DRAFT
INITIAL STUDY AND
MITIGATED NEGATIVE DECLARATION
SHERMAN ISLAND Belly WETLAND RESTORATION PROJECT

Reclamation District 341
Sacramento County, CA
February 20, 2019

Draft Mitigated Negative

Declaration for the

Sherman Island Belly Wetland Restoration Project

Sherman Island, CA

Project Description: The Sherman Island Belly Wetland Restoration Project (Project) will restore approximately 1000 acres of palustrine emergent wetlands within a 1936-acre Project boundary. This project will be constructed on (entirely or a portion of) 14 parcels totaling nearly 2,840-acres, all of which are owned by the California Department of Water Resources. The property is currently managed for flood irrigated pasture or row crops, which includes a regular and extensive disturbance regime associated with field prepping, disking, and grazing.

Approximately 1,200,000 cubic yards of material will be redistributed within the site, which is necessary to sculpt the swales and to create berms for this wetland habitat area. Approximately 35 water control structures will be installed. The interior of the site will be divided up into as many as 12 managed wetland units separated by approximately 75,000 lineal feet of proposed interior berms, and crossed with conveyance swales, in order to facilitate appropriate water and vegetation management capabilities. Water levels in each unit will be managed independently to create and maintain the desired emergent wetland conditions throughout the site. When the Project is completed, water is proposed to be maintained on the Project Site year-round, effectively creating a permanent wetland.

Post construction operation of the site will include water delivery via the existing gravity siphons along the San Joaquin River Levee as well as water control structures on the Sherman Island Overland Water Delivery Canal. Fish screens are installed on existing gravity siphons to be utilized for the project as well as siphons that supply water to the Sherman Island Overland Water Delivery Canal. Water will be conveyed within the wetland system via gravity flow from the higher elevation units to the lower elevation units until it is discharged from the site into the existing drainage canal that flows to the south.

Pending permit approvals, construction will begin in May 2019. Initial site preparation includes vegetation removal prior to earth moving activities. Construction will stop by 15 October 2019. Work will commence again in May 2020 and will be completed by October 15. If work is not completed in 2020, it will commence again in May 2021. Work will be scheduled to accommodate approved giant garter snake work windows. Earth moving activities will be performed by a licensed contractor, utilizing agricultural scrapers and excavators to construct the site's interior and perimeter berms, loafing islands, swales and potholes, while an excavator and/or backhoe will be used to construct conveyance ditches and install necessary piping.

The ultimate outcome of the Project will result in approximately 1,000 additional acres of freshwater emergent wetlands being constructed. Each wetland unit will be a mosaic of open water channels and emergent vegetation comprised predominantly of California bulrush (*Schoenoplectus californicus*) and narrow leaved cattails (*Typha angustifolia*). Other native plant restoration components may include installation of native trees and shrubs compatible with their respective hydrologic regime as well as upland transitional habitat area, all of which will provide a diversity of habitat structure and function.

Project Location: The approximately 1936-acre Project is located on Sherman Island, Assessor's Parcel Numbers:

158-0070-018-0000 (this parcel comprising a total of 56 acres),
158-0070-017-0000 (this parcel comprising a total of 60 acres),
158-0070-047-0000 (this parcel comprising a total of 254 acres),
158-0070-051-0000 (this parcel comprising a total of 211 acres),
158-0070-004-0000 (this parcel comprising a total of 126 acres),
158-0070-061-0000 (this parcel comprising a total of 72 acres),

158-0070-006-0000 (this parcel comprising a total of 121 acres),
158-0070-043-0000 (this parcel comprising a total of 6 acres),
158-0030-013-0000 (this parcel comprising a total of 165 acres),
158-0030-003-0000 (this parcel comprising a total of 338 acres),
158-0030-007-0000 (this parcel comprising a total of less than 1 acres),
158-0030-005-0000 (this parcel comprising a total of 411 acres),
158-0030-014-0000 (this parcel comprising a total of 158 acres),
158-0020-034-0000 (this parcel comprising a total of 858 acres),

These parcels are located in southwest Sacramento County, CA and are shown on the Jersey Island, CA USGS topographic quadrangle. This un-sectionalized portion of Sherman Island would be considered to be generally located within Sections 1, 2, 3, and 10, Township 2N Range 2E and Sections 25, 26, 35 and 36, Township 3N Range 2E.

The Project is located approximately 8 miles south-southwest of the City of Rio Vista, northwest of the city of Antioch, and east of Highway 160. The approximate center of the site is located at Latitude 38° 2' 54"N, Longitude 121° 43' 29"W.

Project Proponent: Reclamation District 341 c/o Gallery & Barton, 1112 I Street, Suite 240, Sacramento, CA 95814; Contact: Mr. Jesse Barton, (916) 444-2880.

Proposed Finding and Basis: Although the proposed Project could have a significant effect on the environment, there will not be a significant effect in this case because the District (RD 341) has agreed to reduce those effects by incorporating mitigation measures into the Project. The mitigation measures are set forth in Appendix E to this document.

Authority and Points of Contact: This document reflects the independent judgment of Reclamation District 341. This Mitigated Negative Declaration is filed pursuant to Section 15072 of the Guidelines for Implementation of the California Environmental Quality Act. The Initial Study and other project information are available for review by calling Mr. Jesse Barton at (916) 444-2880.

Review of Mandatory Findings of Significance:

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

Determination: On the basis of this Initial Study, I find that the proposed Project will not have a significant effect on the environment, and that this Mitigated Negative Declaration has been drafted in accordance with the California Environmental Quality Act.

Date: 2/20, 2019

Juan Mercado, Jr., President
Reclamation District 341

Reclamation District 341
Sherman Island
P.O. Box 140
Isleton, CA 95641

February 20, 2019

NOTICE OF INTENT TO ADOPT A MITIGATED NEGATIVE DECLARATION ON THE ENVIRONMENTAL IMPACT FOR THE SHERMAN ISLAND BELLY WETLAND RESTORATION PROJECT

Notice is hereby given that at a meeting scheduled for April 9, 2019, the Board of Trustees of Reclamation District 341 will consider the approval and adoption of a Mitigated Negative Declaration on the environmental impacts of the project entitled "Sherman Island Belly Wetland Restoration Project."

Project Description: The Sherman Island Belly Wetland Restoration Project (Project) will restore approximately 1000 acres of palustrine emergent wetlands within a 1936-acre Project boundary. This project will be constructed on (entirely or a portion of) 14 parcels totaling nearly 2,840-acres, all of which are owned by the California Department of Water Resources. The property is currently managed for flood irrigated pasture or row crops, which includes a regular and extensive disturbance regime associated with field prepping, disking, and grazing.

Pending permit approvals, construction will begin in 2019 and continue until 2021.

Project Location: The Project is located approximately 8 miles south-southwest of the City of Rio Vista, northwest of the city of Antioch, and east of Highway 160. The approximate center of the site is located at Latitude 38° 2' 54"N, Longitude 121° 43' 29"W.

Hazardous Waste Lists: No known hazardous waste sites exist in the project area.

Public Review and Time for Comment: The proposed Mitigated Negative Declaration and Initial Study are available for public review and comment until 5:00 PM on March 27, 2019. Comments received after this time will not be accepted. At the above scheduled meeting, the Board of Trustees will consider the public comments and will decide whether to adopt a Board resolution approving the proposed Mitigated Negative Declaration. Copies of the Initial Study/Mitigated Negative Declaration and all supporting information are available for review at the District's attorney's office during normal business hours; in addition, submit all comments to the following address:

Reclamation District 341
c/o Gallery & Barton
1112 I Street, Suite 240
Sacramento, CA 95814
Contact: Mr. Jesse Barton, (916) 444-2880.

Juan Mercado, President, Reclamation District 341

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH #

Project Title: Sherman Island Belly Wetland Restoration Project

Lead Agency: Reclamation District 341 | Contact Person: Jesse W. Barton
Mailing Address: 1112 I Street, Suite 240 | Phone: (916) 444-2880
City: Sacramento | Zip: 95814 | County: Sacramento

Project Location: County: Sacramento | City/Nearest Community: Antioch
Cross Streets: Sherman Island Crossing Road & Highway 160 | Zip Code: 94571
Longitude/Latitude (degrees, minutes and seconds): 38 ° 2 ' 54 " N / 121 ° 43 ' 29 " W | Total Acres: 1,936
Assessor's Parcel No.: 158-0070-018-0000 and others | Section: 1,2,3,10 | Twp.: 2N | Range: 2E | Base: MDBM
Within 2 Miles: State Hwy #: 160 | Waterways: Sacramento River
Airports: none | Railways: none | Schools: none

Document Type:

CEQA: ☐ NOP ☐ Early Cons ☐ Neg Dec ☒ Mit Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ☐ Other:
NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI
Other: ☐ Joint Document ☐ Final Document ☐ Other:

Local Action Type:

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☒ Other: Habitat Restora

Development Type:

☐ Residential: Units ____ Acres ____
☐ Office: Sq.ft. ____ Acres ____ Employees ____
☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
☐ Educational:
☐ Recreational:
☐ Water Facilities: Type ____ MGD ____
☐ Transportation: Type
☐ Mining: Mineral
☐ Power: Type ____ MW
☐ Waste Treatment: Type ____ MGD
☐ Hazardous Waste: Type
☒ Other: Habitat Restoration

Project Issues Discussed in Document:

☐ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☒ Biological Resources
☐ Coastal Zone
☐ Drainage/Absorption
☐ Economic/Jobs
☐ Fiscal
☐ Flood Plain/Flooding
☐ Forest Land/Fire Hazard
☒ Geologic/Seismic
☒ Minerals
☐ Noise
☐ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☐ Schools/Universities
☐ Septic Systems
☐ Sewer Capacity
☐ Soil Erosion/Compaction/Grading
☐ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☐ Vegetation
☒ Water Quality
☐ Water Supply/Groundwater
☐ Wetland/Riparian
☐ Growth Inducement
☒ Land Use
☐ Cumulative Effects
☐ Other:

Present Land Use/Zoning/General Plan Designation:

AG-80

Project Description: *(please use a separate page if necessary)*

This project comprises a total of 1,936 acres in which a total of 1000 acres of palustrine wetlands will be restored through a combination of reestablishment and rehabilitation. The underlying purpose of the project will be to stop or reverse subsidence, create habitat, and sequester atmospheric carbon. By maintaining permanent and adequate water levels, the growth and subsequent decomposition of emergent vegetation is expected to grow peat, which will raise surface elevations on the property. The project is expected to provide year-round wetland habitat for waterfowl and other wildlife. The project is also anticipated to provide climate benefits by sequestering atmospheric carbon that will help provide a net reduction in greenhouse gases.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Revised 2010

Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

____ Air Resources Board	____ Office of Historic Preservation
____ Boating & Waterways, Department of	____ Office of Public School Construction
____ California Emergency Management Agency	____ Parks & Recreation, Department of
____ California Highway Patrol	____ Pesticide Regulation, Department of
____ Caltrans District # ____	____ Public Utilities Commission
____ Caltrans Division of Aeronautics	____ Regional WQCB # ____
____ Caltrans Planning	____ Resources Agency
____ Central Valley Flood Protection Board	____ Resources Recycling and Recovery, Department of
____ Coachella Valley Mtns. Conservancy	____ S.F. Bay Conservation & Development Comm.
____ Coastal Commission	____ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
____ Colorado River Board	____ San Joaquin River Conservancy
____ Conservation, Department of	____ Santa Monica Mtns. Conservancy
____ Corrections, Department of	____ State Lands Commission
X Delta Protection Commission	____ SWRCB: Clean Water Grants
____ Education, Department of	X SWRCB: Water Quality
____ Energy Commission	____ SWRCB: Water Rights
X Fish & Game Region # ____	____ Tahoe Regional Planning Agency
____ Food & Agriculture, Department of	____ Toxic Substances Control, Department of
____ Forestry and Fire Protection, Department of	____ Water Resources, Department of
____ General Services, Department of	
____ Health Services, Department of	____ Other: ____
____ Housing & Community Development	____ Other: ____
X Native American Heritage Commission	

Local Public Review Period (to be filled in by lead agency)

Starting Date ____ Ending Date ____

Lead Agency (Complete if applicable):

Consulting Firm: ____
Address: ____
City/State/Zip: ____
Contact: ____
Phone: ____

Applicant: ____
Address: ____
City/State/Zip: ____
Phone: ____

Signature of Lead Agency Representative: ____ **Date:** 2/20/19

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

Initial

Study for

the

Sherman Island Belly Wetland Restoration Project

Sherman Island, CA

1. **Project title:**
   Sherman Island Belly Wetland Restoration Project

2. **Lead agency name and address:**
   Reclamation District
   341 c/o Gallery &
   Barton
   1112 I Street, Suite
   240
   Sacramento, CA 95814

3. **Contact person and phone number:**
   Gallery & Barton
   1112 I Street, Suite 240
   Sacramento, CA 95814
   Phone: 916/ 444-2880
   Contact: Mr. Jesse Barton

4. **Project location:**
   The approximately 1936-acre Sherman Island Belly Wetland Restoration Project (Project) is located on Sherman Island. The Project will be constructed on all or a portion of the following parcels:
   158-0070-018-0000 (this parcel comprising a total of 56 acres),
   158-0070-017-0000 (this parcel comprising a total of 60 acres),
   158-0070-047-0000 (this parcel comprising a total of 254 acres),
   158-0070-051-0000 (this parcel comprising a total of 211 acres),
   158-0070-004-0000 (this parcel comprising a total of 126 acres),
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   158-0030-007-0000 (this parcel comprising a total of less than 1 acres),
   158-0030-005-0000 (this parcel comprising a total of 411 acres),
   158-0030-014-0000 (this parcel comprising a total of 158 acres),
   158-0020-034-0000 (this parcel comprising a total of 858 acres),
   Sacramento County, CA and is shown on the Jersey Island, CA USGS topographic quadrangle. This un-sectionalized portion of Sherman Island would be considered to be generally located within Sections 1, 2, 3, and 10, Township 2N Range 2E and Sections 25, 26, 35 and 36, Township 3N Range 2E. The Project is located approximately 8 miles south-southwest of the City of Rio Vista, 5 miles northwest of the city of Antioch, and 2 miles east of Highway 160. The approximate center of

the site is located at Latitude 38° 2' 54"N, Longitude 121° 43' 29"W.

5. **Project sponsor's name and address:**
   Reclamation District
   341 c/o Gallery &
   Barton 1112 I Street,
   Suite 240
   Sacramento, CA 95814

6. **General plan designation:**
   Agricultural Cropland

7. **Zoning:**
   AG-80 (F). Agricultural with a minimum lot area requirement of 80 acres. The Project Site is located within a floodplain combining zone.

8. **Description of the Project:**

Purpose

The ultimate purpose of the Project is to restore approximately 1000 acres of permanent palustrine emergent wetlands and upland habitat within a 1936-acre Project boundary through a combination of reestablishment and rehabilitation. The intent of the Project is to stop or reverse subsidence, provide native habitat for a diversity of wildlife, and sequester atmospheric carbon. By maintaining permanent and adequate water levels, the growth and subsequent decomposition of emergent vegetation is expected to grow peat which will raise surface elevations on the property. The Project is expected to provide year- round wetland and upland habitat for waterfowl and other wildlife.

The Project will provide climate benefits by sequestering atmospheric carbon dioxide (CO_2) that will help provide a net reduction in greenhouse gases (GHGs). Pending the availability of funding, the Project Site will provide an opportunity for researchers to use on-site monitoring and data from applied research sites on Sherman and Twitchell Islands to quantify climate benefits. GHG reductions quantified for the site's permanent water management regime have the potential to be extrapolated to other similar sites throughout the Delta.

Background

The Project Site is located on Sherman Island in southwest Sacramento County, owned by the Department of Water Resources (DWR). Sherman Island is protected by approximately 18-miles of levee which encompass approximately 9,937 acres of land, according to the 1995 Sacramento Delta San Joaquin Atlas. Approximately nine miles of levee are project levee, constructed by the US Army Corps of Engineers, and approximately nine miles of levee are non-project levee. The entire levee system is maintained by RD 341. The Project Site is owned by DWR. Historically, the project area was a marsh that was diked off from the Sacramento River and drained between 1850 and 1873 to facilitate agriculture. As a result of more than 130 years of farming practices, irrigation, and exposure of soils to air, the Island has subsided as much as 16 ft. A high water table currently makes the Project Site unsustainable for long-term agriculture.

Before the Delta was diked, drained, and farmed, it was subject to significant seasonal fluctuations in freshwater inflows, which worked in concert with large tidal ranges. Natural levees were formed by sediments deposited during spring floods and stabilized by vegetation. Dominant vegetation within the natural levees included tules - marsh plants that live in fresh and brackish water. Decomposing tules and reed vegetation formed the peat soils over thousands of years. In waterlogged conditions, decaying

tules decompose slowly to release carbon dioxide and methane, which is trapped in the soils by water. Once the soil was diked and then dried, the peat soils decompose, which leads to microbial digestion and oxidation of the Carbon in the soil and ultimately subsidence.

Subsidence has reduced the distance from the soil surface to the water table. The resulting high water table makes the Site mostly unsustainable for crop production, although portions of the Site are currently used for corn and safflower production and pasture. Ongoing research over the past several decades shows that restoring wetlands will mitigate the impacts of subsidence, greenhouse gas emissions, and provide excellent habitat for native species.

Project Description

The Project focuses on the restoration of palustrine emergent wetlands, complemented with upland and grassland plantings to add diversity of structure and habitat to the site. Restoration of wetlands will be accomplished by upgrading existing water management infrastructure and installing new infrastructure such as water control structures and water conveyance channels. In addition, the Project may create habitat loafing islands. When the Project is completed, water will be maintained on the Project Site year-round, effectively creating a permanent wetland. Restoring permanent wetlands on Delta islands has been shown to halt and reverse subsidence. This Project will combine the wildlife benefits of wetland restoration with the importance of reversing Delta island subsidence. Upland vegetation may be planted at higher elevation areas adjacent to the wetlands. Pending permit approval, site preparation will begin in May 2019. Construction activities in 2019, will be completed by October 15. Work will commence again in May 2020, and will be completed by October 15. If work is not completed in 2020, it will commence again in May 2021. All work will be performed on-site.

Planned Construction

During construction of the Project, perimeter ditches, perimeter berms, interior berms, interior water conveyance swales, habitat islands, and water control structures will be installed or improved or constructed. It is anticipated that the Project will excavate approximately 1,200,000 cubic yards from various locations within the Project site and relocate that material in different areas to build the necessary project features. No material will be imported or exported and a cut/fill balance will be achieved. Details of planned improvements to water management infrastructure and construction of additional infrastructure required to manage the Project as emergent wetlands are described below.

New perimeter and interior berms up to 6-feet high and 16-feet wide will be constructed and utilized to separate management units to allow for water levels to be maintained at the optimal management elevation. The existing elevation of the Project site ranges from approximately 14 feet above sea level to 20 feet below sea level. The berms will have at least 3 ft of freeboard and a 12-ft or 16-ft top width. The 16-ft wide berms will be utilized as haul roads, providing access to the site for future maintenance purposes. Berm height above existing ground will vary depending on existing topography. Materials to create the perimeter berm will be obtained onsite from the creation of swales and other open water areas. Development of perimeter and interior berms will allow water levels to be increased to restore and maintain permanently flooded emergent wetlands onsite. The top of the improved perimeter berm elevations will vary; however, the typical height will be approximately 9-14 ft below sea level.

Approximately 35 water control structures will be installed. The interior of the site will be divided into 12 managed wetland units, separated by approximately 75,000 lineal feet of proposed berms, and crossed with conveyance swales, in order to facilitate appropriate water and vegetation management capabilities. Water levels in each unit will be managed independently to restore the desired emergent wetland conditions throughout the site. When the Project is completed, water is proposed to be maintained in the project area year-round, effectively creating a permanent wetland.

Water will be conveyed within the wetland units and through the managed system via gravity flow from the higher elevation units to the lower elevation units. The water level in the wetland units can be

lowered, or removed to provide better circulation, through an outlet water control structure that drains to the Sherman Island drainage canal pump station south of the project boundary. The ultimate outcome of the Project will be approximately 1,000 acres of freshwater emergent wetlands. Each wetland unit will be a mosaic of open water, swales and emergent vegetation comprised predominantly of species such as California bulrush (*Schoenoplectus californicus*) and narrow leaved cattails (*Typha angustifolia*).

Interior water conveyance swales will be excavated in the wetland management units to provide water delivery and circulation to desired areas of the Project. The conveyance swales will provide numerous wetland and wildlife benefits to the project area. Material excavated to construct the swales will provide material for the interior and perimeter berms. Construction of conveyance swales will convert existing wetland and upland areas into permanent open water that will facilitate water conveyance.

The swales will be managed to encourage the growth of submerged aquatic and floating wetland vegetation and discourage the growth of invasive species. Open water areas will provide waterfowl with areas to land, loaf, and feed. It is anticipated that the presence of permanent open water will increase the amount of waterfowl breeding and brood rearing in the Project site.

Conveyance swales will have an approximately 30-ft wide bottom with gradual 5:1 side slopes. Most of the existing agricultural drainage ditches on Sherman Island have rectangular configurations. These existing drainage ditches will be regraded to provide a more gradual side slope. A gradual swale side slope will allow for easy wildlife movement across the ditches and swales while reducing swale erosion by encouraging vegetation growth along the swale's edges. Depth of swale excavation will vary depending on existing topography, however swales are generally designed to a depth of 2.5 feet below existing ground surface.

In addition to the swales, larger open water areas will also be created through excavation. These larger open water areas will be connected to the conveyance swales and are similarly designed to a typical depth of 2.5 feet below existing ground surface. The large open water areas will serve as waterfowl brood rearing areas in the spring and loafing/storm-shelter locations in the winter. Material borrowed from these areas will be incorporated into the interior and perimeter berms or used to construct habitat islands.

As part of creating varying topography and diverse emergent wetland vegetation communities within the project area, habitat islands will be established in multiple locations. Habitat islands will vary in size and shape. The subtle change in micro-topography as a result of the habitat islands will create habitat diversity and greater hydro-geomorphic interspersion.

The water source to the 10 wetland units east of Sherman Island Crossing Road will be delivered by four existing gravity siphons along the San Joaquin River Levee and five newly installed water control structures from the Overland Water Delivery Canal. At this time, it is anticipated that siphons 13, 15, 19 and 20 will be utilized as the primary source of water to the southern edge of these units. Each of these siphons are constructed of 12-inch diameter pipe that is reportedly capable of providing approximately 2,500 gallons per minute. All of these siphons currently have operational fish screens to ensure fish are not entrained within the newly constructed wetland.

It is anticipated that newly installed water control structures 25, 26, 35, 43, and 44 will be utilized as the primary source of water to the northern edge of these units. The water control structures will each include a 12-inch polyvinyl chloride (PVC) pipe that will draw water from the Overland Water Delivery Canal and convey it via gravity flow to the newly constructed wetland units. The Canal is fed by 3 existing siphons on the Sacramento River Northwest of the project site adjacent to Decker Island. All siphons feeding this Canal have operating fish screens, as well.

Water to the 2 wetland units west of Sherman Island Crossing Road will be delivered by one existing gravity siphon along the San Joaquin River Levee. At this time, it is anticipated that siphon 21 will be utilized as the primary source of water to the southern edge of these units. Siphon 21 is constructed of a 12-inch diameter pipe that is reportedly capable of providing approximately 2,500 gallons per minute. This siphon also has an operating fish screen.

Water will be conveyed within the wetland system via gravity flow from the higher elevation units to the lower elevation units until it finally makes its way back to the District's pump station along the southern boundary of the Project.

Improvements to the outlet of the functional siphons may include replacing outlet valves and installing additional appurtenances as needed to improve the control of the water supply to the Project. All siphon improvements will take place on the interior (land) side of the San Joaquin River levee. All siphons utilized are equipped with water meters as well as previously stated fish screens. Water delivered to the site will circulate through the system to maintain appropriate water quality conditions and prevent stagnation and maintain appropriate salinity levels.

Several existing agricultural drainage ditches occur within the interior and exterior of the Project. These ditches connect to the master drainage system of the southeastern portion of Sherman Island. The drainage ditches within the proposed project boundaries will be incorporated into the internal water conveyance system (swale system). A ditch along the exterior perimeter of the restoration area, north of the existing Main Drain, will be constructed to provide drainage from the surrounding landscape and will include proper drainage for the District's toe ditches. This ditch will have a 4-foot bottom and 2:1 side slopes. A ditch along the exterior of the restoration area, south of the existing Main Drain, will be constructed as a realignment of the Main Drain. This ditch will have a 12 -foot bottom and 2:1 side slopes.

An area along the southern edge of the Project site will likely be utilized as a borrow area during construction. High points within this borrow area will be graded and excavated material will be used to complete construction of the berms and habitat islands, if necessary. This area will be outside of the exterior berm of the wetland units. Following project completion, the borrow area is currently proposed to be used as open pasture or for agricultural crop production.

Construction Schedule and Methods

Construction activities will be performed during the dry season between May 1st and October 15th in 2019 depending on permit acquisitions and if necessary between May 1st and October 15th, during subsequent years. Earth moving activities will be performed by a licensed contractor and will likely use agricultural scrapers to transport soils during the excavation of swales and open water areas to construct the Project's interior and perimeter berms as well as habitat islands. Excavators will likely be used to create ditches and install piping.

Delta islands have extensive peat soils that retain groundwater. A field investigation during the height of the irrigation season revealed an elevated water table and saturated soils throughout the Project. This was largely due to extensive flood irrigation activities in the pasture fields and high water in the perimeter ditches. Construction will likely require the water table be lowered as much as possible. Initial site preparation includes the dewatering of ditches in order to dry soils for construction, where feasible. This will be accomplished by verifying that the interior agricultural ditches are clean and flowing freely to the District's drainage canal. The District's discharge pump located near the site may also need to be adjusted to keep the water level in the main drainage ditch lower than normal.

Proposed work within the Overland Water Delivery Canal includes the installation of five water control structures within the channel and the removal of eight. Conditions and/or biological resources may require the work areas are dried out and as such, coffer dams may need to be constructed within the canal adjacent to the work areas to isolate these areas from flowing or standing water.

Up to ten temporary coffer dams may be constructed, one upstream and one downstream of each of the five proposed water control structure locations within the Overland Water Delivery Canal. Each temporary coffer dam will temporarily fill approximately 0.04 acres of ditch. Each will be approximately 50 feet wide and require approximately 200 cubic yards of material. Both upstream and downstream coffer dams will be removed after construction of the water control structures is completed. The material used to construct the coffer dams will be sourced from onsite and ultimately used to construct Project features after removal.

Initial site preparation for the Project will include the removal of vegetation, including invasive weeds. This site preparation will take place in areas where swales and ponds will be excavated and used as a source for borrow material necessary to construct the berms. Additionally, the areas that will be the foundation for berm construction will be stripped of vegetation, minimizing the plant material within the berm that would compromise the permeability of the berms.

The Project will be completely enclosed by a perimeter berm that will prevent any discharge of storm runoff. Best management practices (BMPs) for erosion control and hazardous materials handling will be implemented during construction. Any spills of hazardous materials will be cleaned up immediately and reported to the responsible resource agencies within 24 hours. Any such spills, and the success of the cleanup efforts, shall also be reported in post-construction compliance reports. Measures will be taken to minimize windborne transport of fine particles to adjacent areas. A storm water permit issued by the State Water Resources Control Board will be obtained prior to project construction.

Natural Resources and Management

Management of the Site will have three goals: to maintain permanently flooded emergent wetlands to reverse subsidence, maximize GHG sequestration, and provide permanent wetland and upland habitat for a diverse range of wildlife. The Habitat and Water Management Plan is included as Appendix F.

Existing Habitat Conditions

Existing habitat conditions on the site are included in the Wetland Delineation Report (Wetland Delineation for the Sherman Island Wetland Restoration Project: Phase II Sacramento County, California, October 30, 2018) and the Botanical Assessment and Protocol-level Rare Plant Survey (WRA 2018, Appendix B).

Desired Habitat Conditions

The desired habitat conditions include a restored wetland with permanently flooded emergent vegetation dominated by hard stem bulrush and cattails with a diverse mosaic of associated upland habitat types. Berms will attain a cover of grasses with shrubs and trees which may be planted on the berm slopes, which will be maintained for site access. Habitat restoration areas will be planted in a diverse complex of shrubs, trees, and grassland, which will provide valuable ecological complexity. Habitat areas will be designed to maximize habitat value while minimizing the maintenance required to manage for invasive weeds.

Consultation with the Sacramento Yolo Mosquito and Vector Control District (SYMVCD) has been initiated and preliminary design review has taken place. Additional consultations with SYMVCD, and incorporation of design recommendations, will ensure water flow and water level criteria for mosquito control will be realized. This collaboration will allow the SYMVCD to implement a wide variety of effective mosquito control options, if they become necessary. Mosquito control best management practices (BMPs) as identified in the Central Valley Joint Venture "Technical Guide to Best

Management Practices for Mosquito Control in Managed Wetlands" (Kwansy et al. 2004), have been incorporated into the engineering design as well as the Habitat and Water Management Plan (Appendix F).

Water Use

As discussed above, water to the site will be provided by siphons along the San Joaquin River, as well as the Sacramento River via the Sherman Island Overland Water Delivery Canal. All siphons utilized for this project are equipped with flow meters as well as fish screens maintained by DWR. Water will be conveyed within the wetland system via gravity flow from the higher elevation units to the lower elevation units until it finally makes its way back to the District's drainage canal and pump station located south of the Project Site.

A Habitat and Water Management Plan (Appendix F) was prepared that includes a complete water budget for the Site. As water levels will remain fairly constant throughout the year, the Site is expected to divert less water from the San Joaquin and Sacramento Rivers on an annual basis than the existing irrigated agricultural uses during the summer months. It is anticipated that water will be used during the winter to slowly fill the wetlands until an initial average operating level of approximately 1 – 2 feet is achieved. This initial water level will be maintained during the first full year to prevent bank erosion due to wave wash from occurring prior to emergent vegetation establishment. Water will then slowly be added over the following late winter and early spring, again from District drainage, to increase the average operating level to approximately 2.5 feet in the deepest areas and 0.5 feet in the shallowest, which will be the optimal average operating water level. Maintenance of water levels throughout the year will require only minimal water withdraws from the San Joaquin River to balance evapotranspiration.

9. Surrounding land uses and setting: Briefly describe the Project's surroundings:

The Project Site is located on a southeastern portion of Sherman Island near the San Joaquin River. The Site is located at the southern boundary of Sacramento County in the Sacramento-San Joaquin River Delta. Solano County is located approximately 2 miles to the north across the Sacramento River and Contra Costa County is located approximately 1 mile to the south across the San Joaquin River.

Approximately 90% of Sherman Island, including the Project Site, is owned by DWR. Land uses in the vicinity of the site are primarily agricultural, rural residential, recreational, and permanent wetlands similar to this Project.

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement).

Approving Agency	Required Permits and Applications
Federal Agencies	
U.S. Army Corps of Engineers (Corps)	Nationwide Section 404 Discharge Permit. (Clean Water Act, 33 USC 1341)
U.S. Fish and Wildlife Service (USFWS)	Section 7 Consultation
State Agencies	
State Water Resources Control Board, Regional Water Quality Control Board	National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activity State Water Resources Control Board Order No. 2009-0009-DWQ as amended by 2010-0014-DWQ Water Quality Certification (Clean Water Act) Section 401
Department of Fish & Wildlife	Environmental Review and Approval Incidental Take Permit
Delta Stewardship Council	Consistency Determination with Delta EIR

Figure 1. Project Location

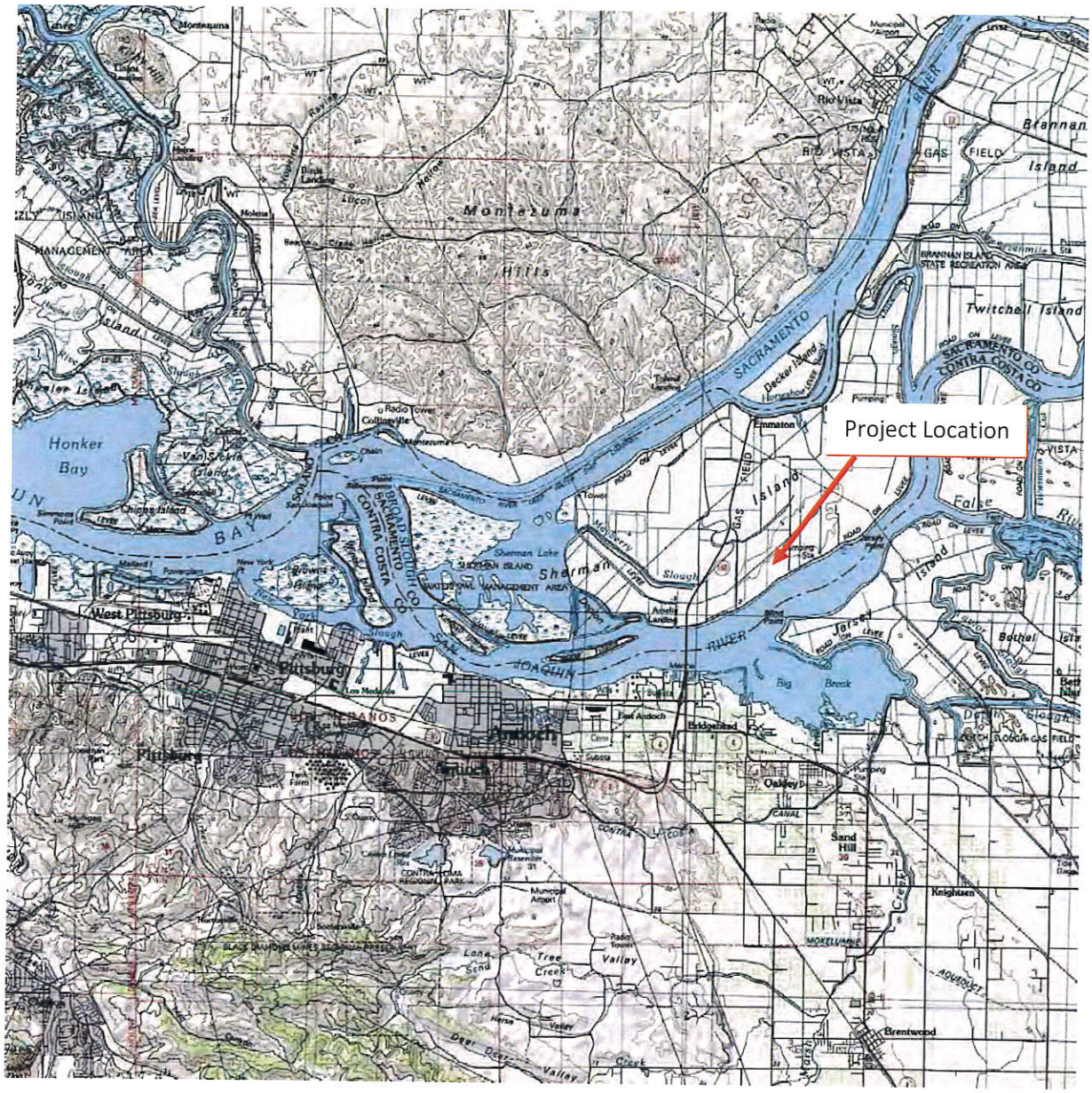


Figure 2. Infrastructure Map

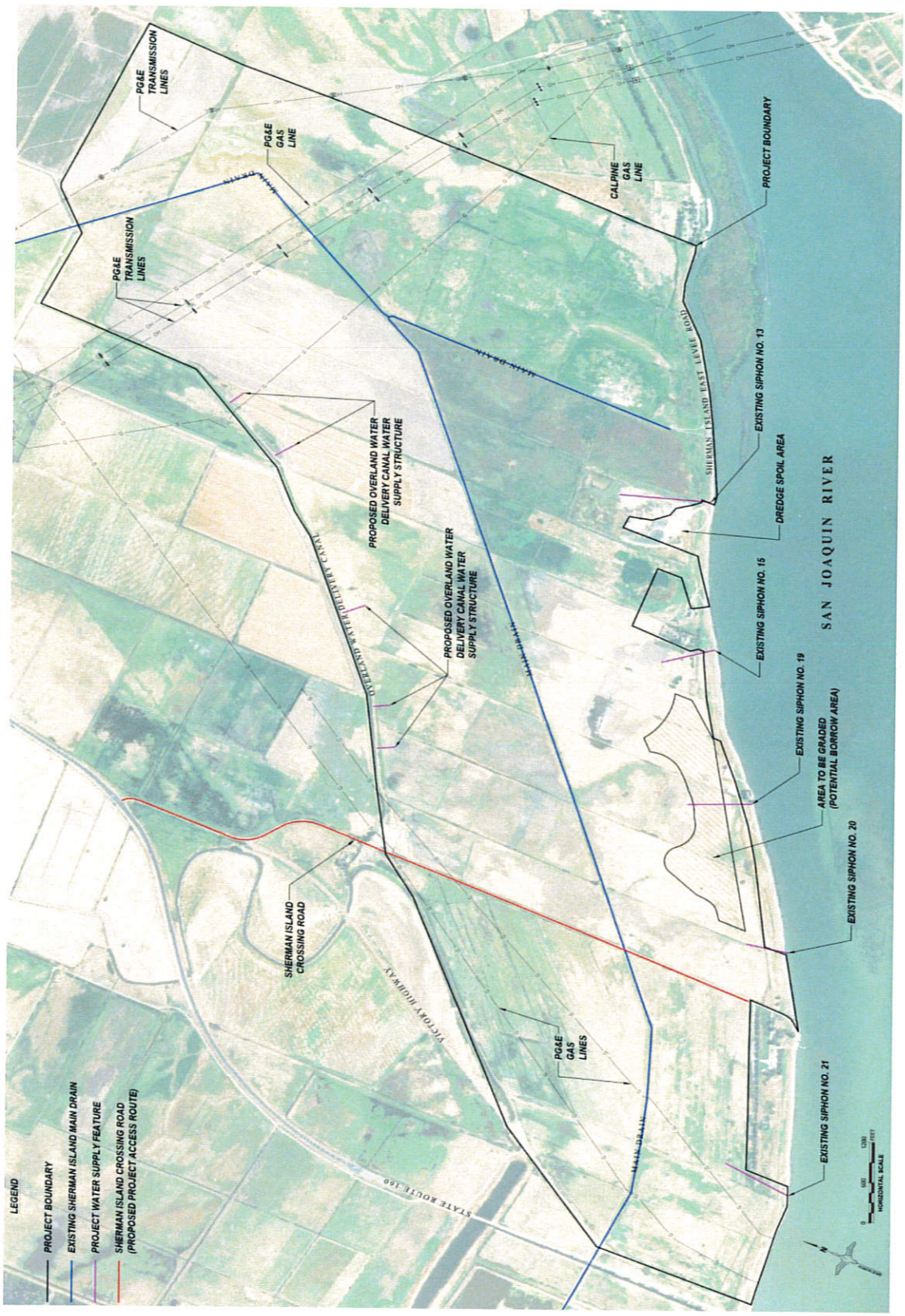


Figure 3. Restoration Plan Map

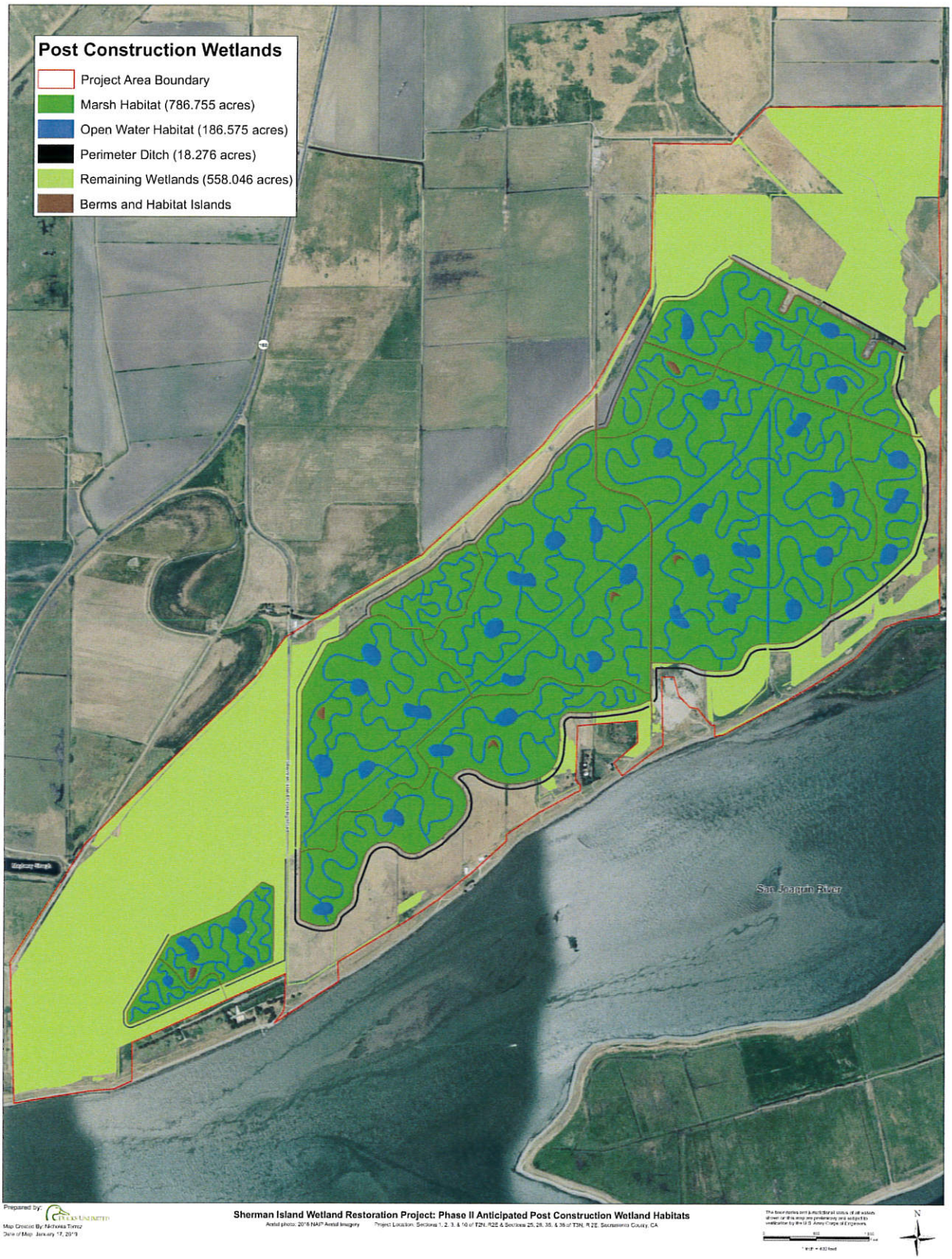
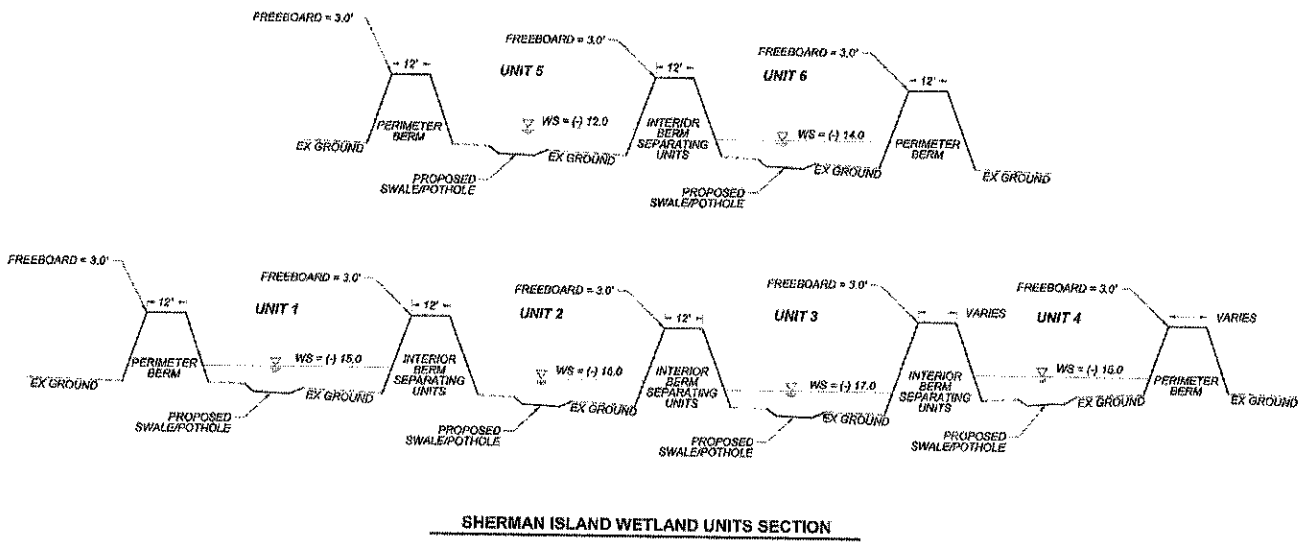


Figure 4. Typical Cross Sections



SHERMAN ISLAND WETLAND UNITS SECTION

Figure 5. Biological Communities Map (November 2018)

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

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

☐ Aesthetics	☐ Agriculture Resources	☐ Air Quality
☐ Biological Resources	☐ Cultural Resources	☐ Geology /Soils
☐ Hazards & Hazardous Materials	☐ Hydrology / Water Quality	☐ Land Use / Planning
☐ Mineral Resources	☐ Noise	☐ Population / Housing
☐ Public Services	☐ Recreation	☐ Transportation/Traffic
☐ Utilities / Service Systems	☐ Mandatory Findings of Significance	

DETERMINATION:
On the basis of this initial evaluation:

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

Signature _____ Date _____

Juan Mercado, Jr. _____ President Reclamation District 341

Printed Name _____ Title

EVALUATION OF ENVIRONMENTAL IMPACTS:

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

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

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

4) "Negative Declaration: Less Than Significant With Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from Section XVII, "Earlier Analyses," may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). In this case, a brief discussion should identify the following:
   a) Earlier Analysis Used. Identify and state where they are available for review.
   b) Impacts Adequately Addressed. Identify which effects from the above checklist were within the scope of and adequately analyzed in an earlier document pursuant to applicable legal standards, and state whether such effects were addressed by mitigation measures based on the earlier analysis.
   c) Mitigation Measures. For effects that are "Less than Significant with Mitigation Measures Incorporated," describe the mitigation measures which were incorporated or refined from the earlier document and the extent to which they address site-specific conditions for the project.

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

7) Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

8) This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

9) The explanation of each issue should identify:
   a) The significance criteria or threshold, if any, used to evaluate each question; and
   b) The mitigation measure identified, if any, to reduce the impact to less than significance.

Project Title: Sherman Island Belly Wetland Restoration Project

Project Description: The Sherman Island Belly Wetland Restoration Project will restore approximately 1000 acres of palustrine emergent wetlands on parcels owned by the California Department of Water Resources.

Environmental Checklist and Discussion

1. AESTHETICS	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
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) Substantially degrade the existing visual character or quality 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?	☐	☐	☐	☑

Response:

a. The Project Site is located on the landward side of a portion of the levee system that surrounds Sherman Island. The elevation of the levee is approximately 10 feet above sea level. Elevation at the Project Site is approximately 14-24 feet below sea level. Therefore, the Project Site is only visible from the levee or the immediately surrounding area. The Project Site is currently being used for agriculture and pasture for grazing. Some of the land is fallow. Thus, there will be little difference from the existing uses to the proposed uses and there will be no impact to a scenic vista.

b. The nearest state designated scenic highway is Highway 160, which is located more than 2500 feet to the west of the Project Site. The Project Site is only visible while driving on the Antioch Bridge. Since there are no scenic values at the existing site, no loss of scenic values could reasonably be expected.

c. The Project Site will not substantially degrade the existing visual character or quality of the site or its surroundings because the site is currently irrigated agriculture or pasture. The Project will merely be irrigating a wetland instead of commercial crops.

d. No lighting is proposed for the Project. No impact would occur.

2. AGRICULTURE RESOURCES	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. 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) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☑

Response:

For background purposes, it is important to note that islands within the Sacramento-San Joaquin Delta originally were formed by sediments deposited during spring floods that were stabilized by vegetation. The peat soils were formed from tules and reed vegetation over thousands of years. Beginning in the late 1850s, the natural vegetation was cleared and levees were built to create the farmland. Semi-continuous pumps were used to remove agricultural drainage and maintain a low water table. Over the years, the highly organic peat soils have dried, been subject to wind erosion, compaction, and oxidation (conversion to CO2). As peat soils decompose, the land subsides (Fleck et al. 2007). As a result of nearly 150 years of farming practices, sub-surface irrigation, and exposure of soils to air, the Project Site has subsided approximately 10 to 30 ft below sea level.

a. Conventional farming practices over the past several decades on Sherman Island have resulted in extensive subsidence of the peat soils with some elevations on the island now nearly 30 feet (NAVD 88) below sea level. Because Sherman Island is located in the Western Delta, at the confluence of the Sacramento-San Joaquin Rivers, it is strategically important for protecting the water quality of the Delta. Hence it is imperative to end land subsiding practices – including, in some cases, conventional agriculture such as grazing – and implement land use practices which accrete soil and reverse subsidence.

The proposed Project will accomplish those goals while continuing to provide the existing recreational opportunities of the Site. Accretion of soil on the interior of Sherman Island may (over several years) in turn reduce the risk of flooding on Sherman Island. This subsidence reversal may support some on-going, appropriate agricultural activities. The heavily subsided location and high water table makes the Site unsustainable for agricultural crop production. Thus, most of the Site is managed for grazing or agriculture on short-term leases. For these reasons, the entire Project Site is mapped as Farmland of Local Importance by the Department of Conservation (2010), rather than any form of prime or important farmland; therefore, the Project will have a less than significant impact on agricultural resources.

b. The Project Site is owned by DWR and like the majority of Sherman Island, is not under a Williamson Act contract. In any event, the open space activities proposed would not be incompatible with the agricultural or open space uses as fish and wildlife enhancement and preservation are a compatible land use. The single legal parcel within the Project Site is currently zoned AG-80(F) under the Sacramento County Zoning Ordinance with a minimum parcel size of 80 gross acres. According to the Sacramento County Code, wildlife habitat is an allowable land use under the AG-80 zoning designation. Furthermore, as a State agency, DWR is exempt from local regulation (as established by *Hall vs. City of Taft* [1952] 47 Cal.2d 177).
No impact would occur.

c. Conventional farming practices over the past several decades on Sherman Island have resulted in extensive subsidence of the peat soils with some elevations approaching 30 feet (NAVD 88) below sea level. Agricultural production is no longer sustainable on the Project Site without significant public and private expenditures, including levee maintenance, pumping, and other inputs which may further exacerbate subsidence and ultimately, the sustainability of agricultural uses.

This Project is consistent with the Delta Stewardship Council's 2013, Environmental Impact Report, as well as DWR's 1990 Proposed Wildlife Management Plans developed for Sherman and Twitchell Islands. Those plans and attending environmental documents:

- Emphasize development of wetland and riparian habitats to maximize wildlife benefits;
- Maintain the integrity of the island and reduce the probability of flooding by reducing the rate of soil subsidence that is largely caused by current farming practices; and
- Effectively managing the island for wildlife.

No impact would occur.

3. AIR QUALITY	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☑	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☑
c) 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 (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☑
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☑
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☑

Response:

Environmental Setting

Sherman Island is situated in southern Sacramento County at the southern end of the Sacramento Valley Air Basin. Moderately high precipitation, frequent strong daytime winds, and the rural location can result in relatively clean air conditions. However, during certain seasons, these conditions can combine to entrain substantial dust (including particulate matter, PM10) from agricultural fields. Existing agricultural activities on Sherman and other Delta islands can periodically influence various non-attainment conditions in the Sacramento Valley Air Basin (and adjacent Air Basins), which include standards for carbon monoxide, hydrogen sulfide, lead, nitrogen dioxide, sulfur dioxide, sulfides, ozone, and PM10.

Discussion

a. **Less than Significant with Mitigation Incorporated.** The Site is located in the Sacramento Metropolitan Air Quality Management District (SMAQMD). The district is currently a non-attainment area for carbon monoxide (Sacramento urbanized area - Maintenance), ozone, and particulate matter (PM10) (SMAQMD 2012). The California Clean Air Act (CCAA) of 1988 requires non-attainment areas to achieve and maintain the state ambient air quality standards by the earliest practicable date and local air districts to

develop plans for attaining the state ozone, carbon monoxide, sulfur dioxide, and nitrogen dioxide standards. In compliance with the CCAA, the Sacramento Metropolitan Air Quality Management District (SMAQMD) prepared and submitted the 1991 Air Quality Attainment Plan (AQAP) to address Sacramento County's non-attainment status for ozone and carbon monoxide, and although not required, particulate matter (PM10). The 1991 AQAP was designed to make expeditious progress toward attaining the state ozone standard and contained preliminary implementation schedules for control programs on stationary sources, transportation, and indirect sources, and a vehicle/fuels program. Sacramento County has met the ambient air quality standards for sulfur dioxide and nitrogen dioxide. (SMAQMD 2012)

Work proposed in this Project is not in conflict with or would not obstruct implementation of any applicable air quality plan for the Sacramento Valley or the adjacent other Air Basins. While construction equipment emits ozone precursors, such emissions are included in the emission inventory that is the basis for regional air quality plans. Therefore, construction emissions are not expected to impede attainment or maintenance of ozone standards in the area. To mitigate for any significant impacts, a strict no-idle of heavy equipment policy will be enforced. In addition, to avoid the spreading of substantial dust (PM10) as a result of scraping or grading activities, water trucks will be utilized to keep the soil moist and heavy. Additionally, if wind is forecasted to be greater than 30 miles per hour on a given day, construction work will be postponed in order to avoid the creation of substantial dust (PM10). There will be no significant impact with mitigation incorporated.

b.-e. – The brief usage of heavy equipment, which operates routinely at the Project Site under most normal circumstances, is not expected to create any additional discernible pollutants or odors. No impact would occur.

4. BIOLOGICAL RESOURCES	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	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 Game 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 Game or U.S. Fish and Wildlife Service?	☐	☐	☑	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☑	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☑	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☑
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☑

Response:

Environmental Setting
The 1936 acre Project Site is shown on the Jersey Island, CA USGS topographic quadrangle (Figure 1; un-sectionalized portion of Sherman Island). The Site is in the Lower Sacramento Watershed (hydrologic unit code 18020109), and its centroid is the latitude and longitude of the approximate center of the site are Latitude 38° 2' 54"N, Longitude 121° 43' 29"W. Elevation on the Site ranges from 14 to 20 ft below sea level. Topography across the Project Site is generally flat.

The Project Site is bordered by the San Joaquin River to the east, agricultural land to the north, south, and west. The entire Project Site was surveyed for the project as denoted in Table 1 for categorization of biological communities. The Project Site is composed of the ruderal upland, pasture fields and seasonal wetlands, freshwater canals and ditches, freshwater marsh, and Himalayan blackberry patches.

These broad biological community descriptions are defined by species composition and relative abundance. Biological communities and other features on-site are listed in Table 1 and mapped on Figure 5. Wetland and channel features are discussed in more detail in a separate jurisdictional delineation report (Wetland Delineation for the Sherman Island Wetland Restoration Project: Phase II Sacramento County, California, October 30, 2018).

Vegetation Communities in the Project Site

Table 1. Biological communities and acreages.

Biological Community	Approximate Acreage
Ruderal Upland	113.91
Pasture Fields	1414.50
Crop Fields	366.70
Pond	1.75
Irrigation Canals and Ditches	49.39
Dredge Spoils	12.62
Himalayan Blackberry Brambles	7.28
	Total: 1966.15

Ruderal Upland – Ruderal upland vegetation occurs in areas where there has been a high degree of disturbance which allows for opportunistic invasive species to establish. In the Project Area, ruderal upland areas are situated in the southern portion, where it is associated with Sherman Island East Levee Road, a section in the northern portion where it is associated with an area assumed to be a site of dredging spoils deposition, and along several canal crossroads. The canal crossroad locations are too small to be mapped. The vegetation within these areas are dominated by a mosaic of non-native, ruderal and often invasive species, which do not appear to form distinct vegetation alliances as described in the *Manual of California Vegetation* (CNPS 2018b). Dominant species include ripgut brome (*Bromus diandrus*), slim oat (*Avena barbata*), prostrate knotweed (*Polygonum aviculare* spp. *aviculare*), Canada horseweed (*Erigeron canadensis*), yellow star thistle (*Centaurea solstitialis*) fennel (*Foeniculum vulgare*), dwarf mallow (*Malva neglecta*), and smooth crabgrass (*Digitaria ischaemum*).

Pasture Fields and Crop Fields – Pasture fields dominate the Project Area and consist primarily of Bermuda grass (*Cynodon dactylon*). Associated species included alkali mallow (*Malvella leprosa*), bird's foot trefoil (*Lotus corniculatus*), barley (*Hordeum marinum*), and perennial pepperweed (*Lepidium latifolium*). Italian rye grass (*Festuca perennis*) common mustard

(*Brassica rapa*), western goldenrod (*Euthamia occidentalis*), perennial pepperweed and hairy leaved sunflower (*Helianthus annuus*) also occur in scattered locations within the pasture fields. There is no described Bermuda grass vegetation alliance (CNPS 2018b). Several crop fields located in the eastern portion of the Project Area contain corn (*Zea mays*).

Irrigation Canals and Ditches – Irrigation canals and ditches are man-made and located throughout the Project Area. These areas likely supplied water to crops before the land was converted for grazing. Vegetation present on the banks and within the channels includes two vegetation alliances: broadleaf cattail marsh (*Typha latifolia* Herbaceous Alliance) and California bulrush marsh (*Schoenoplectus californicus* Herbaceous Alliance) (CNPS 2018b). Dominant species include broadleaf cattail, California bulrush with associated species of poison hemlock (*Conium maculatum*), perennial pepperweed, barnyard grass (*Echinochloa crus-galli*), Himalayan blackberry, tall cyperus and common reed (*Phragmites australis*). In areas of still water, pondweed (*Potamogeton nodosus*), and mosquito fern (*Azolla filiculioides)* occurred on the water surface. The banks and channel walls of the canals and ditches were observed to be either heavily vegetated with little bare ground exposed or only exposed soil with no water.

Himalayan Blackberry Brambles – Several large, monotypic patches of Himalayan blackberry occur in the northeast and southern portions of the Project Area and can be classified as Himalayan Blackberry Brambles (*Rubus armeniacus* Shrubland Semi-Natural Alliance) (CNPS 2018b). Several smaller patches occur in mesic areas, especially adjacent to the irrigation ditches; however they are not large enough to be mapped. Due to the dense growth structure of Himalayan blackberry few species grow within the brambles.

Dredge Spoils – Sandy dredge spoils were placed in a large area in the southern portion of the Project Area. The vegetation on the dredge spoils was a matrix of dense narrowleaf willow (*Salix exigua* var. *exigua*) patches and bare ground with sparse Bermuda grass. Additional species observed on the dredge spoils include bristly ox-tongue (*Helminthotheca echioides*), spring vetch (*Vicia sativa*), seaside heliotrope (*Heliotropium curassavicum* var. *oculatum*), arroyo willow (*Salix lasiolepis*), rose clover (*Trifolium hirtum*), and short-podded mustard (*Hirschfeldia incana*).

Pond – Two small ponds are located in the southern portion of the Project Area, adjacent to the dredge spoils. Vegetation along the perimeter of the ponds was dominated by common reed, narrow leaf cattail (*Typha angustifolia*), poison hemlock, western goldenrod, perennial pepperweed, and California bulrush. Vegetation associated with the ponds can be best classified as Common Reed Marsh (*Phragmites australis* Herbaceous Alliance) (CNPS 2018b). The banks of the ponds were heavily vegetated, with the smaller pond nearly absent of open water due to dense vegetation.

Determination of Special-Status Species in the Project Site

Data from the California Natural Diversity Database (CNDDB), California Department of Fish and Wildlife (DFW), California Native Plant Society (CNPS), USFWS, California Consortium of Herbaria (CCH) and field surveys were used to determine special-status plant species that could occur in the Project Site. Field surveys were conducted to determine whether habitat for special-status animal species identified in the file data is present in the Project Site. Special-status animal species for which suitable habitat is present in the Project Site are listed in Table 2. Special-status fishes are included in this evaluation despite not having habitat on the island interior, because the project relies on the screened diversion of water from the San Joaquin and Sacramento Rivers, which provide habitat for these species.

Special-Status Plant Species Site Evaluation - WRA's preliminary review of available resources and databases (CNDDB, CNPS Electronic Inventory, USFWS Species List, CA Consortium of Herbaria) suggested that sixty special-status plant species have been documented within the greater vicinity of the Project Site. Of these, the botanical assessment determined that twelve special-status plants had the potential

to occur, with one identifiable during the early season and fourteen identifiable in the late-season (Table 2). The remaining forty-eight species were determined to have no potential to occur or are unlikely to occur in the Project Site due to the absence of suitable habitat, absence of suitable soil types, absence of associated species outside of the known elevation range, and/or the degree of disturbance present in the Project Site. WRA botanists performed a botanical assessment and protocol-level rare plant surveys at the site during May and August 2015, June 2016, and September 2018 (WRA 2018). No special-status plant species were observed during the protocol-level rare plant surveys. A combined total of 134 plant species were observed during the survey, of which fifty-three species are native and seventy-nine are not native to California. Of the seventy-nine non-native species, forty are considered to be invasive by the California Invasive Plant Council (Cal-IPC), including seven ranked "high." seventeen ranked "moderate," and sixteen ranked "limited."

Special Status Animal Species Site Evaluation - DWR biologists conducted bird and habitat surveys of the Site during the non-breeding- (February 4, 2016; February 14, 2017; and February 23, 2018) to evaluate the avian community composition, document the presence of special status bird species and associated habitats, and develop estimates of bird species richness, diversity, and abundance (DWR 2013). DWR will repeat this effort throughout the project's 5-year post- construction monitoring period. Special status avian species are listed in table 2. No suitable habitat was found for the California clapper rail or the California least tern within the Project Site.

Table 2. Special-status species for which suitable habitat occurs in the Project Site.

Special-Status Species	Common Name	Federal Status & other codes [a, b]	State Status [a] & other codes [b]	Source [c]	Habitat Present?[d] / Species Observed ?
Fish					
Acipenser medirostris	Green sturgeon	T, CH	SSC	1	See text.
Hypomesus transpacificus	Delta smelt	T, CH	E	1, 2	See text.
Spirinchus thaleichthys	Longfin smelt	--	T	2	See text.
Oncorhynchus mykiss	Central Valley steelhead Distinct Population Segment (DPS)	T, CH	--	1	See text.
Oncorhynchus tshawytscha	Central Valley spring-run Chinook salmon ESU	T, CH	T	1	See text.
Oncorhynchus tshawytscha	Sacramento River Winter-run Chinook salmon ESU	E, CH	E	1	See text.
Pogonichthys macrolepidotus	Sacramento splittail	--/ --	SSC	2	See text.

Reptiles					
Actinemys marmorata	Western pond turtle	--	SSC	2,3	Yes/ Yes
Thamnophis gigas	Giant garter snake	T	T	1,2	Yes/ No
Birds					
Agelaius tricolor	Tricolored blackbird	MBTA	T	3	Yes/Yes
Athene cunicularia ssp. hypugaea	Western burrowing owl	MBTA	SSC	1,2	Yes/No
Buteo swainsoni	Swainson's hawk	MBTA	T	2,3	Yes[1]/ Yes[2]
Elanus leucurus	White-tailed kite	MBTA	FP	3	Yes[1]/ Yes
Circus cyaneus	Northern harrier	MBTA	SSC	2,3	Yes[1]/Yes
Lanius ludovicianus	Loggerhead shrike	--	SSC	2,3	Yes/ Yes
Melospiza melodia mailliardi	Modesto song sparrow	--	SSC	2	Yes/No
Migratory Birds & Birds of Prey	Various	MBTA	--	3	Yes/ Yes
Plants			**/CNPS List [b]**		
Brasenia schreberi	Watershield	--	--/2B.3	4	Yes/No
Carex comosa	Bristly sedge	--	--/2B.1	4	Yes/No
Centromadia parryi congdonii	Congdon's tarplant	--	--/1B.1	4	Yes/No
Centromadia parryi parryi	Pappose tarplant	--	--/1B.2	4	Yes/No
Centromadia parryi rudis	Parry's rough tarplant	--	--/4.2	4	Yes/No
Cicuta maculate bolanderi var. *bolanderi*	Bolander's waterhemlock	--	--/2B.1	2,4	Yes/No
Hibiscus lasiocarpus occidentalis	Wooly rose-mallow	--	--/1B.2	4	Yes/No
Lathyrus jepsonii jepsonii	Delta tule pea	--	--/1B.2	2,4	Yes/No
Potamogeton zosteriformis	Eel-grass pondweed	--	--/2B.2	4	Yes/No
Sagittaria sanfordii	Sanford's arrowhead	--	--/1B.2	4	Yes/No
Scutellaria lateriflora	Side-flowering (Blue) skullcap	--	--/2B.2	4	Yes/No
Symphyotrichum lentum	Suisun Marsh aster	--	--/1B.2	2,4	Yes/No

[a] **Listing Status** Federal status determined from USFWS species list (2013). State status determined from DFW (2011a; 2013 b,c). Codes used in table are: **E** = Endangered; **T** = Threatened; **P** = Proposed; **C** = Candidate; **R** = California Rare; * = Possibly extinct.

[b] **Other Codes** Other codes determined from USFWS species list; DFW (2011a,b; 2012 a,b; 2013 a,b) and CNPS (2012, 2013). Codes used in table are as follows: **SSC** = DFW Species of Special Concern; **FP** = DFW Fully Protected; **Prot** = DFW Protected; **CH** = Critical habitat designated; **MBTA** = protected by Migratory Bird Treaty Act

CNPS List (plants only): **1A** = Presumed Extinct in CA; **1B** = Rare or Endangered (R/E) in CA and elsewhere; **2B** = R/E in CA and more common elsewhere

CNPS List Decimal Extensions: .1 = Seriously endangered in California (over 80% of occurrences threatened / high degree and immediacy of threat); **.2** = Fairly endangered in CA (20-80% of occurrences threatened); **.3** = Not very endangered in CA (< 20% of occurrences threatened or no current threats known).

[c] **Sources** 1 = From USFWS letter. **2** = From CNDDB. **3** = Observed by DWR biologists. 4 = CNPS

[d] **Habitat types/Species Observed** 1 = Project Site has foraging habitat, but no nesting habitat; 2 = Observed only during winter survey(s)

Biological Resources Impact Discussion:

a. Less than Significant with Mitigation Incorporation The project should not have a substantial adverse effect, either directly or indirectly, on any species. There are several possible special status species in the area of the Project. Each of these species is listed and discussed below.

Giant garter snake (GGS; *Thamnophis gigas*)

The emergent wetland habitat of the drainage ditches provide habitat for GGS on the Site. Wetland habitats are divided into several categories, including perennial herbaceous wetlands associated with the ditches and predominantly ruderal herbaceous wetlands in the wetter portions of the highly grazed pasture fields. Among these, only perennial herbaceous wetlands provide suitable giant garter snake habitat (Hansen, 2009). Perennial herbaceous wetlands are characterized by emergent macrophytes such as tule (*Scirpus acutus*) and cattail (*Typha* sp.), which are characteristic of the marshes and low-gradient streams inhabited by giant garter snakes throughout the Central Valley. Though characterized by dense, brushy growth that may obscure sunlight and limit basking/thermoregulation activities, riparian shrub wetlands are also associated with seasonal or perennial waters providing potential habitat for giant garter snake. Riparian shrub is characterized by species such as Himalayan blackberry, which is tolerated by giant garter snakes if associated with a clear open-water interface. Both of these suitable habitat types are generally associated with herbaceous ruderal uplands that provide terrestrial refuge. Herbaceous ruderal uplands are typically characterized by grasses and forbs.

Some of the drainage ditches on-site may contain water during the active season of GGS (early spring through mid-fall). The drainage ditches and palustrine emergent wetlands on-site provide adequate emergent, herbaceous wetland vegetation, such as cattails and bulrushes, for escape cover and foraging habitat during the active season. The Site provides adequate openings in waterside vegetation for basking. The only higher elevation uplands on-site are located along the top and sides of the levee surrounding the Project Site. Although no small mammal burrows were observed in these areas, some burrows could be present, hidden under vegetation.

Scattered records suggest that giant garter snakes may have occupied the Sacramento-San Joaquin River Delta at one time, but reclamation of wetlands for intense agricultural applications has eliminated most suitable habitat (Hansen 1986). Recent sightings within the Sacramento-San Joaquin Delta are haphazard,

and repeated surveys have failed to identify any extant population clusters in the region (Hansen 1986, Patterson and Hansen 2003a, Swain 2004). Current locality records indicate that within its range, GGS are distributed in thirteen unique population clusters coinciding with historical flood basins, marshes, wetlands, and tributary streams of the Central Valley (Hansen 1980, Brode and Hansen 1992, USFWS 1997, USFWS 1999). These populations are isolated, without protected dispersal corridors to adjacent populations, and are threatened by land use practices and other human activities, including development of wetland and suitable agricultural habitats. The closest CNDDB record for this species is about 0.26 miles east of the Site on along the Highway 16 (CNDDB 2010). The next closest observation is approximately 3.5 miles northeast of the Site along Horseshoe Bend, Sherman Island (CNDDB 1998). Both observations are located on the Jersey Island quad. DWR conducted habitat assessments and trapping surveys for GGS on Twitchell and Sherman Islands in 2009 as part of ongoing planning activities (DWR 2010). The methods employed were designed to assess habitat quality and detect self-sustaining subpopulations of GGS on the islands. The total trapping effort amounted to approximately 14,000 trap days, 2,800 of which were conducted at 16 sites on Sherman Island (five within one mile of the Site) out of twenty total sites. Halstead et. al. (USGS 2011) subsequently published recommendations for detection of GGS presence in low-density areas. Although DWR's methodology was not as robust, no GGS were observed or captured as a result of this effort. According to Laura Patterson, DFW (personal communication) the individual observations on record most likely washed down from upstream areas and are not indicative of a population in the west Delta.

Upon completion of the proposed project, approximately 1000 acres of permanently flooded wetlands and other waters of the U.S. will occur on-site. Managed wetlands that provide permanent water with a mixture of open water and emergent marsh adjacent to upland habitat are known to provide high quality habitat for GGS (Halstead et. al 2010, Hansen 2009). The net result of the proposed project will be a substantial increase in area and quality of potential GGS habitat.

AVOIDING AND MINIMIZING TAKE

Certain aspects of the project could result in direct mortality or species take if giant garter snakes do occur in the Project Site. Potential temporary impacts are associated with earth moving activities, reduced habitat due to ditch abandonment or open water relocation, and vehicle traffic on surface roads adjacent to open-water habitat during project construction. Steps will be taken to reduce the risk and/or minimize the likelihood of species take by following the USFWS standard Minimization and Avoidance Measures as well as direct consultation with USFWS.

Critical habitat for GGS has not been designated. Significant impacts to GGS will be avoided with the implementation of the following mitigation measures

Mitigation Measure 4.a(2)

Although GGS are very unlikely to occur on the Site, the project will require a Section 7 consultation with USFWS. To avoid impacts to the GGS, the Standard Avoidance and Minimization Measures developed by the USFWS (1997) will be implemented during construction, unless otherwise advised by the USFWS. Implementation of these measures will minimize the potential for harm, harassment, and direct mortality of GGS and its habitat on the Site from project-related activities, should any occur near the site during construction. These measures include the following:

- ☐ Within the Project Site, aquatic ditch habitat for GGS will be lowered as much as possible and then maintained as low as possible for at least fifteen consecutive days prior to the initiation of construction activities. Complete dewatering is likely not possible due to the high water table and continuous levee under seepage on the Project Site. At most 24-hours prior to the commencement of construction activities, the Site shall be surveyed for giant garter snakes by a USFWS-approved biologist. The biologist will provide the USFWS with a written report that adequately documents the monitoring efforts within 24-hours of commencement of construction activities. The Project Site shall be re-inspected by the monitoring biologist whenever a lapse in construction activity of two weeks or greater has occurred.

- ☐ A Worker Environmental Awareness Training Program for construction personnel shall be conducted by a USFWS-approved biologist for all construction workers, including contractors, prior to the commencement of construction activities.
- Conducting grading, clearing, grubbing, or other similar construction-related disturbance of suitable upland habitat within 200 feet of suitable aquatic and/or wetland habitat will be conducted during the GGS active period of May 1 to October 1, when GGS are able to avoid or evade construction activities. If it appears that construction activity may go beyond October 1, the project proponents shall contact the USFWS as soon as possible, but not later than September 15 of the year in question, to determine if additional measures are necessary to minimize take. Construction activities within 200 feet from the banks of snake aquatic habitat will be avoided during the snake's inactive season.
- ☐ Clearing activities will be confined to the minimum necessary to facilitate construction activities.
- ☐ Project-related vehicles will observe a twenty mile-per-hour speed limit within construction areas, except on existing paved roads where they will adhere to the posted speed limits.
- ☐ If a snake is encountered during construction activities, all activities will cease and the USFWS will be notified immediately to determine the appropriate procedures related to the collection and relocation of the snake. A report will be submitted to the USFWS and will include the date(s), location(s), habitat description, and any corrective measures taken to protect the snake, within one (1) business day. The applicant is required to report any take of listed species to the USFWS immediately by telephone at 916-930-5603 and by electronic mail or written letter addressed to the Assistant Field Supervisor, ESA/Regulatory Division of the BDFWO, within one (1) working day of the incident.
- ☐ Contract and bid specifications will require contractor to implement best management practices (BMPs) to prevent wildlife entanglements in fencing, and impacts to water quality in undrained ditches. These shall include all food-related trash items (e.g., wrappers, cans, bottles, and food scraps) will be disposed of in closed containers and removed at the end of each workday.

Tricolored blackbird (*Agelaius tricolor*)

There is limited nesting habitat within the project site and within the project vicinity for Tricolored Blackbird. However, tricolored blackbirds were observed during winter avian surveys in 2016, 2017 and 2018. Impacts to white-tailed kite will be avoided with the implementation of Mitigation Measure 4.a3.

Western burrowing owl (*Athene cunicularia* ssp. *hypugaea*)

There are some areas within the project vicinity which could provide suitable habitat for burrowing owls, and increased noise and human activity in the work area could adversely affect owls if they are found. However, the soils in the immediate project area are likely too wet and vegetation is taller than what is normally tolerated by burrowing owls. Therefore, it is unlikely that burrowing owls will be found within the project area in areas that cannot be avoided using the standard avoidance buffers recommended by CDFW (CDFW 2012). This project is not likely to adversely affect burrowing owls because BIO 7 (below) will be implemented to avoid impacts to the species. Therefore, impacts to burrowing owls will be less-than-significant.

Swainson's hawk (*Buteo swainsoni*)

The project will not have impacts on large trees or other potential nesting and roosting locations for Swainson's hawk and other raptors. Foraging habitat includes ruderal vegetation and irrigated pasture (Woodbridge 1998, Estep 1989).

Although no Swainson's hawk were observed during the avian and habitat survey of the Site in February 2016, 2017 or 2018. There are 17 occurrences in the CNDDB records within 5 miles of the project site. No Swainson's hawks were detected during the 2016, 2017, or 2018 winter survey.

The existing project footprint is considered low quality foraging habitat for Swainson's hawk (e.g.,, irrigated pasture and ruderal lands). Although the acreage of available foraging habitat will decline with project implementation, the Swainson's hawk foraging habitat created by the project will be of higher quality (i.e.,

native grasses that are not subject to disturbance from agricultural practices on upland habitat areas, berms, and landside levee slopes The Project will be beneficial to foraging Swainson's hawks because it will also provide potential future suitable nesting trees. Impacts to Swainson's hawks will be avoided with the implementation of Mitigation Measure 4.a(3).

White-tailed kite (*Elanus leucurus*)

Foraging habitat occurs on-site, but there are no trees suitable for nesting on the Site, and therefore no nests. White-tailed kite nesting sites are of concern to DFW (2011a). White-tailed kites were observed during winter avian surveys in 2016, 2017 and 2018. Impacts to white-tailed kite will be avoided with the implementation of Mitigation Measure 4.a3.

Loggerhead shrike (*Lanius ludovicianus*)

The Site provides foraging habitat for this species and the willows trees and Himalayan blackberry shrubs provide loafing habitat. Loggerhead shrike nest sites are of concern to DFW (2011a). Loggerhead shrikes were observed on-site only during winter avian surveys in 2016, 2017 and 2018. No nests were observed on the Site. Impacts to loggerhead shrike will be avoided with the implementation of the Mitigation Measure 4.a3.

Modesto song sparrow (*Melospiza melodia mailliardi*)

The Site is located near the distributional limits of Modesto song sparrow, a DFW species of special concern (Shuford and Gardali 2008). The Site likely provides habitat for Modesto song sparrow. Song sparrows were not observed during all avian surveys in 2016, 2017 and 2018. The Modesto population range encompasses the Site including the Central Valley and Sacramento/San Joaquin Delta. Nesting can occur in vegetation adjacent to irrigation canals and hedgerows. A potentially significant impact would occur if an active nest was removed during construction or if construction disturbance caused nest abandonment prior to fledging of the young birds. Construction of the project will likely provide significant habitat resources for this species (Shuford and Gardali 2008). Impacts to Modesto song sparrow will be avoided with the implementation of Mitigation Measure 4.a3.

Migratory Birds & Birds of Prey

The Site provides less than ideal potential nesting habitat for some birds of prey and birds listed by the Migratory Bird Treaty Act (MBTA). The nesting season is generally from February 1 through August 31. An active nest is one which contains eggs or unfledged young. A potentially significant impact would occur if an active nest was removed during construction or if construction disturbance caused nest abandonment prior to fledging of the young birds. Significant impacts to nesting birds will be avoided with the implementation of following mitigation measure. The Site provides foraging habitat for covered species including Swainson's hawk, white-tailed kite, and the northern harrier.

Mitigation Measures 4.a(3)

- ☐ If construction is scheduled to begin between February 1 and August 31 then a qualified biologist shall conduct a preconstruction survey for active nests at the construction site and within 0.25 mile of the construction site from publicly accessible areas within 30 days prior to construction. If no active nest of a bird of prey or MBTA bird is found, then no further mitigation measures are necessary.
- If an active nest of a bird of prey or MBTA bird is found, then the biologist shall flag a minimum 250 foot (1320 ft. (0.25 mile) for Swainson's hawk) Environmentally Sensitive Area (ESA) around the nest if the nest is of a bird of prey, and a minimum 100-foot ESA around the nest tree if the nest is of an MBTA bird other than a bird of prey.
- ☐ No construction activity shall be allowed in the buffer until the biologist determines that the nest is no longer active, or unless monitoring determines that a smaller buffer will protect the active nest.
- ☐ The buffer may be reduced if the biologist monitors the construction activities and determines that no disturbance to the active nest is occurring. The size of suitable buffers depends on the species of

bird, the location of the nest relative to the project, project activities during the time the nest is active, and other project specific conditions. Before any work is authorized within a buffer, DFW shall be consulted. If construction is allowed within the buffer, a biologist will be present to monitor nests and will have the authority to halt construction activities within the buffer if the nesting birds show signs of agitation or potential abandonment. Active nests with transportation routes that are within the buffer zone should be monitored for signs of distress, with routes being altered, or implementing other measures to minimize disturbances.

b. Less than Significant Impact - Wetlands on-site are sensitive communities and are discussed in Issue c.

c. Less than Significant with Mitigation Incorporation - A wetland delineation has been conducted for the Site and a preliminary map has been prepared that demonstrates the presence of approximately 1448.895 acres of waters of the U.S. in the Project Site. The USACE must verify the map prior to construction in order to issue federal permits. The proposed Project will restore and/or enhance approximately 1000 acres of emergent wetlands in association with transitional and upland habitats that will benefit migratory birds, giant garter snakes, western pond turtles, and other wildlife species. The project will result in a net increase in the functions and services (values) of mostly marginal wetland habitat on-site and will provide beneficial effects including subsidence reversal and levee stability.

Fill of jurisdictional wetlands for aquatic habitat restoration, establishment, and enhancement activities may be authorized under a Section 404 CWA Nationwide Permit 27 and a Section 401 CWA Water Quality Certification. Significant impacts to wetlands and waters of the U.S. will be avoided with the implementation of the following mitigation measure. Permit applications are proposed to be submitted in January 2019.

Mitigation Measure 4.c.

- ☐ Project proponent shall obtain a Section 404 CWA Nationwide Permit and a Section 401 CWA Water Quality Certification for impacts to Corps jurisdictional features. The project proponent shall fulfill the requirements of the permits.

d. Less than Significant with Mitigation Incorporation - Construction of the Project may temporarily disrupt movement of native wildlife species that occur on-site during construction. The Project may impact the movement of WPT hatchlings between nest sites on or near the Project Site and existing aquatic habitat. Refer to Mitigation Measure 4.a1.

The proposed project will restore and/or enhance approximately 1000 ac of freshwater emergent wetlands that will provide improved functions and services (values) for migratory waterfowl and other wildlife species. Refer to Issue A for mitigation measures that will protect special status animal species.

The Site does not provide habitat for state or federal listed fishes since the project footprint is located on the island interior and does not overlap their respective habitats. Therefore, the proposed project will not substantially interfere with the movement of native resident fish or wildlife. The managed wetlands will source its water needs from four existing screened gravity siphons along Mayberry Slough/San Joaquin River to the south of the Site, and augmented by levee under seepage, agricultural drainage, and a high water table. Since the four diversions are screened to protect Delta fishes, are maintained regularly by the District and DWR, and since construction of the Project will not result in an impact to special status fishes and their habitat in Mayberry Slough and the San Joaquin River.

e. No Impact - The Sacramento County Tree Preservation Ordinance (Sacramento County 1981) requires a permit for removal of or impacts to oak trees greater than 6" diameter at breast height (dbh). The project will not conflict with the County's tree preservation ordinance. No impact will occur and no mitigation is necessary.

f. No Impact - There is no adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan in the vicinity of the Site. No impact to any of these would occur.

5. CULTURAL RESOURCES	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☑
b) Cause a substantial adverse change in the significance of an archaeological resources pursuant to §15064.5?	☐	☐	☐	☑
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☑
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☑	☐

Environmental Setting:
The Swamp Land Act of 1850 enabled California to reclaim thousands of acres of land, creating the fertile Sacramento River Delta's islands of agricultural fields. Agriculture and recreation have been the primary uses of Sherman Island, typical of the Sacramento Delta region.

Impact Discussion:

a. There are no historical resources as defined in CEQA Guidelines Section 15064.5 in the projectarea (Tom Origer & Associates dated May 2, 2016 and Revised November 9, 2018) (Appendix D). No impact would occur.

b. There are no archeological resources as defined in CEQA Guidelines Section 15064.5 in the project area (Tom Origer & Associates dated May 2, 2016 and Revised November 9, 2018). No impact would occur.

c. Because of its geologic history, the project area is considered an unlikely environment for the presence of paleontological resources and for unique geologic features (Tom Origer & Associates dated May 2, 2016 and Revised November 9, 2018). No impact would occur.

d. Because the Site was historically seasonally flooded, it is unlikely that the site was used for interment by natives or early settlers. The potential for disturbance to human remains is considered less than significant. If any historical or cultural resources are discovered during the construction process, all construction shall cease until a qualified professional evaluates theresource. Consultation with appropriate tribes has been conducted and consultation letters along with responses are contained in Appendix D.

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

Response:

Environmental Setting:
The Delta collects all the freshwater runoff from the Central Valley, which is subject to constant interaction with ocean tidal forces and salt water, and then discharges it toward San Francisco Bay and the Pacific Ocean. The complexity of the Delta is primarily the result of its geologic evolution and a long history of basin subsidence, sediment deposition, biotic activity, and interactions with sea-level changes over the past several million years. At times, the Delta was predominately a freshwater body receiving abundant sediment generated from active glaciations and outwash from the Sierra Nevada; during other periods, mineral sedimentation was limited, and land- and soil-forming processes were dominated by profuse marsh vegetation growth and development of peat soils (EDAW 2007).

Impact Discussion:
a. Although the Site is not in a seismically active area, an earthquake occurring in a nearby seismically active area could make the site vulnerable to levee failure and flooding by liquefaction and settling. The western Delta islands, particularly Sherman Island, is considered to be the most vulnerable to seismic levee failure and would have the greatest salinity intrusion impact on the water supply if they failed. Conversely, long-term restoration of Sherman Island to tidal marsh eases pressure on the levees by raising ground elevations behind the levees and thus, reduces the potential for seawater intrusion impacts in the event of future levee failure (Mount and Twiss 2005).

The proposed project would require the use of personnel and vehicles to construct the restoration project. A small number of people and vehicles would be used intermittently to maintain the wetlands and implement the vector control program. The potential for substantial injury or death would be low, because of the limited number of individuals involved in construction and on-going maintenance of the Project. There are no people or homes in the vicinity of the project. The Project would have a less than significant impact on increasing earthquake-related risks.

The Site is not in an area susceptible to landslides. No impact would occur.

b. The Project involves the creation of permanently flooded areas and emergent wetlands. As a result, the project will not cause a substantial loss of topsoil or erosion. No impact would occur.

c. The proposed Project is not on a geologically unstable soil and does not include structural development. Furthermore, it has been designed to reverse subsidence that has occurred because of past agricultural and land management practices. Studies at a similar project site have shown that surface elevation changes due to accretion ranges from 1.3 - 2.2 inches/year, while surrounding areas used for agriculture continue to subside. No impact would occur.

d. The proposed project is not located on expansive soils and no structures would be constructed. No impact would occur.

e. No septic tanks or waste water systems are proposed or would be required for the proposed project. No impact would occur.

7. GREENHOUSE GAS EMISSIONS	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	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 regulations adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☐	☑

Response:

a. Warming of the climate system is now considered to be unequivocal (IPCC, 2007). Global average surface temperature has increased approximately 1.33 °F over the last one hundred years, with the most severe warming occurring in the most recent decades. Eleven of the twelve years from 1995 to 2006, rank among the twelve warmest years in the instrumental record of global average surface temperature (going back to 1850). Continued warming is projected to increase global average temperature between 2 and 11 °F over the next one hundred years (IPCC, 2007).

The causes of this warming have been identified as both natural processes and as the result of human actions. Increases in greenhouse gas (GHG) concentrations in the Earth's atmosphere are thought to be the main cause of human induced climate change. GHGs naturally trap heat by impeding the exit of solar radiation that has hit the Earth and is reflected back into space. The six principal GHGs of concern are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulfur hexafluoride (SF6), hydrofluorocarbons, and perfluorocarbons. The scale of this project is relatively small, and much of the work will be done with equipment that operates in these agricultural fields on a near-daily basis. In response to California Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006, an estimation of the greenhouse gas (GHG) emissions that will be produced by this project has been developed. The effect of the six principal GHGs of concern are normally reported as "CO_2 equivalents," which is a convention that converts each GHG to an equivalent amount of CO_2, accounting for the varying global warming potential of each gas.

Construction of a farm scale permanent wetland on the western side of Sherman Island would contribute to GHG emissions primarily through the use of diesel-powered construction equipment. The combustion of diesel fuel in off-road construction equipment and on-road vehicles (backhoe, trucks, etc.) would emit greenhouse gases consisting mainly of carbon dioxide (CO_2), along with small amounts of methane (CH_4) and nitrous oxide (N_2O). Over the short term of project construction, this project is expected to generate approximately 1,115 metric tons of CO_2-equivalent emissions, 1,105 metric tons of construction equipment emissions, about 5 metric tons of construction workforce transportation emissions, and about 5 metric tons of construction workforce transportation emissions.

No state or federal agency has yet established significance criteria (thresholds of significance) for GHG or other impacts to global climate change. However, some statewide standards have been established that provide information about the order of magnitude of emissions that might be considered significant. Pursuant to AB 32, the California Air Resources Board (CARB) mandates that only "large" facilities (i.e., stationary, continuous sources of GHG emissions) that generate greater than 25,000 metric tons of CO_2 equivalents (CO_2e) per year report their GHG emissions. In addition, CARB has released a preliminary draft staff proposal that recommends 7,000 metric tons of CO_2e per year be used as the baseline threshold for impacts. It is not the intention of the lead agency to adopt a 25,000 or 7,000 $MTCO_2e$ threshold of significance, but only to provide context to the scale of the emissions from the proposed project. The emissions from the proposed project are three and two orders of magnitude lower than CARB's current reporting level and proposed significance threshold, respectively.

The Project is anticipated to provide climate benefits by sequestering atmospheric carbon dioxide (CO2) that will help provide a net reduction in greenhouse gases (GHGs). Pending the availability of funding, the Project Site will provide the opportunity for researchers to use on-site monitoring and data from applied research sites on Sherman and Twitchell Islands to quantify climate benefits. GHG reductions quantified for the site's permanent water management regime have the potential to be extrapolated to other similar sites throughout the Delta.

There will be approximately 1000 acres of restored wetlands on this Sherman Island site. The created wetlands are managed in a manner that sequesters atmospheric carbon.Rates of sequestration and emission from such agriculture practices depend upon many factors, including tule species, depth and duration of inundation, and the age of the wetlands. There are too many variables to accurately estimate the amount of carbon the mature tule fields will sequester, but based on the Department's most current understanding of these systems, the tule fields are anticipated to be a net carbon sink. It is estimated, based on recent research results, that approximately 112 acres of wetlands could sequester the total CO2 produced (1,120 metric tons) during the construction phase of the project in one year's time. (Phillip Williams & Associates, 2009)

Based on the review of the discussed above, this project does not conflict with any statewide or local goals with regard to reduction of GHG and the discharge of greenhouse gases to the atmosphere during and after construction is believed to be less than significant, and no significant negative impact to air quality or climate change is expected.

b. Since scale of this project is relatively small, and much of the work will be done with equipment that operates in these agricultural fields on a near-daily basis. No impact.

Construction Equipment Emissions

Type of Equipment	Maximum Number per Day	Total Operation Days[1]	Total Operation hours[2]	Fuel Consumption Per Hour[3]	Total Fuel Consumption (gal. diesel)	CO_2e/gal Diesel[4]	Total CO_2 Equivelant Emissions (metric tons)
Backhoe	1	60	480	3	1,440	0.010391	14.96
Excavator	1	80	640	5	3,200	0.010391	33.25
Water Truck	3	121	2904	3	8,712	0.010391	90.53
Scraper	8	121	7744	12	92,928	0.010391	965.65
TOTAL					106,280		1,104.40

[1] A 121-day total construction season is assumed (June 1-October1)

[2] A 8-hour work day is assumed, multiplied by the maximum number per day. This list of equipment is estimated and could change depending on equipment availability.

[3] Caterpillar Performance Handbook. Edition 36

[4] World Resources Institute-Mobile combustion CO2 emissions tool. June 2003 Version 1.2

Construction Workforce Transportation Emissions

Average Number of Workers per Day	Total Number of Workdays	Average Distance Travelled (round trip)	Total Miles Travelled	Average Passenger Vehical Fuel Efficiency[5]	Total Fuel Consumption (gal. gasoline)	CO_2e/gal Gasoline[5]	Total CO_2 Equivelant Emissions (metric tons)
5	121	20	12100	20.8	581.7	0.00901	5.2

[5] United States Environmental Protection Agency. 2008. Light-Duty Automotive Technology and Fuel Economy Trends:

Construction Materials Transportation Emissions

Trip Type	Total Number of Trips[6]	Average Trip Distance	Total Miles Travelled	Average Semi-truck Fuel Efficiency	Total Fuel Consumption (gal. diesel)	CO_2e/gal Diesel[3]	Total CO_2 Equivelant Emissions (metric tons)
Delivery	25	120	3000	6	500	0.010391	5.20
Spoils	0	0	0	6	0	0.010391	-
TOTAL					500.00		5.20

[6] Total Number of Trips determined by estimating the quantity of hydraulic materials (pipe, fittings, joints, water control structures, etc.) that needed to be delivered via semi-truck to the work site (conservative estimate was 25 truck loads).

Operational Emissions

Average Annual Electricity Needed	NA	
Average Annual Production Emissions	NA	
TOTAL	0	

Total Greenhouse Gas Emissions 1,114.8 MT CO_2 equivelants

Construction Equipment Emissions	1,104.4
Workforce Transportation Emissions	5.2
Construction Materials Emissions	5.2
Operational Emissions	-

8. HAZARDS AND HAZARDOUS MATERIALS	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☑	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☑
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☑
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☑
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☑
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☑
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☑
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☑

Response:

a. Management of the wetlands and vector control activities may require the use of herbicides and pesticides (Ducks Unlimited 2008). The transport, use and disposal of herbicides and pesticides will be in compliance with the manufacturers' guidelines and will not create a significant hazard to the public or environment. This impact would be less than significant.

b. Hazardous material will not be stored on site. No impact would occur.

c. There are no existing or proposed schools located within one-quarter mile of the Site. No impact would occur.

d. The Project Site is not listed as having hazardous material sites within its boundaries (Department of Toxic Substance Control 2008). No impact would occur.

e. The Project Site is not located within an airport land use plan or within 2 miles of a public airport or public use airport. The closest airport is located approximately 7 miles from the Site. No impact would occur.

f. No private airstrips are within 2 miles of the Project Site. No impact would occur.

g. Activities would not impair implementation of or physically interfere with any emergency response or evacuation plans. Reclamation District 341 does have an emergency response plan in case of high water or flooding, but because the Project is located on land below sea level and not in any evacuation path, no impact could be reasonably expected to occur.
No impact would occur.

h. The perennially flooded conditions of the Site would substantially reduce the potential for any wildland fires to occur. No impact would occur.

9. HYDROLOGY AND WATER QUALITY	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☐	☑
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☐	☑
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?	☐	☐	☑	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☐	☐	☑	☐
e) 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?	☐	☐	☐	☑
f) Otherwise substantially degrade water quality?	☐	☑	☐	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☑

h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☑
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☑
j) [Expose people or structures to] inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☑

Response:

Environmental Setting:

The project involves restoring palustrine emergent wetlands to reverse land subsidence that has been caused by exposure of organic soils to air as a result of farming activities. Through many years of subsidence, the Project Site is located in a basin up to 20 ft below sea level, protected from Delta waters by the levees around Sherman Island. Semi-continuous pumps have historically been used to remove agricultural drainage and maintain a low water table. Upon completion of the project, the wetland will require regular water deliveries, draw downs, and overall management to support the desired vegetation and wildlife communities (USGS 2006).

The Delta serves as a vast drainage area for agricultural and urban runoff. This runoff contains a variety of surplus and residual pesticides and nutrients, in addition to contaminants leached from the soils of specific regions. Drainage from within the Delta contains dissolved organic compounds (DOCs) from the islands' peaty soils, which increase downstream water treatment costs and drinking water quality risks. Sacramento Valley drainage includes mercury and other wastes from historic mining activities, and San Joaquin Valley agricultural drainage includes salts originating in the soils in the Valley's west side and in irrigation water (Lund et al. 2007).

Failure of the levees and the flooding of subsided islands such as Sherman Island, particularly during the spring and summer months, has the potential to significantly degrade Delta water by drawing brackish water into the Delta during rapid flooding of Delta islands, and changing the dynamics of the tides in the west Delta (Mount and Twiss 2005). Controlling and reversing subsidence on these highly subsided delta Islands is seen as a way to reduce the risk of catastrophic levee failure, and therefore reduce the potential of degraded water quality.

Impact Discussion:

a. The Project is designed to retain all water provided to it and not release any water to surrounding water bodies (see discussion below). The proposed project would not generate wastes that would be intentionally discharged to surface waters. No impact would occur.

b. The project would not affect groundwater supplies or interfere with groundwater recharge because the project will not withdraw groundwater. The source of water for the project will be drainage water pulled from with the island's existing drainage canals. No impact would occur.

c. The existing drainage pattern through the site will be substantially altered, but not in a manner that would result in substantial erosion or siltation on- or off-site. The created open water and restored wetlands will be completely enclosed perimeter berms that will prevent discharge of storm runoff. Best management practices for erosion control and hazardous materials handling will be implemented during construction. These activities would have a less than significant impact.

d. The existing drainage pattern through the site will be substantially altered, but not in a manner that would result in (unintended) flooding on- or off-site. The goal of this Project is to flood a portion of Sherman Island and restore several hundred acres of palustrine wetlands; therefore there will be flooding onsite, but certainly not flooding that would be harmful or create any adverse environmental impact. This Project will not alter how runoff is removed from the rest of the island. These activities would have a less than significant impact.

e. The Project would not increase runoff volumes or add substantial pollutants to storm-water flows to the Delta. Small amounts of water, less than current levels may be discharged from the site at times to maintain salinity levels within freshwater marsh. However, the Project is designed to retain all water provided to it and not release any water to surrounding water bodies. Wetlands provide a natural mechanism to reduce pollutants in storm-water. This impact is less than significant.

f. The Project is designed to retain all water provided to it and not release any water to surrounding water bodies. As such the potential to create Mosquito breeding habitat is likely. Wetlands in the Central Valley and Sacramento-San Joaquin Delta are well known for their capabilities to produce mosquitoes. Because of its flooded pasture land uses, Sherman Island in particular produces some of the highest numbers of mosquito larvae in the western Delta. The island is within the Sacramento-Yolo Mosquito and Vector Control District (SYMVCD). The SYMVCD regularly inspects and controls mosquito larvae on the island using larvacide control methodologies. In an effort to minimize mosquito production from this project, the SYMVCD has been an active participant in the planning process. Using water and habitat Best Management Practices (BMPs) to limit the growth and spread of mosquitoes is important. The BMPs included in Appendix F have been incorporated and utilized during the development and long-term management of the project to minimize the growth of mosquito populations. In fact, by utilizing these BMPs, studies performed by the SYMVCD on Sherman Island have shown to reduce the number of mosquitoes as compared to current irrigated pasture land use due to the ability for mosquito fish penetration and effectiveness.

While the Project will request a 401 Water Quality Certification it is not anticipated that the CVRWQCB will recommend site-specific monitoring for methylmercury. However, any and all 401 Water Quality Certification requirements will be incorporated into the Project and made a material part of the mitigation and monitoring program if required. Potential impacts from methylmercury will be less than significant.

g. No housing is proposed as part of the proposed project. Therefore, no impact would occur.

h. The project is located within the 100-yr floodplain Zone AE (FEMA 1988), but entirely within flood control levees specifically designed to redirect flood flows. If the flood control levees hold during a flood, the project will have no impact on flood flows. If the flood control levees do not hold, then the small berms used as part of the project will have no effect on the flood flows. The project will improve the existing berms and also includes installation of various water control structures typical of managed wetlands throughout the Central Valley. The water control structures are designed only to regulate water levels within and between units, meandering berms and canals to support the desired vegetation and wildlife communities but no volume loss would occur as these berms would be off-set by cuts. No impact would occur.

i. Continued subsidence of Delta islands combined with a rise in sea level caused by global warming, significantly threatens levee stability in the Delta (Mount and Twiss 2005). Reversing the subsidence would have a net beneficial effect on existing conditions by reducing the potential for levee failure by relieving pressure on the levees. No impact would occur.

j. The project does not increase potentials for inundation by seiche, tsunami, or mudflow. No impact will occur.

10. LAND USE AND PLANNING	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Would the project:				
a) Physically divide an established community?	☐	☐	☐	☑
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☑
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☑

Environmental Setting:
The Project is located in southwest Sacramento County. Solano County is located across the Sacramento River to the north and Contra Costa located across the San Joaquin River to the south. Land uses in the immediate vicinity of the site include primarily livestock grazing. The majority of Sherman Island on which the Site is located, is owned by the State Department of Water Resources (DWR).

Impact Discussion:
a. The proposed project would not physically divide an established community as none occur in or immediately adjacent to the Site. No impact would occur.

b. State agencies are exempt (as established by *Hall vs. City of Taft* [1952] 47 Cal.2d 177) from complying with local or county plans, policies, or zoning regulations. State agencies however, must comply with state laws and regulations, including CEQA, and in so doing, minimize environmental effects, such as conflicts with local plans and policies intended to protect the environment. For these reasons, DWR takes into account local land use policies and regulations when making land use planning decisions.

The site is located in Sacramento County, so the General Plan for Sacramento County was considered in the development of this project. The 1993 General Plan Land Use Diagram identifies Sherman Island as Agricultural Cropland under the Sacramento County General Plan with a combining designation of Resources Conservation Area (Sacramento County 2008). This designation represents agricultural lands most suitable for intensive agriculture. The designation is generally limited to areas where soils are rated from Class I to Class IV by the Soil Conservation Service, or are classified Prime, Statewide, or Unique significance by the State of California Conservation Department. However, due to continuing subsidence and a high water table, continuing traditional agricultural practices are considered unsustainable and increase the risk of catastrophic levee failure, which would lead to degraded water quality. No impact would occur.

c. There is no applicable habitat conservation plan or natural community conservation plan currently in place. No impact would occur.

11. MINERAL RESOURCES	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	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?	☐	☐	☐	☑

Response:

Environmental Setting:

Mineral resources in Sacramento County include natural gas, petroleum, sand, gravel, clay, gold, silver, peat, topsoil, and lignite. The natural gas production areas of Sacramento County are located mostly in the Delta's Rio Vista Field located approximately 3 miles northeast of the Site (County of Sacramento 2006). Peat is not commercially mined in Sacramento County and no other mineral resources are found in or immediately adjacent to the Site.

Impact Discussion:

a. The proposed project would not compromise the availability of any known mineral resources. While no known natural gas fields occur within the area of the Site, it is possible that the resource does exist within the boundaries of the site. Nevertheless, the ability to extract natural gas would not be compromised by the Project. No impact would occur.

b. The Sacramento County General Plan's Conservation Element indicates that there are no mineral resources located in or immediately adjacent to the Site. No impact would occur.

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

Environmental Setting:

The Site is located in a rural area of Sacramento County and the noise environment surrounding the Site is typical of a rural environment. There are no sensitive noise receptors within one mile of the Site.

Impact Discussion:

a. Temporary increases in noise levels from existing conditions would result from heavy equipment during construction of conveyance channels, improvements to existing berms, and loafing islands. The

Sacramento County performance standards are based on the type of receptor that would hear the noise. Because no sensitive noise receptors occur within one mile of the Site, no impact would occur.

b. Construction activities will not create excessive ground borne vibrations or ground borne noise levels. Because no sensitive noise receptors occur in or within one mile of the Site, no impact would occur.

c. After construction, periodic monitoring, maintenance, and vector control activities would be conducted. These activities would not result in a substantial permanent increase in ambient noise levels above existing noise levels. No impact would occur.

d. After construction, periodic monitoring, maintenance, and vector control activities would be conducted. These activities would not result in a substantial permanent increase in ambient noise levels above existing noise levels. No impact would occur.

e. The Project is not located within an airport land use plan area or in an area where a plan is being contemplated. The closest airport is ± 7 miles from the Site. No impact would occur.

f. The proposed project would not be located within the vicinity of a private airstrip. No impact would occur.

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

Response:

Environmental Setting:

The Site is located on Sherman Island in a rural area of Sacramento County. There are several residences on Sherman Island on lands not owned by DWR. The area where the Project is proposed to be built was farmed for many years. The only on-site improvements are related to distribution of water for crop irrigation, e.g., ditches and flashboards.

Impact Discussion:

a. The proposed project does not involve construction of any new homes, businesses, roads, or other growth inducing infrastructure. No impact would occur.

b. No demolition of housing would occur as a result of removal activities. The project is located on an uninhabited portion of a mostly uninhabited island. Therefore, displacement of housing would not occur. Indirect impacts on residential areas elsewhere would not be expected to occur. No impact would occur.

c. The proposed project area is located in an area where no housing is currently present. Thus, the Project could not be reasonably expected to displace people or require the construction of housing elsewhere. No impact would occur.

14. PUBLIC SERVICES	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
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 services ratios, response times or other performance objectives for any of the public services:	☐	☐	☐	☑
Fire protection?	☐	☐	☐	☑
Police protection?	☐	☐	☐	☑
Schools?	☐	☐	☐	☑
Parks?	☐	☐	☐	☑
Other public facilities?	☐	☐	☐	☑

Response:

Environmental Setting:

The Site is located in a rural area of Sacramento County with relatively few public services.

Impact Discussion:

The proposed project would not require additional fire protection. Permanent inundation of wetlands would reduce the potential fire hazard on the site. The proposed project would not require police services. No schools are located in the vicinity of the Site. The proposed project would not lead to population increases in numbers of students. The project is not located near recreational facilities. The activities associated with the subsidence reversal project would not adversely affect public facilities because of the small number of persons and vehicles undertaking these activities and the intermittent nature of the activities. No impact would occur under any of the above circumstances.

15. RECREATION	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	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?	☐	☐	☑	☐

Response:

Environmental Setting:

Recreational facilities in the vicinity of the Site provide a variety of activities. Recreational demand in the Delta has resulted in development of parks, marinas, launching ramps, and fishing piers.

Impact Discussion:

a. The proposed Project will not affect park use at any neighborhood, regional or other recreational facilities. No impact would occur.

b. The project could result in an increase in recreational hunting because the Site may be used for hunting in the future. Any impact from this speculative possibility would nevertheless be less than significant.

16. TRANSPORTATION / TRAFFIC	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☐	☐	☐	☑
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☐	☐	☐	☑
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☑
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☑
e) Result in inadequate emergency access?	☐	☐	☐	☑
f) Result in inadequate parking capacity?	☐	☐	☐	☑
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☑

Response:

Environmental Setting:

Regional access to the site is via Hwy. 160.

Impact Discussion:

a. The proposed project would not result in a substantial increase in traffic nor have the potential to result in a substantial increase in the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections. While during construction various pieces of heavy equipment will be moved on to the Site, the mobilization and demobilization of this type of heavy equipment is common in the

area and would not be expected to result any increase in traffic relative to the amount of traffic experienced during agricultural operations. No impact would occur.

b. The proposed project would generate negligible traffic and as such would not exceed a level of service standard, either individually or cumulatively. No impact would occur.

c. The proposed project will not result in any change in air traffic. No impact would occur.

d. The proposed project would not result in any new road construction and therefore would not present hazards due to a design feature or incompatible uses. No impact would occur.

e. The proposed project would not have the potential to affect emergency access. No impact would occur.

f. The proposed would not affect parking capacity. No impact would occur.

g. The proposed Project would not affect policies with respect to alternative transportation. No impact would occur.

17. UTILITIES AND SERVICE SYSTEMS	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☐	☑
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☑
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☐	☑
e) Result in a determination by the wastewater treatment provider which services 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?	☐	☐	☐	☑
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☑
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☑

Response:

Environmental Setting:

The Site is located in a rural area and has no urban utilities and services.

Impact Discussion:

a. The project does not require waste water treatment capabilities. No impact would occur.

b. The proposed project does not include structural development that would require water delivery or would generate wastewater. No impact would occur.

c. No development requiring storm drainage facilities would occur as a result of the proposed project. No impact would occur.

d. The Site has been historically operated as irrigated agricultural land. The proposed project will use a large volume of water initially to saturate the wetlands. Following initial inundation of the Site, the project would require less water to maintain water levels in the wetlands than it currently receives for irrigation (HydroFocus 2008). The water required to maintain the proposed wetlands is available through existing entitlements. No impact would occur.

e. The proposed project does not require wastewater treatment services. No impact would occur.

f. The proposed project will not generate solid waste. No impact would occur.

g. The project will not generate solid waste. No impact would occur.

18. MANDATORY FINDINGS OF SIGNIFICANCE	Potentially Significant Impact	Less than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☑	☐
b) Does the project have 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?	☐	☐	☐	☑

Impact Discussion:

a. The purpose of the Project is to reverse land subsidence on a portion of Sherman Island. Implementation of the project will result in wetlands being created thereby increasing the suitable habitat for waterfowl and other wildlife species. No significant environmental or biological resources would be adversely affected. Therefore, the project will not result in a significant impact to the environment.

b. The project would have a de minimis contribution to the effects of other developments. Since all impacts would be less than significant, no significant cumulative impacts would occur.

c. No potentially substantial adverse effects on human beings will occur as a result of the project.

Appendix A

References

Books, Journal Articles, Reports:

Brode, J., and G. Hansen. 1992. Status and future management of the giant garter snake (Thamnophis gigas) within the southern American Basin, Sacramento and Sutter counties, California. California Department of Fish and Wildlife, Inland Fisheries Division.

California Department of Conservation (CDC), Division of Land Resource Protection, Farmland Mapping and Monitoring Program. Sacramento County important farmland 2010 (map). State of California Department of Conservation, Sacramento, CA. ftp://ftp.consrv.ca.gov/pub/dlrp/FMMP/pdf/2010/sac10.pdf

California Department of Fish and Wildlife (DFW 2013). Email correspondence with Laura Patterson, Statewide Coordinator for Reptile Conservation, on August 20-21, 2013.

California Department of Fish and Wildlife. 2018. State and federally listed endangered and threatened animals of California. Habitat Conservation Division, CNDDB, Sacramento, CA. <http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEAnimals.pdf>

California Department of Fish and Wildlife. 2018. Special vascular plants, bryophytes, and lichens list. Habitat Conservation Division, CNDDB, Sacramento, CA. <http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPPlants.pdf>

California Department of Fish and Wildlife. 2018. State and federally listed endangered, threatened, and rare plants of California. Habitat Conservation Division, CNDDB, Sacramento, CA. <http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf>

California Department of Water Resources (DWR 2008). Unpublished document titled: Mayberry Farms Subsidence Reversal Project Description.

California Department of Water Resources (DWR. 2010). Results of giant garter snake trapping effort on Twitchell and Sherman Islands in 2009. Unpublished data.

California Department of Water Resources (DWR 2013). August 2012. *DWR Bird Monitoring within the West Delta Monitoring Report for 2012-13 Surveys at Sherman Island Whale's Mouth Project Site.* Ron Melcer, Environmental Scientist (DWR).

California Native Plant Society (CNPS). Accessed 2018. Inventory of rare and endangered plants. California Native Plant Society, Sacramento, CA. <http://www.cnps.org/inventory>

Central Valley Regional Water Quality Control Board (CVRWQCB). February 2008. Amendments to the water quality control plan for the Sacramento River and San Joaquin River basins for the control of methylmercury and total mercury in the Sacramento-San Joaquin Delta Estuary: Staff Report: Draft report for public review. California Environmental Protection Agency, Regional Water Quality Control Board Central Valley Region, Rancho Cordova, CA. <http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/delta_hg/staff_report_feb08/bpa_full_rpt.pdf>

Department of Toxic Substance Control. Accessed 2012. EnviroStor search for Antioch, Federal superfund sites (NPL), State response sites, voluntary cleanup sites, school cleanup sites, permitted sites, corrective action sites. <http://www.envirostor.dtsc.ca.gov/public/map.asp?global_id=07010012>

Department of Water Resources and Ducks Unlimited, Inc. 2018. Habitat and water management plan for the Belly Wetland Habitat Restoration Project

Ducks Unlimited, Inc. 2018. Wetland Delineation for the Sherman Island Belly Wetland Habitat Restoration Project, Sacramento County, California.

EDAW. April 2007. Lower Sherman Island Wildlife Area Land Management Plan. Prepared for the California Department of Fish and Wildlife.

Estep. J. 1989. Biology, Movements, and Habitat Relationships of the Swainson's Hawk in the Central Valley of California, 1986-87. California Department of Fish and Wildlife, Nongame Bird and Mammal Section Report, 52pp.

Fleck, J. A., M. Fram, and R. Fujii. 2007. Organic Carbon and disinfection byproduct precursor loads from a constructed, non-tidal wetland in California's Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science 5:2 (Article 1). <http://repositories.cdlib.org/jmie/sfews/vol5/iss2/art1>

Hansen, G. E. 1986. Status of the giant garter snake Thamnophis couchi gigas (Fitch) in the Southern San Joaquin Valley During 1986. Final report for California Department of Fish and Game, Standard Agreement No. C-1433. Unpublished. 31 pp.

Hansen, R.W. 1980. Western aquatic garter snakes in central California: an ecological and evolutionary perspective. Master of Arts thesis, California State University, Fresno, California, 78 pp.

Halstead, Brian J., Glenn D. Wylie, and Michael L. Casazza. 2010. Habitat Suitability and Conservation of the Giant Gartersnake (Thamnophis gigas) in the Sacramento Valley of California. Copeia 4: 591- 599.

Intergovernmental Panel on Climate Change. 2007. Climate Change 2007 Synthesis Report. <http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm>

Kwansy, D. C., M. Wolder, and C. R. Isola. June 2004. Technical guide to best management practices for mosquito control in managed wetlands. Central Valley Joint Venture and printed by U.S. Bureau of Reclamation.

Lund, J., E. Hanak, W. Fleenor, R. Howitt, J. Mount, and P. Moyle. 2007. Envisioning futures for the Sacramento—San Joaquin Delta. Public Policy Institute of California, San Francisco, CA.

Mount, J. and R. Twiss. 2005. Subsidence, sea level rise, seismicity in the Sacramento-San Joaquin Delta. San Francisco Estuary and Watershed Science 3:1 (Article 5). <http://repositories.cdlib.org/jmie/sfews/vol3/iss1/art5>

Patterson, L. and E. Hansen. 2003. Giant Garter Snake Surveys on Bacon Island and Webb Tract in 2003. California Department of Water Resources: Sacramento, California. 22 pages.

Philip Williams & Associates, Ltd. And Science Applications International Corporation. 2009. Greenhouse Gas Mitigation Typology Issues Paper Tidal Wetlands Restoration. California Climate Action Registry. 69 pgs.

Sacramento County. 1981. Sacramento County Tree Preservation Ordinance Chapter 19.12. Planning and Community Development Department, County of Sacramento, Sacramento, CA.

Sacramento County. Accessed 2012. General plan land use diagram, December 15, 1993, Sacramento County, CA. <http://www.planning.saccounty.net/general-plan/docs/pdf/GP-Maps/Land-Use-Diagram.pdf>

Sacramento County. 23 June 2006. Mineral resources map. *In* Conservation element of County of Sacramento General Plan. Resolution No. 2004-0174, Control No. 02-GPB-0379. Planning and Community Development Department, General and Advance Planning Section, County of Sacramento, Sacramento, CA.

Sacramento Metropolitan Air Quality Management District. 2013. Air quality standards attainment status chart for Sacramento County. <http://www.airquality.org/aqdata/attainmentstat.shtml>

Schlorff, R.W. and P.H. Bloom. 1984. Importance of Riparian Systems to Nesting Swainson's Hawks in the Central Valley of California. In: California Riparian Systems: Ecology, Conservation, and Productive Management. Berkeley: University of California Press, c1984 1984. http://ark.cdlib.org/ark:/13030/ft1c6003wp/.

Shuford, W. D. and T. Gardali, eds. 2008. California bird species of special concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, CA and California Department of Fish and Wildlife, Sacramento, CA.

Swaim, K.. 2004. Results of surveys for the giant garter snake (Thamnophis gigas) in Marsh Creek and the Contra Costa Canal, Northeast Contra Costa County, California. Report prepared for Sycamore Associates LLC, Walnut Creek, by Karen Swaim, Swaim Biological Consulting, Livermore CA.

Tom Origer and Associates (2018). A Cultural Resources Study for the Sherman Island Wetland Restoration Project-Phase II DU Project No. US-CA-437-4 Sacramento County, California.

U.S. Environmental Protection Agency. 2008. Light Duty Automotive Technology and Fuel Economy Standards.

U.S. Fish and Wildlife Service (USFWS 2012). 18 April 2012. Official Species List for Twitchell Island (Document No. 120418052904)

U.S. Fish and Wildlife Service (USFWS 1997). 13 November 1997. Programmatic formal consultation for U.S. Army Corps of Engineers 404 permitted projects with relatively small effects on the giant garter snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter and Yolo counties, California. U.S. Fish and Wildlife Service, Sacramento, CA.

U.S. Fish and Wildlife Service (USFWS 1999). 1999. Draft Recovery Plan for the Giant Garter Snake (Thamnopsis gigas). Sacramento Fish and Wildlife Office, Sacramento, CA. 192 pp.

U.S. Geological Survey (USGS 2006). Subsidence reversal and carbon sequester using re-establishing wetlands. CA Department of Water Resources and the U.S. Geological Survey.

U.S. Geological Survey (USGS 2011). Bayesian Adaptive Survey Protocols for Resource Management.. Brian Halstead et. al. , U.S. Geological Survey, Western Ecological Research Center, Dixon Field Station, 6924 Tremont Road, Dixon, CA

Woodbridge, B. 1998. Swainson's Hawk (Buteo swainsoni). In the Riparian Bird Conservation Plan: a strategy for reversing the decline of riparian-associated birds in California. California Partners in Flight. https://www.prbo.org/calpif/htmldocs/riparian_v-2.html

World Resources Institute-Mobile combustion CO2 emissions tool. June 2003, version 1.2.

WRA (November 2018) Special-Status Plant Survey Report Sherman Island Wetland Restoration Project: Phase II Sherman Island Sacramento County, California

CDFW 2012. Staff Report on Burrowing Owl Mitigation. March 7. Accessed from http.//www.dfg.ca.gov/wildlife/nongame/survey_monitor.html on May 12, 2016.

Conway, Courtney J, Victoria Garcia, Matthew D. Smith, and Katie Hughes. 2008. Factors Affecting Detection of Burrowing Owl Nests During Standardized Surveys. The Journal of Wildlife Management. 72(3): 688-696.

Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. Burrowing Owl (Speotyto cunicularia). In A. Poole and F. Gill, eds. The Birds of North America, No. 61. The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Thomsen, L. 1971. Behavior And Ecology Of Burrowing Owls On The Oakland Municipal Airport. Condor 73: 177-192.

Beedy EC, Hamilton WJ III, Meese RJ, Airola DA, Pyle P. 2017. Tricolored blackbird (Agelaius tricolor), version 3.0 [Internet]. In Rodewald PG, editor. The birds of North America. Ithaca (NY, USA): Cornell Lab of Ornithology. Available from: https://doi.org/10.2173/bna.tribla.03.

[CDFW] California Department of Fish and Wildlife [Internet]. CWHR life history accounts and range maps [accessed 2018 Jan]. Available from: https://map.dfg.ca.gov/imaps/cwhr/cwhrlife.html.

APPENDIX B

WRA Rare Plant Survey Report

Special-Status Plant Survey Report

Sherman Island Wetland Restoration Project: Phase II
Sherman Island
Sacramento County, California

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TABLE OF CONTENTS

LIST OF APPENDICES

1.0 INTRODUCTION

The approximately 1,966-acre Sherman Island Restoration Project site (Project Area), located in Sacramento County, California, is bounded by contiguous agricultural and pasture lands, associated ditches, and rural gravel roads, as well as the outboard levee of Sherman Island. The Project Area comprises pasture land and crop fields with associated irrigation canals and ditches. Areas not regularly grazed or tilled for crops are dominated primarily by ruderal vegetation. A small area of dredge spoils is also within the Project Area.

The purpose of this document is to describe the methods and results of protocol-level special-status plant surveys conducted by WRA, Inc. (WRA) in September 2018. Previous surveys were conducted by WRA in May and August 2015, and June 2016. The surveys are intended to determine the absence or presence of special-status plants protected under the Federal and State Endangered Species Acts (ESA, CESA), and through the California Environmental Quality Act (CEQA). Twelve special-status plant species were determined to have high or moderate potential to be present within the Project Area.

WRA botanists familiar with the vegetation and special-status plant species habitats in the Sacramento Delta conducted the protocol-level special-status plant surveys. The surveys coincided with the blooming period and/or a period sufficient to accurately identify the 12 special-status plant species with the potential to occur within the Project Area.

1.1 Project Area Description

The Project Area is located immediately east of Highway 160 on Sherman Island, situated immediately north of Sherman Island East Levee Road.

1.1.1 Vegetation

The Project Area vegetation is composed of ruderal upland areas, pasture and crop fields, irrigation canals and ditches, ponds, Himalayan blackberry (*Rubus armeniacus*) brambles, and dredge spoils. These habitats are summarized below.

Ruderal Upland. Ruderal upland vegetation occurs in areas where there has been a high degree of disturbance which allows for opportunistic invasive species to establish. In the Project Area, ruderal upland areas are situated in the southern portion, where it is associated with Sherman Island East Levee Road, a section in the northern portion where it is associated with an area assumed to be a site of dredging spoils deposition, and along several canal crossroads. The canal crossroad locations are too small to be mapped. The vegetation within these areas are dominated by a mosaic of non-native, ruderal and often invasive species, which do not appear to form distinct vegetation alliances as described in the *Manual of California Vegetation* (CNPS 2018b). Dominant species include ripgut brome (*Bromus diandrus*), slim oat (*Avena barbata*), prostrate knotweed (*Polygonum aviculare* spp. *aviculare*), Canada horseweed (*Erigeron canadensis*), yellow star thistle (*Centaurea solstitialis*) fennel (*Foeniculum vulgare*), dwarf mallow (*Malva neglecta*), and smooth crabgrass (*Digitaria ischaemum*).

Pasture Fields and Crop Fields. Pasture fields dominate the Project Area and consist primarily of Bermuda grass (*Cynodon dactylon*). Associated species included alkali mallow (*Malvella leprosa*), bird's foot trefoil (*Lotus corniculatus*), barley (*Hordeum marinum*), and perennial pepperweed (*Lepidium latifolium*). Italian rye grass (*Festuca perennis*) common mustard (*Brassica rapa*), western goldenrod (*Euthamia occidentalis*), and hairy leaved sunflower (*Helianthus annuus*) also occur in scattered locations within the pasture fields. There is no described Bermuda grass vegetation alliance (CNPS 2018b). Several crop fields located in the eastern portion of the Project Area contain corn (*Zea mays*).

Irrigation Canals and Ditches. Irrigation canals and ditches are man-made and located throughout the Project Area. These areas likely supplied water to crops before the land was converted for grazing. Vegetation present on the banks and within the channels includes two vegetation alliances: broadleaf cattail marsh (*Typha latifolia* Herbaceous Alliance) and California bulrush marsh (*Schoenoplectus californicus* Herbaceous Alliance) (CNPS 2018b). Dominant species include broadleaf cattail, California bulrush with associated species of poison hemlock (*Conium maculatum*), perennial pepperweed, barnyard grass (*Echinochloa crus-galli*), Himalayan blackberry, tall cyperus and common reed (*Phragmites australis*). In areas of still water, pondweed (*Potamogeton nodosus*), and mosquito fern (*Azolla filiculoides)* occurred on the water surface. The banks and channel walls of the canals and ditches were observed to be either heavily vegetated with little bare ground exposed or only exposed soil with no water.

Himalayan Blackberry Brambles. Several large, monotypic patches of Himalayan blackberry occur in the northeast and southern portions of the Project Area and can be classified as Himalayan Blackberry Brambles (*Rubus armeniacus* Shrubland Semi-Natural Alliance) (CNPS 2018b). Several smaller patches occur in mesic areas, especially adjacent to the irrigation ditches; however they are not large enough to be mapped. Due to the dense growth structure of Himalayan blackberry few species grow within the brambles.

Dredge Spoils. Sandy dredge spoils were placed in a large area in the southern portion of the Project Area. The vegetation on the dredge spoils was a matrix of dense narrowleaf willow (*Salix exigua* var. *exigua*) patches and bare ground with sparse Bermuda grass. Additional species observed on the dredge spoils include bristly ox-tongue (*Helminthotheca echioides*), spring vetch (*Vicia sativa*), seaside heliotrope (*Heliotropium curassavicum* var. *oculatum*), arroyo willow (*Salix lasiolepis*), rose clover (*Trifolium hirtum*), and short-podded mustard (*Hirschfeldia incana*).

Pond. Two small ponds are located in the southern portion of the Project Area, adjacent to the dredge spoils. Vegetation along the perimeter of the ponds was dominated by common reed, narrow leaf cattail (*Typha angustifolia*), poison hemlock, western goldenrod, perennial pepperweed, and California bulrush. Vegetation associated with the ponds can be best classified as Common Reed Marsh (*Phragmites australis* Herbaceous Alliance) (CNPS 2018b). The banks of the ponds were heavily vegetated, with the smaller pond nearly absent of open water due to dense vegetation.

2.0 METHODS

2.1 Habitat Assessment

The terms "special-status plant species" and "rare plant species" are used herein synonymously, and are defined here to include: (1) all plants that are federal- or state-listed as rare, threatened or endangered, (2) all federal and state candidates for listing, (3) all plants included in Lists 1

through 2 of the California Native Plant Society Rare plant Inventory and (4) plants that qualify under the definition of "rare" in the California Environmental Quality Act, section 15380.

A background information search was conducted to identify potential special-status plant species that may occur in the vicinity of the Project Area. A table of these species, and their protection status, habitat requirements, and likelihood to occur in the Project Area is provided in Appendix B. Sources for this search included the United States Fish and Wildlife Service (USFWS) Species List for Sacramento County (USFWS 2018), California Consortium of Herbaria (CCH 2018), California Department of Fish and Wildlife (CDFW) Natural Diversity Database (CNDDB 2018) database, and the California Native Plant Society (CNPS) Electronic Inventory of Rare and Endangered Vascular Plants of California (CNPS 2018). Searches included Jersey Island, Birds Landing, Rio Vista, Isleton, Antioch North, Bouldin Island, Antioch South, Bentwood, and Woodward Island USGS 7.5-minute quadrangles.

Based on the results of the background literature search, WRA botanists familiar with the vegetation and special-status plant species of the Sacramento Delta region remotely assessed the Project Area for habitat sufficient to support all special-status plant species documented within the greater vicinity of the Project Area. The assessment was conducted by utilizing the latest aerial photographs, soil maps, the Jersey Island and Antioch North USGS 7.5-minute quadrangles, and the relative location of the nearest documented occurrences of special-status plant species. Species dependent upon habitats absent within the Project Area (e.g. coastal scrub, serpentine grassland), were removed from further analysis.

Following the remote assessment, WRA botanists conducted a site visit to further assess the habitats within the Project Area, to determine the potential for special-status species to occur in the Project Area (Appendix B). Following the site visit, the remaining special-status plant species were further assessed based on known habitat requirements of the species, including: vegetation communities, soil affinity, associated species, topographic position, shade tolerance, disturbance tolerance, climatic conditions, and population distribution. The potential for each special-status plant species to occur in the Project Area was then evaluated according to the following criteria:

> **High Potential**: All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.
>
> **Moderate Potential**: Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.
>
> **Unlikely**: Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.
>
> **No Potential**: Habitat on and adjacent to the site is clearly unsuitable for the species requirements (associated species, substrate, elevation, hydrology, plant community, site history, disturbance regime).

2.2 Field Survey

Floristic, protocol-level special-status plant surveys were conducted in September 2018 to supplement previous special-status plant surveys conducted by WRA, Inc. in May 2015, August 2015, and June 2016. The surveys corresponded to peak blooming or fruiting periods for

observing and accurately identifying hundreds of plant species in the Delta, including the 12 special-status plant species determined to have a moderate or high potential to occur in the Project Area. The field surveys were conducted by botanists familiar with the flora Sacramento Delta region. Where and when possible, WRA consulted with other botanists, reviewed dates of historical documentation, or conducted reference site visits to ensure that the surveys were conducted within a period sufficient to identify the potentially occurring special-status plant species.

The surveys followed the protocol for plant surveys described by Nelson (1987), which complies with recommended resource agency guidelines (CNPS 2001, CDFG 2000, CDFG 2009, USFWS 1996). The Project Area was traversed on foot whereupon each habitat was thoroughly searched and all plant species observed were recorded (Appendix C). Plants were identified using *The Jepson Manual, 2nd Edition* (Baldwin et al. 2012) and *Jepson eFlora* (Jepson Flora Project 2018) to the taxonomic level necessary to determine whether or not they were rare. Nomenclature follows the Baldwin et al. (2012), the most recent and widely accepted authority on California floristics.

The surveys focused on capturing blooming periods of the special-status species determined to have potential to occur in the Project Area (Appendix B).

3.0 RESULTS AND DISCUSSION

3.1 Habitat Assessment

Results based upon a review of CNDDB (CDFW 2018), CNPS Electronic Inventory (CNPS 2018), and USFWS Species List (USFWS 2018) databases, 60 special-status plant species are documented in the greater vicinity of the Project Area; those recorded within a 5-mile radius of the Project Area are illustrated in Figure 3. A table of all 60 special-status plant species, including their habitat requirements, blooming periods, elevation ranges, and status, is provided in Appendix B.

Of the 60 potential sensitive species, 48 are unlikely or have no potential to occur in the Project Area due to one or more of the following reasons:

- Hydrologic conditions (e.g. vernal pool habitat) necessary to support the special-status plants do not exist in the Project Area;
- Edaphic (soil) conditions (e.g. volcanics) necessary to support the special-status plants do not exist in the Project Area;
- Topographic conditions (e.g. north-facing, mountainous, elevation range) necessary to support the special-status plants do not exist in the Project Area;
- Associated vegetation communities (e.g. chaparral, woodland) necessary to support the special-status plants do not exist in the Project Area;
- Suitable habitat and/or occurrences were not documented during prior (May and August 2015, June 2016) surveys;
- The Project Area is significantly disturbed and does not contain typical habitat for the species.

The remaining 12 species were determined to have a high or moderate potential to occur within the Project Area because the Project Area supports associated natural communities and there are documented occurrences within the vicinity of the Project Area.

There are several CNDDB special status plant species polygons mapped adjacent to the Project Area. It is known that frequently CNDDB polygons are generally mapped and therefore do not necessarily reflect the exact location of a reported population(s). The CNDDB polygons of Mason's Lilaeopsis (*Lilaeopsis masonii)*, soft salty bird's beak *(Chloropyron molle* ssp. *molle)*, delta mud wort *(Limosella australis)* and Suisun Marsh aster *(Symphyotrichum lentum)* which appear to be within the Project Area were visited as reference sites; no plants were observed. Additionally, the CNDDB records for these polygons indicate the habitats for the mapped species are located on the outboard side of the levy along the San Joaquin River, which is outside the Project Area (CNDDB 2018).

3.2 Field Survey

A combined total of 134 species were observed during the survey, of which 53 species are native and 79 are not native to California. Of the 79 non-native species, 40 are considered by the California Invasive Plant Council (Cal-IPC) to be invasive including seven ranked "High", 17 ranked "Moderate", and 16 ranked "Limited" (Cal-IPC 2018). A "High" ranking indicates the species have severe ecological impacts on physical processes, biotic communities. These species have attributes conducive to moderate or high rates of dispersal and establishment; most are widely distributed. A "Moderate" ranking indicates the species has a substantial but not severe ecological impact. These species have attributes for moderate to high rates of dispersal though establishment is generally dependent upon ecological disturbance. "Limited" ranking indicates the species are invasive but ecological impacts are limited on a statewide level but they may be locally persistent and problematic. These species have attributes that result in a low to moderate rate of invasiveness. Prior to conducting the surveys, CNDDB records very near the Project Area were visited to determine phenology of those sensitive species. Suisun marsh aster (*Symphyotrichum lentum*) was observed; no other special-status plants were seen during the reference site visits.

The protocol-level surveys of the Project Area for the target species resulted in a negative finding.

4.0 CONCLUSIONS AND RECOMMENDATIONS

WRA botanists familiar with the vegetation and special-status plant species habitats in the Sacramento Delta, including Sacramento, Solano, San Joaquin, and Contra Costa counties, performed protocol-level special-status plant surveys in September 2018 as well as in May and August 2015 and June 2016. Twelve special-status plant species were determined to have a moderate or high potential to occur within the Project Area. Survey dates were performed in a period sufficient to identify each species; however, no special-status plant species were observed during the surveys. Therefore, impacts to special-status plant species are not anticipated within the Project Area.

5.0 REFERENCES

Baldwin, B.G., D.H. Goldman, D.J. Keil, R. Patterson, T.J. Rosatti, and D.H. Wilken. 2012. The Jepson Manual: Vascular Plants of California 2nd Edition. University of California Press. Berkeley and Los Angeles, California.

California Department of Fish and Game (CDFG). May 2000. Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities. State of California, The Resources Agency, California Department of Fish and Game, Sacramento.

California Department of Fish and Game (CDFG). 2009. Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. California Natural Resources Agency, California Department of Fish and Game. November 24, 2009.

California Department of Fish and Wildlife (CDFW). 2018. California Natural Diversity Database (CNDDB), Wildlife and Habitat Data Analysis Branch. Sacramento. Accessed: September 2018.

California Native Plant Society (CNPS). June 2001. CNPS Botanical Survey Guidelines. California Native Plant Society Publication.

California Native Plant Society (CNPS). 2018. Electronic Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society, Sacramento, California. Available at: http://www.cnps.org/inventory. Accessed: September 2018.

California Native Plant Society (CNPS). 2018b. Manual of California Vegetation: Online Edition. Available at: http://vegetation.cnps.org/. Accessed: September 2018.

Consortium of California Herbaria (CCH). 2018. Data provided by the participants of the Consortium of California Herbaria. Available at: http://ucjeps.berkeley.edu/consortium. Accessed: September 2018.

Jepson Flora Project (eds.) 2018. *Jepson eFlora*. Available at: http://ucjeps.berkeley.edu/eflora/ Accessed Sep 28, 2018.

Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. The National Wetland Plant List: 2016 wetland ratings. Phytoneuron 2016-30:1–17.

Nelson, J.R. 1987. Rare Plant Surveys: Techniques for Impact Assessment. From Proceedings of a California Conference on the Conservation and Management of Rare and Endangered Plants, Sacramento, California, November 1986. California Native Plant Society Publication.

United States Fish and Wildlife Service (USFWS). September 1996. Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed, and Candidate Plants. Sacramento Fish and Wildlife Office.

United States Fish and Wildlife Service (USFWS). 2018. List of Federal Endangered and Threatened Species that Occur in Sacramento County, California. Available at: http://www.fws.gov/sacramento/es/. Accessed: September 2018.

University of California Integrated Pest Council (UC-IPM). 2018. UC-IPM Online: Weather Data and Products. Available at: http://www.ipm.ucdavis.edu/WEATHER/wxretrieve.html Accessed: September 2018.

APPENDIX A

Figures

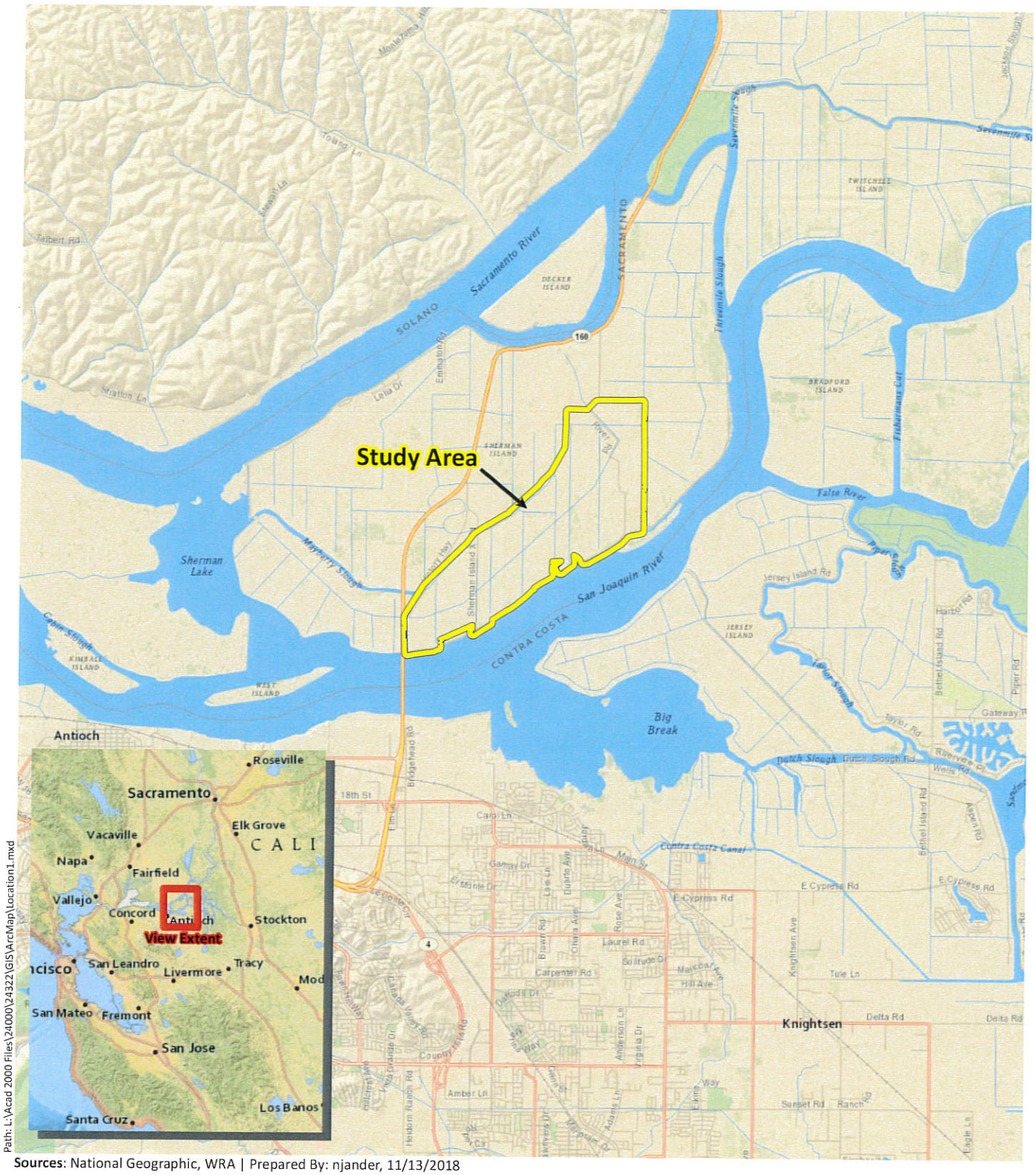

Figure 1. Study Area

Sherman Island Wetland Restoration
Project Phase II
Sacramento County, California

0 1 2 Miles

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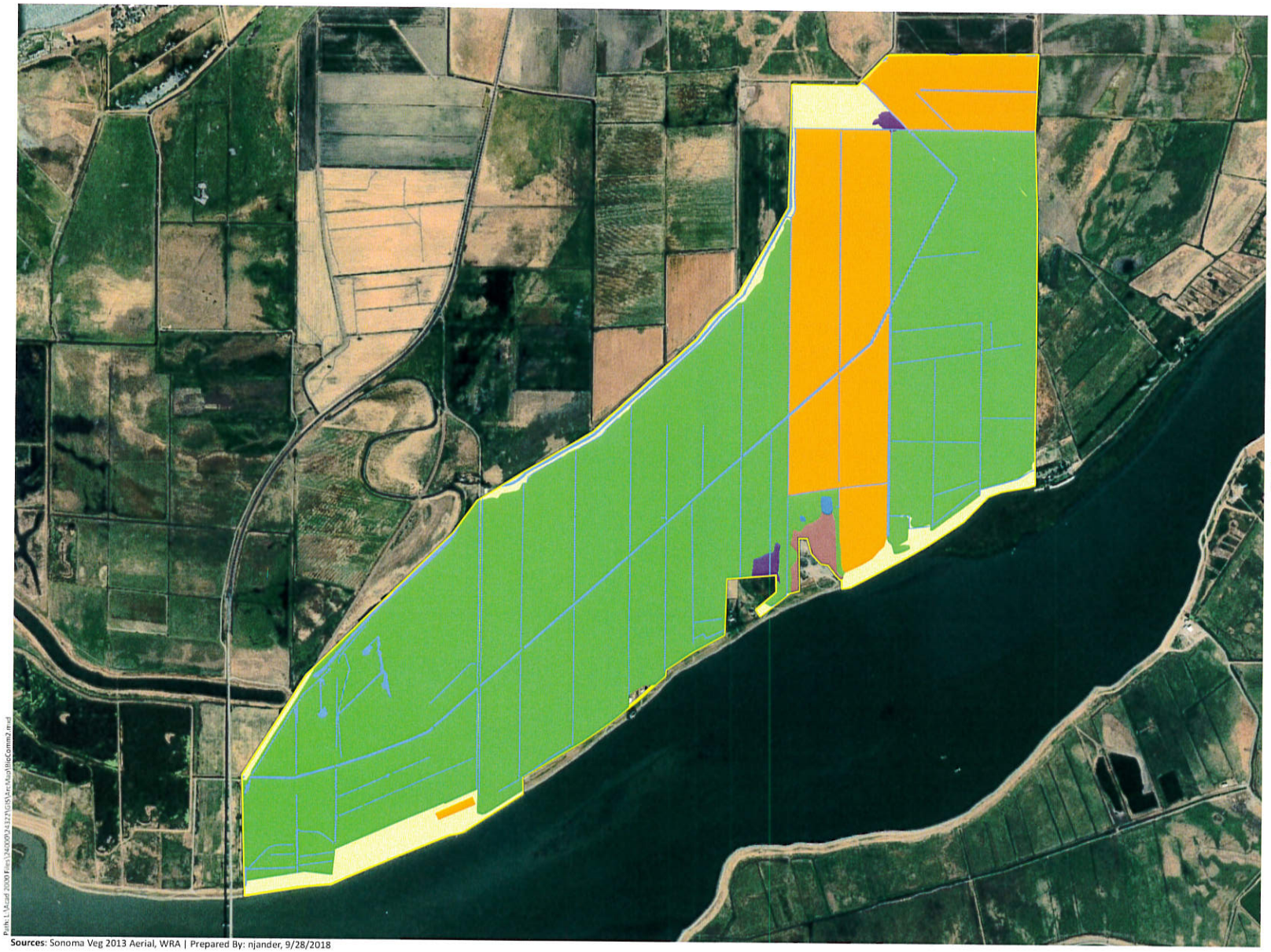

Figure 2.
Biological Communities

Sherman Island
Wetland Restoration
Project Phase II
Sacramento County,
California

Biological Communities

- Himalayan Blackberry Brambles (7.28 acres)
- Irrigation Canals and Ditches (49.38 acres)
- Dredge Spoils (12.62 ac.)
- Pasture Field (1,414.0 acres)
- Pond (1.73 ac.)
- Crop Fields (366.43 acres)
- Ruderal Upland (111.36 acres)
- Study Area (1966.15 acres)

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0 0.25 0.5
Miles

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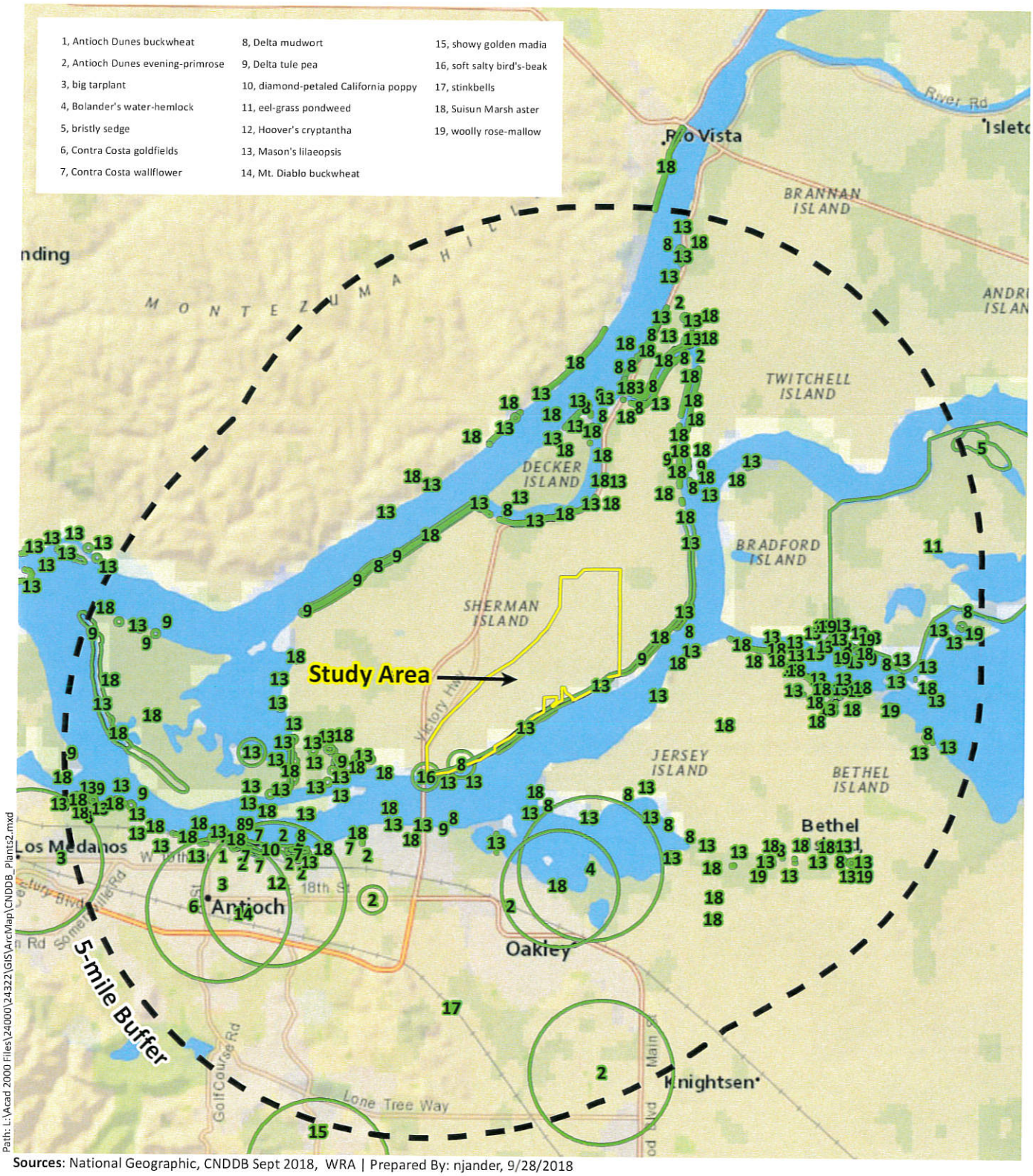
Path: I:\Acad 2000 Files\2400092432\GIS\Arc Map\BioComm2.mxd

Sources: Sonoma Veg 2013 Aerial, WRA | Prepared By: njander, 9/28/2018



Sources: National Geographic, CNDDB Sept 2018, WRA | Prepared By: njander, 9/28/2018

Figure 3. Special-Status Plant Species Documented within 5-miles of the Study Area

Sherman Island Wetland Restoration
Project Phase II
Sacramento County, California

0 1 2 Miles

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APPENDIX B

Potential Special Status Plant Species to Occur in the Project Area

Appendix B. Potential for Special-status Plant Species to Occur in the Project Area. List compiled from the California Department of Fish and Wildlife (CDFW) Natural Diversity Database (September 2018), U.S. Fish and Wildlife Service (USFWS) Species Lists (September 2018), and California Native Plant Society (CNPS) Electronic Inventory (September 2018) searches of the Birds Landing, Rio Vista, Isleton, Bouldin Island, Antioch North, Jersey Island, Woodward Island, Antioch South, and Bentwood USGS 7.5' quadrangles.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
PLANTS				
large flowered fiddleneck *Amsinckia grandiflora*	FE, SE, Rank 1B.1	Cismontane woodland, valley and foothill grassland. Elevation ranges from 885 to 1805 feet (270 to 550 meters). Blooms (Mar)Apr-May.	**No Potential.** The Project Area does not contain woodland or high quality grassland habitat necessary to support this mainland species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Mt. Diablo manzanita *Arctostaphylos auriculata*	Rank 1B.3	Chaparral (sandstone), cismontane woodland. Elevation ranges from 440 to 2135 feet (135 to 650 meters). Blooms Jan-Mar.	**No Potential.** The Project Area does not contain chaparral habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Contra Costa manzanita *Arctostaphylos manzanita* ssp. *laevigata*	Rank 1B.2	Chaparral (rocky). Elevation ranges from 1410 to 3610 feet (430 to 1100 meters). Blooms Jan-Mar(Apr).	**No Potential.** The Project Area does not contain chaparral habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
alkali milk-vetch *Astragalus tener* var. *tener*	Rank 1B.2	Playas, valley and foothill grassland (adobe clay), vernal pools. Elevation ranges from 0 to 195 feet (1 to 60 meters). Blooms Mar-Jun.	**Unlikely.** Although the Project Area contains seasonal wetland habitat, this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
heartscale *Atriplex cordulata* var. *cordulata*	Rank 1B.2	Chenopod scrub, meadows and seeps, valley and foothill grassland (sandy). Elevation ranges from 0 to 1835 feet (0 to 560 meters). Blooms Apr-Oct.	**Unlikely.** Although the Project Area contains seasonal wetlands and moderate alkali conditions this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
crownscale *Atriplex coronata* var. *coronata*	Rank 4.2	Chenopod scrub, valley and foothill grassland, vernal pools. Elevation ranges from 0 to 1935 feet (1 to 590 meters). Blooms Mar-Oct.	**Unlikely.** The Project Area does not contain vernal pools nor areas which are vernally mesic with exposed soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
brittlescale *Atriplex depressa*	Rank 1B.2	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, vernal pools. Elevation ranges from 0 to 1050 feet (1 to 320 meters). Blooms Apr-Oct.	**Unlikely.** Although the Project Area contains seasonal wetlands and moderate alkali conditions this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
big tarplant *Blepharizonia plumosa*	Rank 1B.1	Valley and foothill grassland. Elevation ranges from 95 to 1655 feet (30 to 505 meters). Blooms Jul-Oct.	**No Potential.** The Project Area does not contain hillside or canyon grasslands necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
watershield *Brasenia schreberi*	Rank 2B.3	Marshes and swamps (freshwater). Elevation ranges from 95 to 7220 feet (30 to 2200 meters). Blooms Jun-Sep.	**Moderate Potential.** Although the Project Area contains freshwater marsh habitat the nearest occurrence is from 21 miles north east of the Project Area	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.
Brewer's calandrinia *Calandrinia breweri*	Rank 4.2	Chaparral, coastal scrub. Elevation ranges from 30 to 4005 feet (10 to 1220 meters). Blooms (Jan)Mar-Jun.	**No Potential.** The Project Area does not contain chaparral or coastal scrub habitat.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Mt. Diablo fairy-lantern *Calochortus pulchellus*	Rank 1B.2	Chaparral, cismontane woodland, riparian woodland, valley and foothill grassland. Elevation ranges from 95 to 2755 feet (30 to 840 meters). Blooms Apr-Jun.	**No Potential.** The Project Area does not contain chaparral, woodland, or natural / native upland grassland habitat necessary to support this species. There are no documented occurrences from the Delta islands.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
bristly sedge *Carex comosa*	Rank 2B.1	Coastal prairie, marshes and swamps (lake margins), valley and foothill grassland. Elevation ranges from 0 to 2050 feet (0 to 625 meters). Blooms May-Sep.	**Moderate Potential.** Although the Project Area contains marsh habitat suitable for this species the nearest occurrence is from 10 miles east.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.
Congdon's tarplant *Centromadia parryi* ssp. *congdonii*	Rank 1B.1	Valley and foothill grassland (alkaline). Elevation ranges from 0 to 755 feet (0 to 230 meters). Blooms May-Oct(Nov).	**Moderate Potential.** The Project Area contains grassy sites on wetland fringes that may support this species. Additionally, this species has a prodigious seed set and is relatively tolerant of disturbance. However, this species is known primarily south of the Delta/Suisun Bay. The nearest documented occurrence is from within eight miles of the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
pappose tarplant *Centromadia parryi* ssp. *parryi*	Rank 1B.2	Chaparral, coastal prairie, meadows and seeps, marshes and swamps (coastal salt), valley and foothill grassland (vernally mesic). Elevation ranges from 0 to 1380 feet (0 to 420 meters). Blooms May-Nov.	**Moderate Potential.** The Project Area contains grassy sites and marsh fringe underlain by alkali substrates that may support this species. Additionally, this species has a prodigious seed set and is relatively tolerant of disturbance The nearest documented occurrence is from within eight miles of the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.
Parry's rough tarplant *Centromadia parryi* ssp. *rudis*	Rank 4.2	Valley and foothill grassland, vernal pools. Elevation ranges from 0 to 330 feet (0 to 100 meters). Blooms May-Oct.	**Moderate Potential.** The Project Area contains grassy sites and marsh fringe underlain by alkali substrates that may support this species. Additionally, this species has a prodigious seed set and is relatively tolerant of disturbance	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.
soft bird's-beak *Chloropyron molle* ssp. *molle*	FE, SR, Rank 1B.2	Marshes and swamps (coastal salt). Elevation ranges from 0 to 10 feet (0 to 3 meters). Blooms Jun-Nov.	**Unlikely.** Although the Project Area contains marsh habitat with some associated species; high quality pickleweed marsh with pannes and active tides are not present.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Bolander's water-hemlock *Cicuta maculata* var. *bolanderi*	Rank 2B.1	Marshes and swamps coastal, fresh or brackish water. Elevation ranges from 0 to 655 feet (0 to 200 meters). Blooms Jul-Sep.	**High Potential.** The Project Area contains perennial wetland habitat that may support this species. The nearest documented occurrence is from within five miles of the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.
small-flowered morning-glory *Convolvulus simulans*	Rank 4.2	Chaparral (openings), coastal scrub, valley and foothill grassland. Elevation ranges from 95 to 2430 feet (30 to 740 meters). Blooms Mar-Jul.	**No Potential.** The Project Area does not contain chaparral or coastal scrub habitat nor serpentine soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Hoover's cryptantha *Cryptantha hooveri*	Rank 1A	Inland dunes, valley and foothill grassland (sandy). Elevation ranges from 25 to 490 feet (9 to 150 meters). Blooms Apr-May.	**No Potential.** The Project Area does not contain sandy grassland habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
dwarf downingia *Downingia pusilla*	Rank 2B.2	Valley and foothill grassland (mesic), vernal pools. Elevation ranges from 0 to 1460 feet (1 to 445 meters). Blooms Mar-May.	**Unlikely.** Although the Project Area contains seasonal wetland habitat, this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Antioch Dunes buckwheat *Eriogonum nudum* var. *psychicola*	Rank 1B.1	Inland dunes. Elevation ranges from 0 to 65 feet (0 to 20 meters). Blooms Jul-Oct.	**No Potential.** The Project Area does not contain interior dune habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Mt. Diablo buckwheat *Eriogonum truncatum*	Rank 1B.1	Chaparral, coastal scrub, valley and foothill grassland. Elevation ranges from 5 to 1150 feet (3 to 350 meters). Blooms Apr-Sep(Nov-Dec).	**No Potential.** The Project Area does not contain chaparral, scrub, or foothill grassland habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Jepson's coyote thistle *Eryngium jepsonii*	Rank 1B.2	Valley and foothill grassland, vernal pools. Elevation ranges from 5 to 985 feet (3 to 300 meters). Blooms Apr-Aug.	**Unlikely.** The Project Area does not contain vernal pools nor areas which are vernally mesic with exposed soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Delta button-celery *Eryngium racemosum*	SE, Rank 1B.1	Riparian scrub (vernally mesic clay depressions). Elevation ranges from 5 to 100 feet (3 to 30 meters). Blooms Jun-Oct.	**No Potential.** The Project Area contains no riparian scrub.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Contra Costa wallflower *Erysimum capitatum* var. *angustatum*	FE, SE, Rank 1B.1	Inland dunes. Elevation ranges from 5 to 65 feet (3 to 20 meters). Blooms Mar-Jul.	**No Potential.** The Project Area does not contain interior dune habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
diamond-petal poppy *Eschscholzia rhombipetala*	Rank 1B.1	Valley and foothill grassland (alkaline, clay). Elevation ranges from 0 to 3200 feet (0 to 975 meters). Blooms Mar-Apr.	**No Potential.** The Project Area does not contain high quality alkali grassland habitat necessary to support this mainland species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
San Joaquin spearscale *Extriplex joaquinana*	Rank 1B.2	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland. Elevation ranges from 0 to 2740 feet (1 to 835 meters). Blooms Apr-Oct.	**Unlikely.** Although the Project Area contains seasonal wetlands and moderate alkali conditions this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
stinkbells *Fritillaria agrestis*	Rank 4.2	Chaparral, cismontane woodland, pinyon and juniper woodland, valley and foothill grassland. Elevation ranges from 30 to 5100 feet (10 to 1555 meters). Blooms Mar-Jun.	**No Potential.** The Project Area does not contain woodland, chaparral, serpentine, or high quality clay grassland habitat necessary to support this mainland species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
fragrant fritillary *Fritillaria liliacea*	Rank 1B.2	Cismontane woodland, coastal prairie, coastal scrub, valley and foothill grassland. Elevation ranges from 5 to 1345 feet (3 to 410 meters). Blooms Feb-Apr.	**No Potential.** The Project Area does not contain high quality, native / natural grassland underlain by clay substrate necessary to support this species. Additionally, this species is typically associated with foothill sites or mima mound areas away from the Delta islands.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
phlox-leaf serpentine bedstraw *Galium andrewsii* ssp. *gatense*	Rank 4.2	Chaparral, cismontane woodland, lower montane coniferous forest. Elevation ranges from 490 to 4755 feet (150 to 1450 meters). Blooms Apr-Jul.	**No Potential.** The Project Area does not contain chaparral, woodland or coniferous forest habitat.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Diablo helianthella *Helianthella castanea*	Rank 1B.2	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. Elevation ranges from 195 to 4265 feet (60 to 1300 meters). Blooms Mar-Jun.	**No Potential.** The Project Area does not contain chaparral, woodland, forest, or scrub habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
hogwallow starfish *Hesperevax caulescens*	Rank 4.2	Valley and foothill grassland (mesic, clay), vernal pools (shallow). Elevation ranges from 0 to 1655 feet (0 to 505 meters). Blooms Mar-Jun.	**Unlikely.** The Project Area does not contain vernal pools nor areas which are vernally mesic with exposed soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Brewer's western flax *Hesperolinon breweri*	Rank 1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Elevation ranges from 95 to 3100 feet (30 to 945 meters). Blooms May-Jul.	**No Potential.** The Project Area does not contain chaparral, woodland, or serpentine grassland habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
woolly rose-mallow *Hibiscus lasiocarpus* var. *occidentalis*	Rank 1B.2	Marshes and swamps (freshwater). Elevation ranges from 0 to 395 feet (0 to 120 meters). Blooms Jun-Sep.	**Moderate Potential.** The Project Area contains freshwater margins and sloughs that may support this species. However, this species has not been documented as far west in the Delta as the Project Area. The nearest documented occurrence is from within six miles of the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Carquinez goldenbush *Isocoma arguta*	Rank 1B.1	Valley and foothill grassland (alkaline). Elevation ranges from 0 to 65 feet (1 to 20 meters). Blooms Aug-Dec.	**Unlikely.** Although the Project Area contains swale-like drainages, this species is known from alkali grassland habitats not present in the Project Area.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Northern California black walnut *Juglans hindsii*	Rank 1B.1	Riparian forest, riparian woodland. Elevation ranges from 0 to 1445 feet (0 to 440 meters). Blooms Apr-May.	**No Potential.** This species is widely planted and is only considered special-status within its native range which is outside of the Project Area.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Contra Costa goldfields *Lasthenia conjugens*	FE, Rank 1B.1	Cismontane woodland, playas (alkaline), valley and foothill grassland, vernal pools. Elevation ranges from 0 to 1540 feet (0 to 470 meters). Blooms Mar-Jun.	**Unlikely.** Although the Project Area contains seasonal wetland habitat, this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	Rank 1B.2	Marshes and swamps (freshwater and brackish). Elevation ranges from 0 to 15 feet (0 to 5 meters). Blooms May-Jul(Aug-Sep).	**High Potential.** The Project Area contains slough margins and associated species that may support this species. The nearest documented occurrence is from the outboard levee of southern Sherman Island, immediately adjacent to the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.
Mason's lilaeopsis *Lilaeopsis masonii*	SR, Rank 1B.1	Marshes and swamps (brackish or freshwater), riparian scrub. Elevation ranges from 0 to 35 feet (0 to 10 meters). Blooms Apr-Nov.	**Unlikely.** Although the Project Area contains freshwater marsh habitat, the niche of this species of mud banks was not observed in the Project Area. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Delta mudwort *Limosella australis*	Rank 2B.1	Marshes and swamps (freshwater or brackish), riparian scrub. Elevation ranges from 0 to 10 feet (0 to 3 meters). Blooms May-Aug.	**Unlikely.** Although the Project Area contains freshwater marsh habitat, the niche of this species of mud banks was not observed in the Project Area. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
showy golden madia *Madia radiata*	Rank 1B.1	Cismontane woodland, valley and foothill grassland. Elevation ranges from 80 to 3985 feet (25 to 1215 meters). Blooms Mar-May.	**No Potential.** The Project Area does not contain high quality grassland, woodland, or chenopod scrub habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Hall's bush mallow *Malacothamnus hallii*	Rank 1B.2	Chaparral, coastal scrub. Elevation ranges from 30 to 2495 feet (10 to 760 meters). Blooms (Apr)May-Sep(Oct).	**No Potential.** The Project Area does not contain chaparral habitat or serpentine soils necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
little mousetail *Myosurus minimus* ssp. *apus*	Rank 3.1	Valley and foothill grassland, vernal pools (alkaline). Elevation ranges from 65 to 2100 feet (20 to 640 meters). Blooms Mar-Jun.	**Unlikely.** The Project Area does not contain vernal pools nor areas which are vernally mesic with exposed soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Tehama navarretia *Navarretia heterandra*	Rank 4.3	Valley and foothill grassland (mesic), vernal pools. Elevation ranges from 95 to 3315 feet (30 to 1010 meters). Blooms Apr-Jun.	**Unlikely.** The Project Area does not contain vernal pools nor areas which are vernally mesic with exposed soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	Rank 1B.1	Cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools. Elevation ranges from 15 to 5710 feet (5 to 1740 meters). Blooms Apr-Jul.	**Unlikely.** The Project Area does not contain vernal pools nor areas which are vernally mesic with exposed soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
adobe navarretia *Navarretia nigelliformis* ssp. *nigelliformis*	Rank 4.2	Valley and foothill grassland vernally mesic, vernal pools sometimes. Elevation ranges from 325 to 3280 feet (100 to 1000 meters). Blooms Apr-Jun.	**Unlikely.** The Project Area does not contain vernal pools nor areas which are vernally mesic with exposed soils.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
shining navarretia *Navarretia nigelliformis* ssp. *radians*	Rank 1B.2	Cismontane woodland, valley and foothill grassland, vernal pools. Elevation ranges from 210 to 3280 feet (65 to 1000 meters). Blooms (Mar)Apr-Jul.	**No Potential.** The Project Area does not contain woodland nor upland grassland habitat. Although the Project Area contains seasonal wetland habitat, this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Colusa grass *Neostapfia colusana*	FT, SE, Rank 1B.1	Vernal pools (adobe, large). Elevation ranges from 15 to 655 feet (5 to 200 meters). Blooms May-Aug.	**Unlikely.** Although the Project Area contains seasonal wetlands, this species is known from high quality, deep vernal pool habitat not present in the Project Area.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Antioch Dunes evening-primrose *Oenothera deltoides* ssp. *howellii*	FE, SE, Rank 1B.1	Inland dunes. Elevation ranges from 0 to 100 feet (0 to 30 meters). Blooms Mar-Sep.	**No Potential.** The Project Area does not contain interior dune habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
bearded popcornflower *Plagiobothrys hystriculus*	Rank 1B.1	Valley and foothill grassland (mesic), vernal pools margins. Elevation ranges from 0 to 900 feet (0 to 274 meters). Blooms Apr-May.	**Unlikely.** Although the Project Area contains seasonal wetland habitat, this species was unlikely to occur historically on Sherman Island. Additionally, a viable seed source is unlikely to colonize in the current conditions.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
eel-grass pondweed *Potamogeton zosteriformis*	Rank 2B.2	Marshes and swamps (assorted freshwater). Elevation ranges from 0 to 6100 feet (0 to 1860 meters). Blooms Jun-Jul.	**Moderate Potential.** The Project Area contains standing water that may support this species. The nearest documented occurrence is from 10 miles within the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
Sanford's arrowhead *Sagittaria sanfordii*	Rank 1B.2	Marshes and swamps (assorted shallow freshwater). Elevation ranges from 0 to 2135 feet (0 to 650 meters). Blooms May-Oct(Nov).	**Moderate Potential.** The Project Area contains standing water that may support this species. However, this species has not been documented as far west in the Delta as the Project Area. The nearest documented occurrence is from 10 miles within the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.
marsh skullcap *Scutellaria galericulata*	Rank 2B.2	Lower montane coniferous forest, meadows and seeps (mesic), marshes and swamps. Elevation ranges from 0 to 6890 feet (0 to 2100 meters). Blooms Jun-Sep.	**No Potential.** This species occurs above 3,000 feet within the Tahoe Basin and Modoc Plateau, which is outside of the Project Area.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
side-flowering skullcap *Scutellaria lateriflora*	Rank 2B.2	Meadows and seeps (mesic), marshes and swamps. Elevation ranges from 0 to 1640 feet (0 to 500 meters). Blooms Jul-Sep.	**Moderate Potential.** The Project Area contains marsh habitat that may support this species. However, this species has not been documented as far west in the Delta as the Project Area. The nearest documented occurrence is from 12 miles within the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
chaparral ragwort *Senecio aphanactis*	Rank 2B.2	Chaparral, cismontane woodland, coastal scrub. Elevation ranges from 45 to 2625 feet (15 to 800 meters). Blooms Jan-Apr(May).	**No Potential.** The Project Area does not contain woodland or scrub habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
sweet marsh ragwort *Senecio hydrophilioides*	Rank 4.2	Lower montane coniferous forest, meadows and seeps. Elevation ranges from 0 to 9185 feet (0 to 2800 meters). Blooms May-Aug.	**No Potential.** The Project Area does not contain meadows and seeps in coniferous forest.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Keck's checkerbloom *Sidalcea keckii*	FE, Rank 1B.1	Cismontane woodland, valley and foothill grassland. Elevation ranges from 245 to 2135 feet (75 to 650 meters). Blooms Apr-May(Jun).	**No Potential.** The Project Area does not contain blue oak woodland habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
Suisun Marsh aster *Symphyotrichum lentum*	Rank 1B.2	Marshes and swamps (brackish and freshwater). Elevation ranges from 0 to 10 feet (0 to 3 meters). Blooms (Apr)May-Nov.	**High Potential.** The Project Area contains slough margins with associated species that may support this species. The nearest documented occurrence is from the outboard levee of southern Sherman Island, immediately adjacent to the Project Area.	**Not Observed.** This species was not observed during survey. No further actions are recommended for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE**	RECOMMENDATIONS
caper-fruited tropidocarpum *Tropidocarpum capparideum*	Rank 1B.1	Valley and foothill grassland (alkaline hills). Elevation ranges from 0 to 1495 feet (1 to 455 meters). Blooms Mar-Apr.	**No Potential.** The Project Area does not contain high quality alkali grassland habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.
oval-leaf viburnum *Viburnum ellipticum*	Rank 2B.3	Chaparral, cismontane woodland, lower montane coniferous forest. Elevation ranges from 705 to 4595 feet (215 to 1400 meters). Blooms May-Jun.	**No Potential.** The Project Area does not contain chaparral, woodland, or forest habitat necessary to support this species.	**Assumed Absent.** The Project Area does not contain suitable habitat for this species. No further actions are recommended for this species.

*** Key to status codes:**

FE	Federal Endangered
FT	Federal Threatened
SE	State Endangered
ST	State Threatened
SR	State Rare
Rank 1A	Presumed extirpated in California and either rare or extinct elsewhere
Rank 1B	Rare, threatened, or endangered in California and elsewhere
Rank 2A	Presumed extirpated in California, but more common elsewhere
Rank 2B	Rare, threatened, or endangered in California, but more common elsewhere
Rank 3	Plants about which more information is needed - A review list
Rank 4	Plants of limited distribution - A watch list
Threat Ranks	
0.1	Seriously threatened in California
0.2	Moderately threatened in California
0.3	Not very threatened in California

Species Evaluations:

No Potential. Habitat on and adjacent to the site is clearly unsuitable for the species requirements (cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).

Unlikely. Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.

Moderate Potential. Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.

High Potential. All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.

Present. Species was observed on the site or has been recorded (i.e. CNDDB, other reports) on the site recently.

APPENDIX C

Plant Species Observed in the Project Area

Appendix C. Plant species observed in the Project Area

Family	Scientific name	Common name	Life form	Origin	Rare Status[1]	Invasive Status[2]	Wetland indicator[3]
Amaranthaceae	*Amaranthus retroflexus*	Rough pigweed	annual herb	non-native	-	-	FACU
Apiaceae	*Conium maculatum*	Poison hemlock	perennial herb	non-native	-	Moderate	FACW
Apiaceae	*Foeniculum vulgare*	Fennel	perennial herb	non-native	-	High	-
Apiaceae	*Oenanthe sarmentosa*	Water parsley	perennial herb	native	-	-	OBL
Apocynaceae	*Apocynum cannabinum*	Indian hemp	perennial herb	native	-	-	FAC
Arecaceae	*Washingtonia robusta*	Washington fan palm	tree	non-native	-	Moderate	FACW
Asparagaceae	*Asparagus officinalis* ssp. *officinalis*	Asparagus	perennial herb	non-native	-	-	FACU
Asteraceae	*Ambrosia* sp.	-	-	-	-	-	-
Asteraceae	*Artemisia dracunculus*	Tarragon	perennial herb	native	-	-	-
Asteraceae	*Baccharis pilularis* ssp. *consanguinea*	Coyote brush	shrub	native	-	-	-
Asteraceae	*Baccharis salicifolia* ssp. *salicifolia*	Mule fat	shrub	native	-	-	FAC
Asteraceae	*Carduus pycnocephalus*	Italian thistle	annual herb	non-native	-	Moderate	-
Asteraceae	*Centaurea solstitialis*	Yellow star thistle	annual herb	non-native	-	High	-
Asteraceae	*Cichorium intybus*	Chicory	perennial herb	non-native	-	-	FACU
Asteraceae	*Cirsium vulgare*	Bull thistle	perennial herb	non-native	-	Moderate	FACU
Asteraceae	*Cotula coronopifolia*	Brass buttons	perennial herb	non-native	-	Limited	OBL
Asteraceae	*Cynara cardunculus* ssp. *cardunculus*	Artichoke	perennial herb	non-native	-	-	-
Asteraceae	*Erigeron bonariensis*	Flax-leaved horseweed	annual herb	non-native	-	-	FACU
Asteraceae	*Erigeron canadensis*	Canada horseweed	annual herb	native	-	-	FACU
Asteraceae	*Euthamia occidentalis*	Western goldenrod	perennial herb	native	-	-	FACW
Asteraceae	*Helianthus annuus*	Hairy leaved sunflower	annual herb	native	-	-	FACU
Asteraceae	*Helminthotheca echioides*	Bristly ox-tongue	annual, perennial herb	non-native	-	Limited	FAC
Asteraceae	*Lactuca serriola*	Prickly lettuce	annual herb	non-native	-	-	FACU
Asteraceae	*Pseudognaphalium luteoalbum*	Jersey cudweed	annual herb	non-native	-	-	FAC
Asteraceae	*Salsola soda*	Alkali Russian thistle	annual herb	non-native	-	Moderate	FACW
Asteraceae	*Silybum marianum*	Milk thistle	annual, perennial herb	non-native	-	Limited	-
Asteraceae	*Sonchus asper* ssp. *asper*	Prickly sow thistle	annual herb	non-native	-	-	FAC
Asteraceae	*Sonchus oleraceus*	Common sow thistle	annual herb	non-native	-	-	UPL
Asteraceae	*Symphyotrichum subulatum* var. *parviflorum*	Eastern annual saltmarsh aster	perennial herb	native	-	-	OBL

Family	Scientific name	Common name	Life form	Origin	Rare Status[1]	Invasive Status[2]	Wetland indicator[3]
Asteraceae	*Taraxacum officinale*	Red seeded dandelion	perennial herb	non-native	-	-	FACU
Asteraceae	*Tragopogon porrifolius*	Salsify	perennial herb	non-native	-	-	-
Asteraceae	*Xanthium spinosum*	Spiny cocklebur	annual herb	native	-	-	FACU
Asteraceae	*Xanthium strumarium*	Cocklebur	annual herb	native	-	-	FAC
Azollaceae	*Azolla filiculoides*	Mosquito fern	fern	native	-	-	OBL
Betulaceae	*Alnus rhombifolia*	White alder	tree	native	-	-	FACW
Boraginaceae	*Amsinckia intermedia*	Common fiddleneck	annual herb	native	-	-	-
Boraginaceae	*Heliotropium curassavicum* var. *oculatum*	Seaside heliotrope	perennial herb	native	-	-	FACU
Boraginaceae	*Heterotheca grandiflora*	Telegraph weed	annual, perennial herb	native	-	-	-
Brassicaceae	*Brassica nigra*	Black mustard	annual herb	non-native	-	Moderate	-
Brassicaceae	*Brassica rapa*	Common mustard	annual herb	non-native	-	Limited	FACU
Brassicaceae	*Hirschfeldia incana*	Short-podded mustard	perennial herb	non-native	-	Moderate	-
Brassicaceae	*Lepidium latifolium*	Perennial pepperweed	perennial herb	non-native	-	High	FAC
Brassicaceae	*Lepidium nitidum*	Shining pepper grass	annual herb	native	-	-	FAC
Brassicaceae	*Nasturtium officinale*	Watercress	perennial herb	native	-	-	OBL
Brassicaceae	*Raphanus raphanistrum*	Jointed charlock	perennial herb	non-native	-	-	-
Brassicaceae	*Raphanus sativus*	Wild radish	annual, biennial herb	non-native	-	Limited	-
Caryophyllaceae	*Spergularia macrotheca* var. *macrotheca*	Sticky sand spurry	perennial herb	native	-	-	FAC
Chenopodiaceae	*Atriplex prostrata*	Fat-hen	annual herb	non-native	-	-	FACW
Chenopodiaceae	*Bassia hyssopifolia*	Five horn bassia	annual herb	non-native	-	Limited	FACU
Chenopodiaceae	*Beta vulgaris*	common beet	perennial forb	non-native	-	-	NL
Chenopodiaceae	*Chenopodium album*	Lambs quarters	annual herb	non-native	-	-	FACU
Chenopodiaceae	*Dysphania ambrosioides*	Mexican tea	perennial herb	non-native	-	-	FAC
Chenopodiaceae	*Kochia scoparia* ssp. *scoparia*	red sage	annual herb	non-native	-	Limited	FAC
Convolvulaceae	*Convolvulus arvensis*	Field bindweed	perennial herb, vine	non-native	-	-	-
Cyperaceae	*Bolboschoenus maritimus* ssp. *paludosus*	Saltmarsh bulrush	perennial graminoid	native	-	-	OBL
Cyperaceae	*Cyperus eragrostis*	Tall cyperus	perennial graminoid	native	-	-	FACW
Cyperaceae	*Cyperus esculentus*	Nut grass	perennial graminoid	native	-	-	FACW
Cyperaceae	*Eleocharis macrostachya*	Spike rush	perennial graminoid	native	-	-	OBL
Cyperaceae	*Schoenoplectus californicus*	California bulrush	perennial graminoid	native	-	-	OBL

Family	Scientific name	Common name	Life form	Origin	Rare Status[1]	Invasive Status[2]	Wetland Indicator[3]
Fabaceae	*Glycyrrhiza lepidota*	American licorice	perennial herb	native	-	-	FAC
Fabaceae	*Lathyrus jepsonii* var. *californicus*	California tule pea	perennial herb	native	-	-	OBL
Fabaceae	*Lotus corniculatus*	Bird's foot trefoil	perennial herb	non-native	-	-	FAC
Fabaceae	*Medicago polymorpha*	California burclover	annual herb	non-native	-	Limited	FACU
Fabaceae	*Medicago sativa*	Alfalfa	perennial herb	non-native	-	-	UPL
Fabaceae	*Melilotus albus*	White sweetclover	annual, biennial herb	non-native	-	-	-
Fabaceae	*Melilotus indicus*	Annual yellow sweetclover	annual herb	non-native	-	-	FACU
Fabaceae	*Trifolium dubium*	Shamrock	annual herb	non-native	-	-	UPL
Fabaceae	*Trifolium fragiferum*	Strawberry clover	perennial herb	non-native	-	-	FAC
Fabaceae	*Trifolium hirtum*	Rose clover	annual herb	Non-native	-	Limited	NL
Fabaceae	*Vicia sativa*	Spring vetch	Annual herb	Non-native	-	-	FACU
Frankeniaceae	*Frankenia salina*	Alkali heath	perennial herb	native	-	-	FACW
Geraniaceae	*Erodium cicutarium*	Red stemmed filaree	annual herb	non-native	-	Limited	-
Juncaceae	*Juncus bufonius* var. *bufonius*	Toad rush	annual graminoid	native	-	-	FACW
Juncaceae	*Juncus effusus* ssp. *pacificus*	Pacific rush	perennial graminoid	native	-	-	FACW
Juncaceae	*Juncus patens*	Common rush	perennial graminoid	native	-	-	FACW
Juncaceae	*Juncus phaeocephalus* var. *paniculatus*	Rush	perennial graminoid	native	-	-	FACW
Lamiaceae	*Mentha pulegium*	Pennyroyal	perennial herb	non-native	-	Moderate	OBL
Lamiaceae	*Stachys albens*	Cobwebby hedge nettle	perennial herb	native	-	-	OBL
Lythraceae	*Lythrum hyssopifolia*	Hyssop loosestrife	perennial herb	non-native	-	Limited	OBL
Malvaceae	*Abutilon theophrasti*	Velvet leaf	annual herb	non-native	-	-	UPL
Malvaceae	*Malva neglecta*	Dwarf mallow	perennial herb	non-native	-	-	-
Malvaceae	*Malva parviflora*	Cheeseweed	annual herb	non-native	-	-	-
Malvaceae	*Malvella leprosa*	Alkali mallow	perennial herb	native	-	-	FACU
Onagraceae	*Epilobium ciliatum* ssp. *ciliatum*	Willow herb	perennial herb	native	-	-	FACW
Onagraceae	*Ludwigia* sp.	-	-	-	-	-	-
Plantaginaceae	*Plantago major*	Common plantain	perennial herb	non-native	-	-	FAC
Poaceae	*Agrostis gigantea*	Creeping bentgrass	perennial grass	non-native	-	-	FACW
Poaceae	*Arundo donax*	Giant reed	perennial grass	non-native	-	High	FACW
Poaceae	*Avena barbata*	Slim oat	perennial grass	non-native	-	Moderate	-
Poaceae	*Bromus catharticus* var. *elatus*	Chilean brome	perennial grass	non-native	-	-	-
Poaceae	*Bromus diandrus*	Ripgut brome	annual grass	non-native	-	Moderate	-

Family	Scientific name	Common name	Life form	Origin	Rare Status[1]	Invasive Status[2]	Wetland indicator[3]
Poaceae	*Bromus hordeaceus*	Soft chess	annual grass	non-native	-	Limited	FACU
Poaceae	*Cynodon dactylon*	Bermuda grass	perennial grass	non-native	-	Moderate	FACU
Poaceae	*Digitaria ischaemum*	Smooth crabgrass	annual grass	non-native	-	-	FACU
Poaceae	*Distichlis spicata*	Salt grass	perennial grass	native	-	-	FAC
Poaceae	*Echinochloa crus-galli*	Barnyard grass	annual grass	non-native	-	-	FACW
Poaceae	*Elymus caput-medusae*	Medusa head	annual grass	non-native	-	High	-
Poaceae	*Elymus repens*	Quack grass	perennial grass	non-native	-	-	FAC
Poaceae	*Elymus triticoides*	Beardless wild rye	perennial grass	native	-	-	FAC
Poaceae	*Festuca arundinacea*	Reed fescue	perennial grass	non-native	-	Moderate	FACU
Poaceae	*Festuca perennis*	Italian rye grass	annual, perennial grass	non-native	-	Moderate	FAC
Poaceae	*Hordeum brachyantherum* ssp. *brachyantherum*	Meadow barley	perennial grass	native	-	-	FACW
Poaceae	*Hordeum jubatum* ssp. *jubatum*	Foxtail barley	perennial grass	native	-	-	FAC
Poaceae	*Hordeum marinum* ssp. *gussoneanum*	Mediterranean barley	annual grass	non-native	-	Moderate	FAC
Poaceae	*Hordeum murinum* ssp. *murinum*	Wall barley	annual grass	non-native	-	Moderate	FACU
Poaceae	*Paspalum distichum*	Knot grass	perennial grass	native	-	-	FACW
Poaceae	*Phalaris aquatica*	Harding grass	perennial grass	non-native	-	Moderate	FACU
Poaceae	*Phragmites australis*	Common reed	perennial grass	native	-	-	FACW
Poaceae	*Polypogon monspeliensis*	Annual beard grass	annual grass	non-native	-	Limited	FACW
Poaceae	*Sorghum halepense*	Johnson grass	perennial grass	non-native	-	-	FACU
Poaceae	*Stipa miliacea* var. *miliacea*	Smilo grass	perennial grass	non-native	-	Limited	-
Poaceae	*Zea mays*	corn	annual grass	non-native	-	-	NL
Polygonaceae	*Persicaria amphibia*	Water smartweed	perennial herb	native	-	-	OBL
Polygonaceae	*Persicaria hydropiperoides*	Water pepper	perennial herb	native	-	-	OBL
Polygonaceae	*Persicaria lapathifolia*	Common knotweed	annual herb	native	-	-	FACW
Polygonaceae	*Persicaria maculosa*	Spotted ladysthumb	annual herb	non-native	-	-	FACW
Polygonaceae	*Persicaria punctata*	Dotted smartweed	perennial herb	native	-	-	OBL
Polygonaceae	*Polygonum aviculare* ssp. *aviculare*	Prostrate knotweed	perennial herb	non-native	-	-	FACW
Polygonaceae	*Rumex crispus*	Curly dock	perennial herb	non-native	-	Limited	FAC
Polygonaceae	*Rumex pulcher*	Fiddleleaf dock	perennial herb	non-native	-	-	FAC
Pontederiaceae	*Eichhornia crassipes*	Water hyacinth	perennial herb	non-native	-	High	OBL
Potamogetonaceae	*Potamogeton nodosus*	Pondweed	perennial herb	native	-	-	OBL

Family	Scientific name	Common name	Life form	Origin	Rare Status[1]	Invasive Status[2]	Wetland indicator[3]
Ranunculaceae	*Ranunculus sceleratus*	Cursed crowfoot	annual herb	native	-	-	OBL
Rosaceae	*Rubus armeniacus*	Himalayan blackberry	shrub	non-native	-	High	FAC
Salicaceae	*Populus fremontii* ssp. *fremontii*	Cottonwood	tree	native	-	-	FAC
Salicaceae	*Salix exigua* var. *exigua*	Narrowleaf willow	tree, shrub	native	-	-	FACW
Salicaceae	*Salix lasiolepis*	Arroyo willow	tree, shrub	native	-	-	FACW
Solanaceae	*Nicotiana glauca*	Tree tobacco	tree, shrub	non-native	-	Moderate	FAC
Typhaceae	*Typha angustifolia*	Narrow leaf cattail	perennial herb	non-native	-	-	OBL
Typhaceae	*Typha latifolia*	Broadleaf cattail	perennial herb	native	-	-	OBL
Urticaceae	*Urtica dioica* ssp. *gracilis*	Nettle	perennial herb	native	-	-	FAC
Verbenaceae	*Phyla nodiflora*	Common lippia	perennial herb	native	-	-	FACW
Zygophyllaceae	*Tribulus terrestris*	Puncture vine	annual herb	non-native	-	Limited	-

All species identified using the *Jepson Manual, 2nd Edition* (Baldwin et al. 2016) and *Jepson eFlora* (Jepson Flora Project 2018); nomenclature follows Jepson Flora Project (2018).

[1]Rare Status:

FE:	Federal Endangered
FT:	Federal Threatened
SE:	State Endangered
ST:	State Threatened
SR:	State Rare

The CNPS Inventory of Rare and Endangered Plants (CNPS 2018):

Rank 1A	Presumed extirpated in California and either rare or extinct elsewhere
Rank 1B	Rare, threatened, or endangered in California and elsewhere
Rank 2A	Presumed extirpated in California, but more common elsewhere
Rank 2B	Rare, threatened, or endangered in California, but more common elsewhere
Rank 3	Plants about which more information is needed - A review list
Rank 4	Plants of limited distribution - A watch list

Threat Ranks

0.1	Seriously threatened in California
0.2	Moderately threatened in California
0.3	Not very threatened in California

[2]Invasive Status: California Invasive Plant Inventory (Cal-IPC 2018)

High:	Severe ecological impacts; high rates of dispersal and establishment; most are widely distributed ecologically.
Moderate:	Substantial and apparent ecological impacts; moderate-high rates of dispersal, establishment dependent on disturbance; limited-moderate distribution ecologically
Limited:	Minor or not well documented ecological impacts; low-moderate rate of invasiveness; limited distribution ecologically

Assessed: Assessed by Cal-IPC and determined to not be an existing current threat

[3]Wetland Status: National List of Plant Species that Occur in Wetlands, California – Region 10 (Lichvar 2016)

OBL:	Almost always a hydrophyte, rarely in uplands
FACW:	Usually a hydrophyte, but occasionally found in uplands
FAC:	Commonly either a hydrophyte or non-hydrophyte
FACU:	Occasionally a hydrophyte, but usually found in uplands
UPL:	Rarely a hydrophyte, almost always in uplands
NL:	Rarely a hydrophyte, almost always in uplands
NI:	No information; not factored during wetland delineation

APPENDIX D

Representative Photographs of the Project Area

Photo 1. View of a grazed pasture dominated by non-native weedy species.

Photo 2. View of a cultivated corn field.

Photo 3. View of an irrigated canal dominated by aquatic vegetation, such as water primrose (*Ludwigia* sp.) Banks are dominated by smartweed (*Persicaria* spp.)

Photo 4. View of an irrigation ditch (foreground) flowing through a heavily grazed pasture with Himalayan blackberry brambles in the background. The irrigation ditch is dominated by broadleaf cattail marsh.

APPENDIX C

Wetland Delineation Report

Wetland Delineation
for the
Sherman Island Wetland Restoration Project: Phase II
Sacramento County, California

October 30, 2018

Prepared By:
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Western Regional office
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Rancho Cordova, CA 95670-6116
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Table of Contents

Figures

Tables

Appendices

Executive Summary

Ducks Unlimited, Inc. (DU) working in partnership with the California Department of Water Resources (DWR), conducted a delineation of waters of the United States, including wetlands, under the jurisdiction of the Army Corps of Engineers (Corps) pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, occurring within the Sherman Island Wetland Restoration Project: Phase II site in Sacramento County, California.

The study area is located in the delta on the southeast portion of Sherman Island. It is located just east of the Antioch Bridge, near Antioch California (Figure 1). The study area encompasses actively managed irrigated pasture, wetlands, and a marginal buffer around the proposed work area (Figure 2). The land in the study area is owned and managed by the DWR and is currently comprised of irrigated pasture and croplands.

The delineation study was conducted on September 29 & 30, December 1 & 2, 2015, and April 13, 20, & 27, May 22, June 14, September 6, 10, 11, & 12, 2018 using Corps-approved methods. DU identified approximately 1,448.895 acres of jurisdictional waters of the US within the Sherman Island Wetland Restoration Project: Phase II area, which includes approximately:

- 0.814 acres of San Joaquin River
- 54.914 acres of Ditch
- 280.496 acres of Flood Irrigated Cropland
- 996.230 acres of Flood Irrigated Pasture
- 9.236 acres of Perennial Marsh
- 107.205 acres of Seasonal Wetland

This report presents the preliminary delineation of jurisdictional wetlands and other waters of the U.S. that were found to be present in the study area as of October 30, 2018.

1.0 Introduction

This report summarizes the results of a delineation of jurisdictional waters of the U.S. on the Sherman Island Wetland Restoration Project: Phase II area located in Sacramento County. The delineation was conducted to identify and delineate wetlands and other waters of the United States within the project site that are under the jurisdiction of the Corps through Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act.

The study area encompasses a series of existing roads, levees, agricultural ditches, agricultural fields and wetlands. The study area is owned and managed by the California Department of Water Resources, West Delta Program.

1.1 Contact Information

Property Owner:
California Department of Water Resources
West Delta Program
1416 9th Street, Suite 1601
Sacramento, CA 95814
Contact: Bryan Brock, P.E.
Phone: (916) 651-0836
Email: bryan.brock@water.ca.gov

Delineator:
Ducks Unlimited, Inc.
3074 Gold Canal Drive
Rancho Cordova, CA 95670-6116
Contact: Patrick Britton or Nicholas Torrez
Phone: (916) 852-2000
Email: pbritton@ducks.org or
ntorrez@ducks.org

2.0 Background

2.1 Site Location

The approximately 1,969-acre Sherman Island Wetland Restoration Project: Phase II site is located approximately 9.5 miles southwest of the City of Isleton, 5.8 miles northeast of the city of Antioch, and east of Highway 160. The site is in Sections 1, 2, 3, and 10 of T2N, R2E and Sections 25, 26, 35, and 36 of T3N, R 2E on the 7.5-minute Jersey Island, CA USGS quadrangle and 7.5-minute Antioch North, CA USGS quadrangle (Figure 1). The latitude and longitude of the approximate center of the site are 38° 3'2.39" North and 121°43'8.56" West. The site sits at approximately 14 to -20 feet in elevation. Surrounding land use is dominated by various agricultural operations. Figure 2 shows the site and surrounding land uses.

Directions to the site: From Sacramento take Interstate 5 south to E. Kettleman Lane (Highway 12 West). Continue on E. Kettleman Lane heading west for approximately 16 miles to Highway 160 and continue south. In approximately 8.2 miles turn left (south) onto Sherman Island Crossing Road and continue for approximately 1.3 miles. After driving for 1.3 miles turn left (east) into staging area directly south of the drainage canal. This parking location is within the study area boundaries.

2.2 Site History

Historically, the study area was a marsh that was diked off from the Sacramento River and drained between 1850 and 1860 to facilitate agriculture. As a result of more than 150 years of farming practices, irrigation, and exposure of soils to air, the study area has subsided as much as

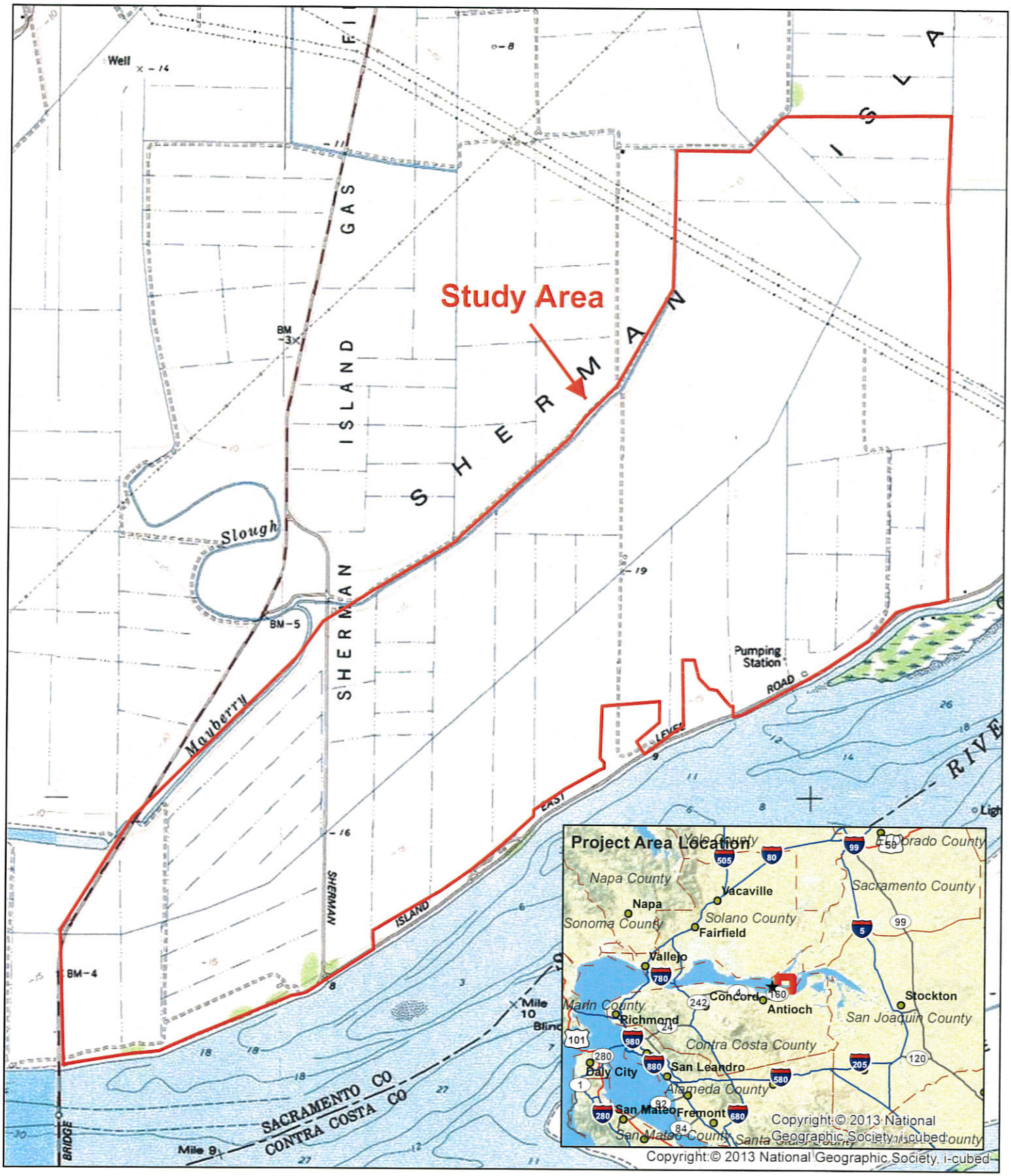

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Figure 1. Sherman Island Wetland Restoration Project: Phase II Site & Vicinity Map

Base maps: Jersey Island, CA USGS 7.5 minute togographic quadrangle
Sections 1, 2, 3 & 10 of T2N, R2E; Sections 25, 26, 35 & 36 of T3N, R2E, Sacramento County, CA

N

0 1,000 2,000 Feet

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Figure 2. Sherman Island Wetland Restoration Project: Phase II Aerial Photo Map

Study Area

Aerial photo: 2014 FSA 1 Meter Color Orthophotography

Project location: Sections 1, 2, 3 & 10 of T2N, R2E;
Sections 25, 26, 35 & 36 of T3N, R2E, Sacramento County, CA

N

0 1,000 2,000
Feet

15 ft. A high water table currently makes the project site unsustainable as a long-term agricultural area.

Before the Delta was diked, drained, and farmed, it was subject to significant seasonal fluctuations in freshwater inflows, which worked in concert with large tidal ranges. Natural levees were formed by sediments deposited during spring floods and stabilized by vegetation. Dominant vegetation within the natural levees included tules - marsh plants that live in fresh and brackish water. Decomposing tules and reed vegetation formed the peat soils over thousands of years. In waterlogged conditions, decaying tules decompose slowly to release carbon dioxide and methane, which is trapped in the soils by water. Once the soil was diked and then dried, the peat soils decompose, which leads to compaction and subsidence.

Subsidence has reduced the distance from the soil surface to the water table. The resulting high water table makes the Site unsustainable for crop production, although much of the site is currently used for cropland and pasture.

DWR is reevaluating how their properties in the region are managed and is particularly interested in incorporating land-use practices that reduce or reverse subsidence. Research on DWR-owned property elsewhere on Twitchell Island has shown that permanently flooded emergent wetlands gain land surface elevation. Therefore, DWR is interested in restoring the entire site back to the palustrine emergent wetland type that existed in the early part of last century. In addition, subsidence reversal in the study area will be monitored and evaluated with the goal of undertaking similar projects elsewhere in the Delta.

3.0 Methods

Waters of the United States were delineated on September 29 & 30, December 1 & 2, 2015, and April 13, 20, & 27, May 22, June 14, September 6, 10, 11, & 12, 2018 by Patrick Britton, Nicholas Torrez, and Aaron Will. The delineation was conducted in accordance with the standards specified by the U.S. Army Corps of Engineers (Corps) Wetland Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation manual: Arid West region (version 2.0) (U.S. Army Engineer Research and Development Center, 2008). Numerous soil pits were dug, and information about vegetation, soils, and hydrology was recorded at sixty-four locations. Data sheets are located in Appendix A.

Information on soils was taken from the Soil Survey Geographic (SSURGO) database for Sacrament County, California (USDA, NRCS 2012). In the field, a Munsell Color (2000) chart was used to determine moist soil colors.

Common plant names are used in this document. Appendix B is a list of plants observed during the delineation, along with the scientific name and wetland status of each species. The wetland status for species observed was taken from the National Wetland Plant List 2016.

A Trimble GeoXH global positioning system (GPS) (sub-meter) was used to obtain location information about data points, wetland areas, and other pertinent features. The GPS data were corrected in the office using the nearest available base station. A topographic map was

superimposed over a recent georeferenced aerial photograph of the site and was used as the basemap. The wetland delineation map was created using ArcMap and is presented as Figure 4. The rationale for the wetland-upland boundaries in each habitat type was determined by collecting data at paired sample points, and then extrapolating the data to similar wetland types. The last point on the gradient where evidence of all three parameters was present determined the upper limits of the wetland boundaries.

All acreage calculations were conducted using ArcMap 10.2 (GIS) software.

4.0 Results

4.1 Climate

The Natural Resources Conservation Service (NRCS) weather station located closest to the site is the Sacramento 5ESE, CA (WETS Station SACRAMENTO 5ESE, CA). Data from this station is presented here as a reasonable approximation of climate conditions at the site.

The mean annual air temperature at the NRCS station at Sacramento is 62.7°F, and the growing season is typically year round. Mean annual precipitation (70-year period of record) is 18.84 inches, and mean annual snowfall is 0.0 inches.

4.2 Soils

Nine soil units have been mapped within the study area: Columbia fine sandy loam, partially drained, 0 to 2 percent slopes; Egbert clay, 0 to 2 percent slopes; Egbert clay, drained, 2 to 5 percent slopes; Gazwell mucky clay, partially drained, 0 to 2 percent slopes; Rindge mucky silt loam, partially drained, 0 to 2 percent slopes; Sailboat variant silty clay loam, partially drained, 0 to 2 percent slopes; Scribner clay loam, partially drained, 0 to 2 percent slopes; Valpac variant sandy loam, partially drained, 0 to 2 percent slopes; and Water (Figure 3).

Columbia soils are coarse-loamy, mixed, superactive, nonacid, thermic Oxyaquic Xerofluvents. They consist of very deep, moderately well drained soils, with moderately rapid permeability formed in alluvium from mixed sources.

Egbert soils are fine, mixed, superactive, thermic Cumulic Endoaquolls. They consist of very deep, poorly drained soils formed in alluvium from mixed sources. Egbert soils are poorly drained, very slow to slow runoff with slow permeability. They are commonly used for irrigated croplands.

Gazwell soils are fine, mixed, superactive, thermic Cumulic Endoaquolls. They consist of very deep, very poorly drained mineral soils with a buried organic soil. They are formed in alluvium from mixed rock sources underlain by decomposed hydrophytic plant remains.

Rindge soils are Euic, thermic Typic Haplosaprists. They consist of very deep, very poorly drained organic soils that formed in fresh water marshes, sloughs and drainage channels from mixed decomposed reeds, tules ad alluvium. Rindge soils are poorly drained, with very slow runoff, and rapid permeability. They are found in the islands of the Sacramento-San Joaquin Delta and along the central coast of California.

Sailboat soils are fine-loamy, mixed, active, nonacid, thermic Aquic Xerofluvents. They consist of very deep, somewhat poorly drained soils which contain buried soil and that formed in alluvium from mixed sources. Sailboat soils are somewhat poorly drained, have slow runoff and exhibit moderately slow permeability. They are found the edges of backswamps and on natural levees of high flood plains.

Scribner soils are fine-loamy, mixed, superactive, thermic Cumulic Endoaquolls. They consist of very deep, poorly drained soils that formed in mixed alluvium. These soils are found on the edge of backswamps and have slopes of 0 – 2 percent. They are poorly drained with negligible to low runoff and moderately slow and slow permeability.

Valpac soils are fine-loamy, mixed, superactive, thermic Fluvaquentic Haploxerolls. They consist of very deep, somewhat poorly drained soils formed in alluvium derived from mixed rocks. They occur on natural levees of high floodplains. They are somewhat poorly drained with slow runoff and moderately slow permeability.

4.3 Hydrology

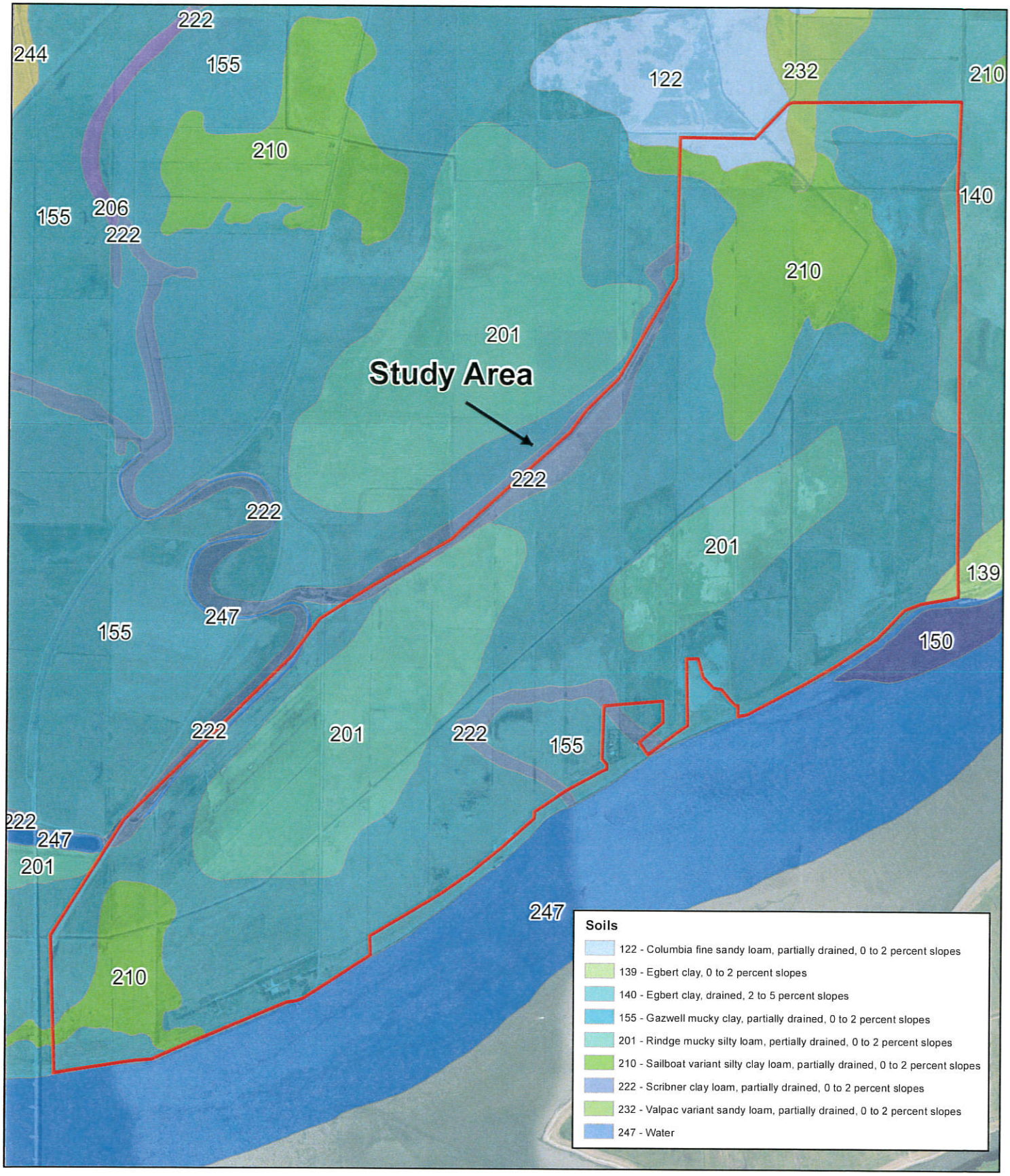
The project site is located on Sherman Island which is completely surrounded by a levee system. The site has subsided between 10 feet and 20 feet below the adjacent elevations of the San Joaquin River. The site is comprised of a complex network of berms, water delivery and drainage ditches, and water control structures. The wetlands on the site are a product of water brought onto the island as part of the flood irrigated management practices, seepage through the perimeter berm, and precipitation. Water is delivered onto the property via siphons in the southern section of the study area and water control structure in the northern section of the study area. It is then conveyed to the agricultural fields by a series of water delivery canals and manipulated with water control structures. The Sherman Island Wetland Restoration Project: Phase II is located in the Lower Sacramento watershed (HUC 18020109). Water from the site eventually is pumped back into the San Joaquin River.

4.4 Vegetation

The study area vegetation is composed of ruderal uplands, pasture fields and crop fields, irrigation canals and ditches, Himalayan blackberry patches, and wetlands containing several vegetation alliances. These habitats are summarized described below.

Ruderal Upland Areas

Ruderal upland areas are located throughout the study area and consist of gravel and dirt roads, levees, and laydown areas for farm equipment. The vegetation within these areas is dominated by a mosaic of non-native ruderal and often invasive species, which do not appear to form distinct vegetation alliances. Dominant species include black mustard (*Brassica nigra*), fennel (*Foeniculum vulgare*), ripgut brome *(Bromus diandrus),* and wild oat (*Avena sp.*). Associated species include common mallow (*Malva neglecta*) and wild artichoke (*Cynara cardunculus).* These areas have very little potential to support special-status plant species due to the degree of disturbance, altered substrate and hydrology, and the density of ruderal vegetation.



DUCKS UNLIMITED

Figure 3. Sherman Island Wetland Restoration Project: Phase II Soil Map

Study Area

Aerial photo: 2014 FSA 1 Meter Color Orthophotography

Project location: Sections 1, 2, 3 & 10 of T2N, R2E;
Sections 25, 26, 35 & 36 of T3N, R2E, Sacramento County, CA

N

0 1,000 2,000 Feet

Pasture Fields and Crop Fields
Pasture fields dominate the study area and consist primarily of perennial pepper weed (*Lepidium latifolium*), bird's-foot trefoil (*Lotus corniculatus*), wall barley (*Hordeum murinum)*, and Bermuda grass (*Cynodon dactylon)* in various ratios and do not form distinct vegetation alliances. Associated species within the pasture fields include, rough cocklebur (*Xanthium strumarium*), bull thistle (*Cirsium vulgare*), brass buttons (*Cotula coronopifolia*), rabbit's foot grass (*Polypogon monspeliensis*), wild lettuce (*Lactuca serriola)*, wild artichoke (*Cynara cardunculus)*, salt grass (*Distichlis spicata*), and Mediterranean barley (*Hordeum marinum*).

Crop fields consist primarily of monocultures of corn (*Zea mays)*, broom corn (*Sorghum bicolor)*, and safflower (*Carthamus tinctorius*). These crop fields are part of an active agriculture operation and are managed to maximize production. The pasture fields and crop fields within the study area provide limited habitat sufficient to support special-status plant species due to the degree of disturbance and density of planted crop species.

Irrigation Canals and Ditches
Irrigation canals and ditches are man-made and located throughout the study area. These areas supply water to pasture and crops as part of an active agriculture operation. The banks and channel walls of the canals and ditches were observed to be heavily vegetated with little bare ground exposed. Hydrophytic vegetation is present on the banks and within the channels. Dominant species include cattail (*Typha ssp.*), tule (*Schoenoplectus ssp.*) with associated species of poison hemlock (*Conium maculatum*), perennial pepper weed (*Lepidium latifolium*), Himalayan blackberry (*Rubus armeniacus)*. In areas of still water, water primrose (*Ludwigia peploides*) occurred on the water surface. Canals and ditches provide limited habitat sufficient to support special-status plant species despite disturbance caused by annual maintenance.

Himalayan Blackberry Patches
Large, monotypic patches of Himalayan blackberry occur throughout the study area in sufficient densities to constitute separate habitat, particularly within pasture fields and adjacent to freshwater ditches. These areas provide very little potential to support special-status plant species due to the dense nature of the vegetation.

Wetlands
Several wetland types were identified within the study area including: flood irrigated pasture, flood irrigated cropland, perennial marsh, and seasonal wetland. These individual features are described in more detail in the following section.

4.5 Waters of the United States
Six categories of waters of the United States have been mapped on the site: San Joaquin River, ditch, flood irrigated cropland, flood irrigated pasture, perennial marsh, and seasonal wetland. Table 1 is an acreage summary of the types, and the wetland delineation map is included as Figure 4.

Table 1.
Waters of the United States

Type	Acreage
Waters:	
San Joaquin River	
SJR-01	0.814
Ditch	
D-01	0.591
D-02	0.671
D-03	0.529
D-04	0.333
D-05	52.790
Wetlands:	
Flood Irrigated Cropland	
FIC-01	35.104
FIC-02	217.349
FIC-03	6.963
FIC-04	21.080
Flood Irrigated Pasture	
FIP-01	149.941
FIP-02	155.072
FIP-03	4.853
FIP-04	47.389
FIP-05	48.932
FIP-06	47.130
FIP-07	63.469
FIP-08	15.312
FIP-09	11.757
FIP-10	0.146
FIP-11	0.121
FIP-12	40.333
FIP-13	25.143
FIP-14	27.415
FIP-15	19.577
FIP-16	17.251
FIP-17	1.879
FIP-18	33.419
FIP-19	25.878
FIP-20	0.150

Type	Acreage
FIP-21	27.302
FIP-22	42.037
FIP-23	0.468
FIP-24	1.620
FIP-25	0.416
FIP-26	148.412
FIP-27	1.532
FIP-28	39.276
Perennial Marsh	
PM-01	9.236
Seasonal Wetland	
SW-01	5.230
SW-02	6.185
SW-03	9.375
SW-04	6.043
SW-05	1.562
SW-06	0.349
SW-07	0.111
SW-08	25.584
SW-09	1.432
SW-10	0.742
SW-11	0.027
SW-12	0.093
SW-13	0.317
SW-14	0.191
SW-15	0.053
SW-16	15.974
SW-17	0.184
SW-18	0.175
SW-19	1.593
SW-20	6.219
SW-21	3.781
SW-22	0.039
SW-23	4.775
SW-24	0.024
SW-25	1.400
SW-26	1.374
SW-27	3.403

Type	Acreage
SW-28	0.329
SW-29	0.014
SW-30	0.029
SW-31	0.140
SW-32	0.680
SW-33	6.377
SW-34	0.022
SW-35	0.144
SW-36	0.564
SW-37	2.671
Total Waters of the United States	**1448.895**

San Joaquin River

A large perennial river is located along the southern boundary of the study area. The river is separated from the rest of the study are by a man-made levee system. A wrack line consisting of organic matter was observed and is consistent with the lower limit of woody perennial vegetation. Rip rap is located along the banks of the river, to protect from erosion. A small amount of the vegetation growing within the river channel. Dominant species include California tule (*Schoenoplectus californicus*), hardstem tule (*Schoenoplectus acutus)*, and willow species (*Salix ssp.*).

Ditches

Freshwater canals and ditches are man-made conveyances and associated culverts that provide water delivery throughout the study area. Ditches vary in width from large canals 30 feet or more across to smaller ditches conveying water to flood irrigated pastures with widths as small as 4 feet wide. These ditches likely supplied water to crops before the land was converted for grazing. Hydrophytic vegetation is present on the banks and within the channels. Dominant species include perennial pepper weed (*Lepidium latifolium*) and poison hemlock (*Conium maculatum)* along the banks and rabbit's foot grass (*Polypogon monspeliensis*), broadleaf cattail (*Typha latifolia*), narrowleaf cattail (*Typha augustifolia),* California bulrush (*Schoenoplectus californicus*), and hardstem tule (*Schoenoplectus acutus*) within the channel.

Flood Irrigated Cropland

Flood irrigated cropland is present in the northwest corner of the study area. Flood irrigated cropland is inundated seasonally through a series of ditch networks located within and adjacent to the crops. Inundation is dependent on the irrigation requirements of the crops that are being grown. Currently corn (*Zea mays*), broom corn (*Sorghum bicolor)*, and safflower (*Carthamus tinctorius)* are being grown within the study area.

Flood Irrigated Pasture

Flood irrigated pastures dominate the study area and consist primarily of perennial pepper weed (*Lepidium latifolium*), bird's-foot trefoil (*Lotus corniculatus*), fat-hen (*Atriplex prostrata*), and Mediterranean barley (*Hordeum marinum*) in various ratios and do not form distinct vegetation alliances. Standing water is present in depressions scattered within the flood irrigated pastures. The amount of water on the field is dependent upon irrigation practices of resident cattle ranchers and precipitation events. Associated species within the pasture fields include

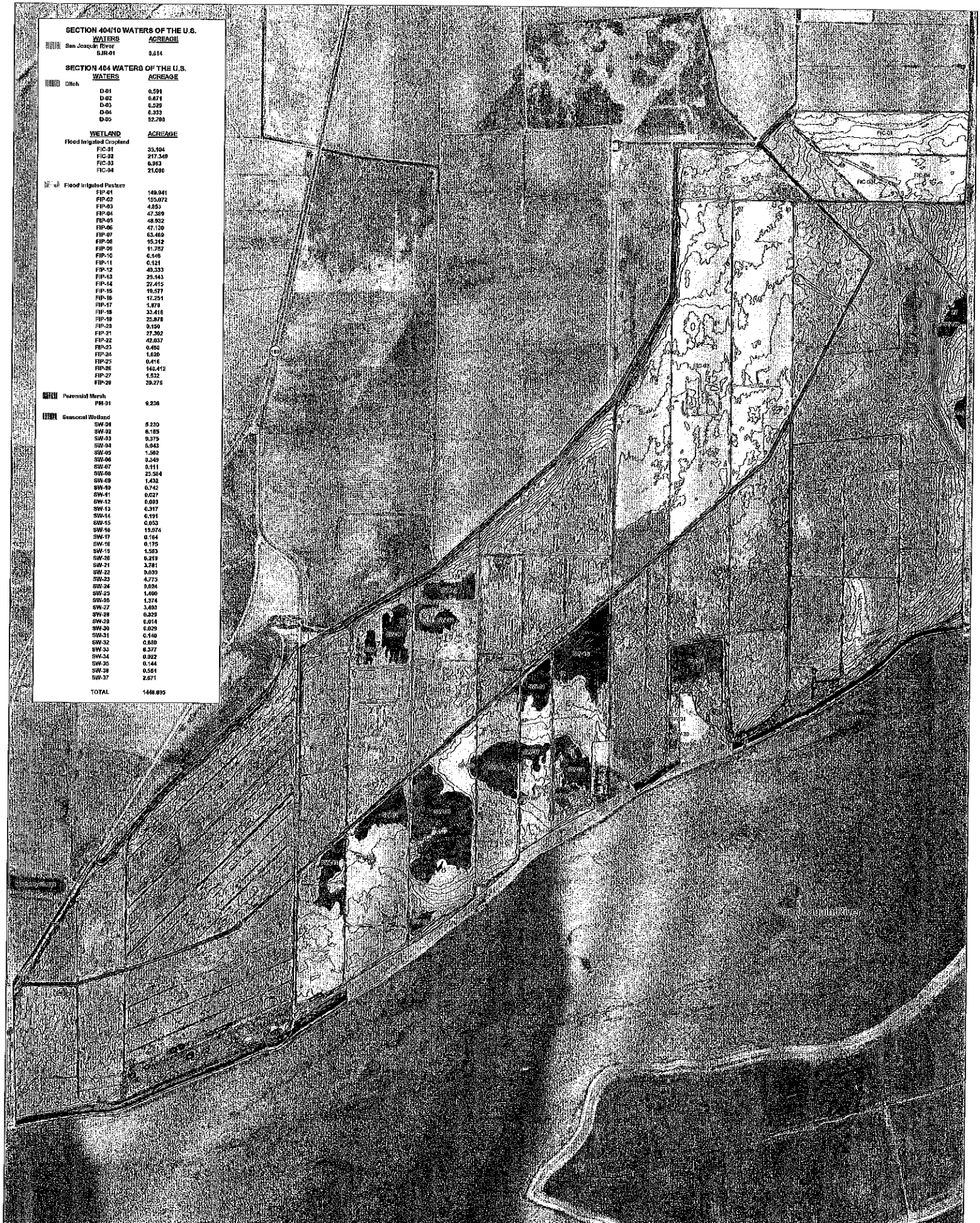
Italian rye grass (*Lolium perenne*) rough cocklebur (*Xanthium strumarium*), brass buttons (*Cotula coronopifolia*), rabbit's foot grass (*Polypogon monspeliensis*), and Bermuda grass (*Cynodon dactylon).*

Perennial Marsh

Perennial marsh is present in one location within the study area. This wetland consists of a mosaic of open water and marsh habitat. The vegetation is dominated by hydrophytic species including broadleaf cattail (*Typha latifolia*), narrowleaf cattail (*Typha augustifolia),* common reed (*Phragmites australis*), California bulrush (*Schoenoplectus californicus*), and hardstem tule (*Schoenoplectus acutus*). Associated species include perennial pepper weed (*Lepidium latifolium*), fat-hen (*Atriplex prostrata*), poision hemlock (*Conium maculatum)*, and rabbits foot grass (*Polypogon monspeliensis*). Open water habitat is scattered throughout these marshes in deeper areas where truly aquatic species are more prevalent.

Seasonal Wetlands

Seasonal wetlands are present throughout the study area, particularly in depressional areas and adjacent to pasture fields. These wetlands are dominated by hydrophytic species, many of which are weedy non-native species; however, there are no distinct vegetation alliances. Dominant species are a mosaic of hydrophytic species including perennial pepper weed (*Lepidium latifolium*), Mediterranean barley (*Hordeum marinum*), brass buttons (*Cotula coronopifolia*), rabbit's foot grass (*Polypogon monspeliensis*), and salt grass (*Distichlis spicata*). Associated species include fat hen (*Atriplex prostrata*), rough cocklebur (*Xanthium strumarium*), bird's-foot trefoil (*Lotus corniculatus*), and Bermuda grass (*Cynodon dactylon*).



Prepared by:

Delineation by: Patrick Brilliot, Nicholas Tanner, & Aaron Hill
Date of Field Work: 6/29/15, 8/30/15, 12/1/15, 3/29/16, 4/13/16, 4/20/16, 4/27/16, 5/22/16, 6/14/16, 8/8/16, 8/10/16, 8/11/16, & 8/12/16
Date of Field Verification: TBD
Date of Map: 10/30/16

Figure 4 Sherman Island Wetland Restoration Project: Phase II Wetland Delineation Map

Study Area (1969 acres) — Contour lines ● Upland data point ● Wetland data point ● Waters data point ····· Ordinary High Water Mark ▣ Pump Station

Aerial photo: 2016 NAIP Aerial Imagery
Project Location: Sections 1, 2, 3, & 10 of T2N, R2E & Sections 25, 26, 35, & 36 of T3N, R2E, Sacramento County, CA

The boundaries and jurisdictional status of all waters shown on this map are preliminary and subject to verification by the U.S. Army Corps of Engineers.

0 600 1,200 Feet

1 inch = 400 feet

N

5.0 References and other Sources

Environmental Laboratory. 1987. Corps of Engineers' Wetlands Delineation Manual. (Technical Report Y-87-1). Vicksburg, MS.

Environmental Laboratory. 2008. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0) – ERDC/EL TR-08-28. Vicksburg MS. U.S. Army Engineer Research and Development Center.

Hurt, P.M. Whited, and R.F. Pringle (eds.) USDA, NRCS in cooperation with the National Technical Committed for Hydric Soils, Fort Worth, TX.

Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. The National Wetland Plant List: 2016 wetland ratings. Phytoneuron 2016-30: 1-17. Published 28 April 2016. ISSN 2153 733X

Munsell Color. 2000. Munsell Soil Color Charts. Gretag Macbeth. New Windsor, NY.

Richardson, J.L. and M.J. Vepraskas (eds.). Wetland Soils: Genesis, Hydrology, Landscapes, and Classification. Lewis Publishers, Boca Raton, FL.

Soil Survey Staff. 1992. Keys to Soil Taxonomy, 5th Edition. SMSS Technical Monograph No. 19. Pocahontas Press, Blacksburg, VA.

Sprecher, S. 1999. Using the NRCS Hydric Soil Indicators with Soils with Thick A Horizons. WRP Technical Notes Collection (TN WRP SG-DE-4.1). Vicksburg, MS.

USDA, NRCS. 2003. Field Indicators of Hydric Soils in the United States, Version 4.01. G.W.

USDA, NRCS. 2012. Soil Survey Geographic (SSURGO) database for Sacramento County, California. Fort Worth, TX.

USDA, NRCS. 2018. Climate Analysis for Wetlands by County. WETS Station SACRAMENTO 5ESE, CA. Accessed May 4, 2018 at http://agacis.rcc-acis.org/?fips=06067

Vepraskas, M.J. 1999. Redoximorphic Features for Identifying Aquic Conditions. North Carolina Agricultural Research Service, Technical Bulletin 301. Raleigh, NC.

Appendix A. Wetland Data Sheets

Appendix B. Wetland Status of Plant Species Observed

Appendix C. GIS Files

GIS Files are provided to the Corps and are available upon request.

Appendix D. RGL 16-01

Appendix E. Aquatic Resource Classification Table

Waters Name	State	Cowardin Code	Meas Type	Amount	Units	Waters Type	Latitude	Longitude
SJR-01	CALIFORNIA	R1RS	Area	0.814	ACRE	DELINEATE	38.045788	-121.711808
D-01	CALIFORNIA	R5UB	Area	0.591	ACRE	DELINEATE	38.069504	-121.705579
D-02	CALIFORNIA	R5UB	Area	0.671	ACRE	DELINEATE	38.049237	-121.718179
D-03	CALIFORNIA	R5UB	Area	0.529	ACRE	DELINEATE	38.033589	-121.744802
D-04	CALIFORNIA	R5UB	Area	0.333	ACRE	DELINEATE	38.040024	-121.738253
D-05	CALIFORNIA	R5UB	Area	52.790	ACRE	DELINEATE	38.05058	-121.724681
FIC-01	CALIFORNIA	PEM	Area	35.104	ACRE	DELINEATE	38.0704	-121.706062
FIC-02	CALIFORNIA	PEM	Area	217.349	ACRE	DELINEATE	38.060851	-121.714984
FIC-03	CALIFORNIA	PEM	Area	6.963	ACRE	DELINEATE	38.068379	-121.707097
FIC-04	CALIFORNIA	PEM	Area	21.080	ACRE	DELINEATE	38.068677	-121.704398
FIP-01	CALIFORNIA	PEM	Area	149.941	ACRE	DELINEATE	38.040395	-121.741763
FIP-02	CALIFORNIA	PEM	Area	155.072	ACRE	DELINEATE	38.059776	-121.705778
FIP-03	CALIFORNIA	PEM	Area	4.853	ACRE	DELINEATE	38.066837	-121.704092
FIP-04	CALIFORNIA	PEM	Area	47.389	ACRE	DELINEATE	38.048884	-121.718436
FIP-05	CALIFORNIA	PEM	Area	48.932	ACRE	DELINEATE	38.045202	-121.734791
FIP-06	CALIFORNIA	PEM	Area	47.130	ACRE	DELINEATE	38.053511	-121.712311
FIP-07	CALIFORNIA	PEM	Area	63.469	ACRE	DELINEATE	38.053103	-121.722396
FIP-08	CALIFORNIA	PEM	Area	15.312	ACRE	DELINEATE	38.049156	-121.725793
FIP-09	CALIFORNIA	PEM	Area	11.757	ACRE	DELINEATE	38.053636	-121.71855
FIP-10	CALIFORNIA	PEM	Area	0.146	ACRE	DELINEATE	38.048193	-121.709652
FIP-11	CALIFORNIA	PEM	Area	0.121	ACRE	DELINEATE	38.050698	-121.702351
FIP-12	CALIFORNIA	PEM	Area	40.333	ACRE	DELINEATE	38.050329	-121.708417
FIP-13	CALIFORNIA	PEM	Area	25.143	ACRE	DELINEATE	38.054276	-121.709398
FIP-14	CALIFORNIA	PEM	Area	27.415	ACRE	DELINEATE	38.054487	-121.706589
FIP-15	CALIFORNIA	PEM	Area	19.577	ACRE	DELINEATE	38.057142	-121.708028
FIP-16	CALIFORNIA	PEM	Area	17.251	ACRE	DELINEATE	38.062313	-121.709688
FIP-17	CALIFORNIA	PEM	Area	1.879	ACRE	DELINEATE	38.047804	-121.714
FIP-18	CALIFORNIA	PEM	Area	33.419	ACRE	DELINEATE	38.052136	-121.715399
FIP-19	CALIFORNIA	PEM	Area	25.878	ACRE	DELINEATE	38.048232	-121.712483
FIP-20	CALIFORNIA	PEM	Area	0.150	ACRE	DELINEATE	38.053744	-121.724717
FIP-21	CALIFORNIA	PEM	Area	27.302	ACRE	DELINEATE	38.047063	-121.728789
FIP-22	CALIFORNIA	PEM	Area	42.037	ACRE	DELINEATE	38.045781	-121.73203
FIP-23	CALIFORNIA	PEM	Area	0.468	ACRE	DELINEATE	38.037382	-121.749371

FIP-24	CALIFORNIA	PEM	Area	1.620	ACRE	DELINEATE	38.041749	-121.745155
FIP-25	CALIFORNIA	PEM	Area	0.416	ACRE	DELINEATE	38.038035	-121.748414
FIP-26	CALIFORNIA	PEM	Area	148.412	ACRE	DELINEATE	38.034591	-121.7438
FIP-27	CALIFORNIA	PEM	Area	1.532	ACRE	DELINEATE	38.048564	-121.716255
FIP-28	CALIFORNIA	PEM	Area	39.276	ACRE	DELINEATE	38.042976	-121.740622
PM-01	CALIFORNIA	PEM	Area	9.236	ACRE	DELINEATE	38.048833	-121.715627
SW-01	CALIFORNIA	PEM	Area	5.230	ACRE	DELINEATE	38.047776	-121.723759
SW-02	CALIFORNIA	PEM	Area	6.185	ACRE	DELINEATE	38.042531	-121.73157
SW-03	CALIFORNIA	PEM	Area	9.375	ACRE	DELINEATE	38.044482	-121.725671
SW-04	CALIFORNIA	PEM	Area	6.043	ACRE	DELINEATE	38.044644	-121.721905
SW-05	CALIFORNIA	PEM	Area	1.562	ACRE	DELINEATE	38.043344	-121.722342
SW-06	CALIFORNIA	PEM	Area	0.349	ACRE	DELINEATE	38.043259	-121.724426
SW-07	CALIFORNIA	PEM	Area	0.111	ACRE	DELINEATE	38.043573	-121.723923
SW-08	CALIFORNIA	PEM	Area	25.584	ACRE	DELINEATE	38.042101	-121.728754
SW-09	CALIFORNIA	PEM	Area	1.432	ACRE	DELINEATE	38.038206	-121.729733
SW-10	CALIFORNIA	PEM	Area	0.742	ACRE	DELINEATE	38.038252	-121.731255
SW-11	CALIFORNIA	PEM	Area	0.027	ACRE	DELINEATE	38.037983	-121.730574
SW-12	CALIFORNIA	PEM	Area	0.093	ACRE	DELINEATE	38.037829	-121.731358
SW-13	CALIFORNIA	PEM	Area	0.317	ACRE	DELINEATE	38.040823	-121.732759
SW-14	CALIFORNIA	PEM	Area	0.191	ACRE	DELINEATE	38.042505	-121.726642
SW-15	CALIFORNIA	PEM	Area	0.053	ACRE	DELINEATE	38.041458	-121.726253
SW-16	CALIFORNIA	PEM	Area	15.974	ACRE	DELINEATE	38.049121	-121.721287
SW-17	CALIFORNIA	PEM	Area	0.184	ACRE	DELINEATE	38.04945	-121.733041
SW-18	CALIFORNIA	PEM	Area	0.175	ACRE	DELINEATE	38.048903	-121.733062
SW-19	CALIFORNIA	PEM	Area	1.593	ACRE	DELINEATE	38.049361	-121.732434
SW-20	CALIFORNIA	PEM	Area	6.219	ACRE	DELINEATE	38.049872	-121.731107
SW-21	CALIFORNIA	PEM	Area	3.781	ACRE	DELINEATE	38.050466	-121.729098
SW-22	CALIFORNIA	PEM	Area	0.039	ACRE	DELINEATE	38.051195	-121.729257
SW-23	CALIFORNIA	PEM	Area	4.775	ACRE	DELINEATE	38.051686	-121.728277
SW-24	CALIFORNIA	PEM	Area	0.024	ACRE	DELINEATE	38.051186	-121.727137
SW-25	CALIFORNIA	PEM	Area	1.400	ACRE	DELINEATE	38.052896	-121.725593
SW-26	CALIFORNIA	PEM	Area	1.374	ACRE	DELINEATE	38.059024	-121.702065
SW-27	CALIFORNIA	PEM	Area	3.403	ACRE	DELINEATE	38.062871	-121.702442
SW-28	CALIFORNIA	PEM	Area	0.329	ACRE	DELINEATE	38.045425	-121.716725
SW-29	CALIFORNIA	PEM	Area	0.014	ACRE	DELINEATE	38.045147	-121.716913
SW-30	CALIFORNIA	PEM	Area	0.029	ACRE	DELINEATE	38.045875	-121.71688

SW-31	CALIFORNIA	PEM	Area	0.140	ACRE	DELINEATE	38.046357	-121.716917
SW-32	CALIFORNIA	PEM	Area	0.680	ACRE	DELINEATE	38.047422	-121.725091
SW-33	CALIFORNIA	PEM	Area	6.377	ACRE	DELINEATE	38.039993	-121.734337
SW-34	CALIFORNIA	PEM	Area	0.022	ACRE	DELINEATE	38.053119	-121.724518
SW-35	CALIFORNIA	PEM	Area	0.144	ACRE	DELINEATE	38.03087	-121.74612
SW-36	CALIFORNIA	PEM	Area	0.564	ACRE	DELINEATE	38.044511	-121.727048
SW-37	CALIFORNIA	PEM	Area	2.671	ACRE	DELINEATE	38.045004	-121.723943

APPENDIX D

Cultural Resources

A Cultural Resources Study for the Sherman Island Wetland Restoration Project-Phase II DU Project No. US-CA-437-4 Sacramento County, California

Taylor Alshuth, B.A.
and
Tom Origer, M.A.
Registered Professional Archaeologist (#10333)

May 2, 2016

Revised November 9, 2018

A Cultural Resources Study for the Sherman Island Wetland Restoration Project-Phase II DU Project No. US-CA-437-4 Sacramento County, California

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May 2, 2016

Revised November 9, 2018

ABSTRACT

Tom Origer & Associates conducted a cultural resources survey of an approximately 1,970 acre portion of Sherman Island, Sacramento County, California, as requested by Aaron Will, Regional Biologist for Ducks Unlimited, Inc (Ducks). The project proponent is proposing to restore wetland habitat on Sherman Island. This study was designed to meet the requirements of Section 106 of the National Historic Preservation Act as well as the California Environmental Quality Act.

The study included archival research at the North Central Information Center, Sacramento State University, examination of the library and files of Tom Origer & Associates, contact with the Native American community, and field inspection of the project's Area of Potential Effects (APE). Field survey found a disturbed scatter of fragments of concrete, ceramics, glass, and wood and a segment of lead pipe adjacent to the APE. Documentation pertaining to this study is on file at the offices of Tom Origer & Associates (File No. 2016-56S and 2018-91S).

Principal field survey of approximately 1,850 acres for this project was completed in 2016. We were contacted by Ducks in Fall 2018 to survey an additional 120 acres for this project. The additional surveyed acreage was located to the south of the previous APE's southern extent.

Synopsis

Project:	Sherman Island Wetland Restoration Project-Phase II
Location:	Sherman Island, Sacramento County, California
Quadrangle:	Antioch North, California 7.5' series
Study Type:	Intensive survey
Scope:	~1,970 acres of reclaimed land
Finds:	a disturbed scatter of fragments of concrete, ceramics, glass, and wood and a segment of lead pipe adjacent to the APE.

Key Project Personnel

Tom Origer provided project oversight and participated in the field phase of this project. Mr. Origer obtained a Master of Arts in Anthropology from San Francisco State University in 1983, after obtaining a Bachelor of Arts degree in Anthropology at Sonoma State University in 1974. He has over forty years of experience in cultural resources management throughout Northern California. His experience includes work that has been completed in compliance with local ordinances, CEQA, NEPA, and Section 106 (NHPA) requirements. Mr. Origer has been teaching archaeological analysis and field archaeology classes at Santa Rosa Junior College since 1979. He is affiliated with the Society for California Archaeology (Presidential duties from April 1998 to April 2001), the International Association for Obsidian Studies (charter member and President from 1990-1992), the Archaeological Institute of America (President of the North Coast Society from 1985 to 1987), the Society for American Archaeology, the Society for Historical Archaeology, and the Register of Professional Archaeologists.

Taylor Alshuth participated in the field phase and prepared the report for this project. Mr. Alshuth obtained a Bachelor of Arts degree in Anthropology from Humboldt State University in 2014, after obtaining a Associate of Arts degree in Anthropology at Santa Rosa Junior College in 2012. He is affiliated with the Society for California Archaeology, the Archaeological Institute of America, and the Archaeological Conservancy.

CONTENTS

FIGURES

TABLES

INTRODUCTION

This report describes a cultural resources study for the Sherman Island Wetland Restoration Project-Phase II in Sacramento County, California (Figure 1). The Area of Potential Effects includes approximately 1,850 acres in the central portion of Sherman Island where wetland restoration activities are to take place. The study was requested by Aaron Will of Ducks Unlimited, Inc., and was designed to satisfy requirements of Section 106 of the National Historic Preservation Act and the California Environmental Quality Act. Documentation pertaining to this study is on file at the offices of Tom Origer & Associates (File No. 2016-56S and 2018-91S).

REGULATORY CONTEXT

This project is subject to Section 106 of the National Historic Preservation Act (Section 106). Under Section 106, when a federal agency is involved in an undertaking, it must take into account the effects of the undertaking on historic properties (36CFR Part 800). Compliance with Section 106 requires that agencies make an effort to identify historic properties that might be affected by a project.

The California Environmental Quality Act (CEQA) requires that cultural resources be considered during the environmental review process. This is accomplished by creating an inventory of cultural properties within a project's Area of Potential Effects (APE) and by assessing the potential that cultural resources could be affected by the project.

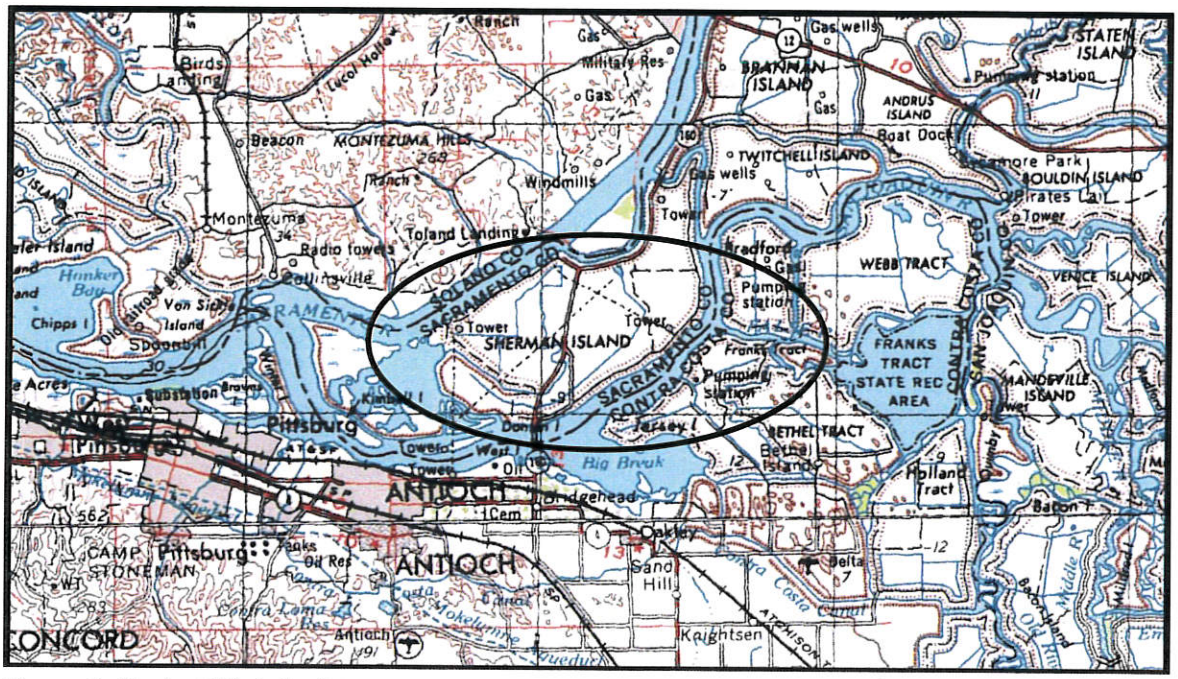


Figure 1. Project Vicinity (adapted from the 1980 Sacramento 1:250,000-scale USGS map).

Pursuant to Section 106 and the CEQA Guidelines, the goals of this study were to: 1) identify all historic properties within the project's APE; 2) provide an evaluation of the significance of identified properties; 3) determine the properties' vulnerability to adverse affects that could arise from project activities; and 4) offer recommendations designed to protect historic property values, as warranted.

The National Register defines a historic property as a district, site, building, structure, or object significant in American history, architecture, engineering, archaeology, and culture, and that may be of value to the nation as a whole or important only to the community in which it is located. These resource types are described by the National Park Service (NPS) as follows (NPS 1995:4-5).

> **Site.** A site is the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archaeological value regardless of the value of any existing structure.
>
> **Building.** A building, such as a house, barn, church, hotel, or similar construction, is created principally to shelter any form of human activity. "Building" may also be used to refer to a historically and functionally related unit, such as a courthouse and jail, or a house and barn.
>
> **Structure.** The term "structure" is used to distinguish from buildings those functional constructions made usually for purposes other than creating human shelter.
>
> **Object.** The term "object" is used to distinguish from buildings and structures those constructions that are primarily artistic in nature or are relatively small in scale and simply constructed. Although it may be, by nature or design, movable, an object is associated with a specific setting or environment.
>
> **District.** A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.

Significance Criteria

When a project might affect a cultural resource, the project proponent is required to conduct an assessment to determine whether the effect may be one that is significant. Consequently, it is necessary to determine the importance of resources that could be affected. For purposes of the National Register, the importance of a historic resource is evaluated in terms of criteria put forth in 36CFR60 (see below). Eligibility criteria for the California Register of Historical Resources (Title 14 CCR, §4852) are very similar and will not be presented here.

> The quality of significance is present in properties that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of persons significant in our past; or

C. That embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded or may be likely to yield, information important in prehistory or history.

Additionally, the OHP advocates that all historical resources over 45 years old be recorded for inclusion in the OHP filing system (OHP 1995:2), although professional judgment is urged in determining whether a resource warrants documentation.

PROJECT DESCRIPTION AND SETTING

Project Location and Description

The APE is located in the Sacramento-San Joaquin river delta, in the extreme southwestern part of Sacramento County. The APE consists of reclaimed marshland used primarily as pasture and cropland on Sherman Island near the confluence of the Sacramento and San Joaquin rivers. The APE is bordered by a slough on the north, on the south by the San Joaquin River and on the east and west by pasture and cropland. Terrain within the APE is flat. Localized areas within the APE are inundated. The APE is artificially drained by a series of ditches and protected from flooding by levees. (Figure 2).

Soils within the APE are a mix of Egbert, Gazwell, Rindge, Sailboat, Scribner and Valpac soils (Tugel 1993: Sheet 22). Egbert soils are composed of poorly drained alluvium derived from mixed rock sources. Vegetation supported by Egbert soils include annual grasses and forbs. Egbert soils are mainly used for growing irrigated crops (Tugel 1993:50). Gazwell soils are composed of alluvium, and are generally found at or below sea level. Vegetation support by Gazwell soils include hydrophytic plants, annual grasses and forbs. Gazwell soils are mainly used for range (Tugel 1993:61). Rindge soils are composed of a mucky, silt loam that occurs at elevations from 5-20 feet below sea level, and were formed in very poorly drained tule and reed plant remains. Vegetation supported by Rindge soils include hydrophytic plants, annual grasses, and forbs. Rindge soils are mainly used for growing irrigated crops (Tugel 1993:91-93). Sailboat soils are composed of poorly drained alluvium derived from mixed rock sources and underlain by hydrophytic plant remains. Vegetation supported by Sailboat soils include hydrophytic plants, annual grasses and forbs. Sailboat soils are mainly used for growing irrigated crops (Tugel 1993:97). Scribner soils are composed of poorly drained alluvium derived from mixed rock sources. Vegetation supported by Scribner soils include hydrophytic plants, annual grasses, and forbs. Scribner soils are mainly used for growing irrigated crops (Tugel 1993:107). Valpac soils are composed of poorly drained alluvium derived from mixed rock sources and underlain by alluvium that has a high content of hydrophytic plant remains. Vegetation supported by Valpac soils include hydrophytic plants, annual grasses, and forbs. Valpac soils are mainly used for growing irrigated crops (Tugel 1993:111-112). Geology within the APE is composed of Holocene estuarine deposits deposited at, or near sea level in tidal marshes of the Sacramento-San Joaquin river delta (Dawson 2009).

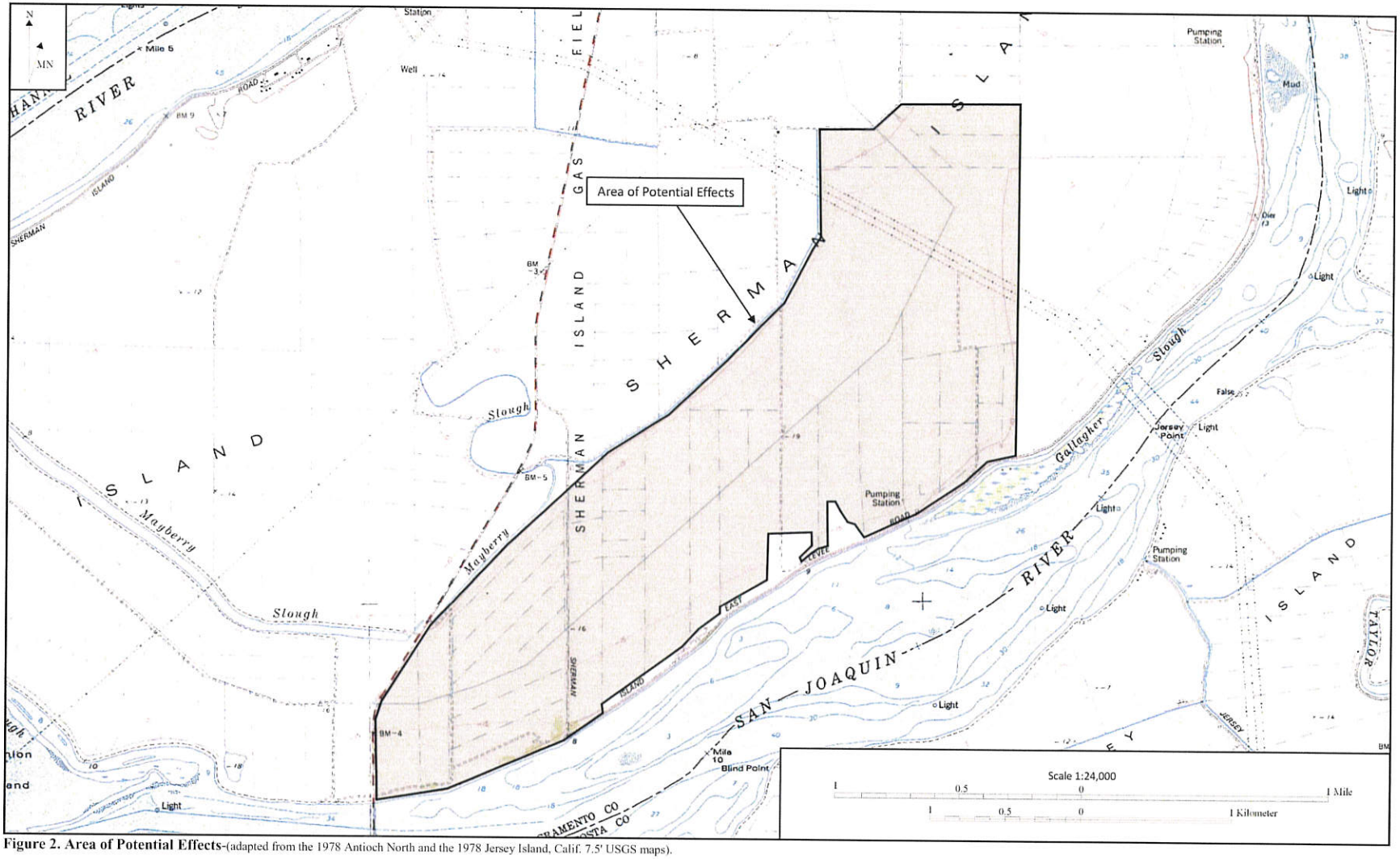


Figure 2. Area of Potential Effects-(adapted from the 1978 Antioch North and the 1978 Jersey Island, Calif. 7.5' USGS maps).

At the end of the Last Glacial Maximum, approximately 18,000 years ago, sea levels were about 130 meters below current levels, San Francisco Bay was open grassland, and one could walk to the Farallon Islands (Bickel 1978; Burroughs 2005:41; Parkman 2006:1). As temperatures began to rise, so too did sea levels. By 7,000 years ago waters began to push past San Francisco Bay into what is now the Sacramento-San Joaquin river delta (Drexel *et al.* 2009:372; Mount and Twiss 2005:3). Sea levels reached within five meters of their current levels approximately 4,000 years ago (Booth *et al.* 2004:30). Recent studies have corroborated the date of the development of the delta area by carbon-14 dating cores taken on Sherman Island, (both within and outside of the current APE) and other areas in the delta. Dates taken from the bottom of the cores were consistently approximately 6,500 years old (Drexel *et al.* 2009). Over the next 6,350 years the Sacramento-San Joaquin delta developed into a tule marsh lined with riparian forests along natural levees (West *et al.* 2007:24). Studies have shown that during this 6,350 year time, several meters of peat soils formed above the old ground surface. It is estimated that a total of five billion cubic meters of tidal marsh sediment have accumulated in the delta (Mount and Twiss 2005:12). Although several meters of soil have been lost to subsidence (Deverel and Leighton 2012; Drexel *et al.* 2009; Mount and Twiss 2005) there is still an estimated 5-15 meter thick surface deposit of peat-rich soils remaining on Sherman Island (Deverel and Leighton 2010).

In short, the APE was below sea level for several thousand years, and it had been until it was historically drained in the mid to late 19th century.

Cultural Setting

Archaeological evidence indicates that human occupation of California began at least 11,000 years ago (Erlandson *et al.* 2007). Early occupants appear to have had an economy based largely on hunting, with limited exchange, and social structures based on extended family units. Later, milling technology and an inferred acorn economy were introduced. This diversification of economy appears coeval with the development of sedentism, population growth, and expansion. Sociopolitical complexity and status distinctions based on wealth are also observable in the archaeological record, as evidenced by an increased range and distribution of trade goods (e.g., shell beads, obsidian tool stone), which are possible indicators of both status and increasingly complex exchange systems.

At the time of European settlement, the APE was within the territory controlled by the Bay Miwok branch of the Eastern Miwok, near the boundary common to the Plains Miwok (Kroeber 1925; Levy 1978). The Bay Miwok were hunter-gatherers in a rich environment that allowed for dense populations. They settled in large, permanent villages about which were distributed seasonal camps and task-specific sites. Primary villages were inhabited throughout the year while other sites were visited seasonally to obtain particular resources. Sites were often established near fresh water sources and at ecotones where plant and animal life was diverse and abundant. The marsh setting enjoyed by the Bay Miwok provided abundant plant and animal resources for their use.

There are no historically documented Native American sites within or adjacent to the APE (Kroeber 1932; Levy 1978). More information about the Eastern Miwok is available in Bennyhoff (1977) and Milliken (1995), and a good overview of prehistoric use of the Delta Region is found in Waugh (1986).

The Swamp Land Act of 1850 enabled California to reclaim thousands of acres of land, creating the fertile Sacramento-San Joaquin river delta's islands of agricultural fields. Levee construction on Sherman Island began in the late 1850s, and the island was reportedly reclaimed by 1873 (Thompson and West 1890:220). The early levees were built by hand primarily using Chinese labor. These low,

peat levees proved inadequate against heavy winter flooding. Sherman Island flooded regularly, and by the late 1870s the early levees were destroyed. After the initial phase of reclamation, steam dredges were put into action and new levees were built that were taller and stronger, and able to better withstand the heavy flooding. Strengthening the levees is an ongoing activity. Agriculture and recreation have been the primary uses of Sherman Island, typical of the Sacramento-San Joaquin delta region.

STUDY PROCEDURES AND FINDINGS

Native American Contact Procedures

In 2016, a request was sent to the State of California's Native American Heritage Commission (NAHC) seeking information from the sacred lands files and the names of Native American individuals and groups that would be appropriate to contact regarding this project. Letters were also sent to the following groups:

Buena Vista Rancheria of Me-Wuk Indians
Ione Band of Miwok Indians
Nashville-El Dorado Miwok
Shingle Springs Band of Miwok Indians
Tsi Akim Maidu
United Auburn Indian Community of the Auburn Rancheria
Wilton Rancheria

A letter was also sent the following individual:

Randy Yonemura

In 2018, a request was sent to the NAHC seeking information from the sacred lands files and the names of Native American individuals and groups that would be appropriate to contact regarding this project. Letters were also sent to the following groups:

Buena Vista Rancheria of Me-Wuk Indians
Colfax-Todds Valley Consolidated Tribe
Ione Band of Miwok Indians
Nashville Enterprise Miwok-Maidu-Nishinam Tribe
Shingle Springs Band of Miwok Indians
Tsi Akim Maidu
United Auburn Indian Community of the Auburn Rancheria
Wilton Rancheria

A log of contact efforts and copies of correspondence are provided at the end of this report (Appendix A).

Native American Contact Results

In 2016, the NAHC responded on May 13, 2016. Their review of the Sacred Lands File did not indicate the presence of any sacred sites within the APE. A Native American Consultation list was also provided.

Daniel Fonseca, the Tribal Historic Preservation Officer representing the Shingle Springs Band of Miwok Indians, responded on June 1, 2016. They have requested copies of completed record searches or surveys that were done in or around the project area up to and including environmental, archaeological, and cultural reports.

Gene Whitehouse, Chairman of the United Auburn Indian Community of the Auburn Rancheria, responded on July 14, 2016. They have requested copies of archaeological reports and environmental documents related to this project. They also requested a meeting or site visit to begin consultation on the project, and recommended that tribal representatives observe and participate in the field survey.

In 2018, the NAHC responded on September 26, 2018. Their review of the Sacred Lands File did not indicate the presence of any sacred sites within the APE. A Native American Consultation list was also provided.

Gene Whitehouse, Chairman of the United Auburn Indian Community of the Auburn Rancheria, responded on October 12, 2018. They have requested copies of archaeological reports and environmental documents related to this project. They also requested a meeting or site visit to begin consultation on the project, and recommended that tribal representatives observe and participate in the field survey.

Daniel Fonseca, the Tribal Historic Preservation Officer representing the Shingle Springs Band of Miwok Indians, responded on October 24, 2018. They have requested copies of completed record searches or surveys that were done in or around the project area up to and including environmental, archaeological, and cultural reports.

No additional responses have been received as of the date of this report. A log of contact efforts and copies of correspondence are provided at the end of this report (Appendix A).

Archival Study Procedures

Archival research included examination of the library and project files at Tom Origer & Associates, and the archaeological site base maps and records, survey reports, and other materials on file at the North Central Information Center (NCIC), Sacramento State University was conducted by Rachel Hennessy on September 26, 2018 (NCIC File No.: SAC-18-164). Sources of information included but were not limited to the current listings of properties on the National Register of Historic Places, California Historical Landmarks, California Register of Historical Resources, and California Points of Historical Interest as listed in the Office of Historic Preservation's *Historic Property Directory* (OHP 2012). In addition, ethnographic literature, county histories, and other primary and secondary sources were reviewed. Sources reviewed are listed in the "Materials Consulted" section of this report.

The State Office of Historic Preservation has determined that structures in excess of 45 years of age should be considered to be potentially important resources, and former building and structure locations could be potentially important historic archaeological sites. Archival research included an examination of historical maps to gain insight into the nature and extent of historical development in the general vicinity, and especially within and adjacent to the study area. Maps ranged from hand-drawn maps of the 1800s to topographic quadrangles issued by the United States Geological Survey (USGS). Included were General Land Office survey plats (1862 and 1867), an early survey of the Sacramento River (Ringgold 1852), and early USGS topographic maps (USGS 1910, 1952a, 1952b, 1968, 1978).

Archival Study Results

A search of the archaeological base maps at the NCIC found that small portions of the APE have been subject to prior cultural resources surveys; however, the entire APE has not been previously surveyed (Ambacher 2013; Hagensieker and Beard 2012; Perry and Montag 2003; Schmid 2008; Wohlgemuth 2005, 2006). These surveys resulted in the documentation of the Sherman Island levee and a sheet pile retaining wall.

There have been thirteen surveys conducted within one-half mile of the APE. See Table 1 for a list of surveys conducted within one-half mile of the APE.

Table 1. Surveys conducted within one-half mile of the APE

Author	Date	SA#
Arnold	1964	8079
Barrow	2013	N/A
Beard	2008	9239
Beard	2012	N/A
Blackmer	1991	6150
Gilbert	2012	11005
Gilbert	2013	11295
Hale	1999	7962
Leach-Palm *et al.*	2008	9326
Orlins	1997	2389
Price	1991	1782
Seldomridge and Smith-Madeson	1976	N/A
Theodoratus Cultural Research	1980	8017

In 2006 JRP Historical Consulting, LLC conducted a cultural resources inventory and evaluation of historic-era structures on Sherman Island. Included in their report was an evaluation of the significance of the levee surrounding the island (JRP Historical Consulting, LLC 2006). They concluded that the levee did not meet criteria for listing in the NRHP or on the CRHR because it lacks integrity. Thus, there are no historic properties within the APE.

Review of the ethnographic literature found no reported ethnographic village sites within or near the study area (Kroeber 1925, Levy 1978).

There are no local, state, or federally recognized historic properties within or adjacent to the APE (OHP 2012; State of California Department of Parks and Recreation 1976). With the exception of the Sherman Island levee system, the 1910 USGS topographic map is the earliest map showing buildings within the APE. A total of ten buildings on lands adjacent to the landward side of the levee are shown as being within the APE. By 1978, no buildings are shown in the APE, suggesting they were no longer standing by then (USGS 1978).

In the Sacramento-San Joaquin river delta, archaeological sites are typically found, "on the tops of partly drowned dunes (so-called sand mounds) and higher natural levees" (West *et al.* 2007:24). The marshland portions of the delta could have been a place people would visit to collect resources. It is

possible that isolated tools could be found as a result of this activity, but there is a low likelihood of buried prehistoric sites being present within the peat soils which would have been marshland between 150 and 6,500 years ago.

Prehistoric archaeological site indicators expected to be found in the region include but are not limited to: obsidian and chert flakes and chipped stone tools; slabs and handstones, and mortars and pestles; and locally darkened soils containing some of the previously listed items plus fragments of bone, shellfish, and fire affected stones. Historic period site indicators generally include: fragments of glass, ceramic, and metal objects; milled and split lumber; and structure and feature remains such as building foundations and discrete trash deposits (e.g., wells, privy pits, dumps).

Field Survey Procedures

A intensive survey of the APE was completed by Taylor Alshuth, Mark Arsenault, Lauren Carriere, Julia Franco, Glen Halverson, Devin Hayward, Rachel Hennessy, Amber Lion, Tom Origer, Tanner Samples, Sue Ann Schroder, and Erica Thompson. Field work took place March 29 through the 31, on April 14 through the 17, 2016, and on October 26, 2018. The APE was surveyed intensively with transects spaced approximately 10-20 meters apart. Visibility ranged from good to poor with standing water and vegetation being the chief hindrances. Hoes were used, as needed, to clear small patches of vegetation so that the ground surface could be inspected.

Field Survey Results

Archaeology
Sherman House Location #1. The site area is marked by a disturbed scatter of fragments of concrete, ceramics, glass, and wood and a segment of lead pipe. Some items were modern (e.g., plastic bottles), while other items were temporally nondiagnostic. The materials were found at the location of a former residence shown on the 1910 Jersey USGS topographic map. Bulldozer tracks indicate that the site deposit surface and down to 6" was recently disturbed. The items observed do not extend to or past the fence to the north into the APE.

Built Environment
No historic properties were identified within the APE.

FINDINGS AND RECOMMENDATIONS

Archaeology
The disturbed items lack integrity. Most of the items that were found exhibit some degree of fire damage and were likely displaced from their original positions. The materials observed have been documented and no recommendations are warranted.

Buried Archaeological Site Sensitivity

Geology within the APE is composed of Holocene (11,700 years ago-present) estuarine deposits deposited at, or near sea level in tidal marshes of the Sacramento-San Joaquin river delta. These deposits coincide with human arrival and occupation of California. Based on criteria derived from King's soil sensitivity for buried sites, the APE is categorized as having a high sensitivity for buried

sites (King 2004). However, prior to the 1850s, the entirety of the APE was underwater (Thompson and West 1890:220). Therefore, there is a remote possibility of there being buried archaeological sites within the APE.

Accidental Discovery

Although a low likelihood, if buried materials are encountered, all soil disturbing work should be halted at the location of any discovery until a qualified archaeologist completes a significance evaluation of the find(s) pursuant to CEQA (§15064.5 [f]) and Section 106 of the National Historic Preservation Act (36CFR60.4). Prehistoric archaeological site indicators that might be found within the general area include: chipped chert and obsidian tools and tool manufacture waste flakes; grinding and hammering implements that look like fist-size, river-tumbled stones; and for some rare sites, locally darkened soil that generally contains abundant archaeological specimens. Historical remains that have been found in the general area commonly include items of ceramic, glass, and metal. Features that might be present include structure remains (e.g., cabins or their foundations) and pits containing historical artifacts.

The following actions are promulgated in the CEQA Guidelines Section 15064.5(d) and pertain to the discovery of human remains. If human remains are encountered, excavation or disturbance of the location must be halted in the vicinity of the find, and the county coroner contacted. If the coroner determines the remains are Native American, the coroner will contact the Native American Heritage Commission. The Native American Heritage Commission will identify the person or persons believed to be most likely descended from the deceased Native American. The most likely descendent makes recommendations regarding the treatment of the remains with appropriate dignity.

SUMMARY

Tom Origer & Associates conducted a cultural resources survey of an approximately 1,850 acre portion of Sherman Island, as requested by Aaron Will of Ducks Unlimited, Inc. A small scatter of burned glass, wood debris, and lead pipe was identified during this study. However, the items lack integrity and no resource specific recommendations are warranted. Documentation pertaining to this study is on file at the offices of Tom Origer & Associates (File No. 2016-56S and 2018-91S).

MATERIALS CONSULTED

Ambacher, P.
2013 Letter report regarding a Cultural Resources Analysis for Curtis Landing Fish Release Site Project. Document SA-11296 on file at the North Central Information Center, Sacramento State University, Sacramento.

Arnold, B.
1964 *A Survey of Archaeological Resources along the Pacific Gas and Electric Company's Canadian Gas Line in California.* Document SA-8079 on file at the North Central Information Center, Sacramento Sate University, Sacramento.

Barrow, E.
2013 *A Cultural Resources Survey for the Sherman Island-Whale's Mouth Subsidence Mitigation Funding Project, DU Project No. US-CA-437-3, Sacramento County, California.* Document on file at the offices of Tom Origer & Associates.

Beard, V.
2008 *A Cultural Resources Survey for the Mayberry Farms Subsidence Reversal Project on Sherman Island, Sacramento County, California.* Document SA-9239 on file at the North Central Information Center, Sacramento State University, Sacramento.

2012 *A Cultural Resources Survey for the Proposed Parcel 11 Expansion Project on Sherman Island, Sacramento County, California.* Document on file at the office of Tom Origer & Associates, Santa Rosa, California.

Bennyhoff, J.
1977 *The Ethnohistory of the Plains Miwok.* Center for Archaeological Research at Davis, Publication No. 2. University of California, Davis.

Bickel, P.
1978 Changing Sea Levels Along the California Coast: Anthropological Implications. *The Journal of California Anthropology* 5(1):6-20.

Blackmer, E.
1991 *Negative Archaeological Survey Report DPD-EP-25.* Document SA-6150 on file at the Northwest Information Center, Sonoma State University, Rohnert Park.

Booth, D., K. Goetz Troost, J. Clague, and R. Waitt
2004 The Cordilleran Ice Sheet. In Jim Rose, series ed., *The Quaternary Period in the United States, Developments in Quaternary Science*, 1. By A.R. Gillespie, S.C. Porter, and B.F. Atwater. pp. 17-43. Elsevier, San Francisco, California.

Burroughs, William J.
2005 *Climate Change in Prehistory: The End of the Reign of Chaos.* Cambridge University Press, Cambridge, United Kingdom.

Davis, W.
1890 *Illustrated History of Sacramento County, California.* Lewis Publishing, Chicago.

Deverel, S. and D. Leighton

2010 *Historic, Recent, and Future Subsidence, Sacramento-San Joaquin Delta, California, USA.* San Francisco Estuary & Watershed Science.

Drexel, J., C. de Fontaine, and S. Deverel
2009 *The Legacy of Weland and Drainage on the Remaining Peat in the Sacramento-San Joaquin Delta, California, USA.* Wetlands Vol. 29, No. 1 pp. 372-386.

Erlandson, J., T. Rick, T. Jones, and J. Porcasi
2007 One if by Land, Two if by Sea: Who Were the First Californians? In*: California Prehistory: Colonization, Culture, and Complexity* (pp 53-62) T. Jones and K. Klar, Editors. AltaMira Press. Lanham, MD.

Fredrickson, D.
1984 The North Coastal Region. In *California Archaeology*, edited by M. Moratto. Academic Press, San Francisco.

General Land Office
1862 Survey plat for T3N/R2E, MDBM. Department of the Interior, Washington, D.C.

1867 Survey plat for T3N/R2E, MDBM. Department of the Interior, Washington, D.C.

Gilbert, R.
2012 *Department of Water Resources Archaeological Survey Report for Curtis Landing Fish Release Site Project: Geotechnical Explorations.* Document SA-11005 on file at the North Central Information Center, Sacramento State University, Sacramento.

2013 *Curtis Landing Fish Release Site Permanent Improvements Project, Sacramento County, California.* Document SA-11295 on file at the North Central Information Center, Sacramento State University, Sacramento.

Hagensieker, V. and V. Beard
2012 *A Cultural Resources Survey for the Sherman Island PL 84-99 Repair Project Sacramento County, California.* Document SA-11067 on file at the North Central Information Center, Sacramento State University, Sacramento.

Hale, M.
1999 *Archaeological Reconnaissance in Sacramento & San Joaquin Counites, California.* Document SA-7962 on file at the Northwest Information Center, Sacramento State University, Sacramento.

Hoover, M., H. Rensch, E. Rensch, and W. Abeloe
1966 *Historic Spots in California.* 3rd edition, Stanford University Press. Stanford.

Hoover, M., H. Rensch, E. Rensch, W. Abeloe, and D. Kyle
1990 *Historic Spots in California.* 4th edition, Stanford University Press. Stanford.

2002 *Historic Spots in California.* 5th edition, Stanford University Press. Stanford.

JRP Historical Consulting, LLC.
2006 *Cultural Resources Inventory and Evaluation Report, Reclamation District 341 Setback Levee Habitat Enhancement Project.* Prepared for Reclamation District 341, Rio Vista, California.

King, J.
2004 Surface and Subsurface Archaeological Sensitivity. In: *Landscape Evolution and the Archaeological Record: A Geoarchaeological Study of the Southern Santa Clara Valley and Surrounding Region* (pp 81-94). J. Rosenthal and J. Meyer, Authors. Center for Archaeological Research at Davis, University of California.

Kroeber, A.
1925 *Handbook of the Indians of California.* Bureau of American Ethnology, Bulletin 78, Smithsonian Institution, Washington, D.C.

1932 *The Patwin and Their Neighbors.* University of California Publications in American Archaeology and Ethnology Vol. 29, No. 4, pp. 253-423. University of California Press, Berkeley.

Leach-Palm, L., P. Mikkelsen, P. Brandy, J. King, and L. Hartman
2008 *Cultural Resources Inventory of Caltrans District 3 Rural Conventional Highways in Butte, Colusa, El Dorado, Glenn, Nevada, Placer, Sacramento, Sierra, Sutter, Yolo, and Yuba Counties.* Document SA-9326 on file at the North Central Information Center, Sacramento State University, Sacramento.

Levy, R.
1978 Eastern Miwok. In *California* edited by R. Heizer, pp. 398-411. Handbook of North American Indians, Vol. 8, W. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Meighan, C.
1955 *Archaeology of the North Coast Ranges, California.* Reports of the University of California Archaeological Survey No. 30. Berkeley.

Milliken, R.
1995 *A Time of Little Choice.* Ballena Press, Menlo Park.

Moratto, M.
1984 *California Archaeology.* Academic Press, San Francisco.

Mount, J. and R. Twiss
2005 *Subsidence, Sea Level Rise, and Seismicity in the Sacramento-San Joaquin Delta.* San Francisco Estuary & Watershed Science. Vol. 3, Issue 1 (March 2005), Article 5.

Office of Historic Preservation
1995 *Instructions for Recording Historic Resources.* Office of Historic Preservation, Sacramento.

2012 *Historic Property Directory.* Office of Historic Preservation, Sacramento.

Parkman, E. Breck
2006 *The California Serengetti: Two Hypotheses Regarding the Pleistocene Paleoecology of the San Francisco Bay Area.* Electronic document http://www.parks.ca.gov/pages/22491/files/the_california_serengetti_pleistocene_paleoecology_of_san_francisco_bay.pdf accessed on July 27, 2009. California Department of Parks and Recreation.

Perry, R., and M. Montag
2003 *Archaeological Survey of Approximately 132 Acres on Sherman Island, California, for the Sherman Island Expanded Scour Pond Dredge Material Placement Site Project, Sacramento County, California.* Document SA-7935 on file at the North Central Information Center, Sacramento State University, Sacramento.

Ringgold, C.
1852 General chart embracing surveys of the Farallones, entrance to the Bay of San Francisco, bays of San Francisco and San Pablo, Straits of Carquines and Suisun Bay and the Sacramento and San Joaquin rivers to the cities of Sacramento and San Joaquin, California. <http://www.davidrumsey.com/detail?id=1-1-24355-890046& name= General+chart,+San+Francisco+Bay>.

Schmid, T.
2008 *Department of Water Resources Archaeological Survey Report for the Sherman and Twitchell Island Fish Screen Project.* Document SA-9372 on file at the North Central Information Center, Sacramento State University, Sacramento.

State of California Department of Parks and Recreation
1976 *California Inventory of Historic Resources.* Department of Parks and Recreation, Sacramento.

Theodoratus Cultural Research
1980 *Montezuma I & II Cultural Resources.* Document SA-8017 on file at the North Central Information Center, Sacramento State University, Sacramento.

Thompson, T., and A. West
1880 *History of Sacramento County, California.* Thompson & West, Oakland.

Tugel, A.
1993 *Soil Survey of Sacramento County, California.* United States Department of Agriculture Soil Conservation Service in cooperation with the University of California Agricultural Experiment Station. <http://soildatamart.nrcs.usda.gov/Manuscripts/ CA067/0/sacramento.pdf>.

United States Geological Survey
1910 Jersey, California. 7.5' map. Department of the Interior, Washington, D.C.

1952a Jersey Island, California. 7.5' map. Department of the Interior, Washington, D.C.

1952b Rio Vista, California. 15' map. Department of the Interior, Washington, D.C.

1968 Jersey Island, California. 7.5' map. Department of the Interior, Washington, D.C.

1978 Jersey Island, California. 7.5' map. Department of the Interior, Washington, D.C.

West, G. J, W. Woolfenden, J. Wanket, and R.S. Anderson
2007 *Late Pleistocene and Holocene Environments.* In, California Prehistory: Colonization, Culture, and Complexity, edited by Terry L. Jones and Kathryn A. Klar, pp. 11-34. AltaMira Press, Lanham, Maryland.

Wohlgemuth, E.

2005 *Archaeological Reconnaissance of the Pacific Gas and Electric Company 230 kV Delta Transmission Line Reconductoring Project, Solano, Sacramento, and Contra Costa Counties, California.* Document SA-9211 on file at the North Central Information Center, Sacramento State University, Sacramento.

2006 *Archaeological Reconnaissance of the Sherman Island Setback Levee, Western Sacramento County, California.* Document SA-7832 on file at the North Central Information Center, Sacramento State University, Sacramento.

APPENDIX A

Native American Contact

Native American Contact Log
Copies of Correspondence

Native American Contact Efforts
Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Organization	Contact	Letters	Results
Native American Heritage Committee		4/25/16	No response received as of the date of this report.
Buena Vista Rancheria	Rhonda Morningstar Pope	4/27/16	No response received as of the date of this report.
Ione Band of Miwok Indians	Anthony Burris Yvonne Miller	4/27/16	No response received as of the date of this report.
Wilton Rancheria	Andrew Franklin Steven Hutchason	4/27/16	No response received as of the date of this report.
	Randy Yonemura	4/27/16	No response received as of the date of this report.

Sacred Lands File & Native American Contacts List Request

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710
(916) 373-5471 – Fax
nahc@nahc.ca.gov

Information Below is Required for a Sacred Lands File Search

Project: Sherman Island Wetland Restoration Project-Phase II
County: Sacramento

USGS Quadrangles
Name: Jersey Island
Township T3N Range R2E Section(s) Reclaimed Land MDBM

Date: April 25, 2016
Company/Firm/Agency: Tom Origer & Associates
Contact Person: Taylor Alshuth

Address: PO Box 1531
City: Rohnert Park Zip: 94927
Phone: (707) 584-8200 Fax: (707) 584-8300
Email: Taylor@origer.com

Project Description:
The project area is approximately 1,850 acres. The project consists of wetland habitat restoration on Sherman Island, Sacramento County

Tom Origer & Associates
Archaeology / Historical Research

April 27, 2016

Rhonda Morningstar Pope
Buena Vista Rancheria
1418 20th Street, Suite 200
Sacramento, CA 95824

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Dear Ms. Pope:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration of approximately 1,850 acres on Sherman Island, Sacramento County. The project area has been previously surveyed and no cultural resources were found. Ducks Unlimited is coordinating regulatory compliance for this project (Project No. US-CA-437-4). If you have and questions, contact Aaron Will, Ducks Unlimited (916-852-2000) 3074 Gold Canal Drive, Rancho Cordova, CA 95670-6116.

Enclosed is a map with portions of the Jersey Island, Calif. 7.5' USGS map showing the project location.

Sincerely,

Ta

Taylor Alshuth
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

April 27, 2016

Anthony Burris
Ione Band of Miwok Indians Cultural Committee
P.O. Box 699
Plymouth, CA 95669

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Dear Mr. Burris:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration of approximately 1,850 acres on Sherman Island, Sacramento County. The project area has been previously surveyed and no cultural resources were found. Ducks Unlimited is coordinating regulatory compliance for this project (Project No. US-CA-437-4). If you have and questions, contact Aaron Will, Ducks Unlimited (916-852-2000) 3074 Gold Canal Drive, Rancho Cordova, CA 95670-6116.

Enclosed is a map with portions of the Jersey Island, Calif. 7.5' USGS map showing the project location.

Sincerely,

Taylor Alshuth
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

April 27, 2016

Yvonne Miller
Ione Band of Miwok Indians
P.O. Box 699
Plymouth, CA 95669

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Dear Ms. Miller:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration of approximately 1,850 acres on Sherman Island, Sacramento County. The project area has been previously surveyed and no cultural resources were found. Ducks Unlimited is coordinating regulatory compliance for this project (Project No. US-CA-437-4). If you have and questions, contact Aaron Will, Ducks Unlimited (916-852-2000) 3074 Gold Canal Drive, Rancho Cordova, CA 95670-6116.

Enclosed is a map with portions of the Jersey Island, Calif. 7.5' USGS map showing the project location.

Sincerely,

Taylor Alshuth
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

April 27, 2016

Andrew Franklin
Wilton Rancheria
9300 W Stockton , Suite 200
Elk Grove, CA 95758

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Dear Mr. Franklin:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration of approximately 1,850 acres on Sherman Island, Sacramento County. The project area has been previously surveyed and no cultural resources were found. Ducks Unlimited is coordinating regulatory compliance for this project (Project No. US-CA-437-4). If you have and questions, contact Aaron Will, Ducks Unlimited (916-852-2000) 3074 Gold Canal Drive, Rancho Cordova, CA 95670-6116.

Enclosed is a map with portions of the Jersey Island, Calif. 7.5' USGS map showing the project location.

Sincerely,

Taylor Alshuth
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

April 27, 2016

Steven Hutchason
Wilton Rancheria
9300 W Stockton , Suite 200
Elk Grove, CA 95758

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Dear Mr. Hutchason:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration of approximately 1,850 acres on Sherman Island, Sacramento County. The project area has been previously surveyed and no cultural resources were found. Ducks Unlimited is coordinating regulatory compliance for this project (Project No. US-CA-437-4). If you have and questions, contact Aaron Will, Ducks Unlimited (916-852-2000) 3074 Gold Canal Drive, Rancho Cordova, CA 95670-6116.

Enclosed is a map with portions of the Jersey Island, Calif. 7.5' USGS map showing the project location.

Sincerely,

Taylor Alshuth
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

April 27, 2016

Randy Yonemura
4305 39th Avenue
Sacramento, CA 95824

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Dear Mr. Yonemura:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration of approximately 1,850 acres on Sherman Island, Sacramento County. The project area has been previously surveyed and no cultural resources were found. Ducks Unlimited is coordinating regulatory compliance for this project (Project No. US-CA-437-4). If you have and questions, contact Aaron Will, Ducks Unlimited (916-852-2000) 3074 Gold Canal Drive, Rancho Cordova, CA 95670-6116.

Enclosed is a map with portions of the Jersey Island, Calif. 7.5' USGS map showing the project location.

Sincerely,

Taylor Alshuth
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Native American Contact Efforts
Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Organization	Contact	Letters	Results
Native American Heritage Committee		9/10/18	The NAHC responded on 9/26/18. Their review of the Sacred Lands File did not indicate the presence of any sacred sites within the APE. A Native American Consultation list was also provided.
Buena Vista Rancheria of Me-Wuk Indians	Rhonda Morningstar Pope	10/2/18	No response received as of the date of this report.
Colfax-Todds Valley Consolidated Tribe	Pamela Cubbler Clyde Prout	10/2/18	No response received as of the date of this report.
Ione Band of Miwok Indians	Sara Dutschke Setchwaelo	10/2/18	No response received as of the date of this report.
Nashville Enterprise Miwok-Maidu-Nishinam Tribe	Cosme Valdez	10/2/18	No response received as of the date of this report.
Shingle Springs Band of Miwok Indians	Regina Cuellar	10/2/18	Daniel Fonseca, the Tribal Historic Preservation Officer representing the Shingle Springs Band of Miwok Indians, responded on 10/24/18. They have requested copies of completed record searches or surveys that were done in or around the project area up to and including environmental, archaeological, and cultural reports.
Tsi Akim Maidu	Grayson Coney Don Ryberg	10/2/18	No response received as of the date of this report.

Native American Contact Efforts
Sherman Island Wetland Restoration Project-Phase II, Sacramento County

Organization	Contact	Letters	Results
United Auburn Indian Community of the Auburn Rancheria	Gene Whitehouse	10/2/18	Gene Whitehouse, Chairman of the United Auburn Indian Community of the Auburn Rancheria, responded on 10/12/18. They have requested copies of archaeological reports and environmental documents related to this project. They also requested a meeting or site visit to begin consultation on the project, and recommended that tribal representatives observe and participate in the field survey.
Wilton Rancheria	Raymond Hitchcock	10/2/18	No response received as of the date of this report.

Sacred Lands File & Native American Contacts List Request

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710
(916) 373-5471 – Fax
nahc@nahc.ca.gov

Information Below is Required for a Sacred Lands File Search

Project: Sherman Island Wetland Restoration-Phase II Update
County: Sacramento

USGS Quadrangles
Name: Jersey Island
Township 3N Range 2E Section(s) Reclaimed Land MDBM

Date: September 10, 2018
Company/Firm/Agency: Tom Origer & Associates
Contact Person: Taylor Alshuth

Address: PO Box 1531
City: Rohnert Park Zip: 94927
Phone: (707) 584-8200 Fax: (707) 584-8300
Email: taylor@origer.com

Project Description:
The project area is approximately 120 acres. The project proponent is proposing to restore wetland habitat on Sherman Island.

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Rhonda Morningstar Pope
Buena Vista Rancheria of Me-Wuk Indians
1418 20th Street, Suite 200
Sacramento, California 95811

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Ms. Morningstar Pope:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Pamela Cubbler
Colfax-Todds Valley Consolidated Tribe
Post Office Box 4884
Auburn, California 95604

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Ms. Cubbler:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Clyde Prout
Colfax-Todds Valley Consolidated Tribe
Post Office Box 4884
Auburn, California 95604

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Mr. Prout:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Sara Dutschke Setchwaelo
Ione Band of Miwok Indians
Post Office Box 699
Plymouth, California 95669

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Ms. Dutschke Setchwaelo:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Cosme Valdez
Nashville Enterprise Miwok-Maidu-Nishinam Tribe
Post Office Box 580986
Elk Grove, California 95669

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Mr. Valdez:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Regina Cuellar
Shingle Springs Band of Miwok Indians
Post Office Box 1340
Shingle Springs, California 95682

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Ms. Cuellar:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Grayson Coney
Tsi Akim Maidu
Post Office Box 510
Browns Valley, California 95918

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Mr. Coney:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Don Ryberg
Tsi Akim Maidu
Post Office Box 510
Browns Valley, California 95918

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Mr. Ryberg:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Gene Whitehouse
United Auburn Indian Community of the Auburn Rancheria
10720 Indian Hill Road
Auburn, California 95603

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Mr. Whitehouse:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

Tom Origer & Associates
Archaeology / Historical Research

October 2, 2018

Raymond Hitchcock
Wilton Rancheria
9728 Kent Street
Elk Grove, California 95624

Re: Sherman Island Wetland Restoration Project-Phase II, Sacramento County, California

Dear Mr. Hitchcock:

I write to notify you of a proposed project within Sacramento County, for which our firm is conducting a cultural resources study. The Sherman Island Wetland Restoration Project-Phase II consists of wetland habitat restoration. In 2016, our firm surveyed 1,850 acres for this project and found no cultural resources. The project proponent is adding an additional 120 acres, for which this letter regards. Our proposed scope of work is designed to meet the requirements of the United States Army Corps of Engineers, Section 106 of the National Historic Preservation Act, and those of the California Environmental Quality Act. This letter does not constitute formal consultation under SB18 and AB52.

Enclosed is a portion of the Jersey Island, Calif. 7.5' USGS quadrangle depicting the additional 120-acre study area.

Sincerely,

Rachel Hennessy
Associate

P.O. Box 1531, Rohnert Park, California 94927 ♦ www.origer.com Phone (707) 584-8200

MIWOK MAIDU United Auburn Indian Community of the Auburn Rancheria

Gene Whitehouse, Chairman
John L. Williams, Vice Chairman
Calvin Moman, Secretary
Jason Camp, Treasurer
Gabe Cayton, Council Member

October 12, 2018

Rachel Hennessy
Tom Origer & Associates
PO Box 1531
Rohnert Park, CA 94927

Subject: Proposed Sherman Island Wetland Restoration Project, Phase II, Sacramento

Dear Rachel Hennessy,

Thank you for requesting information regarding the above referenced project. The United Auburn Indian Community (UAIC) of the Auburn Rancheria is comprised of Miwok and Southern Maidu (Nisenan) people whose tribal lands are within Placer County and whose service area includes El Dorado, Nevada, Placer, Sacramento, Sutter, and Yuba counties. The UAIC is concerned about development within its aboriginal territory that has potential to impact the lifeways, cultural sites, and landscapes that may be of sacred or ceremonial significance. We appreciate the opportunity to comment on this and other projects. The UAIC would like to consult on this project.

In order to ascertain whether the project could affect cultural resources that may be of importance to the UAIC, we would like to receive copies of any archaeological reports that are completed for the project. We also request copies of environmental documents for the proposed project so that we have the opportunity to comment on appropriate identification, assessment and mitigation related to cultural resources. Finally, we request and recommend that UAIC tribal representatives observe and participate in all cultural resource surveys. To assist in locating and identifying cultural resources, UAIC's Preservation Department offers a mapping, records and literature search services program. This program has been shown to assist project proponents in complying with applicable environmental protection laws and choosing the appropriate mitigation measures or form of environmental documentation during the planning process. If you are interested in the program, please let us know.

The UAIC's Preservation Committee would like to set up a meeting or site visit, and begin consulting on the proposed project. Based on the Preservation Committee's identification of cultural resources in and around your project area, the UAIC recommends that a tribal monitor be present during any ground disturbing activities. Thank you again for taking these matters into consideration, and for involving the UAIC early in the planning process. We look forward to reviewing the documents requested above and consulting on your project. Please contact Marcos Guerrero, Cultural Resources Manager, at (530) 883-2364 or by email at mguerrero@auburnrancheria.com if you have any questions.

Sincerely,

Gene Whitehouse,
Chairman

CC: Marcos Guerrero, CRM

SHINGLE SPRINGS BAND
OF MIWOK INDIANS

Shingle Springs Rancheria
(Verona Tract), California
5168 Honpie Road
Placerville, CA 95667
Phone: 530-676-8010
shinglespringsrancheria.com

CULTURAL RESOURCES

October 24, 2018

Tom Origer
P.O. Box 1531
Rohnert Park, CA 94927

RE: Sherman Island Wetland Restoration Project-Phase II

Dear Rachel Hennessy,

Thank you for your letter dated October 2, 2018 in regard to the above mentioned project. Based on the information provided, the Shingle Springs Band Of Miwok Indians is not aware of any known cultural resources on this site. However, SSR would like to have continued consultation through updates, as the project progresses. This will foster a greater communication between the Tribe and your agency.

SSR would also like to request any and all completed record searches and or surveys that were done in or around the project area up to and including environmental, archaeological and cultural reports. If during the progress of the project new information or human remains are found, we would like to be able to go over our process with you to protect such important and sacred artifacts (especially near rivers and streams).

If such finds are made, please contact Kara Perry, Cultural Outreach Coordinator, at (530) 488-4049 or kperry@ssband.org.
Thank you for providing us with this notice and opportunity to comment.

Sincerely,

Daniel Fonseca
Cultural Resource Director
Tribal Historic Preservation Officer (THPO)
Most Likely Descendant (MLD)

APPENDIX B

Resource Documentation

PRIMARY RECORD

Primary # P-
HRI #
Trinomial:
NRHP Status Code:
Other Listings:
Review Code: **Reviewer:** **Date:** **Resource Name or #:** Sherman Island House Loc. #1

P1. Other Identifier:

P2. Location: Unrestricted
a. County: Sacramento
b. USGS 7.5' Quad: Jersey Island **Date:** 1978
T 2N/**R** 2E; unsectioned land, **MDBM**
c. Address: **City:** **Zip:**
d. UTM: Zone: 10 611990**mE** 4210920**mN**
e. Other Locational Information: Site is located between two power poles approximately 400 feet northeast of the property at 20175 Sherman Island East Levee Road.

P3a. Description: Site area marked by a disturbed scatter of fragments of concrete, ceramics, glass, and wood and a segment of lead pipe. Some items were modern (e.g., plastic bottles), while other items were temporally nondiagnostic. The materials were found at the location of a former residence shown on the 1910 Jersey USGS topographic map. Bulldozer tracks indicate that the site deposit surface and down to 6" was recently disturbed. The items observed do not extend to or past the fence to the north.

P3b. Resource Attributes: AH4. Trash scatter

P4. Resources Present: Site

P5. Photograph or Drawing: Photo

P5b. Description of Photo: Overview of site, camera facing east

P6. Date Constructed/Age and Sources:
Historic

P7. Owner and Address:

P8. Recorded by:
Taylor Alshuth
Tom Origer & Associates
P.O. Box 1531
Rohnert Park, CA 94927

P9. Date Recorded:
11/1/18

P10. Type of Survey:
Intensive Pedestrian Survey

P11. Report Citation:

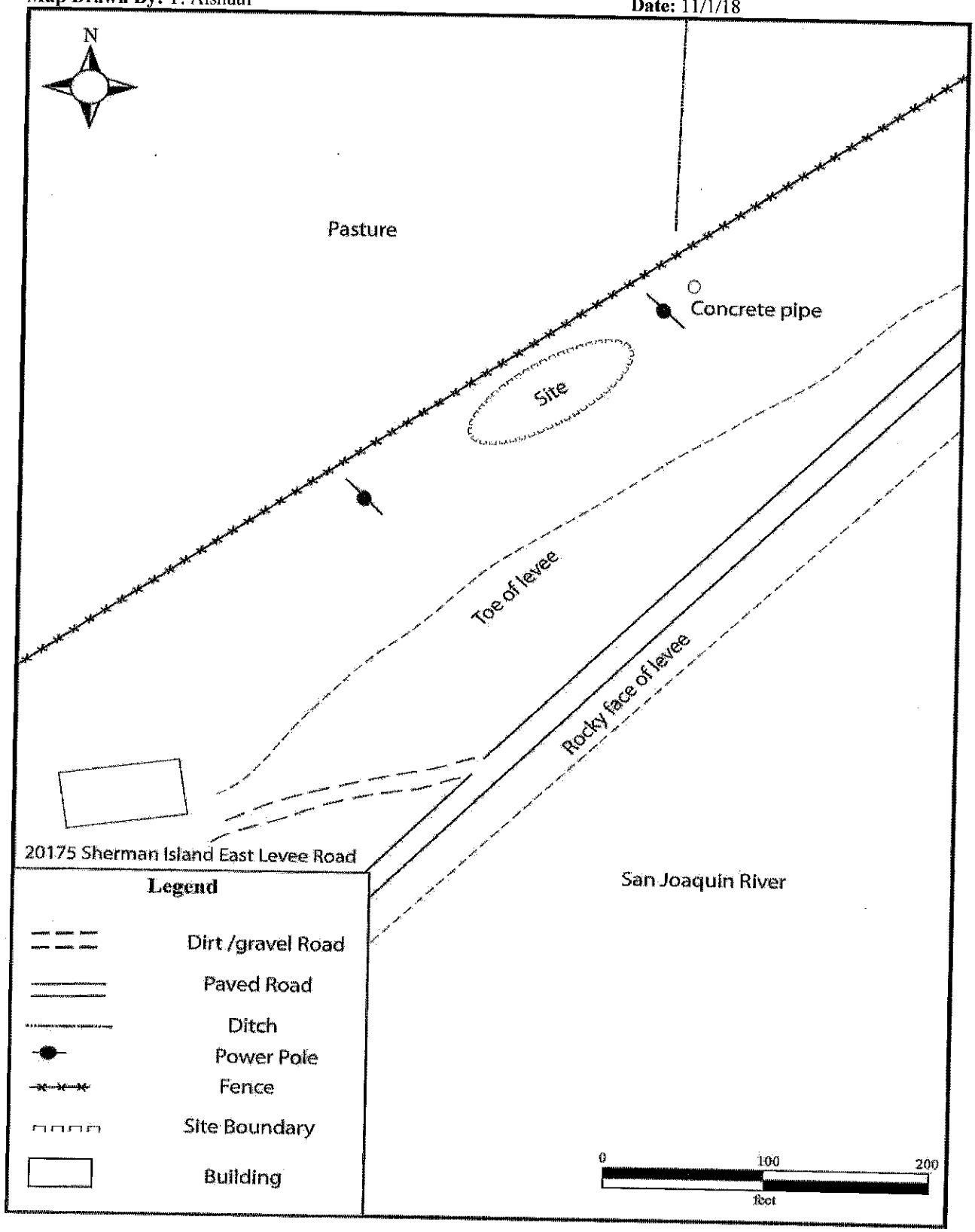
Alshuth, T., and T. Origer. *A Cultural Resources Study for the Sherman Island Wetland Restoration Project-Phase II DU Project No. US-CA-437-4, Sacramento County, California.* 2018

P12. Attachments: Sketch Map, Location Map

SKETCH MAP

Primary # P-
HRI #
Trinomial: CA-
Resource Name or #: Sherman Island House Loc. #1
Date: 11/1/18

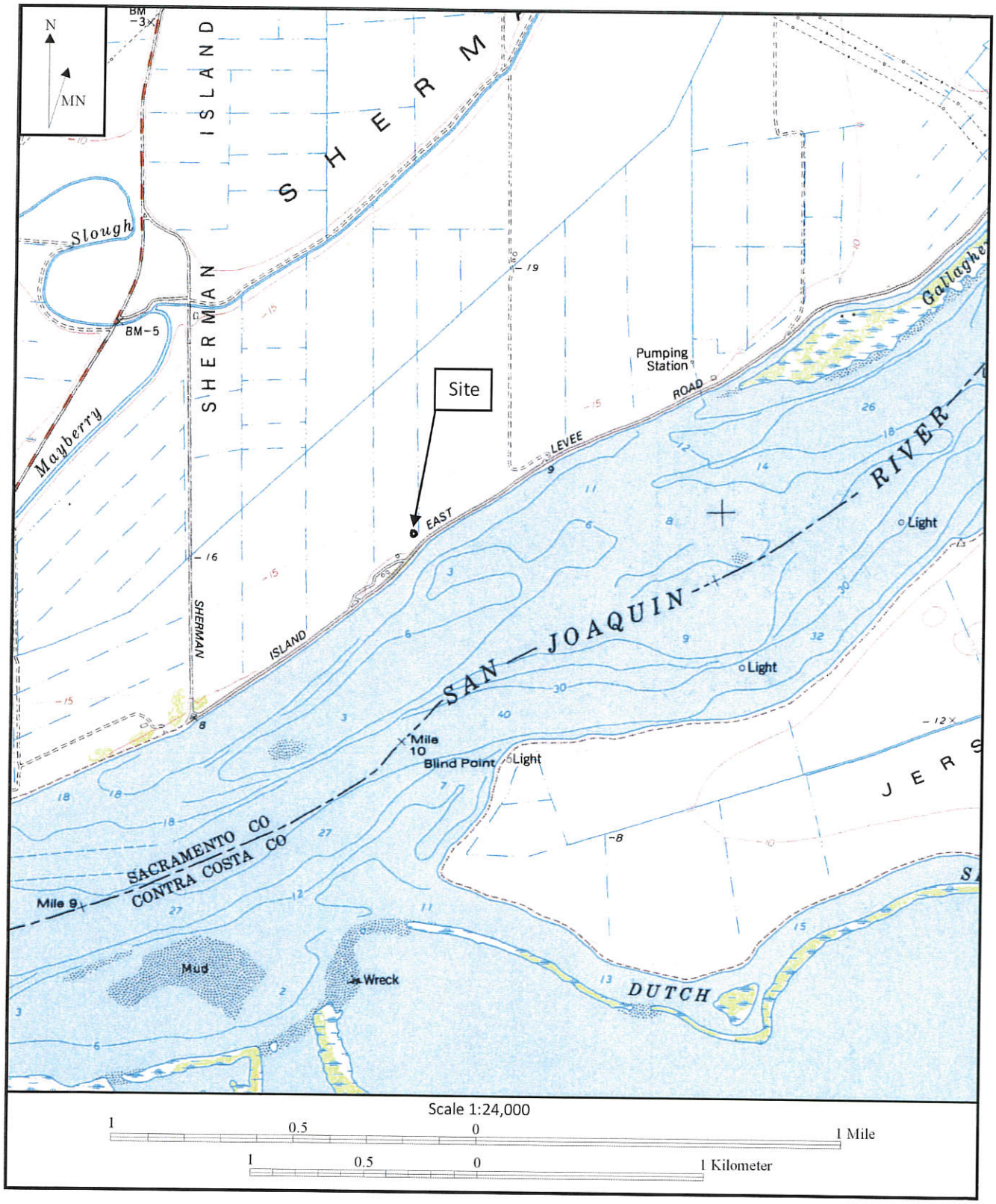
Map Drawn By: T. Alshuth



LOCATION MAP

Primary #: P-
HRI #:
Trinomial:
Resource Name or #: Sherman Island House Loc. #1
Date of Map: 1978

Page 3 of 3
Map Name: Jersey Island **Scale:** 7.5'



APPENDIX E
Mitigation Measures

Proposed Mitigation	Impact	Summary of Measures
IV. BIOLOGICAL RESOURCES		
MM 3.a	Air Quality Plan	To mitigate for any significant impacts, a strict no-idle of heavy equipment policy will be enforced. In addition, to avoid the spreading of substantial dust (PM10) as a result of scraping or grading activities, water trucks will be utilized to keep the soil moist and heavy. Additionally, if wind is forecasted to be greater than 30 miles per hour on a given day, construction work will be postponed in order to avoid the creation of substantial dust (PM10).

MM 4.a(2)	Giant garter snake	Within the Project Site, aquatic ditch habitat for GGS will be lowered as much as possible and then maintained as low as possible for at least fifteen consecutive days prior to the initiation of construction activities Complete dewatering is likely not possible due to the high water table and continuous levee under seepage on the Project Site. At most 24-hours prior to the commencement of construction activities, the Site shall be surveyed for giant garter snakes by a USFWS-approved biologist. The biologist will provide the USFWS with a written report that adequately documents the monitoring efforts within 24-hours of commencement of construction activities. The Project Site shall be re-inspected by the monitoring biologist whenever a lapse in construction activity of two weeks or greater has occurred. ☐ A Worker Environmental Awareness Training Program for construction personnel shall be conducted by a USFWS-approved biologist for all construction workers, including contractors, prior to the commencement of construction activities. • Conducting grading, clearing, grubbing, or other similar construction-related disturbance of suitable upland habitat within 200 feet of suitable aquatic and/or wetland habitat will be conducted during the GGS active period of May 1 to October 1, when GGS are able to avoid or evade construction activities. If it appears that construction activity may go beyond October 1, the project proponents shall contact the USFWS as soon as possible, but not later than September 15 of the year in question, to determine if additional measures are necessary to minimize take. Construction activities within 200 feet from the banks of snake aquatic habitat will be avoided during the snake's inactive season. ☐ Clearing activities will be confined to the minimum necessary to facilitate construction activities. ☐ Project-related vehicles will observe a twenty mile-per-hour speed limit within construction areas, except on existing paved roads where they will adhere to the posted speed limits. ☐ If a snake is encountered during construction activities, all activities will cease and the USFWS will be notified immediately to determine the appropriate procedures related to the collection and relocation of the snake. A report will be submitted to the USFWS and will include the date(s), location(s), habitat description, and any corrective measures taken to protect the snake, within one (1) business day. The applicant is required to report any take of listed species to the USFWS immediately by telephone at 916- 930-5603 and by electronic mail or written letter addressed to the Assistant Field Supervisor, ESA/Regulatory Division of the BDFWO, within one (1) working day of the incident. • Contract and bid specifications will require contractor to implement best management practices (BMPs) to prevent wildlife entanglements in fencing, and impacts to water quality in undrained ditches. These shall include all food-related trash items (e.g., wrappers, cans, bottles, and food scraps) will be disposed of in closed containers and removed at the end of each workday.

MM 4.a(3).	Swainson's hawk, Western burrowing owl, Tricolored blackbird, White-tailed kite, , Loggerhead shrike, Modesto song sparrow, and Migratory Birds & Birds of Prey	• If construction is scheduled to begin between February 1 and August 31 then a qualified biologist shall conduct a preconstruction survey for active nests at the construction site and within 0.25 mile of the construction site from publicly accessible areas within 30 days prior to construction. If no active nest of a bird of prey or MBTA bird is found, then no further mitigation measures are necessary. • If an active nest of a bird of prey or MBTA bird is found, then the biologist shall flag a minimum 250 foot (1320 ft. (0.25 mile) for Swainson's hawk) Environmentally Sensitive Area (ESA) around the nest if the nest is of a bird of prey, and a minimum 100-foot ESA around the nest tree if the nest is of an MBTA bird other than a bird of prey. • No construction activity shall be allowed in the buffer until the biologist determines that the nest is no longer active, or unless monitoring determines that a smaller buffer will protect the active nest. • The buffer may be reduced if the biologist monitors the construction activities and determines that no disturbance to the active nest is occurring. The size of suitable buffers depends on the species of bird, the location of the nest relative to the project, project activities during the time the nest is active, and other project specific conditions. Before any work is authorized within a buffer, DFW shall be consulted. If construction is allowed within the buffer, a biologist will be present to monitor nests and will have the authority to halt construction activities within the buffer if the nesting birds show signs of agitation or potential abandonment. Active nests with transportation routes that are within the buffer zone should be monitored for signs of distress, with routes being altered, or implementing other measures to minimize disturbances.
MM 4.c.	Jurisdictional wetland impacts	• Project proponent shall obtain a Section 404 CWA Nationwide Permit and a Section 401 CWA Water Quality Certification for impacts to Corps jurisdictional features. The project proponent shall fulfill the requirements of the permits.
MM 9.f	Water Quality Impacts - Mosquitos	Project proponent shall incorporate Best Management Practices (BMPs) to limit the growth and spread of mosquitoes is important. The BMPs included in Appendix F will be incorporated and utilized during the development and long-term management of the project to minimize the growth of mosquito populations.

APPENDIX F

Habitat and Water Management Plan

HABITAT AND WATER MANAGEMENT PLAN

Sherman Island Belly Wetland Habitat Restoration Project

Prepared By:
California Department of Water Resources

and

Ducks Unlimited, Inc.

December 2018

INTRODUCTION

The **Sherman Island's Belly Wetland Habitat Restoration Project (Project)** will create approximately 1000 acres of permanently flooded wetlands on Sherman Island. The Project will be located on property owned by the Department of Water Resources (DWR; Figure 1). The goals of the project are:

- ☐ Control and reverse subsidence by using permanent flooding techniques;
- ☐ Create wetland and riparian habitat and monitor biological enhancement;
- ☐ Provide carbon sequestration benefits and evaluate the net greenhouse gas (GHG) benefits by restoring permanently flooded emergent wetlands on highly organic soils;
- ☐ Demonstrate the applicability of tested management practices to Delta and Suisun Marsh.

The Project will provide subsidence reversal benefits and develop knowledge that can be used by operators of private wetlands, including "duck clubs," which manage lands for waterfowl-based recreation. By maintaining permanent water, the growth and subsequent decomposition of emergent vegetation is expected to control and reverse subsidence. The project is expected to provide year-round wetland habitat for waterfowl and other wildlife.

To achieve final restoration goals, these wetlands will be managed through a system of water supply structures (including siphons, ditches, and swales), berms to provide proper water management depths and site access, and water outflow control structures. Proper water management is critical for establishing and maintaining healthy habitat conditions in all managed wetlands. Managing water for the appropriate time of application, duration of inundation, and depth are the three key factors to support the desired vegetation and wildlife communities in a managed marsh. The restored permanent wetlands will require regular and attentive water deliveries, draw downs, and overall management to achieve the project's goals.

Throughout the year, water levels will be managed to encourage the establishment and maintenance of annual, perennial, emergent, and submerged aquatic vegetation. Subsequently, these vegetation communities will provide habitat for a variety of wetland dependent wildlife. Water management provides the means to vary water levels within and between units to distribute nutrients, decrease stagnant conditions, provide quality habitat, and minimize vector production.

PROJECT SUMMARY

The Project Site is located on Sherman Island, in southwest Sacramento County, CA and is shown on the Antioch North, CA USGS topographic quadrangle. This un-sectionalized portion of Sherman Island would be considered to be generally located within Sections 4, 5, 8, and 9, Township 2N Range 2E. This land is owned by the Department of Water Resources (DWR).

Sherman Island is approximately 10,000-acre Island in the western Delta approximately 70 mi southwest of the City of Sacramento. Historically, the project area was a marsh that was diked off from the Sacramento River and drained between 1850 and 1873 to facilitate agriculture. As a result of more than 130 years of farming practices, irrigation, and exposure of soils to air, the project area has subsided as much as 20 ft. A high water table currently makes the Project Site unsustainable as a long-term agricultural area.

Before the Delta was diked, drained, and farmed, it was subject to significant seasonal fluctuations in freshwater inflows, which worked in concert with large tidal ranges. Natural levees were formed by sediments deposited during spring floods and stabilized by vegetation. Dominant vegetation within the natural levees included tules - marsh plants that live in fresh and brackish water. Decomposing tules and reed vegetation formed the peat soils over thousands of years. In waterlogged conditions, decaying tules decompose slowly to release carbon dioxide and methane, which is trapped in the soils by water. Once the

soil was diked and then dried, the peat soils decompose, which leads to subsidence.

Subsidence has reduced the distance from the soil surface to the water table. The resulting high water table makes the Site unsustainable for crop production, although much of the Site is currently used for corn production and pasture.

Recent environmental concerns in the Delta have prompted DWR to re-evaluate how properties in the region are managed. DWR is particularly interested in incorporating land-use practices that reduce or reverse subsidence. Research has shown that wetlands that are permanently flooded halt and can reverse subsidence, as well as sequester GHG. Therefore, DWR is interested in restoring the entire project site back to the palustrine emergent wetland type that existed in the early part of last century. In addition, subsidence reversal and GHG in the project area will be monitored and evaluated with the hope of undertaking similar projects elsewhere in the Delta. Management of the restored wetlands will be undertaken by DWR and/or a wetland manager.

The project will restore palustrine emergent wetlands and enhance existing emergent wetlands on site by upgrading existing and installing new water management infrastructure including berms, seasonally flooded islands, water control structures, and water conveyance channels on site.
When the project is completed, water will be maintained in the project area year-round. Restoring permanent wetlands on Delta islands has been shown to halt and reverse subsidence. This project will combine the wildlife benefits of wetland restoration with the importance of reversing Delta island subsidence. Construction activities and earthwork associated with the project will be performed between the months of May and October. Planting will commence during the fall months and continue through spring. Work will be completed within the Site.

Proper water management is critical for maintaining healthy habitat conditions in all managed wetlands. This permanent wetland will require regular and attentive water deliveries, draw downs, and overall management to achieve the project goals. Water depths, duration of inundation, and timing of flooding are the three key features of water management and all contribute to support the desired vegetation and wildlife communities.

WATERFOWL REQUIREMENTS

The Project will be managed to provide a variety environmental functions and values. One of those is wildlife habitat, particularly for breeding and wintering waterfowl. This project differs from other traditional Central Valley waterfowl areas in that it has been designed to maintain permanent vegetation and open water areas throughout. While permanent emergent wetlands are less productive for wintering waterfowl than seasonal wetlands, permanent emergent wetlands provide greater benefit for breeding waterfowl.

Breeding Season

California's breeding duck population is dominated by mallards, although wood ducks, gadwall, and cinnamon teal ducks are also common nesters in the Central Valley. These dabbling ducks need three primary habitat types for successful breeding: pair water, upland nesting areas, and brood water. When properly managed, the site will have an appropriate mixture of permanent wetland vegetation and open water with adjacent upland nesting habitats to encourage waterfowl reproduction.

Pair water refers to habitats used by breeding ducks while establishing territories and accumulating fat and protein reserves prior to nesting. These areas are typically used as brood ponds later in the season. Pair water typically consists of shallow ponds adjacent to upland nesting areas that have abundant invertebrate populations.

Waterfowl nesting occurs between early March and mid-June in upland vegetation adjacent to permanent water. Desirable nesting cover for most waterfowl consists of robust vegetation of

approximately 12 inches or more in height within several hundred feet of permanent water. Although hens rely primarily on body reserves for energy during nesting, they do take "nest breaks" to feed.

Upon successfully hatching a clutch, hens lead their hatchlings to nearby brood water. Here, hens rely on invertebrates as their primary food source for rebuilding body mass depleted from egg laying, while ducklings rely on invertebrates for the next several months during their period of rapid growth prior to fledging. Wetlands with adequate cover and abundant invertebrate food supplies are necessary for optimal hatchling survival. Relatively tall wetland plants such as cattails (*Typha* sp.), tules (*Schoenoplectus acutus* or *californicus*), and other robust emergent vegetation provide cover for many species of wildlife, particularly young ducklings, which need to be able to escape predators.

Wintering Season

Upwards of 4 to 5 million waterfowl winter in the Central Valley. While the areas of the Sacramento Valley near the Sutter Buttes and the Grasslands region of the San Joaquin Valley traditionally support the majority of these birds, wetland habitats in the Delta region are also important. The most productive habitat for wintering waterfowl in the Central Valley is managed seasonally flooded marsh, or moist soil wetlands. These managed habitats support abundant high-calorie seed sources.

Wintering waterfowl have two main habitat requirements: areas with high-calorie foods and resting areas. The Delta region was historically permanently flooded marsh with dense emergent vegetation. This vegetation was dominated by hard-stem bulrush, or tules. While tules do not produce as many energy rich seeds as seasonal wetland plants, they nevertheless provide quality food sources and sheltered resting areas that are protected from storms and predators. Other quality plant food sources in permanent wetlands are submerged aquatic vegetation including widgeon grass and sago pondweed. These plants grow in deeper water than emergent vegetation and have extremely rich seeds, tubers, and associated invertebrate food resources.

Dense tule stands can also provide sheltered rest areas that are protected from storms and predators. Ponds, sloughs, and channels lined with tules are good foraging areas and also make excellent resting areas.

These food sources supply the energy needed to replenish waterfowl body fat reserves following fall migration and to build additional fat reserves to fuel the upcoming spring migration. Wintering waterfowl need to conserve energy as much as possible. Waterfowl that are frequently disturbed lose energy quickly from the demands of taking flight.

WATER MANAGEMENT INFRASTRUCTURE AND MAINTENANCE

Infrastructure

The Project site is divided into four separate wetland management units (Figure 3). Each unit is separated from the other units and the adjacent properties by a berm. This allows for flexibility for maintaining, raising, or drawing down water within and between each unit.

Approximately 1,200,000 cubic yards of material will be redistributed within the site, which is necessary to sculpt the swales and to create berms for this wetland habitat area. Approximately 35 water control structures will be installed. The interior of the site will be divided up into as many as 12 managed wetland units separated by approximately 75,000 lineal feet of proposed interior berms, and crossed with excavated conveyance swales, in order to facilitate appropriate water and vegetation management capabilities. Water levels in each unit will be managed independently to restore the desired emergent wetland conditions throughout the site. When the Project is completed, water is proposed to be maintained on the Project Site year-round, effectively creating a permanent wetland.

Water will be conveyed within the wetland system via gravity flow from the higher elevation units to the lower elevation units until it finally makes its way back to the District's drainage canal, to the east of the project boundary. The ultimate outcome of the restoration project will be approximately 1000 acres of freshwater emergent wetlands. Each wetland unit will be a mosaic of open water channels and emergent vegetation comprised predominantly of species such as California bulrush (*Schoenoplectus californicus*) and narrow leaved cattails (*Typha angustifolia*). Other native plant restoration components will include installation of native trees and shrubs compatible with their respective hydrologic regime as well as a substantial amount of upland transitional area, all of which will provide great diversity and increased habitat opportunity for wildlife.

Interior water conveyance channels will be excavated in the wetland management units to provide water delivery and circulation to all areas of the Site. The conveyance channels will provide numerous wetland and wildlife benefits to the project area. Material excavated to construct the channels will provide material for the buttress berm and the interior and perimeter berms. Construction of conveyance channels will convert existing wetland and upland areas into permanent open water that will facilitate water conveyance.

The channels will be managed to encourage the growth of submerged aquatic and floating wetland vegetation and discourage the growth of invasive species. Open water areas will provide waterfowl with areas to land, loaf, and feed. It is anticipated that the presence of permanent open water will increase the amount of waterfowl breeding and brood rearing in the project area. Conveyance channels will have an approximately 30-ft wide bottom with 5:1 side slopes.

Most of the existing agricultural drainage ditches on Sherman Island have rectangular configurations. These existing drainage ditches will be regraded to provide a more gradual side slope. A gradual swale side slope will allow for easy wildlife movement across the ditches and swales while reducing swale erosion by encouraging vegetation growth along the swale's edges. Depth of swale excavation will vary depending on existing topography, however swales are generally designed to a depth of 2.5 feet below existing ground surface.

In addition to the channels, larger open water areas will also be created through excavation. These larger open water areas will be connected to the conveyance channels and have the same bottom elevations. They will serve as waterfowl brood rearing areas in the spring and loafing/storm-shelter locations in the winter. Material borrowed from these areas will be incorporated into the interior and perimeter berms or used to construct loafing islands.

The water source to the 10 wetland units east of Sherman Island Crossing Road will be delivered by four existing gravity siphons along the San Joaquin River Levee and five newly installed water control structures from the Overland Water Delivery Canal. At this time, it is anticipated that siphons 13, 15, 19 and 20 will be utilized as the primary source of water to the southern edge of these units. Each of these siphons are constructed of 12-inch diameter pipe that is reportedly capable of providing approximately 2,500 gallons per minute. All of these siphons currently have operational fish screens to ensure fish are not entrained within the newly constructed wetland.

It is anticipated that newly installed water control structures 25, 26, 35, 43, and 44 will be utilized as the primary source of water to the northern edge of these units. The water control structures will each include a 12-inch polyvinyl chloride (PVC) pipe that will draw water from the Overland Water Delivery Canal and convey it via gravity flow to the newly constructed wetland units. The Canal is fed by 3 existing siphons on the Sacramento River Northwest of the project site adjacent to Decker Island. All siphons feeding this Canal have operating fish screens, as well.

Water to the 2 wetland units west of Sherman Island Crossing Road will be delivered by one existing gravity siphon along the San Joaquin River Levee. At this time, it is anticipated that siphon 21 will be

utilized as the primary source of water to the southern edge of these units. Siphon 21 is constructed of a 12-inch diameter pipe that is reportedly capable of providing approximately 2,500 gallons per minute. This siphon also has an operating fish screen.

Water will be conveyed within the wetland system via gravity flow from the higher elevation units to the lower elevation units until it finally makes its way back to the District's pump station along the southern boundary of the Project.

Improvements to the outlet of the functional siphon may include replacing outlet valves, installing flow meters, and installing additional appurtenances as needed to improve the control of the water supply to the Site. All siphon improvements will take place on the interior (land) side of the San Joaquin River levee. Water delivered to the Site will circulate through the system to maintain appropriate water quality conditions and prevent stagnation.

Several existing agricultural drainage ditches occur within the interior and exterior of the Site. These ditches connect to the master drainage system of the southeastern portion of Sherman Island. The drainage ditches within the proposed project boundaries will be incorporated into the internal water conveyance system (swale system). A ditch along the exterior perimeter of the restoration area will be constructed to provide drainage from the surrounding landscape, and will include proper drainage for the District's toe ditches.

Maintenance

The project's water management infrastructure is designed for durability although some annual and regular maintenance will be required. The siphons will be inspected frequently (several times a week during irrigation months) to maintain efficient operation. Flash board riser water control structures will require periodic inspections to maintain proper and efficient water management.

Both interior and exterior berms must be inspected for evidence of erosion around water control structures and outlet pipes. Additional inspection of berms and levees is required to identify any holes. Animal burrows and other holes should be repaired and filled immediately to prevent berm failure. Drainage and supply ditches will be maintained and cleaned as needed to allow for efficient water flow.

WATER MANAGEMENT GUIDELINES

Proper water management in any managed wetland is essential for providing quality wetland conditions that support the desired functions and values. Water depths, timing, and duration of inundation, dictate the vegetation community present in any wetland. In a managed wetland, a pre-determined hydrologic regime can be implemented to produce a particular vegetation community and provide the conditions necessary to support the desired wildlife community.

Desired Wetland Condition

Proper vegetation composition and distribution is necessary for controlling subsidence, sequestering GHG, and minimizing vector production. For this project, the optimal vegetation community will be composed of a mixture of cattails and bulrush as these plants are adapted to withstand persistent flooded conditions. Vegetation density should be maximized to control and reverse subsidence. Conversely, open areas are desirable for waterfowl habitat and vector control. To balance these objectives, the established wetland vegetation community should have up to 70% vegetative cover to provide sufficient open water pathways throughout the entire site. Each wetland management unit will have a varying ratio of vegetation to open water depending on ground elevations and maximum water surface elevations.

A permanently flooded wetland structure achieves multiple objectives. Subsidence control and reversal is achieved through persistent flooded conditions and robust emergent vegetation.
Wildlife habitat is improved by providing a diverse mixture of open water and vegetation. Mosquito and

vector control is facilitated with multiple open water areas, which provides access for treatment. Waterfowl hunting is facilitated by providing foraging areas, hunter access throughout the marsh, and providing waterfowl resting areas.

Water Depths, Duration, and Timing

The project will be managed to achieve a relatively constant water level that will provide the desired vegetation/ open water distribution. However, during the project's first year, water will be managed substantially different than subsequent years to encourage the rapid establishment of desirable wetland vegetation. Water depths for the first growing season will be managed to provide optimal germination conditions for cattails and tules on approximately 40% of the area of each wetland management unit. The first several months of the growing season will be critical for monitoring and evaluating the germination extent and rate. Water levels must be managed at first to encourage and then limit germination in order to achieve the desired vegetation to open water ratio.

Precise and careful management of unit water surface elevations is essential to prevent establishment of robust vegetation across the entire unit. When germination reaches the desired coverage, water levels will be raised to prevent additional germination while not drowning the new growth. During this time, germination will be evaluated weekly and water levels adjusted accordingly. If the desired vegetation coverage is not achieved during the first year, this procedure will be followed each successive year until the desired vegetation community is achieved.

Following the establishment of the desired vegetation community, water levels will be managed consistently on an annual basis to maintain wetland vegetation consistent with the project's goals.

Sherman Island Drainage System

Reclamation District 341 is responsible for the operation and maintenance of the drainage system within Sherman Island. This infrastructure consists of a network of drainage ditches and discharge pumps. The Project is part of the southeastern drainage sub-system for the Island. This ditch network collects surface and groundwater from the western half of Sherman Island then channels it to the pumping station on the southwestern side of the island and ultimate discharge into the Sacramento River. The ditches surrounding the project will drain into the existing main ditch on the eastern edge of the site and drain back into the District's main drainage canal. This ditch connects directly to the pump station (Figure 2).

VEGETATION MANAGEMENT

Regular maintenance of the desired wetland vegetation will be necessary following its successful establishment. The project's goal for a permanent wetland condition supporting quality wildlife habitat can only be achieved in the long-term through proper maintenance and management of both wetland and upland vegetation. Ideally, the project should require only minimal management of wetland vegetation and limited annual management of upland vegetation. The desired wetland vegetation community consists of approximately 70% vegetative cover from cattails and tules along with seasonal wetland vegetation located on the islands and submerged aquatic vegetation in the deeper water. The desired upland vegetation is perennial and annual grasses and forbs on the perimeter and interior berms and uplands.

Flooding for Emergent Vegetation

Wetland vegetation management through control of water depths is the most effective tool for controlling vegetation growth in permanent wetlands. This tool not only provides the conditions for optimal spread of desirable vegetation, but can also limit its spread to create the desired mixture of emergent vegetation to open water. In general, water depths of less than 12 inches during the growing season will promote seed germination and have little control of rhizomatous vegetation. Water depths in this range are optimal to encourage the growth of emergent vegetation. Water depths between 12 and 36 inches will prevent germination but allow for the spread of vegetation by rhizomes. Once the desirable

vegetation community is established, water depths during the summer season should be maintained in this range to limit continued spread of emergent vegetation. Water depths of greater than 36 inches will prevent seed germination as well as the spread of emergent vegetation via rhizomes. Persistent water depths of greater than 36-inches during the growing season will eventually eliminate emergent vegetation from these deep flooded areas. Water depths in the conveyance channels should be maintained in this range to maintain water conveyance capabilities.

Draw Downs

Wetland drawdowns are an important management tool for permanent wetlands. Drawdowns reinvigorate wetland nutrient cycles and stimulate vegetation growth. A wetland under draw down conditions mimics a drought cycle. Drawdowns will depend on site conditions and may not be necessary for a period of up to 7 years following establishment of desired vegetation community. Within this time frame, the wetland units should be drawn down on a rotational basis where not more than one unit is drawn down at any one time. This will allow for adequate habitat to remain available on most of the site.

Beginning the fourth year following the establishment of the desired vegetation community, each wetland unit should be drawn down and completely dried on a rotating schedule for several months of the growing season (May through September). This management technique would occur every 5-7 years to reinvigorate the marsh, to control problematic vegetation by mowing or herbicide application, as a best management practice to limit mosquito production, and/or to repair berms and water control structures as needed.

Habitat Islands and Riparian Vegetation

Habitat islands are an important component of the Project. Islands have a diverse array of species, habitat structure and eco-tones. As such, careful consideration of flooding depths and duration must be evaluated for each unit during fluctuation of water levels. Generally, Tules respond faster to water fluctuations than trees or shrubs. Due to the rhizome root system, if Tules are flooded out by depths greater than 2.5-3 feet, populations can recover quickly by reducing the flooding depth and promoting new germination. However, with woody species the flooding tolerances are less. Generally, wetland tree and shrub species as well as riparian species prefer saturated to slightly inundated condition. Surface water conditions resulting in significant flooding of trees and shrubs for durations longer than a several days in the summer and a few weeks during the winter months may kill woody species permanently. This may be necessary for long term increases in water depths for subsidence reversal purposes. However, increases in water depths for non-native invasive species control and or promotion of other native wetland plant communities should be limited to the tolerable constraints of the woody species during normal practices. A good indicator of the limits of tolerable conditions can be noted by observing signs of stress from the trees and shrubs located in the deepest flooded areas of each unit. Signs of stress can include yellowing or browning of leaves, twig dieback or buds failing to open.

It is anticipated that over the course of many years, through accretion that the upland portions of habitat islands will eventually be transformed into wetland habitat. This planned natural progression will likely continue to provide habitat diversity as it will become a deciduous forested and deciduous scrub-shrub wetland habitat amongst a larger area of emergent wetland.

Irrigation of Islands

During hot summer months when irrigation water is readily available, increasing surface water elevations to irrigate habitat islands may be beneficial for tree, shrub and herbaceous species survival as well as non-native species control. After vegetation establishment, surface water elevations should be increased by 0.5 to 1 foot for about 1 week during summer months. The irrigations will also help control upland invasive species like Himalayan blackberry (*Rubus armeniacus*), perennial pepperweed (*Lepidium* sp.), and cocklebur (*Xanthium strumarium*).

Supplemental Planting

Mortality of planted woody species, generally between 20-50 percent, is common for restoration projects. It is very extremely important to replant areas that are prone to erosion in order to establish a diverse vegetative component throughout the project area. Supplementing transitional areas such as berms and islands with additional plantings can be achieved during normal maintenance of berms. Typically, willow tree and shrub branches will need to be trimmed along the access portions of the berms. This maintenance should be conducted during the late fall and winter months when possible. During these months branches can be cut into "Stakes" which can then be planted in areas where additional plantings are desired.

Mowing and Herbicides

Mechanical and chemical removal of problematic vegetation is an important component for habitat management. Wetland vegetation will need to be controlled if plant coverage expands beyond 80% or if the swales and potholes become overgrown with emergent vegetation. Aerial photos can be used to evaluate the percentage of vegetation coverage. Any unit with a vegetation problem will need to be drawn down and dried to allow mower access.

Upland vegetation on the tops of berm should be mowed annually to provide vehicular access to water control structures for regular maintenance, and access by larger equipment for special maintenance needs. Upland vegetation should not be mowed during the avian nesting season between March 1 and June 30.

Annual control of weedy vegetation will be required on annual basis to promote the desired wetland and upland vegetation communities and avoid and control exotic/invasive species. These exotic/invasive species include Himalayan blackberry (*Rubus armeniacus*), common reed (*Phragmites australis*), perennial pepperweed (*Lepidium* sp.), cocklebur (*Xanthium strumarium*), and other species as identified in the field. Each of these species has the capability to overtake both wetland and upland communities. Deeper water levels within the wetland area will help to control the spread of these species. These species can be problematic if not controlled vigorously along the edges of the wetland areas. In areas in which mowing is not practical, chemical control using an herbicide labeled for application in wet environments is recommended. Glyphosate formulated herbicides are effective for controlling annual weeds as well as common reed if applied correctly. Perennial pepperweed can be controlled with imazapyr or chlorsulfuron formulated herbicides. Himalayan blackberry can be controlled using triclopyr in dry areas. All herbicide applications must follow application rates and procedures identified on the packaging label, and will be applied by a certified/licensed applicator.

PEST MANAGEMENT

Pest management is often a necessary management activity for manipulated wetlands in the Central Valley and Sacramento-San Joaquin Delta regions. Mammalian and invertebrate pests can be problematic for the successful operation of the project and achieving the projects goals and must be controlled when warranted.

Mammals

Wetlands and riverine habitats in the Central Valley are preferred habitats for muskrats and beavers. These rodents can damage wetland management infrastructure by burrowing into berms, levees, and around water control structures. If left unchecked, these excavations can ultimately compromise the structural integrity of the water management infrastructure.

To minimize the potential damage these rodents can have on water management infrastructure, several of the berms have been designed with 3:1 side slopes. Gradual slopes limit burrowing activity compared with steep slopes such as a 1:1. In berms constructed at 3:1 slopes, annual inspection is necessary to fill any burrows.

Beavers are instinctively drawn to the sound of flowing water. When the source of the sound is located, beavers will attempt to build a dam and halt the flow of water. Water control structures will be cleared of any debris that may prevent adequate water flow.

Mosquitoes

Wetlands in the Central Valley and Sacramento-San Joaquin Delta are well known for their capabilities to produce mosquitoes. Because of its flooded pasture land uses, Sherman Island in particular produces some of the highest numbers of mosquito larvae in the western Delta. The island is within the Sacramento-Yolo Mosquito and Vector Control District (SYMVCD). The SYMVCD regularly inspects and controls mosquito larvae on the island using larvacide control methodologies. In an effort to minimize mosquito production from this project, the SYMVCD has been an active participant in the planning process.

With the current threat of West Nile and the potential spread of the H5N1 avian influenza, using water and habitat Best Management Practices (BMPs) to limit the growth and spread of mosquitoes is important. The BMPs included in Attachment B have been incorporated and utilized during the development and long-term management of the project to minimize the growth of mosquito populations.

Figure 1. Sherman Island Belly Wetland Restoration Project Site & Vicinity Map

Base maps: Jersey Island, CA USGS 7.5 minute topographic quadrangles

DUCKS UNLIMITED

Figure 1. Sherman Island Wetland Restoration Project: Phase II Site & Vicinity Map

Base maps: Jersey Island, CA USGS 7.5 minute togographic quadrangle
Sections 1, 2, 3 & 10 of T2N, R2E; Sections 25, 26, 35 & 36 of T3N, R2E, Sacramento County, CA

N

0 1,000 2,000
Feet

Figure 2. Infrastructure Map

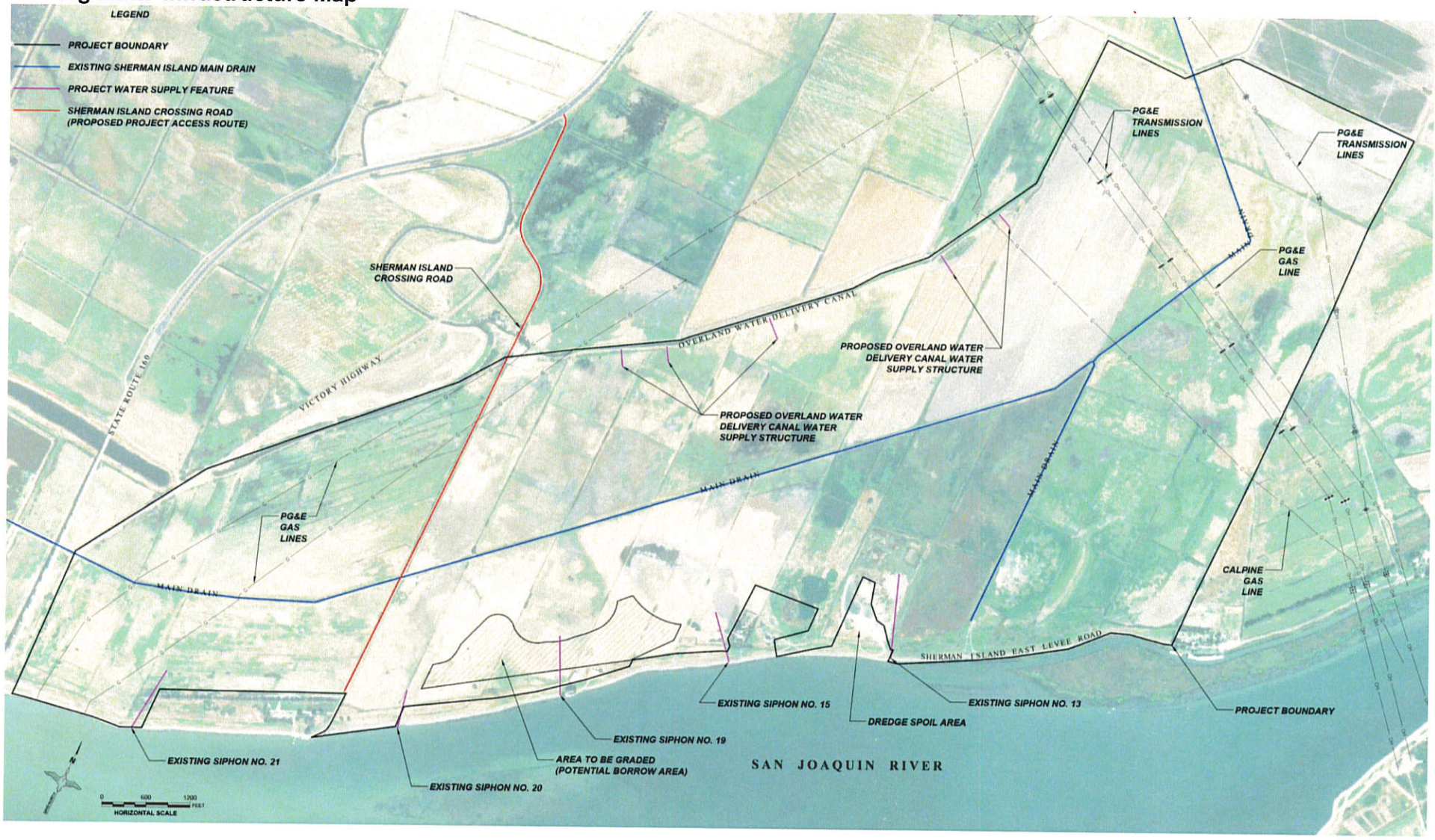
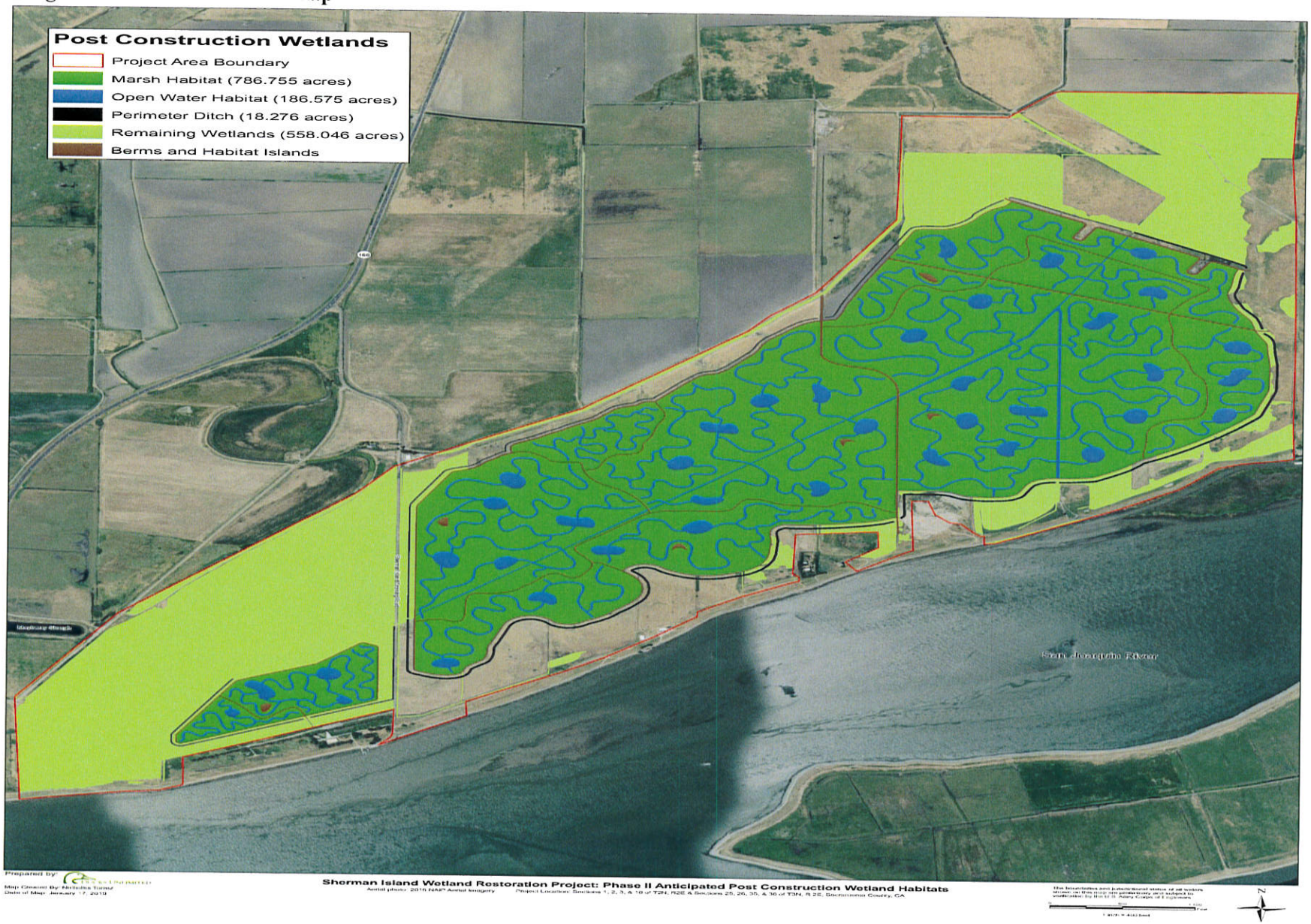


Figure 3. Restoration Plan Map



WATER BUDGET

Background

Currently, the site proposed for this wetland restoration project is being utilized as irrigated pasture for grazing cattle and cropland. The pasture is irrigated so that standing water occurs on some of the ground so the cattle can use the standing water for drinking. In contrast, this project will convert these pastures to permanently flooded wetlands to stop and reverse the effects of subsidence. Additionally, we anticipate constructing the project over three years and have approximated the acreage developed during the first year to be 100 acres, second year to be 400 acres, and the final 500 acres being constructed during the third year. We anticipate flooding up each phase during the months of January through May subsequent to construction completion of that phase. We have estimated the water requirements for the planned wetland as shown in the following table.

Water Demand for Proposed Future Wetland

Total Demand and Components of the Water Budget

Under steady state conditions, the water budget for the proposed wetland can be represented as: Total water demand = evapotranspiration - precipitation. During flood up the water budget for the proposed wetland can be represented as: Total water demand = evapotranspiration + flood depth - precipitation.

The total project site is approximately 1000 acres, and assuming a high groundwater table resulting in low subsurface flow a desired average increase in water depth will be 1.5 feet. Tables 1, 2, and 3, show the components of the water budget with initial flooding and establishment of wetland vegetation per phase, as well as ET balance for the previously constructed phase. Table 4 shows water requirements after construction and flood up has occurred (steady state).

Table 1. Water Demand by Month for Years 1-3 and all subsequent years

Month	Year 1	Year 2	Year 3	Subsequent Years
	Acre -feet			
January	1.27	5.09	6.36	0
February	6.13	24.52	30.65	0
March	21.15	84.59	105.74	0
April	45.97	183.87	229.83	0
May	65.67	262.68	328.35	0
June	55.27	271.34	490.02	427.3
July	60.26	301.29	602.56	602.56
August	52.69	263.45	526.91	526.91
September	38.15	190.74	381.47	381.47
October	17.54	87.72	0	0
November	0	0	0	0
December	0	0	0	0

Evapotranspiration

We estimated wetland evapotranspiration (ET) using meteorological data obtained from UC Berkeley sites on both Sherman and Twitchell Islands. The data set includes data for both agricultural crops, as well previously constructed wetlands.

Monthly ET in ft	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**Sept**	**Oct**	**Nov**	**Dec**
Wetlands (Average)	**0.06**	**0.10**	**0.19**	**0.30**	**0.46**	**0.57**	**0.61**	**0.53**	**0.40**	**0.25**	**0.10**	**0.07**
West Pond	0.07	0.07	0.10	0.18	0.31	0.50	0.61	0.54	0.42	0.27	0.11	0.07
East End	0.06	0.09	0.21	0.34	0.48	0.59	0.61	0.53	0.39	0.22	0.09	0.06
Mayberry	0.06	0.11	0.20	0.35	0.53	0.61	0.65	0.55	0.44	0.27	0.11	0.07
Sherman (Whale's Mouth)	0.07	0.13	0.26	0.35	0.53	0.57	0.56	0.49	0.37	0.26	0.09	0.08
Agricultural Sites:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Sherman Pasture	0.04	0.08	0.16	0.26	0.31	0.32	0.30	0.26	0.21	0.14	0.06	0.05
Twitchell Alfalfa	0.06	0.12	0.23	0.33	0.41	0.41	0.39	0.32	0.24	0.19	0.10	0.07
Twitchell Corn	0.08	0.13	0.19	0.31	0.35	0.19	0.39	0.40	0.23	0.10	0.07	0.09
Bouldin Corn	0.04	0.17	0.19	0.25	0.20	0.20	0.51	0.43	0.20	0.04	0.05	0.05
Average rainfall (in)	3.62	3.46	2.76	1.14	0.67	0.20	0.04	0.04	0.28	0.94	2.09	3.27
Average Rainfall in ft	0.30	0.29	0.23	0.10	0.06	0.02	0.00	0.00	0.02	0.08	0.17	0.27

CENTRAL VALLEY JOINT VENTURE TECHNICAL GUIDE TO BEST MANAGEMENT PRACTICES FOR MOSQUITO CONTROL IN MANAGED WETLANDS

Dean C. Kwasny[1], Mike Wolder[2], and Craig R. Isola[2]

BEST MANAGEMENT PRACTICES

The BMPs in this document are habitat-based strategies that can be implemented when needed for mosquito control in managed wetlands. These strategies represent a range of practices that wetland managers can incorporate into existing habitat management plans or in the design of new wetland restoration or enhancement projects. Ideally, BMPs can be used to decrease the production of mosquitoes and reduce the need for chemical treatment without significantly disrupting the ecological character, habitat function, or wildlife use in managed wetlands. It should be recognized that BMPs function as a first line of defense in deterring mosquito production and can be used in combination with other Integrated Pest Management (IPM) tools such as, biological controls, larvicides (Appendix A), and adulticides (Appendix B) when necessary.

In many cases, BMPs overlap with commonly used habitat management practices to conserve water and manage wetland vegetation for wildlife (Batzer and Resh 1992a, Batzer and Resh 1992b, Resh and Schlossberg 1996). Not all BMPs will be appropriate for a given wetland location or set of circumstances. Therefore, habitat managers are encouraged to work closely with both their local MVCD and agency biologists to select BMPs based on their potential effectiveness for regional or site specific conditions, and habitat management strategies. The implementation of BMPs will likely be limited by cost and personnel constraints, potential impacts on wetland habitat, and wildlife response to these measures.

In the following section, BMPs have been classified into five categories. These categories are not listed in order of importance and may be used in combination.

- Water Management Practices
- Vegetation Management Practices
- Wetland Infrastructure Maintenance
- Wetland Restoration and Enhancement Features
- Biological Controls

Following each category is a table summarizing the BMPs that outlines strategies, mosquito control objectives, advantages, and disadvantages (Tables 1 through 6).

Water Management Practices

Water management is one of the wetland manager's greatest tools for reducing mosquito populations (Table 1). However, it requires that water is readily available, of sufficient quantity and quality, and that the conveyance infrastructure is adequate to permit rapid flooding or drainage. In some instances, circumstances outside the control of wetland managers may limit the ability to implement water management BMPs. Such circumstances may include when agriculture drain water or delivered water is available for flooding, limited water quantity or poor water quality, and undersized water delivery or drainage infrastructure. In managed wetlands where these limitations are not an issue, the following water management practices should be considered.

Timing of Flooding: The timing of wetland flooding can greatly influence mosquito production (Fanara and Mulla 1974; Batzer and Resh 1992a). Delayed flooding may reduce mosquito production by shifting flooding schedules later in the year, when temperatures are cooler and mosquito production is less of a problem. Delayed flooding should be considered for wetlands with historic mosquito problems and those in close proximity to urban areas. However, delayed flooding means that less wetland habitat is available for wildlife during times of the year such as August and

September, when wetlands are particularly limited. Delayed flooding may also have limited applicability for some properties that are required to take water on a "when available" schedule and have little control over the timing of flooding. Delayed flooding may be especially difficult for State and Federal areas that are obligated to provide "early" habitat to reduce crop depredation by waterfowl.

Given the limited feasibility of delayed flooding on some properties, phased flooding of wetlands may be useful to allow habitat managers to provide some level of early flooded habitat while delaying flooding on a portion of a property. Phased flooding involves flooding habitat throughout the fall and winter in proportion to wildlife need and takes into consideration other wetland habitat that may be available in surrounding areas.

For wetlands that are flooded early (August - early September) or in close proximity to urban areas, the use of vegetation and water management BMPs should be a high priority (Tables 1 and 2). *BMPs: Delayed or phased fall flooding, Early fall flood-up planning (see Table 1 for additional explanation)*

Speed of Wetland Flooding: As a general rule, the faster water can be applied during fall flooding and spring/summer irrigation, the fewer generations of mosquitoes will be hatched. Slow feather-edge flooding, although beneficial to foraging waterbirds, can produce multiple, staggered hatches of floodwater mosquitoes and, if treatment is necessary, often requires MVCDs to visit wetlands over a number of days for control activities (Garcia and Des Rochers 1983). Such an intensive treatment effort is expensive and results in additional disturbance to wildlife.

BMPs: Rapid fall flooding, Rapid irrigation (see Table 1 for additional explanation)

Water Control: Once wetlands have been flooded, it is important for wetland managers to maintain consistent pond elevations so that water surface elevation fluctuations do not occur, except during planned drawdowns or periods of low mosquito production (i.e. winter months). Fluctuating water levels tend to expose wetland edges to drying and provide suitable habitat for floodwater mosquitoes to lay eggs (Garcia and Des Rochers 1983). When water levels are subsequently raised, a new cohort of mosquitoes may be hatched. Water levels should be maintained by checking water levels frequently and adding water to offset any losses. A constant maintenance flow of water will also help maintain steady water levels, improve water quality, and reduce stagnation.

If possible, wetlands can be flooded to deeper water depths during the fall and allowed to recede during the cooler winter months to provide shallow water depths for foraging waterbirds. Deeper water depths (24 inches) at initial flooding have been shown to significantly reduce mosquito densities at Grizzly Island Wildlife Area (Batzer and Resh 1992a, b).

When flooding wetlands, water sources containing mosquito predators should be used to help colonize wetlands with predacious insects or mosquitofish that are passively transported by water from upstream locations (Collins and Resh 1989). Predator populations can be maintained in permanent waterways used to flood seasonal wetlands. In the Suisun Marsh, where water is readily available for flooding, seasonal wetlands are often initially flooded, and if mosquitoes become abundant, water levels are drawn down to concentrate mosquito larvae in ditches for biological control, larvicide treatment, or to drown larvae through turbulent water movement (Chappell pers. comm). Following this action, wetlands are immediately re-flooded.

BMPs: Maintain stable water levels, Circulate water, Use deep initial flooding, Subsurface irrigate, Utilize water sources with mosquito predators for flooding, Flood and drain wetland (see Table 1 for additional explanation)

Frequency and Duration of Irrigation: Spring and summer irrigation is a common wetland management practice used to increase seed production and biomass of moist-soil plants (Naylor 2002), and reduce competition from undesirable plants in seasonal wetlands. The need to irrigate seasonal wetlands should be assessed closely by wetland managers. During years with above average spring precipitation, irrigations may not be necessary to maximize moist-soil plant production. When possible, managers should shorten the duration of irrigation to 4 to 10 days to reduce the likelihood of hatching floodwater mosquitoes and eliminate the possibility of creating habitat for standing water mosquitoes. However, shorter irrigations may not always be feasible, especially when growing more water intensive plants such as watergrass and smartweed, or when conducting flooding to control undesirable plant species. In the case of weed control, plants should be monitored and water held only long enough to eliminate weeds. The necessary timing can be determined when weeds have turned black or have disintegrated. Finally, following wetland irrigations, water should be drawn down into waterways containing mosquito predators that can consume any mosquito larvae which may have hatched.

BMPs: Reduce number of irrigations, Use rapid irrigation, Draw down and irrigate in early spring, Irrigate prior to field completely drying, Drain irrigation water into ditches or other water sources with mosquito predators, Use subsurface irrigation (see Table 1 for additional explanation)

Table 1. Water Management Practices to reduce mosquito production in managed wetlands.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Delayed or phased fall flooding	Delay flooding of some wetland units until later in the fall. Delay flooding units with greatest historical mosquito production and/or those closest to urban areas.	To delay initiation of floodwater mosquito production in seasonal wetlands by reducing the amount of mosquito habitat available during optimal breeding conditions (warm summer/early fall weather). Reduce the time available for standing water mosquito production in seasonal wetlands.	Depending on flood date, can reduce the need or amount of additional treatment. Delayed flooding can provide "new" food resources for wildlife later in the season when wetlands are finally flooded.	Reduces the amount of habitat for early fall migrants and other wetland-dependent species, and may increase potential for waterfowl depredation on agricultural crops (especially rice). Flooding is often dictated by water availability or contractual dates for delivery. Delayed flooding may still produce mosquitoes in warm years. Private hunting clubs can't lease blinds that aren't flooded.
Early fall flood-up planning	Apply BMPs to wetlands identified for early flooding. To the extent possible, areas targeted for early fall flooding should not be near urban centers and should not have a history of heavy mosquito production.	To reduce the early season production of mosquitoes or to reduce their encroachment on urban areas.	Allows for the provision of early flooded habitat while minimizing mosquito production and conflicts with urban areas.	Some additional effort required to monitor and identify suitable areas. Requires the extensive use of BMPs so mosquitoes are not produced.
Rapid fall flooding	Flood wetland unit as fast as possible. Coordinate flooding with neighbors or water district to maximize flood-up rate.	To minimize number of mosquito cohorts hatching on a given area.	Reduces the need for multiple treatments needed by synchronizing larval development and adult emergence. In turn, reduces wildlife disturbance by MVCDs.	Requires coordination & ability to flood quickly. Reduces slow, feather-edge flooding that is heavily utilized by waterbirds.
Rapid irrigation	4-10 day irrigation (from time water enters the pond to complete draw-down).	Shorten irrigation period to reduce time available for mosquitoes (especially *Culex tarsalis* and *Anopheles freeborni*) to complete lifecycle.	Provides some level of wetland irrigation while reducing the time available for mosquitoes to complete lifecycle.	Requires ability to rapidly flood & drain wetland. If flooding is used for weed control, rapid irrigation may not be feasible.

Maintain stable water level (summer and early fall flooding)	Provide constant flow of water into pond to reduce water fluctuation due to evaporation, transpiration, outflow, and seepage.	To reduce conditions for additional floodwater mosquito production in summer and fall.	Provides a stable wetland environment for breeding wildlife during spring and summer. Discourages undesired excessive vegetative growth which could also become additional mosquito breeding substrate.	Requires regular monitoring and adjustments to water control structures. May be difficult if water availability is intermittent or unreliable. Reduces mudflat habitat that is attractive to shorebirds and waterfowl.
Water circulation	Provide a constant flow of water equal to discharge at drain structure.	To keep water fresh and moving to deter stagnant conditions for mosquito production; reduces water level fluctuation and potential production of floodwater mosquitoes.	Discourages warm water conditions associated with avian botulism outbreaks.	Requires landowner to purchase additional "maintenance" water. May be difficult if water availability is intermittent or unreliable.
Deep initial flooding (18-24")	Flood wetland as deep as possible at initial flood-up.	To reduce shallow water habitat for mosquito breeding. May provide more open water by over-topping vegetation, thereby facilitating mosquito predation or wind action that drowns larvae.	Potentially slows mosquito development by eliminating warm, shallow water habitat.	Requires additional water and infrastructure adequate to flood deeply. Reduces shallow water foraging habitat for shorebirds and waterfowl.
Utilize water sources with mosquito predators for flooding wetlands	Flood wetlands with water sources containing mosquito fish or other invertebrate predators. Water from permanent ponds can be used to passively introduce mosquito predators.	To inoculate newly flooded wetlands with mosquito predators.	May establish mosquito predators faster than natural colonization.	Requires source of water with already established mosquito predators. Not applicable to wetlands flooded with well water.
Drain irrigation water into ditches or other water bodies with abundant mosquito predators	Drain irrigation water into locations with mosquito predators as opposed to adjacent seasonal wetland or dry fields.	To reduce the amount of larvae through natural predation and minimize the number of adults that emerge.	Already a common wetland management practice.	Must have ditch or water body with established predator population available to accept drain water.

Flood & drain wetland	Flood wetland and hatch larvae in pond. Drain wetland to borrow or other ditch where larvae can be easily treated, drowned in moving water, or consumed by predators. Immediately reflood wetland.	Hatches mosquito larvae and moves them to a smaller area for treatment before they can emerge as adults.	Can eliminate or reduce the need for additional mosquito control efforts.	Additional cost to purchase water to re-flood wetland. Timing is critical. Requires monitoring and is labor intensive.
Reduce number of irrigations	Evaluate necessity of irrigation, especially multiple irrigations, based on spring habitat conditions and plant growth. Eliminate irrigations when feasible.	To eliminate unneeded additional irrigations which could provide potential habitat for mosquitoes.	Reduces potential need for additional mosquito control. Saves water and manpower costs. Discourages excessive growth of undesirable vegetation (i.e. joint and bermuda grass)	May reduce seed production or plant biomass with less irrigation.
Early spring draw-down and irrigation	Draw-down wetland in late March or early April. Irrigate in late April or early May when weather is cooler and mosquitoes are less of a problem.	To reduce need for irrigation in June, July, and August, when potential for mosquito production would be higher.	Wetland irrigation can be accomplished without creating potential mosquito problems. May allow moist-soil plants to take advantage of natural rainfall during the spring.	Reduces shallow wetland habitat for migratory shorebirds and waterfowl in April and May, during a major migration period. Newly germinated wetland plants may be impacted by cold weather conditions. May stimulate germination and growth of undesirable wetland plants.
Don't let field completely dry and crack between spring draw-down and irrigation	Irrigate wetland before soil completely dries.	To eliminate necessary drying period for floodwater mosquito to lay eggs.	May reduce mosquitoes produced from irrigation	Requires close monitoring of soil moisture to correctly time irrigation.
Subsurface irrigation	Maintain high ground water levels by keeping boat channels or deep swales permanently flooded.	To reduce amount of irrigation water during mosquito breeding season.	Reduce need for surface irrigation while maintaining soil moisture to promote moist-soil plant production.	Requires deep swales or boat channels to be effective. Requires additional pipes in channels for equipment access. May not produce intended irrigation result if water table is naturally low. Requires that water be maintained longer than normal in swales. May promote unwanted vegetation growth in swales or promote irrigation of non-target plants in wetland.

Wetland Infrastructure Maintenance

Wetland infrastructure is the foundation for habitat management. A properly functioning water delivery and drainage system, well maintained levees, correctly operating water control structures, and efficient pumps are key to avoiding the unnecessary production of mosquitoes through simple neglect (Table 3). Time and money invested in these proactive maintenance activities will reduce mosquito production and help landowners avoid additional costs of controlling mosquitoes and unwanted vegetation when fall flooding or irrigating wetlands.

Levee and Water Control Structure Inspection and Repair: Levees and water control structures should be inspected on an annual basis to identify problem areas that may inadvertently leak water and produce mosquitoes. This includes identifying weak spots or rodent damage in levees that may seep water during flooding. Water control structures should be water-tight and properly sealed to prevent seepage.

Ditch and Swale Cleaning: Vegetation in water delivery ditches and swales can be problematic by creating habitat for mosquitoes or by simply impeding the flow of water that facilitates rapid flooding or drainage. Typical maintenance activities of water delivery and drainage ditches include the use of herbicides or periodic dredging to remove problem vegetation that inhibits water flow. Ditches and swales should be cut to grade to prevent the unintentional trapping of water. Likewise, silt that accumulates in front of outlet structures should be removed so it does not trap water in drainage swales.

Pump Tests and Repair: If wetland managers use pumps for flooding, periodic pump testing should be conducted to verify pumps are operating at optimum efficiency. This will make sure that pumps are providing maximum output, and will facilitate rapid flooding.

Table 3. Wetland infrastructure maintenance activities used to reduce mosquito production in managed wetlands.

Best Management Practice	Strategies	Mosquito Control Objective	Advantages	Disadvantages
Levee Inspection & Repair	Walk or drive levees, flag problem spots, repair as needed. Consider design elements to improve integrity of levee (see levee design in Table 4).	To reduce mosquito habitat/production caused by seepage into adjacent fields or dry ponds.	Allows for early identification of problem spots. Helps conserve water and reduces growth of unwanted vegetation.	Requires annual monitoring and funding for repairs.
Water Control Structure Inspection, Repair, & Cleaning	Inspect structures and repair or replace as needed. Remove silt and vegetation build-up in front of structures. Adequately close, board or mud-up controls.	To reduce mosquito habitat/production caused by seepage into adjacent ponds or drainage ditches. Remove silt blockages that may trap water and impede drainage.	Enhances water management capabilities and limits unwanted vegetation or standing water.	Requires annual monitoring and funding for cleaning or repair.
Ditch Cleaning	Periodically remove silt or vegetation from ditches to maintain efficient water delivery and drainage.	To allow for rapid flooding/drainage & reduce vegetation substrate for breeding mosquitoes.	Enhances water management capabilities and limits unwanted vegetation or standing water.	Requires funding for ditch cleaning. Excessive vegetation removal on ditch banks can result in negative impacts to nesting birds and other wildlife.
Pump Tests & Repair	Test pump efficiency and make any necessary repairs to maximize output.	Could identify output problems and if corrected, allow managers to flood more rapidly.	May promote faster irrigation and flood-up if output can be improved.	Requires pump test. May be costly to repair or replace pump/well.

Wetland Restoration and Enhancement Features

All well planned wetland restoration and enhancement projects begin with an initial survey and design phase. It is during this phase that landowners and restoration biologists have the opportunity to discuss design features with MVCDs and incorporate BMPs to reduce mosquito production. Time spent at the design stage can save thousands of dollars in annual operation and maintenance costs and prevents problems resulting from poor water management and unintended mosquito production.

Wetland design typically focuses on aspects of water control that promote vegetation beneficial to wildlife, conserve water, and allow for periodic vegetation control. In turn, water control is also an important mosquito BMP (Sacramento-Yolo Mosquito and Vector Control District 2008, Contra Costa Mosquito and Vector Control District 2001).

Wetland design features to reduce mosquito production: Wetland design features that reduce mosquito production include independent flooding and drainage capabilities of wetland units, size considerations in the design of wetland units to facilitate rapid flooding, and the incorporation of design features that promote habitats for mosquito predators and allow those predators access to mosquitoes. Water delivery ditches, water control structures, and levees should be designed and built to specifications that prevent wind and water erosion, provide equipment access for maintenance activities, and reduce damage caused by burrowing animals (Table 4). These design features will facilitate other mosquito BMPs such as water and vegetation management practices, infrastructure maintenance, and natural mosquito predation.

BMPs: Independent water management, Adequately sized water control structures, Swale construction, Wetland size consideration, Ditch design, Levee design & compaction, Deep channels or basins constructed in seasonal wetlands, Permanent water reservoir that floods into seasonal wetlands.