [ ] **Presence of large wood:**
- [ ] **Leaf litter disturbed or washed away:**
- [ ] **Water staining:**
- [ ] **Weathered clasts or bedrock:**

Other observed indicators? Describe:

Break in slope on the bank at MHW and HTL

Change in vegetation type and/or density: vegetation absent to: woody shrub w/alders at MHW; woody shrubs to: graminoids at HTL

Wracking/presence of organic litter: at HTL

Project ID #: Hastings Tract Pipe

Step 4 Is additional information needed to support this determination? ☐ Yes ☐ No If yes, describe and attach information to datasheet:

Step 5 Describe rationale for location of OHWM

HTL - change in vegetation composition from wetter spp to more upland grasses, wracking visible at edge of Rosa californica. Rosa californica, Juncus sp. to Hordeum murinum, Bromus hordeaceus

MHW: change in vegetation from bare bank to mostly Rosa californica with some Alnus rhombifolia. Bank is very steep between MHW & HTL

Additional observations or notes

Attach a photo log of the site. Use the table below, or attach separately.

Photo log attached? ☐ Yes ☒ No If no, explain why not: See Appendix D to Preliminary Wetland Delineation

List photographs and include descriptions in the table below.

Number photographs in the order that they are taken. Attach photographs and include annotations of features.

Photo Number	Photograph description

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 1 Site overview from remote and online resources **Complete Step 1 prior to site visit.**

Online Resources: Identify what information is available for the site. Check boxes on datasheet next to the resources used to assess this site.

a. gage data
b. aerial photos
c. satellite imagery
d. LiDAR
e. topographic maps
f. geologic maps
g. land use maps
h. climatic data (precipitation and temperature)

Landscape context: Use the online resources to put the site in the context of the surrounding landscape.

a. **Note on the datasheet under Step 1:**
   i. Overall land use and change if known
   ii. Recent extreme events if known (e.g., flood, drought, landslides, debris flows, wildfires)
b. Consider the following to inform weighting of evidence observed during field visit.
   i. What physical characteristics are likely to be observed in specific environments?
   ii. Was there a recent flood or drought? Are you expecting to see recently formed or obscured indicators?
   iii. How will land use affect specific stream characteristics? How natural is the hydrologic regime? How stable has the landscape been over the last year, decade, century?

Step 2 Site conditions during the field assessment (assemble evidence)

a. Identify the assessment area.
b. Walk up and down the assessment area noting all the potential OHWM indicators.
c. Note broad trends in channel shape, vegetation, and sediment characteristics.
   i. Is this a single thread or multi-thread system? Is this a stream-wetland complex?
   ii. Are there any secondary and/or floodplain channels?
   iii. Are there obvious man-made alterations to the system?
   iv. Are there man-made (e.g., bridges, dams, culverts) or natural structures (e.g., bedrock outcrops, Large Wood jams) that will influence or control flow?
d. Look for signs of recurring fluvial action.
   i. Where does the flow converge on the landscape?
   ii. Are there signs of fluvial action (sediment sorting, bedforms, etc.) at the convergence zone?
e. Look for indicators on both banks. If the opposite bank is not accessible, then look across the channel at the bank.
f. **In Step 2 of the datasheet** describe any adjacent land use or flow conditions that may influence interpretation of each line of evidence.
   i. What land use and flow conditions may be affecting your ability to observe indicators at the site?
   ii. What recent extreme events may have caused changes to the site and affected your ability to observe indicators?

Step 3a List evidence

Assemble evidence by checking the boxes next to each line of evidence:

a. If needed, use a separate scratch datasheet to check boxes next to possible indicators, or check boxes of possible indicators in pencil and use pen for final decision.
b. If using fillable form, then follow the instructions for filling in the fillable form.

Context is important when assembling evidence. For instance, pool development may be an indicator of interest on the bed of a dry stream, but may not be a useful indicator to take note of in a flowing stream. On the other hand, if the pool is found in a secondary channel adjacent to the main channel, it could provide a line of evidence for a minimum elevation of high flows. Therefore, consider the site context when deciding which indicators provide evidence for identifying the OHWM. Explain reasoning in Step 5.

Questions to consider while making observations and listing evidence at a site:

Geomorphic indicators	**Sediment and soil indicators**	**Vegetation Indicators**	**Ancillary indicators**
Where are the breaks in slope?	Where does evidence of soil formation appear?	Where are the significant transitions in vegetation species, density, and age?	Is there organic litter present?
Are there identifiable banks?		Is there vegetation growing on the channel bed?	
Is there an easily identifiable top of bank?	Are there mudcracks present?	If no, how long does it take for the non-tolerant vegetation to establish relative to how often flows occur in the channel?	Is there any leaf litter disturbed or washed away?
Are the banks actively eroding?			
Are the banks undercut?	Is there evidence of sediment sorting by grain size?	Where are the significant transitions in vegetation?	Is there large wood deposition?
Are the banks armored?			
Is the channel confined by the surrounding hillslopes?		Is the vegetation tolerant of flowing water?	Is there evidence of water staining?
Are there natural or man-made berms and levees?		Has any vegetation been flattened by flowing water?	
Are there fluvial terraces?			
Are there channel bars?			

Are the following features of fluvial transport present?

Evidence of erosion: obstacle marks, scour, armoring
Bedforms; riffles, pools, steps, knickpoints/headcuts
Evidence of deposition: imbricated clasts, gravel sheets, etc.

In some cases, it may be helpful to explain why an indicator was NOT at the OHWM elevation, but found above or below. It can also be useful to note if specific indicators (e.g., vegetation) are NOT present. For instance, note if the site has no clear vegetation zonation.

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 3b Weight each line of evidence and weigh body of evidence

Weight each indicator by considering its importance based upon:

***Landscape context from Step 1 can help determine the relevance, strength, and reliability of the indicators observed in the field.**

a. Relevance:

i. Is this indicator left by low, high, or extreme flows?

Tips on how to assess the indicator relative to type of flow:

Consider the elevation of the indicator relative to the channel bed. What is the current flow level based on season or nearby gages? Consider the elevation of the indicator relative to the current flow. If the stream is currently at baseflow and indicator is adjacent to that, then it is likely a low flow indicator. The difference between high and extreme flow indicators can sometimes be difficult to determine.

***Information in Chapter 2 of the OHWM field manual provides information on specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.**

ii. Did recent extreme events and/or land use affect this indicator?

1. Recent floods may have left many extreme flow indicators, or temporarily altered channel form. Other resources will likely be needed to support any OHWM identification at this site. Field evidence of the OHWM may have to wait for the site to recover from the recent flood.
2. Droughts may cause field evidence of OHWM to be obscured, because there has been an extended time since the last high flow event. There can be overgrowth of vegetation or deposition of material from surrounding landscape that can obscure indicators.
3. Both man-made (e.g., dams, construction, mining activities, urbanization, agriculture, grazing) and natural (e.g., fires, floods, debris flows, beaver dams) disturbances can all alter how indicators are expected to appear at a site. Chapter 6 and Chapter 7 of the OHWM field manual provides specific case-studies that can help in interpreting evidence at these sites.

b. Strength:

i. Is this indicator persistent across the landscape?

1. Look up and downstream and across the channel to see if you see the same indicator at multiple locations.
2. Does the indicator occur at the same elevation as other indicators?

c. Reliability:

i. Is this indicator persistent on the landscape over time? Will this indicator still persist across seasons?

1. This can be difficult to determine for some indicators and may be specific to climatic region (in terms of persistence of vegetation) and history of land use or other natural disturbances.
2. Chapter 2, Chapter 6, and Chapter 7 of the OHWM field manual describes each indicator in detail and provides examples of areas where indicators are difficult to interpret.

d. Weigh body of evidence:

i. Combine weights: integrate the weighted line of evidence (relevance, strength, reliability) of each indicator.

ii. For each of the observed indicators, which are more heavily weighted? Where do high value indicators co-occur along the stream reach? Do they co-occur at a similar elevation along the banks relative to water surface (or channel bed if there is no water).

iii. On datasheet, select the indicators used to identify the OHWM. Information in Chapter 2 of the OHWM field manual provides descriptions of specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.

e. Take photographs of indicators and attach a log using either page 2 of datasheet or another method of logging photos.

i. Annotate photos with descriptions of indicators.

Step 4 Is additional information needed? Are other resources needed to support the lines of evidence observed in the field?

a. If additional resources are needed, then repeat steps 3a and 3b for the resources selected in Step 1 of assembling, weighting, and weighing evidence collected from online resources. Chapter 5 of the OHWM field manual provides information on using online resources.

b. Any data collected from online tools have strengths and weaknesses. Make sure these are clear when determining relevance, strength, and reliability of the remotely collected data. Clearly describe why other resources were needed to support the lines of evidence observed in the field, as well as the relevance, strength, and reliability of the supporting data and/or resources.

c. Attach any remote data and data analysis to the datasheet.

Step 5 Describe rationale for location of OHWM:

a. Why do the combination of indicators represent the OHWM?

b. If there are multiple possibilities for the OHWM, explain why there are two (or more) possibilities. Include any relevant discussion on why specific indicators were not included in the final decision.

c. If needed, add additional site notes on page 2 of the datasheet under Step 5.

U.S. Army Corps of Engineers (USACE)

INTERIM DRAFT RAPID ORDINARY HIGH WATER MARK (OHWM) FIELD IDENTIFICATION DATA SHEET

The proponent agency is Headquarters USACE CECW-CO-R.

Form Approved -
OMB No. 0710-0025
Expires: 01-31-2025

AGENCY DISCLOSURE NOTICE

The public reporting burden for this collection of information, 0710-OHWM, is estimated to average 30 **minutes** per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

Project ID #: Hastings Tract Pipe	Site Name: T3 - Hastings Cut	Date and Time: 4/20/23 11:00
Location (lat/long): 38.26381, -121.771524	Investigator(s): KarleyRodriguez, EmilyApplequist,CarinaBilodeau	

Step 1 Site overview from remote and online resources

Check boxes for online resources used to evaluate site:

- [ ] gage data
- [ ] LiDAR
- [ ] geologic maps
- [ ] climatic data
- [x] satellite imagery
- [ ] land use maps
- [x] aerial photos
- [x] topographic maps
- [x] Other: NWI

Describe land use and flow conditions from online resources. Were there any recent extreme events (floods or drought)?

Delta - agriculture in area, recreational use (hunting), levees bound Lindsey slough on all sides (within Project Area). High flows in preceding winter

Step 2 Site conditions during field assessment. First look for changes in channel shape, depositional and erosional features, and changes in vegetation and sediment type, size, density, and distribution. Make note of natural or man-made disturbances that would affect flow and channel form, such as bridges, riprap, landslides, rockfalls etc.

Steep levee slopes, eroded at base along MHW, water level approximately at MHW

Step 3 Check the boxes next to the indicators used to identify the location of the OHWM.

OHWM is at a transition point, therefore some indicators that are used to determine location may be just below and above the OHWM. From the drop-down menu next to each indicator, select the appropriate location of the indicator by selecting either just below `b', at `x', or just above `a' the OHWM.

Go to page 2 to describe overall rationale for location of OHWM, write any additional observations, and to attach a photo log.

Geomorphic indicators

- [x] **Break in slope:** x
  - [x] *on the bank:* x
  - [ ] *undercut bank:*
  - [ ] *valley bottom:*
  - [ ] Other: _____
- [ ] **Shelving:**
  - [ ] *shelf at top of bank:*
  - [ ] *natural levee:*
  - [ ] *man-made berms or levees:*
  - [ ] *other berms:* _____
- [ ] **Channel bar:**
  - [ ] *shelving (berms) on bar:*
  - [ ] *unvegetated:*
  - [ ] *vegetation transition (go to veg. indicators)*
  - [ ] *sediment transition (go to sed. indicators)*
  - [ ] *upper limit of deposition on bar:*
- [ ] **Instream bedforms and other bedload transport evidence:**
  - [ ] *deposition bedload indicators (e.g., imbricated clasts, gravel sheets, etc.)*
  - [ ] *bedforms (e.g., pools, riffles, steps, etc.):*
- [ ] *erosional bedload indicators (e.g., obstacle marks, scour, smoothing, etc.)*
- [ ] **Secondary channels:**

Sediment indicators

- [ ] **Soil development:**
- [ ] **Changes in character of soil:**
- [ ] **Mudcracks:**
- [ ] **Changes in particle-sized distribution:**
  - [ ] *transition from* _____ to _____
  - [ ] *upper limit of sand-sized particles*
  - [ ] *silt deposits:*

Vegetation Indicators

- [x] **Change in vegetation type and/or density:** x

  Check the appropriate boxes and select the general vegetation change *(e.g., graminoids to woody shrubs).* ***Describe the vegetation transition looking from the middle of the channel, up the banks, and into the floodplain.***

  - [ ] *vegetation absent to:*
  - [ ] *moss to:*
  - [x] *forbs to:* woody shrubs
  - [ ] *graminoids to:*
  - [x] *woody shrubs to:* graminoids
  - [ ] *deciduous trees to:*
  - [ ] *coniferous trees to:*
- [ ] **Vegetation matted down and/or bent:**
- [ ] **Exposed roots below intact soil layer:**

Ancillary indicators

- [x] **Wracking/presence of organic litter:** x
- [ ] **Presence of large wood:**
- [ ] **Leaf litter disturbed or washed away:**
- [ ] **Water staining:**
- [ ] **Weathered clasts or bedrock:**

Other observed indicators? Describe:

Break in slope on the bank: at MHW

Change in vegetation type: forbs to: woody shrubs at MHW; woody shrubs to: graminoids at HTL

Wracking/presence of organic litter: at HTL (Schoenoplectus)

Project ID #: Hastings Tract Pipe

Step 4 Is additional information needed to support this determination? ☐ Yes ☒ No If yes, describe and attach information to datasheet:

Step 5 Describe rationale for location of OHWM

MHW - Juncus/Schoenoplectus with scattered Salix exigua to Rosa californica, change in slope at western bank

HTL - upper extent of wracking; change in vegetation - mostly Rosa californica to graminoids, Arundo donax between MHW & HTL on west bank

Additional observations or notes

Attach a photo log of the site. Use the table below, or attach separately.

Photo log attached? ☐ Yes ☒ No If no, explain why not: See Appendix D to Preliminary Wetland Delineation

List photographs and include descriptions in the table below.

Number photographs in the order that they are taken. Attach photographs and include annotations of features.

Photo Number	Photograph description

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 1 Site overview from remote and online resources **Complete Step 1 prior to site visit.**

Online Resources: Identify what information is available for the site. Check boxes on datasheet next to the resources used to assess this site.

a. gage data
b. aerial photos
c. satellite imagery
d. LiDAR
e. topographic maps
f. geologic maps
g. land use maps
h. climatic data (precipitation and temperature)

Landscape context: Use the online resources to put the site in the context of the surrounding landscape.

a. **Note on the datasheet under Step 1:**
   i. Overall land use and change if known
   ii. Recent extreme events if known (e.g., flood, drought, landslides, debris flows, wildfires)
b. Consider the following to inform weighting of evidence observed during field visit.
   i. What physical characteristics are likely to be observed in specific environments?
   ii. Was there a recent flood or drought? Are you expecting to see recently formed or obscured indicators?
   iii. How will land use affect specific stream characteristics? How natural is the hydrologic regime? How stable has the landscape been over the last year, decade, century?

Step 2 Site conditions during the field assessment (assemble evidence)

a. Identify the assessment area.
b. Walk up and down the assessment area noting all the potential OHWM indicators.
c. Note broad trends in channel shape, vegetation, and sediment characteristics.
   i. Is this a single thread or multi-thread system? Is this a stream-wetland complex?
   ii. Are there any secondary and/or floodplain channels?
   iii. Are there obvious man-made alterations to the system?
   iv. Are there man-made (e.g., bridges, dams, culverts) or natural structures (e.g., bedrock outcrops, Large Wood jams) that will influence or control flow?
d. Look for signs of recurring fluvial action.
   i. Where does the flow converge on the landscape?
   ii. Are there signs of fluvial action (sediment sorting, bedforms, etc.) at the convergence zone?
e. Look for indicators on both banks. If the opposite bank is not accessible, then look across the channel at the bank.
f. **In Step 2 of the datasheet** describe any adjacent land use or flow conditions that may influence interpretation of each line of evidence.
   i. What land use and flow conditions may be affecting your ability to observe indicators at the site?
   ii. What recent extreme events may have caused changes to the site and affected your ability to observe indicators?

Step 3a List evidence

Assemble evidence by checking the boxes next to each line of evidence:

a. If needed, use a separate scratch datasheet to check boxes next to possible indicators, or check boxes of possible indicators in pencil and use pen for final decision.
b. If using fillable form, then follow the instructions for filling in the fillable form.

Context is important when assembling evidence. For instance, pool development may be an indicator of interest on the bed of a dry stream, but may not be a useful indicator to take note of in a flowing stream. On the other hand, if the pool is found in a secondary channel adjacent to the main channel, it could provide a line of evidence for a minimum elevation of high flows. Therefore, consider the site context when deciding which indicators provide evidence for identifying the OHWM. Explain reasoning in Step 5.

Questions to consider while making observations and listing evidence at a site:

Geomorphic indicators	**Sediment and soil indicators**	**Vegetation Indicators**	**Ancillary indicators**
Where are the breaks in slope?	Where does evidence of soil formation appear?	Where are the significant transitions in vegetation species, density, and age?	Is there organic litter present?
Are there identifiable banks?		Is there vegetation growing on the channel bed?	
Is there an easily identifiable top of bank?	Are there mudcracks present?	If no, how long does it take for the non-tolerant vegetation to establish relative to how often flows occur in the channel?	Is there any leaf litter disturbed or washed away?
Are the banks actively eroding?			
Are the banks undercut?	Is there evidence of sediment sorting by grain size?	Where are the significant transitions in vegetation?	Is there large wood deposition?
Are the banks armored?			
Is the channel confined by the surrounding hillslopes?		Is the vegetation tolerant of flowing water?	Is there evidence of water staining?
Are there natural or man-made berms and levees?		Has any vegetation been flattened by flowing water?	
Are there fluvial terraces?			
Are there channel bars?			

Are the following features of fluvial transport present?

Evidence of erosion: obstacle marks, scour, armoring
Bedforms; riffles, pools, steps, knickpoints/headcuts
Evidence of deposition: imbricated clasts, gravel sheets, etc.

In some cases, it may be helpful to explain why an indicator was NOT at the OHWM elevation, but found above or below. It can also be useful to note if specific indicators (e.g., vegetation) are NOT present. For instance, note if the site has no clear vegetation zonation.

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 3b Weight each line of evidence and weigh body of evidence

Weight each indicator by considering its importance based upon:

***Landscape context from Step 1 can help determine the relevance, strength, and reliability of the indicators observed in the field.**

a. Relevance:

i. Is this indicator left by low, high, or extreme flows?

Tips on how to assess the indicator relative to type of flow:

Consider the elevation of the indicator relative to the channel bed. What is the current flow level based on season or nearby gages? Consider the elevation of the indicator relative to the current flow. If the stream is currently at baseflow and indicator is adjacent to that, then it is likely a low flow indicator. The difference between high and extreme flow indicators can sometimes be difficult to determine.

***Information in Chapter 2 of the OHWM field manual provides information on specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.**

ii. Did recent extreme events and/or land use affect this indicator?

1. Recent floods may have left many extreme flow indicators, or temporarily altered channel form. Other resources will likely be needed to support any OHWM identification at this site. Field evidence of the OHWM may have to wait for the site to recover from the recent flood.
2. Droughts may cause field evidence of OHWM to be obscured, because there has been an extended time since the last high flow event. There can be overgrowth of vegetation or deposition of material from surrounding landscape that can obscure indicators.
3. Both man-made (e.g., dams, construction, mining activities, urbanization, agriculture, grazing) and natural (e.g., fires, floods, debris flows, beaver dams) disturbances can all alter how indicators are expected to appear at a site. Chapter 6 and Chapter 7 of the OHWM field manual provides specific case-studies that can help in interpreting evidence at these sites.

b. Strength:

i. Is this indicator persistent across the landscape?

1. Look up and downstream and across the channel to see if you see the same indicator at multiple locations.
2. Does the indicator occur at the same elevation as other indicators?

c. Reliability:

i. Is this indicator persistent on the landscape over time? Will this indicator still persist across seasons?

1. This can be difficult to determine for some indicators and may be specific to climatic region (in terms of persistence of vegetation) and history of land use or other natural disturbances.
2. Chapter 2, Chapter 6, and Chapter 7 of the OHWM field manual describes each indicator in detail and provides examples of areas where indicators are difficult to interpret.

d. Weigh body of evidence:

i. Combine weights: integrate the weighted line of evidence (relevance, strength, reliability) of each indicator.

ii. For each of the observed indicators, which are more heavily weighted? Where do high value indicators co-occur along the stream reach? Do they co-occur at a similar elevation along the banks relative to water surface (or channel bed if there is no water).

iii. On datasheet, select the indicators used to identify the OHWM. Information in Chapter 2 of the OHWM field manual provides descriptions of specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.

e. Take photographs of indicators and attach a log using either page 2 of datasheet or another method of logging photos.

i. Annotate photos with descriptions of indicators.

Step 4 Is additional information needed? Are other resources needed to support the lines of evidence observed in the field?

a. If additional resources are needed, then repeat steps 3a and 3b for the resources selected in Step 1 of assembling, weighting, and weighing evidence collected from online resources. Chapter 5 of the OHWM field manual provides information on using online resources.

b. Any data collected from online tools have strengths and weaknesses. Make sure these are clear when determining relevance, strength, and reliability of the remotely collected data. Clearly describe why other resources were needed to support the lines of evidence observed in the field, as well as the relevance, strength, and reliability of the supporting data and/or resources.

c. Attach any remote data and data analysis to the datasheet.

Step 5 Describe rationale for location of OHWM:

a. Why do the combination of indicators represent the OHWM?

b. If there are multiple possibilities for the OHWM, explain why there are two (or more) possibilities. Include any relevant discussion on why specific indicators were not included in the final decision.

c. If needed, add additional site notes on page 2 of the datasheet under Step 5.

U.S. Army Corps of Engineers (USACE)

INTERIM DRAFT RAPID ORDINARY HIGH WATER MARK (OHWM) FIELD IDENTIFICATION DATA SHEET

The proponent agency is Headquarters USACE CECW-CO-R.

Form Approved -
OMB No. 0710-0025
Expires: 01-31-2025

AGENCY DISCLOSURE NOTICE

The public reporting burden for this collection of information, 0710-OHWM, is estimated to average 30 **minutes** per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

Project ID #: Hastings Tract Pipe	Site Name: T4 - Hastings Cut	Date and Time: 4/20/23 12:00
Location (lat/long): 38.29204, -121.74191	Investigator(s): KarleyRodriguez, EmilyApplequist,CarinaBilodeau	

Step 1 Site overview from remote and online resources

Check boxes for online resources used to evaluate site:

- [ ] gage data
- [ ] climatic data
- [x] aerial photos
- [ ] LiDAR
- [x] satellite imagery
- [x] topographic maps
- [ ] geologic maps
- [ ] land use maps
- [x] Other: NWI

Describe land use and flow conditions from online resources. Were there any recent extreme events (floods or drought)?

Delta - agriculture in area, recreational use (hunting), levees bound Lindsey slough on all sides (within Project Area). High flows in preceding winter

Step 2 Site conditions during field assessment. First look for changes in channel shape, depositional and erosional features, and changes in vegetation and sediment type, size, density, and distribution. Make note of natural or man-made disturbances that would affect flow and channel form, such as bridges, riprap, landslides, rockfalls etc.

Levees block most exchange from Cache Slough into Hastings Cut, apart from large pipes that allow some tidal influence

Step 3 Check the boxes next to the indicators used to identify the location of the OHWM.

OHWM is at a transition point, therefore some indicators that are used to determine location may be just below and above the OHWM. From the drop-down menu next to each indicator, select the appropriate location of the indicator by selecting either just below `b', at `x', or just above `a' the OHWM.

Go to page 2 to describe overall rationale for location of OHWM, write any additional observations, and to attach a photo log.

Geomorphic indicators

- [x] **Break in slope:** x
  - [x] *on the bank:* x
  - [ ] *undercut bank:*
  - [ ] *valley bottom:*
  - [ ] Other: _____
- [ ] **Shelving:**
  - [ ] *shelf at top of bank:*
  - [ ] *natural levee:*
  - [ ] *man-made berms or levees:*
  - [ ] *other berms:* _____
- [ ] **Channel bar:**
  - [ ] *shelving (berms) on bar:*
  - [ ] *unvegetated:*
  - [ ] *vegetation transition (go to veg. indicators)*
  - [ ] *sediment transition (go to sed. indicators)*
  - [ ] *upper limit of deposition on bar:*
- [ ] **Instream bedforms and other bedload transport evidence:**
  - [ ] *deposition bedload indicators (e.g., imbricated clasts, gravel sheets, etc.)*
  - [ ] *bedforms (e.g., pools, riffles, steps, etc.):*
- [ ] *erosional bedload indicators (e.g., obstacle marks, scour, smoothing, etc.)*
- [ ] **Secondary channels:**

Sediment indicators

- [ ] **Soil development:**
- [ ] **Changes in character of soil:**
- [ ] **Mudcracks:**
- [ ] **Changes in particle-sized distribution:**
  - [ ] *transition from* _____ to _____
  - [ ] *upper limit of sand-sized particles*
  - [ ] *silt deposits:*

Vegetation Indicators

- [x] **Change in vegetation type and/or density:** x

  Check the appropriate boxes and select the general vegetation change *(e.g., graminoids to woody shrubs).* ***Describe the vegetation transition looking from the middle of the channel, up the banks, and into the floodplain.***

  - [x] *vegetation absent to:* woody shrubs
  - [ ] *moss to:*
  - [ ] *forbs to:*
  - [ ] *graminoids to:*
  - [x] *woody shrubs to:* graminoids
  - [ ] *deciduous trees to:*
  - [ ] *coniferous trees to:*
- [ ] **Vegetation matted down and/or bent:**
- [ ] **Exposed roots below intact soil layer:**

Ancillary indicators

- [x] **Wracking/presence of organic litter:** x
- [ ] **Presence of large wood:**
- [ ] **Leaf litter disturbed or washed away:**
- [ ] **Water staining:**
- [ ] **Weathered clasts or bedrock:**

Other observed indicators? Describe:

Break in slope: on the bank: at MHW and HTL

Change in vegetation type and/or density: vegetation absent to: woody shrubs at MHW; woody shrubs to: graminoids at HTL

Wracking/presence of organic litter: at MHW and HTL

Project ID #: Hastings Tract Pipe

Step 4 Is additional information needed to support this determination? ☐ Yes ☒ No If yes, describe and attach information to datasheet:

Step 5 Describe rationale for location of OHWM

MHW - generally unvegetated below MHW; low cover of Schoenoplectus acutus transitioning at top of bank to Salix exigua, wracking throughout

HTL - HTL is at top of bank/break in slope with Salix exigua below and Bromus diandrus, Hordeum murinum above; upper extent of wracking

Additional observations or notes

Attach a photo log of the site. Use the table below, or attach separately.

Photo log attached? ☐ Yes ☒ No If no, explain why not: See Appendix D to Preliminary Wetland Delineation

List photographs and include descriptions in the table below.

Number photographs in the order that they are taken. Attach photographs and include annotations of features.

Photo Number	Photograph description

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 1 Site overview from remote and online resources **Complete Step 1 prior to site visit.**

Online Resources: Identify what information is available for the site. Check boxes on datasheet next to the resources used to assess this site.

a. gage data
b. aerial photos
c. satellite imagery
d. LiDAR
e. topographic maps
f. geologic maps
g. land use maps
h. climatic data (precipitation and temperature)

Landscape context: Use the online resources to put the site in the context of the surrounding landscape.

a. **Note on the datasheet under Step 1:**
   i. Overall land use and change if known
   ii. Recent extreme events if known (e.g., flood, drought, landslides, debris flows, wildfires)
b. Consider the following to inform weighting of evidence observed during field visit.
   i. What physical characteristics are likely to be observed in specific environments?
   ii. Was there a recent flood or drought? Are you expecting to see recently formed or obscured indicators?
   iii. How will land use affect specific stream characteristics? How natural is the hydrologic regime? How stable has the landscape been over the last year, decade, century?

Step 2 Site conditions during the field assessment (assemble evidence)

a. Identify the assessment area.
b. Walk up and down the assessment area noting all the potential OHWM indicators.
c. Note broad trends in channel shape, vegetation, and sediment characteristics.
   i. Is this a single thread or multi-thread system? Is this a stream-wetland complex?
   ii. Are there any secondary and/or floodplain channels?
   iii. Are there obvious man-made alterations to the system?
   iv. Are there man-made (e.g., bridges, dams, culverts) or natural structures (e.g., bedrock outcrops, Large Wood jams) that will influence or control flow?
d. Look for signs of recurring fluvial action.
   i. Where does the flow converge on the landscape?
   ii. Are there signs of fluvial action (sediment sorting, bedforms, etc.) at the convergence zone?
e. Look for indicators on both banks. If the opposite bank is not accessible, then look across the channel at the bank.
f. **In Step 2 of the datasheet** describe any adjacent land use or flow conditions that may influence interpretation of each line of evidence.
   i. What land use and flow conditions may be affecting your ability to observe indicators at the site?
   ii. What recent extreme events may have caused changes to the site and affected your ability to observe indicators?

Step 3a List evidence

Assemble evidence by checking the boxes next to each line of evidence:

a. If needed, use a separate scratch datasheet to check boxes next to possible indicators, or check boxes of possible indicators in pencil and use pen for final decision.
b. If using fillable form, then follow the instructions for filling in the fillable form.

Context is important when assembling evidence. For instance, pool development may be an indicator of interest on the bed of a dry stream, but may not be a useful indicator to take note of in a flowing stream. On the other hand, if the pool is found in a secondary channel adjacent to the main channel, it could provide a line of evidence for a minimum elevation of high flows. Therefore, consider the site context when deciding which indicators provide evidence for identifying the OHWM. Explain reasoning in Step 5.

Questions to consider while making observations and listing evidence at a site:

Geomorphic indicators	**Sediment and soil indicators**	**Vegetation Indicators**	**Ancillary indicators**
Where are the breaks in slope?	Where does evidence of soil formation appear?	Where are the significant transitions in vegetation species, density, and age?	Is there organic litter present?
Are there identifiable banks?		Is there vegetation growing on the channel bed?	
Is there an easily identifiable top of bank?	Are there mudcracks present?	If no, how long does it take for the non-tolerant vegetation to establish relative to how often flows occur in the channel?	Is there any leaf litter disturbed or washed away?
Are the banks actively eroding?			
Are the banks undercut?	Is there evidence of sediment sorting by grain size?	Where are the significant transitions in vegetation?	Is there large wood deposition?
Are the banks armored?			
Is the channel confined by the surrounding hillslopes?		Is the vegetation tolerant of flowing water?	Is there evidence of water staining?
Are there natural or man-made berms and levees?		Has any vegetation been flattened by flowing water?	
Are there fluvial terraces?			
Are there channel bars?			

Are the following features of fluvial transport present?

Evidence of erosion: obstacle marks, scour, armoring
Bedforms; riffles, pools, steps, knickpoints/headcuts
Evidence of deposition: imbricated clasts, gravel sheets, etc.

In some cases, it may be helpful to explain why an indicator was NOT at the OHWM elevation, but found above or below. It can also be useful to note if specific indicators (e.g., vegetation) are NOT present. For instance, note if the site has no clear vegetation zonation.

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 3b Weight each line of evidence and weigh body of evidence

Weight each indicator by considering its importance based upon:

***Landscape context from Step 1 can help determine the relevance, strength, and reliability of the indicators observed in the field.**

a. Relevance:

i. Is this indicator left by low, high, or extreme flows?

Tips on how to assess the indicator relative to type of flow:

Consider the elevation of the indicator relative to the channel bed. What is the current flow level based on season or nearby gages? Consider the elevation of the indicator relative to the current flow. If the stream is currently at baseflow and indicator is adjacent to that, then it is likely a low flow indicator. The difference between high and extreme flow indicators can sometimes be difficult to determine.

***Information in Chapter 2 of the OHWM field manual provides information on specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.**

ii. Did recent extreme events and/or land use affect this indicator?

1. Recent floods may have left many extreme flow indicators, or temporarily altered channel form. Other resources will likely be needed to support any OHWM identification at this site. Field evidence of the OHWM may have to wait for the site to recover from the recent flood.
2. Droughts may cause field evidence of OHWM to be obscured, because there has been an extended time since the last high flow event. There can be overgrowth of vegetation or deposition of material from surrounding landscape that can obscure indicators.
3. Both man-made (e.g., dams, construction, mining activities, urbanization, agriculture, grazing) and natural (e.g., fires, floods, debris flows, beaver dams) disturbances can all alter how indicators are expected to appear at a site. Chapter 6 and Chapter 7 of the OHWM field manual provides specific case-studies that can help in interpreting evidence at these sites.

b. Strength:

i. Is this indicator persistent across the landscape?

1. Look up and downstream and across the channel to see if you see the same indicator at multiple locations.
2. Does the indicator occur at the same elevation as other indicators?

c. Reliability:

i. Is this indicator persistent on the landscape over time? Will this indicator still persist across seasons?

1. This can be difficult to determine for some indicators and may be specific to climatic region (in terms of persistence of vegetation) and history of land use or other natural disturbances.
2. Chapter 2, Chapter 6, and Chapter 7 of the OHWM field manual describes each indicator in detail and provides examples of areas where indicators are difficult to interpret.

d. Weigh body of evidence:

i. Combine weights: integrate the weighted line of evidence (relevance, strength, reliability) of each indicator.

ii. For each of the observed indicators, which are more heavily weighted? Where do high value indicators co-occur along the stream reach? Do they co-occur at a similar elevation along the banks relative to water surface (or channel bed if there is no water).

iii. On datasheet, select the indicators used to identify the OHWM. Information in Chapter 2 of the OHWM field manual provides descriptions of specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.

e. Take photographs of indicators and attach a log using either page 2 of datasheet or another method of logging photos.

i. Annotate photos with descriptions of indicators.

Step 4 Is additional information needed? Are other resources needed to support the lines of evidence observed in the field?

a. If additional resources are needed, then repeat steps 3a and 3b for the resources selected in Step 1 of assembling, weighting, and weighing evidence collected from online resources. Chapter 5 of the OHWM field manual provides information on using online resources.

b. Any data collected from online tools have strengths and weaknesses. Make sure these are clear when determining relevance, strength, and reliability of the remotely collected data. Clearly describe why other resources were needed to support the lines of evidence observed in the field, as well as the relevance, strength, and reliability of the supporting data and/or resources.

c. Attach any remote data and data analysis to the datasheet.

Step 5 Describe rationale for location of OHWM:

a. Why do the combination of indicators represent the OHWM?

b. If there are multiple possibilities for the OHWM, explain why there are two (or more) possibilities. Include any relevant discussion on why specific indicators were not included in the final decision.

c. If needed, add additional site notes on page 2 of the datasheet under Step 5.

U.S. Army Corps of Engineers (USACE)

INTERIM DRAFT RAPID ORDINARY HIGH WATER MARK (OHWM) FIELD IDENTIFICATION DATA SHEET

The proponent agency is Headquarters USACE CECW-CO-R.

Form Approved -
OMB No. 0710-0025
Expires: 01-31-2025

AGENCY DISCLOSURE NOTICE

The public reporting burden for this collection of information, 0710-OHWM, is estimated to average 30 **minutes** per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

Project ID #: Hastings Tract Pipe	Site Name: Cache Slough - T5	Date and Time: 4/20/23 12:30pm
Location (lat/long): 38.29236, -121.74103	Investigator(s): KarleyRodriguez, EmilyApplequist,CarinaBilodeau	

Step 1 Site overview from remote and online resources

Check boxes for online resources used to evaluate site:

- [ ] gage data
- [ ] climatic data
- [x] aerial photos
- [ ] LiDAR
- [x] satellite imagery
- [x] topographic maps
- [ ] geologic maps
- [ ] land use maps
- [x] Other: NWI

Describe land use and flow conditions from online resources. Were there any recent extreme events (floods or drought)?

Delta - agriculture in area, recreational use (hunting), levees bound Lindsey slough on all sides (within Project Area). High flows in preceding winter

Step 2 Site conditions during field assessment. First look for changes in channel shape, depositional and erosional features, and changes in vegetation and sediment type, size, density, and distribution. Make note of natural or man-made disturbances that would affect flow and channel form, such as bridges, riprap, landslides, rockfalls etc.

Levees block most exchange from Cache Slough through Hastings Cut, apart from large pipes that allow controlled tidal influence

Step 3 Check the boxes next to the indicators used to identify the location of the OHWM.

OHWM is at a transition point, therefore some indicators that are used to determine location may be just below and above the OHWM. From the drop-down menu next to each indicator, select the appropriate location of the indicator by selecting either just below `b', at `x', or just above `a' the OHWM.

Go to page 2 to describe overall rationale for location of OHWM, write any additional observations, and to attach a photo log.

Geomorphic indicators

- [x] **Break in slope:**
  - [x] *on the bank:* x
  - [ ] *undercut bank:*
  - [ ] *valley bottom:*
  - [ ] Other: _____
- [ ] **Shelving:**
  - [ ] *shelf at top of bank:*
  - [ ] *natural levee:*
  - [ ] *man-made berms or levees:*
  - [ ] *other berms:* _____
- [ ] **Channel bar:**
  - [ ] *shelving (berms) on bar:*
  - [ ] *unvegetated:*
  - [ ] *vegetation transition (go to veg. indicators)*
  - [ ] *sediment transition (go to sed. indicators)*
  - [ ] *upper limit of deposition on bar:*
- [ ] **Instream bedforms and other bedload transport evidence:**
  - [ ] *deposition bedload indicators (e.g., imbricated clasts, gravel sheets, etc.)*
  - [ ] *bedforms (e.g., pools, riffles, steps, etc.):*
- [ ] *erosional bedload indicators (e.g., obstacle marks, scour, smoothing, etc.)*
- [ ] **Secondary channels:**

Sediment indicators

- [ ] **Soil development:**
- [ ] **Changes in character of soil:**
- [ ] **Mudcracks:**
- [ ] **Changes in particle-sized distribution:**
  - [ ] *transition from* _____ to _____
  - [ ] *upper limit of sand-sized particles*
  - [ ] *silt deposits:*

Vegetation Indicators

- [x] **Change in vegetation type and/or density:** x

  Check the appropriate boxes and select the general vegetation change *(e.g., graminoids to woody shrubs).* ***Describe the vegetation transition looking from the middle of the channel, up the banks, and into the floodplain.***

  - [ ] *vegetation absent to:*
  - [ ] *moss to:*
  - [x] *forbs to:* woody shrubs
  - [ ] *graminoids to:*
  - [x] *woody shrubs to:* graminoids
  - [ ] *deciduous trees to:*
  - [ ] *coniferous trees to:*
- [ ] **Vegetation matted down and/or bent:**
- [ ] **Exposed roots below intact soil layer:**

Ancillary indicators

- [x] **Wracking/presence of organic litter:** x
- [ ] **Presence of large wood:**
- [ ] **Leaf litter disturbed or washed away:**
- [ ] **Water staining:**
- [ ] **Weathered clasts or bedrock:**

Other observed indicators? Describe:

Break in slope: on the bank: at HTL

Change in vegetation type and/or density: forbs to: woody shrubs at MHW; woody shrubs to: graminoids + woody shrubs at HTL

Wracking/presence of organic litter: at MHW and HTL

Project ID #: Hastings Tract Pipe

Step 4 Is additional information needed to support this determination? ☐ Yes ☒ No If yes, describe and attach information to datasheet:

Step 5 Describe rationale for location of OHWM

MHW - at transition from Schoenoplectus californica to Salix exigua, ground saturated at time of data collection, wracking present, no significant change in slope

HTL - within Salix exigua, grasses (Bromus diandrus, Cynodon dactylon) start at HTL, wracking below HTL, slight break in slope but not strong indicator

Additional observations or notes

Attach a photo log of the site. Use the table below, or attach separately.

Photo log attached? ☐ Yes ☒ No If no, explain why not: See Attachment D to Preliminary Wetland Delineation

List photographs and include descriptions in the table below.

Number photographs in the order that they are taken. Attach photographs and include annotations of features.

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a. **Note on the datasheet under Step 1:**
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Step 2 Site conditions during the field assessment (assemble evidence)

a. Identify the assessment area.
b. Walk up and down the assessment area noting all the potential OHWM indicators.
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   i. Is this a single thread or multi-thread system? Is this a stream-wetland complex?
   ii. Are there any secondary and/or floodplain channels?
   iii. Are there obvious man-made alterations to the system?
   iv. Are there man-made (e.g., bridges, dams, culverts) or natural structures (e.g., bedrock outcrops, Large Wood jams) that will influence or control flow?
d. Look for signs of recurring fluvial action.
   i. Where does the flow converge on the landscape?
   ii. Are there signs of fluvial action (sediment sorting, bedforms, etc.) at the convergence zone?
e. Look for indicators on both banks. If the opposite bank is not accessible, then look across the channel at the bank.
f. **In Step 2 of the datasheet** describe any adjacent land use or flow conditions that may influence interpretation of each line of evidence.
   i. What land use and flow conditions may be affecting your ability to observe indicators at the site?
   ii. What recent extreme events may have caused changes to the site and affected your ability to observe indicators?

Step 3a List evidence

Assemble evidence by checking the boxes next to each line of evidence:

a. If needed, use a separate scratch datasheet to check boxes next to possible indicators, or check boxes of possible indicators in pencil and use pen for final decision.
b. If using fillable form, then follow the instructions for filling in the fillable form.

Context is important when assembling evidence. For instance, pool development may be an indicator of interest on the bed of a dry stream, but may not be a useful indicator to take note of in a flowing stream. On the other hand, if the pool is found in a secondary channel adjacent to the main channel, it could provide a line of evidence for a minimum elevation of high flows. Therefore, consider the site context when deciding which indicators provide evidence for identifying the OHWM. Explain reasoning in Step 5.

Questions to consider while making observations and listing evidence at a site:

Geomorphic indicators	**Sediment and soil indicators**	**Vegetation Indicators**	**Ancillary indicators**
Where are the breaks in slope?	Where does evidence of soil formation appear?	Where are the significant transitions in vegetation species, density, and age?	Is there organic litter present?
Are there identifiable banks?		Is there vegetation growing on the channel bed?	
Is there an easily identifiable top of bank?	Are there mudcracks present?	If no, how long does it take for the non-tolerant vegetation to establish relative to how often flows occur in the channel?	Is there any leaf litter disturbed or washed away?
Are the banks actively eroding?			
Are the banks undercut?	Is there evidence of sediment sorting by grain size?	Where are the significant transitions in vegetation?	Is there large wood deposition?
Are the banks armored?			
Is the channel confined by the surrounding hillslopes?		Is the vegetation tolerant of flowing water?	Is there evidence of water staining?
Are there natural or man-made berms and levees?		Has any vegetation been flattened by flowing water?	
Are there fluvial terraces?			
Are there channel bars?			

Are the following features of fluvial transport present?

Evidence of erosion: obstacle marks, scour, armoring
Bedforms; riffles, pools, steps, knickpoints/headcuts
Evidence of deposition: imbricated clasts, gravel sheets, etc.

In some cases, it may be helpful to explain why an indicator was NOT at the OHWM elevation, but found above or below. It can also be useful to note if specific indicators (e.g., vegetation) are NOT present. For instance, note if the site has no clear vegetation zonation.

OHWM Field Identification Datasheet Instructions and Field Procedure

Step 3b Weight each line of evidence and weigh body of evidence

Weight each indicator by considering its importance based upon:

***Landscape context from Step 1 can help determine the relevance, strength, and reliability of the indicators observed in the field.**

a. Relevance:

i. Is this indicator left by low, high, or extreme flows?

Tips on how to assess the indicator relative to type of flow:

Consider the elevation of the indicator relative to the channel bed. What is the current flow level based on season or nearby gages? Consider the elevation of the indicator relative to the current flow. If the stream is currently at baseflow and indicator is adjacent to that, then it is likely a low flow indicator. The difference between high and extreme flow indicators can sometimes be difficult to determine.

***Information in Chapter 2 of the OHWM field manual provides information on specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.**

ii. Did recent extreme events and/or land use affect this indicator?

1. Recent floods may have left many extreme flow indicators, or temporarily altered channel form. Other resources will likely be needed to support any OHWM identification at this site. Field evidence of the OHWM may have to wait for the site to recover from the recent flood.
2. Droughts may cause field evidence of OHWM to be obscured, because there has been an extended time since the last high flow event. There can be overgrowth of vegetation or deposition of material from surrounding landscape that can obscure indicators.
3. Both man-made (e.g., dams, construction, mining activities, urbanization, agriculture, grazing) and natural (e.g., fires, floods, debris flows, beaver dams) disturbances can all alter how indicators are expected to appear at a site. Chapter 6 and Chapter 7 of the OHWM field manual provides specific case-studies that can help in interpreting evidence at these sites.

b. Strength:

i. Is this indicator persistent across the landscape?

1. Look up and downstream and across the channel to see if you see the same indicator at multiple locations.
2. Does the indicator occur at the same elevation as other indicators?

c. Reliability:

i. Is this indicator persistent on the landscape over time? Will this indicator still persist across seasons?

1. This can be difficult to determine for some indicators and may be specific to climatic region (in terms of persistence of vegetation) and history of land use or other natural disturbances.
2. Chapter 2, Chapter 6, and Chapter 7 of the OHWM field manual describes each indicator in detail and provides examples of areas where indicators are difficult to interpret.

d. Weigh body of evidence:

i. Combine weights: integrate the weighted line of evidence (relevance, strength, reliability) of each indicator.

ii. For each of the observed indicators, which are more heavily weighted? Where do high value indicators co-occur along the stream reach? Do they co-occur at a similar elevation along the banks relative to water surface (or channel bed if there is no water).

iii. On datasheet, select the indicators used to identify the OHWM. Information in Chapter 2 of the OHWM field manual provides descriptions of specific indicators which can assist in putting these in context and determining relevance, strength, and reliability.

e. Take photographs of indicators and attach a log using either page 2 of datasheet or another method of logging photos.

i. Annotate photos with descriptions of indicators.

Step 4 Is additional information needed? Are other resources needed to support the lines of evidence observed in the field?

a. If additional resources are needed, then repeat steps 3a and 3b for the resources selected in Step 1 of assembling, weighting, and weighing evidence collected from online resources. Chapter 5 of the OHWM field manual provides information on using online resources.

b. Any data collected from online tools have strengths and weaknesses. Make sure these are clear when determining relevance, strength, and reliability of the remotely collected data. Clearly describe why other resources were needed to support the lines of evidence observed in the field, as well as the relevance, strength, and reliability of the supporting data and/or resources.

c. Attach any remote data and data analysis to the datasheet.

Step 5 Describe rationale for location of OHWM:

a. Why do the combination of indicators represent the OHWM?

b. If there are multiple possibilities for the OHWM, explain why there are two (or more) possibilities. Include any relevant discussion on why specific indicators were not included in the final decision.

c. If needed, add additional site notes on page 2 of the datasheet under Step 5.

Appendix D

Representative Photographs

Photo E-1. Transect 1 at MHW (red) and HTL (blue) on Lindsey Slough facing west. HTL indicators include change in vegetation type and presence of organic litter. MHW indicators include change in vegetation type and break in slope.

Photo E-2. Transect 1 upslope of HTL (blue) on Lindsey Slough facing south.

Photo E-3. Transect 2 at HTL (blue) on Lindsey Slough facing southeast. HTL indicators include a change in vegetation type and presence of organic litter.

Photo E-4. Transect 3 at HTL (blue) on Hastings Cut facing north. HTL indicators include change in vegetation type and presence of organic litter.

Photo E-5. Transect 3 at MHW (red) on Hastings Cut facing south. MHW indicators include change in vegetation type and break in slope.

Photo E-6. Transect 4 at MHW (red) on Hastings Cut facing west. MHW indicators change in vegetation density and wracking.

Photo E-7. Transect 4 at HTL (blue) on Hastings Cut facing southeast. HTL indicators include break in slope, change in vegetation type, and presence of organic litter.

Photo E-8. Transect 5 upslope of HTL (blue) on Cache Slough facing northeast. HTL indicators include change in vegetation type, presence of organic litter, and a moderate break in slope.

Photo E-9. Transect 5 at MHW (red) on Cache Slough facing north. MHW indicators include change in vegetation type, presence of organic litter, and soil saturation.