Lower Sherman Island Wildlife Area

Land Management Plan

Final

April 2007

California Department of Fish & Game

EDAW

PWA
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Consultants in Hydrology

LOWER SHERMAN ISLAND WILDLIFE AREA

LAND MANAGEMENT PLAN

FINAL

PREPARED FOR:

CALIFORNIA DEPARTMENT OF FISH AND GAME
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LAND MANAGEMENT PLAN
FOR THE
LOWER SHERMAN ISLAND WILDLIFE AREA

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California Department of Fish and Game
Sacramento Valley Central Sierra Region
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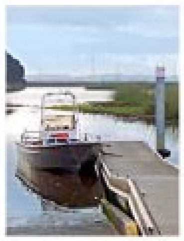

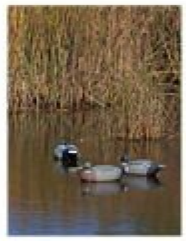

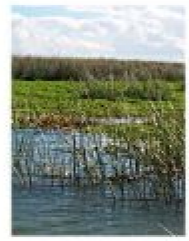

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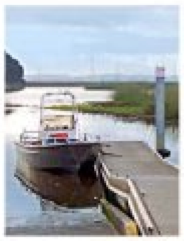
ACRONYMS AND ABBREVIATIONS

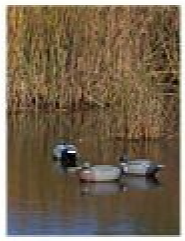
µmhos/cm	micromhos per centimeter
µS/cm	microSiemens per centimeter
basin plans	water quality control plans
Bay–Delta	San Francisco Bay, Suisun Bay, and the western and central Delta
CALFED	California Bay-Delta Program
CDF	California Department of Forestry and Fire Protection
Central Valley Regional Water Board	Central Valley Regional Water Quality Control Board
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CH_3Hg and (CH_3) 2Hg	methylmercury
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society's
CVHJV	Central Valley Habitat Joint Venture
CVP	Central Valley Project
CWA	Clean Water Act
CWHR	California Wildlife Habitat Relationships system
DBPs	Disinfection byproducts
DBW	California Department of Boating and Waterways
Delta	Sacramento–San Joaquin River Delta
Department	California Department of Fish and Game
DOC	dissolved organic carbon
DOF	California Department of Finance
DPC	Delta Protection Commission
DPR	Department of Parks and Recreation
DPS	distinct population segment
DRERIP	Delta Regional Ecosystem Restoration Implementation Plan
DWR	California Department of Water Resources
EC	Electrical conductivity
EFH	Essential Fish Habitat
ERRP	Ecosystem Restoration Program Plan
ESA	Endangered Species Act
ESU	Ecologically Significant Unit

FDA	U.S. Food and Drug Administration
FEMA	Federal Emergency Management Agency
fps	feet per second
ft/sec	feet per second
GRCD	Grasslands Resource Conservation District
Hg	Elemental mercury
HgS	inorganic mercury (as in cinnabar)
ICS	Incident Command System
IS/ND	initial study/ negative declaration
LMP	land management plan
LSIWA	Lower Sherman Island Wildlife Area
MLLW	mean lower low water
MSCS	Multi-Species Conservation Strategy
msl	mean sea level
NAWMP	*North American Waterfowl Management Plan*
NCIC	North Central Information Center
NMFS	National Marine Fisheries Service
OEHHA	California Office of Health Hazard Assessment
PFMC	Pacific Fisheries Management Council
PG&E	Pacific Gas and Electric Company
POC	particulate organic carbon
ppm	parts per million
ppt	parts per thousand
PSUs	practical salinity units
RBDD	Red Bluff Diversion Dam
Reclamation	US Bureau of Reclamation
regional plan	Land Use and Resource Management Plan for the Primary Zone of the Delta

ROD	record of decision
RV	Recreational vehicle
SR	State Route
SRA	shaded riverine aquatic
SRA	State Recreation Area
State Reclamation Board	California Department of Water Resources
SWP	State Water Project
TDS	total dissolved solids
the Department	California Department of Fish and Game
THM	trihalomathane
TMDL	total maximum daily load
TOC	total organic carbon
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UW	University of Washington's
VELB	valley elderberry longhorn beetle

Executive Summary





Final Land Management Plan

EXECUTIVE SUMMARY

The Lower Sherman Island Wildlife Area (LSIWA) occupies roughly 3,100 acres, primarily marsh and open water, at the confluence of the Sacramento and San Joaquin Rivers in the western Sacramento–San Joaquin River Delta (Delta). This extensive tract of natural vegetation and Delta waters provides diverse and valuable wildlife habitats and related recreational opportunities and is integral to the functioning and human use of the Delta.

The California Department of Fish and Game (Department), as part of the Resources Agency of the State of California, has the following mission to guide its planning and operations: "The mission of the Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public."

The purpose of this land management plan (LMP) is to:

1. guide management of habitats, species, and programs described in the LMP to achieve the Department's mission to protect and enhance wildlife values;

2. serve as a guide for appropriate public uses of the LSIWA;

3. serve as descriptive inventory of fish, wildlife, and native plant habitats that occur on or use the LSIWA;

4. provide an overview of the property's operation and maintenance and of the personnel requirements associated with implementing management goals (this LMP also serves as a budget planning aid for annual regional budget preparation); and

5. present the environmental documentation necessary for compliance with state and federal statutes and regulations, provide a description of potential and actual environmental impacts that may occur during plan management, and identify mitigation measures to avoid or lessen these impacts.

The planning process was guided by the general policy parameters that direct the Department, including compliance with all state and federal laws. The Department's mission, the purpose of the wildlife areas, the purpose and history of the acquisition of Lower Sherman Island, and the purposes of land management plans provided broad direction for the development of this plan.

With this broad guidance, the plan was developed from a compilation of the best available data, additional site-specific analyses, consideration of existing land use and resource management plans, and public input. Public input was obtained through 10 interviews with knowledgeable individuals and stakeholders, two public comment meetings, and a number of public comment letters. A summary of public outreach efforts is included in the LMP as Appendix A.

An environmental analysis pursuant to the California Environmental Quality Act (CEQA) was conducted concurrently with plan development to identify the potential environmental impacts of operating the LSIWA under the provisions of this land management plan. As described in the initial study/negative declaration (IS/ND) prepared for the plan under CEQA, implementing the plan would not have a significant impact on the environment. The IS/ND is included in the LMP as Appendix B.

The following sections provide a summary of the LMP and of the CEQA analysis of its potential environmental impacts.

PURPOSE AND HISTORY OF ACQUISITION

The LSIWA property was acquired to establish a public hunting and fishing area. In 1944, the Department assumed management of this property from the California Department of Finance (DOF) for “the purpose of establishing a public shooting ground.” Subsequently, in 1958, the California Fish and Game Commission voted to acquire ownership of this property and “establish the area as a public hunting and fishing area”.

In 1960, DOF transferred title to the Lower Sherman Island area to the California Fish and Game Commission.

PROPERTY DESCRIPTION AND MANAGEMENT SETTING

The LSIWA consists of all land and open water within the historic levees west of Mayberry Slough and Mayberry Cut. The LSIWA is bordered by Mayberry Slough, Sherman Island, and Donlon Island on the east; the Sacramento River on the north; Kimball Island on the southwest; and the San Joaquin River on the south.

The LSIWA is accessible only by boat, except at its northeastern corner, where the only road within the wildlife area runs from West Sherman Island Road at the wildlife area’s eastern boundary to the boat launch and associated facilities operated by Sacramento County. This road, along with the boat launch and associated facilities (i.e., entrance gate, parking areas, lighting, picnic area, restrooms), has been leased by the Department to the County under a 25-year operating agreement that began in 1999.

Other infrastructure at LSIWA includes a gas line and cabins. An 8-inch natural gas pipeline runs north-south across the western portion of Lower Sherman Island. This gas line is operated and maintained by Calpine.

On Lower Sherman Island, there are both abandoned and occupied cabins. Since 1930, individuals from nearby communities have constructed docking facilities, and cabins on Lower Sherman Island, particularly along the levee adjacent to Cabin Slough. After the LSIWA was established, the California Fish and Game Code was amended to allow for and specify the terms of leases for existing cabins and associated docking facilities at LSIWA. These leases can be extended for the natural life of any person who was a leaseholder in January 1, 1991, but will expire upon the death of the last individual who was a leaseholder on January 1, 1991. Currently, the Department leases 15 cabins along Cabin Slough to private individuals.

ENVIRONMENTAL SETTING

GEOLOGY, SOILS, TOPOGRAPHY, AND CLIMATE

GEOLOGY

Much of the Delta, including the LSIWA, is underlain by sedimentary bedrock overlain by thick deposits of alluvial sediments. The most recent deposits are generally dark colored, often highly organic, and of mixed lithologic composition and origin.

Three active faults lie in the area of the LSIWA and are capable of producing strong seismic shocks: the Greenville fault, Antioch fault, and Midland fault zone. The likelihood of a significant seismic event in the next 50 years is high (about the same probability as a 100-year flood event). CALFED’s Seismic Vulnerability Sub-Team of the Levees and Channels Technical Team predicted that an earthquake with a magnitude of 6.0 (Richter Magnitude) has a 25% chance of occurring in the next 50 years.

SOILS

Soils in the LSIWA reflect its original land cover, which consisted mostly of tule marsh vegetation and riparian forest vegetation, and deposition of dredged materials. Known soils in the LSIWA consist of Fluvaquents (very deep, very poorly drained soils that formed in alluvium); Medisaprists (very deep, very poorly drained organic soils in tidal marshes); and Xeropsamments (very deep, moderately well drained to excessively drained soils in areas of dredge piles that have been deposited on floodplains and natural levees).

TOPOGRAPHY

At LSIWA, much of the area that was once reclaimed as agricultural land now lies beneath Sherman Lake. This “lake” is an area of open water partially bounded by Lower Sherman Island and Sherman Island and connected to the Sacramento and San Joaquin Rivers by Mayberry Slough, Mayberry Cut, and breaks in the historic levee system. The western side of Sherman Lake is shallow (most of the area is less than 3 feet deep during low tide), whereas the eastern third of the lake is deeper (up to 12 feet).

CLIMATE

The Delta area climate is characterized by moderately cool, wet winters and hot, dry summers. Rainfall amounts at LSIWA are probably between those at Antioch and Martinez. Near LSIWA, Martinez and Antioch average daily maximum temperatures (in Fahrenheit) range from the mid-50s in the winter to high 80s in summer. Average minimum temperatures range from the high 30s to low 40s in winter and mid-50s in summer. Frosts occur in most years. In Antioch, the annual rainfall averages only 13 inches, whereas in Martinez, annual rainfall is nearly 20 inches on average. More than 90% of rainfall at Antioch and Martinez occurs during October through April.

WATER RESOURCES

HYDRODYNAMICS

Delta hydrodynamics consist of the physical effects of freshwater inflows, tidal action, and movement of water in Delta channels. Because tidal inflows are approximately equivalent to tidal outflows during each daily tidal cycle, tributary inflows and export pumping are the principal variables that define the range of hydrodynamic conditions in the Delta. The Sacramento River contributes about 77 percent of the freshwater flows, the San Joaquin River contributes roughly 15 percent, and east side streams provide the remainder. On average, 10 percent of the Delta inflow is withdrawn for local use, 30 percent is withdrawn for export by the Central Valley Project and State Water Project, and the remaining 60 percent provides outflow to the San Francisco Bay ecosystem.

Tidal changes strongly influence Delta channel conditions twice daily by changing water surface elevation, current velocity, and flow direction. Water levels, or stage, vary greatly during each tidal cycle, from less than 1 foot on the San Joaquin River near Interstate 5 to more than 5 feet near Pittsburg. In the vicinity of the LSIWA, mean higher high water is nearly 4 feet above mean lower low water.

WATER QUALITY

Salinity

Because Sherman Lake lies between the Sacramento and San Joaquin rivers, it is influenced by salinity patterns of both rivers. However, the range of salinity conditions in Sherman Lake can generally be represented by the range of conditions in the San Joaquin River at Antioch. At Antioch salinity ranges from freshwater in the winter high inflow periods to brackish with during summer. However, during wet years such as 1995 and 1998, summer low flow conditions can still be representative of a freshwater ecosystem.

Organic Carbon

In aquatic ecosystems, organic carbon is a complex mixture of different compounds. Although organic carbon is considered a "contaminant" for drinking water supplies, it is a vital nutrient for the Delta's aquatic ecosystem.

Organic carbon negatively affects the quality of drinking water. Treating Delta water to meet drinking water standards requires, among other things, simultaneous disinfection for pathogens and minimization of disinfection byproducts (DBPs), many of which are suspected carcinogens. Disinfection byproducts result when chlorine or ozone react with some forms of Dissolved Organic Carbon (DOC), under some circumstances particulate organic carbon (POC), and bromide, all of which are present in significant concentrations in Delta waters. Thus, organic carbon in Delta waters might have negative effects on water quality for those people using the Delta as a source of drinking water.

Among other sources, organic carbon is produced and modified in, and exported from, tidal marshes like those at the LSIWA. Sources of organic carbon and processes that modify organic carbon within tidal wetlands and flooded islands are especially complex and dynamic. Any contribution of tidal wetland organic carbon to DBPs in drinking water depends not only on the character of the organic carbon produced, but also on the location of the tidal wetlands and hydrodynamic conditions (which affect the movement and form of organic carbon).

Specific information on the carbon processes at LSIWA is lacking. Because organic carbon production and export is complex and affected by a variety of site-specific conditions, it is difficult, and perhaps would be overly speculative, to characterize carbon processes in Sherman Lake with existing information.

Mercury

Mercury is a highly toxic element that is found both naturally and as an introduced contaminant in the environment. Mercury contamination is widespread in sediments and waters of the Delta, including at LSIWA; this is in large part a legacy of mercury mining in the Inner Coast Ranges and of the California gold mining era when mercury was used in the gold refining process.

The ecological and human health implications of this mercury contamination are determined by the likelihood of exposure, the form of mercury present (some forms are more toxic than others), and the geochemical and ecological factors that influence how mercury moves and changes form in the environment.

Most mercury is released into the environment as inorganic mercury, which is primarily bound to sediment particles and organic substances; in this form, it may not be available for direct uptake by aquatic organisms. However, methylmercury, an extremely harmful form of mercury, is readily taken up by aquatic plants, fish, and wildlife; it has been demonstrated to bioaccumulate and transfer through the food web.

Methylmercury is formed by sulfate-reducing bacteria. The most important sites of microbial methylation in the Delta are expected to be in sediments, wetlands, and seasonally inundated, vegetated habitats that provide the necessary conditions for sulfate-reducing bacteria.

Currently, mercury is entering the waters and food web of Sherman Lake and the adjacent marshes of Lower Sherman Island. Aqueous methylmercury concentrations in paired inflowing and outflowing tidal water indicate that Sherman Island is a net source for aqueous methylmercury to surrounding waterways. Also, bioaccumulated concentrations of mercury in Corbicula clams at Sherman Island are relatively high compared to sites throughout the entire Delta (as are other sites in the western Delta).

The concern for human health stems primarily from mercury exposure through consumption of contaminated sport fish. In 1994, an interim fish consumption advisory was issued for the Delta, largely due to concern over human exposure to methylmercury (OEHHA 1994b). Recent studies in the Bay-Delta watershed have continued to find mercury concentrations of potential human health concern in several popular sport fish species.

Other Water Quality Issues

Toxic chemicals have impaired water quality in many Delta waterways. High concentrations of some metals (e.g., copper, cadmium, and lead) appear to be ubiquitous in the Delta. Pesticides are also found throughout the waters and bottom sediments of the Delta, including high levels of chlordane, toxaphene, and DDT.

Suspended sediments (silts, clays, and organic matter) are abundant in the Delta and cause turbidity throughout the region. Most of these sediments enter the Delta with the flow of the tributaries. Continuous dredging operations to maintain deep channels for shipping also contribute to turbidity problems.

In summer, extensive growth of blue-green algae and aquatic plants can contribute a considerable quantity of organic matter to shallow, dead-end sloughs; this may reduce the level of dissolved oxygen in these locations. Most channels at the wildlife area are clogged with such plant growth.

The bacteriological quality of Delta waters, as measured by the presence of coliform bacteria, varies depending upon proximity of waste discharges and significant land runoff. High concentrations of coliform bacteria are unlikely at LSIWA if the septic systems of cabins are maintained in conformance with the standards of the Sacramento County Department of Health and Human Services. Most cabins on Lower Sherman Island are “dry camps” that have no plumbing. Those cabins with plumbing discharge waste water and sewage into septic systems installed in the 1980s in coordination with the Sacramento County Department of Health and Human Services; thus, waste discharges from these cabins are unlikely to produce locally high concentrations of bacteria. The Sherman Island Public Access Facility does not have running water.

BIOLOGICAL RESOURCES OF AQUATIC ECOSYSTEMS

Aquatic Communities and Food Web

The primary energy input to aquatic ecosystems is solar radiation, which is used along with nutrients, by the primary producers (e.g., phytoplankton, vascular plants, and macroalgae) to convert inorganic carbon and nutrients to organic matter through photosynthesis. Zooplankton (e.g., copepods, cladocerans, mysid shrimp), prey on the phytoplankton. Vascular plants and macroalgae are grazed on and also produce detritus, which is decomposed by microbes and consumed by detritivores (e.g., polychaete worms, amphipods, cladocerans, and a diverse group of other fish and macroinvertebrates). The primary consumers are in turn preyed upon by secondary consumers, consisting mainly of a variety of invertebrates (e.g., polychaete worms, snails, copepods, mysid shrimp, bay shrimp, and crabs) and fish (e.g., delta smelt [*Hypomesus transpacificus*], threadfin and American shad [*Dorosoma petenense* and *Alosa sapidissima*], and juvenile chinook salmon [*Oncorhynchus tshawytscha*]). These in turn are preyed on by top consumers, including fish (e.g., striped bass [*Morone saxatilis*], catfish {Order *Siluriformes*}, sturgeon [*Acipenser* spp.], largemouth bass [*Micropterus salmoides*], and Sacramento pikeminnow [*Ptychocheilus grandis*]), birds, and humans.

Aquatic Vegetation

Submerged aquatic vegetation within the open water area of Sherman Lake is dominated by the nonnative species egeria. Egeria also dominates submerged vegetation along the shallower margins of the Sacramento and San Joaquin rivers.

Large expanses of open water at Sherman Lake are dominated by the invasive nonnative species water hyacinth. This plant readily forms dense, interconnected mats that drift along the water’s surface. Its thick, waxy leaves are held upright above the water surface on bulbous, air-filled stalks (Bossard et al. 2000).

Aquatic Habitats

Suisun Bay and the western Delta, including the LSIWA, contain several aquatic habitats, including sloughs and cuts, shallow channel and shoal areas, the main river channels, and open-water aquatic habitats. Together, these habitats support a large and diverse aquatic community, which includes recreationally important and special-status species of fish.

There are many sloughs and cuts within the Sacramento-San Joaquin Delta. Stands of emergent vegetation, particularly cattails (*Typha* spp.) and tules (*Scirpus* spp.), border many of these cuts and sloughs. In addition, there are many sloughs and cuts within Sherman Lake.

Common invertebrates that inhabit Delta sloughs and cuts include amphipods, shrimp, polychaetes (e.g., marine worms), and small bivalves (e.g., clams). Fish commonly found in the area include threadfin shad (*Dorosoma petenense*), striped bass (*Morone saxatilis*), Sacramento splittail (*Pogonichthys macrolepidotus*), delta smelt (*Hypomesus transpacificus*), tule perch (*Hysterocarpus traski*), Sacramento pikeminnow (*Ptychocheilus grandis*), white catfish (*Ameiurus catus*), yellowfin goby (*Acanthogobius flavimanus*), carp (*Cyprinus carpio*), and largemouth bass (*Micropterus salmoides*). In addition, the calm waters and shelter afforded by many of the cuts and sloughs attract early life stages of many fish species.

The area between the shore and deepwater ship channels is characterized by water depth less than 10 feet, a mud and silt or mud–sand bottom, and reduced tidal and river currents. Smaller channels are characterized by water depths less than 6 feet with a silt and mud substrate. Areas within the interior open waters of Sherman Lake are characterized as shallow shoal-type habitat. Many areas adjacent to the shoals and channels are bordered by tules.

Large numbers of small crustaceans, particularly mysid shrimp (*Mysis* spp), bay shrimp (*Palaemon macrodactylus* and *Cragon* spp.), and amphipods inhabit the shallow-water area in and adjacent to the LSIWA. These invertebrates serve as an important food supply for young-of-the-year striped bass, juvenile chinook salmon (*Oncorhynchus tshawytscha*), and other young fish. The shallow shoal areas serve as a foraging and rearing area for juvenile striped bass and chinook salmon, in addition to a variety of other resident and migratory species. Other fish found inhabiting shallow channel and shoal areas include threespine stickleback (*Gasterosteus aculeatus*), tule perch, Sacramento pikeminnow, gobies, inland silversides (*Menidia beryllina*), starry flounder (*Platichthys stellatus*), Sacramento splittail, delta smelt, carp, white catfish, and largemouth bass.

River channels are characterized by depths of more than 10 feet and strong tidal and river currents, typically 1.1-1.5 feet per second (ft/sec) or more. The river bottom in areas where water velocities are high is generally composed of sand. This is typical of the scour that occurs as a result of high tidal current velocities within the deeper levee breaches and within the navigational shipping channels (such as within the lower Sacramento and San Joaquin rivers adjacent to Sherman Lake.) Finer silt and other sediments occur in areas adjacent to the main channel or levee breaches in areas where water velocities are reduced. Invertebrates, which inhabit these channels, include bottom-dwelling polychaetes, amphipods, bivalves, and shrimp. These higher velocity areas also serve as habitat for larger predatory fish, such as striped bass, that prey on smaller fish as they pass in and out of levee breaches and higher-velocity river channels.

The open waters of the Delta serve as migratory routes for several species of anadromous fish whose adults swim upstream to the freshwater reaches of the tributary rivers to spawn and whose juveniles return downstream to the ocean. These fish include steelhead (*Oncorhynchus mykiss*), chinook salmon, white and green sturgeon (*Acipenser transmontanus* and *Acipenser medirostris*), striped bass, and American shad (*Alosa sapidissima*). In addition, the open water habitat within Sherman Lake supports populations of resident species including largemouth bass, Sacramento pikeminnow, white catfish, and threadfin shad.

Special-Status Fish Species

The Delta, including Sherman Lake and waters in the vicinity of LSIWA, serves as habitat for a variety of special-status fish species, several of which have been listed for protection under the federal and/or California Endangered Species Acts.

Chinook salmon, (winter-run, federally- and state-listed as endangered; Central Valley fall/late-fall-run, a federal species of concern and California species of special concern; and spring-run, federally- and state-listed as threatened), steelhead (Central Valley ESU, federally and State listed as threatened), and green sturgeon (proposed federal threatened listing) use the Delta in the vicinity of LSIWA as a migratory corridor. In addition, delta smelt, (federally and State listed as threatened) and Sacramento splittail, (California species of special concern) have been documented within the waters of Suisun Bay and the Delta, including in the vicinity of LSIWA.

Biological Resources of Riparian, Marsh, and Upland Ecosystems

Riparian Vegetation

At LSIWA, riparian scrub/woodland primarily occurs along the historic levees above elevations that support tidal marsh. This riparian vegetation is characterized by narrow linear strips of trees and shrubs, in single-to multiple-story canopies. Some areas consist primarily of shrubs and short trees, whereas in other areas tree canopies can be continuous and can attain heights of 30 feet or more. Native woody plant species occurring in riparian vegetation at LSIWA include Fremont cottonwood (*Populus fremontii*), Goodding's black willow (*Salix gooddingii*), arroyo willow (*Salix lasiolepis*), sandbar willow (*Salix exigua*), red alder (*Alnus rubra*), and California rose (*Rosa californica*). Much of this vegetation type is infested with the invasive nonnative, Himalayan blackberry (*Rubus discolor*), which commonly creates dense, impenetrable thickets along levee surfaces.

In addition to Himalayan blackberry, several invasive non-native species may be present in riparian scrub/woodland at LSIWA. Control of these invasive plants is an important component of enhancing and restoring riparian ecosystems at LSIWA.

Marsh Vegetation

Marsh vegetation at LSIWA includes both emergent marsh and areas of floating aquatic vegetation. Most emergent marsh is dominated by softstem bulrush, California bulrush, cattails, and common reed. In the northwestern portion of Lower Sherman Island, there is also upper elevation marsh dominated by pickleweed and saltgrass. Floating aquatic vegetation is along major channels and the lower elevation fringe of marshes. It is actually a mosaic of scattered bulrushes and floating aquatic vegetation (consisting of water primrose, floating pennywort, and water hyacinth)

Currently, there is little cover of non-native invasive species in most marshes of LSIWA. However, perennial pepperweed (*Lepidium latifolium*) has become abundant in the upper elevation marsh and adjacent uplands in the northwestern portion of Lower Sherman Island.

Upland Vegetation

Grasslands at the LSIWA are dominated by annual grasses, such as wild oats, soft chess, and annual ryegrass (*Lolium multiflorum*), but also include many perennial species that are also common in seasonal wetlands, such as prickly lettuce (*Lactuca serriola*), Bermuda grass (*Cynodon dactylon*), and curly dock (*Rumex crispus*). The grasslands also support invasive nonnative species, in particular Pampas grass (*Cortaderia selloana*) and perennial pepperweed.

Along the northwestern shoreline of Lower Sherman Island there are patches of grassland dominated by tufted hairgrass (*Deschampsia cespitosa* ssp. *holciformis*), a native perennial. This is one of the last representatives of this distinctive plant association in the Delta.

The species composition of disturbed and developed areas at LSIWA is similar to that of grasslands and of riparian scrub, except a number of weedy species (such as prostrate knotweed [*Polygonum aviculare*]) are more common, and bare or sparsely vegetated areas are frequent. Some ornamental tree and shrub species may also occur in these areas, particularly along Cabin Slough.

SPECIAL-STATUS PLANT SPECIES

The Delta is home to many special-status plant species. The California Natural Diversity Data Base (CNDDB) reports that two of these species occur at the LSIWA: Suisun Marsh aster (*Aster lentus*) and Mason’s lilaeopsis (*Lilaeopsis masonii*). Both of these species grow along the shoreline of Lower Sherman Island. There they grow on eroding banks and adjacent marsh of the intertidal zone. Recently, Delta tule pea (*Laythrus jepsonii* var. *jepsonii*), has also been observed at Lower Sherman Island.

Nine additional special-status plant species could occur at the LSIWA, but have not been documented as present: bristly sedge (*Carex comosa*), soft bird’s beak (*Cordylanthus mollis* ssp. *mollis*), Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*), rose-mallow (*Hibiscus lasiocarpus*), Delta mudwort (*Limosella subulata*), Antioch Dunes evening-primrose (*Oenothera deltoides* ssp. *howellii*), marsh skullcap (*Scutellaria galericulata*), and blue skullcap (*Scutellaria lateriflora*). Habitat for one or more of these species occurs in uplands, riparian areas, and upper and lower elevation zones of marshes.

WILDLIFE

At the LSIWA, habitat exists for a wide variety of wildlife species, including numerous bird species. Many of the species that occur in the wildlife area are there only, or primarily, during the fall and winter months, when the Central Valley (including the Delta) becomes home to an abundance of migratory and wintering birds. The most conspicuous groups of wintering birds include waterfowl, shorebirds and wading birds, and raptors. Other groups that utilize the wildlife area include upland game species, cavity-nesting birds, and neotropical migratory birds.

Waterfowl

Because LSIWA is largely inundated, it is of significance for wintering waterfowl that migrate down the Pacific Flyway each year. Species that occur include northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), cinnamon and green-winged teal (*Anas cyanoptera* and *A. crecca*), lesser scaup (*Aythya affinis*), ring-necked duck (*Aythya collaris*), and white-fronted goose (*Anser albifrons*). Some species, such as mallard, gadwall, and Canada goose (*Branta canadensis*) may be year-round residents and breed locally in wetlands and nearby uplands. The number of waterfowl in the wildlife area is greatest during December–April. At LSIWA, open water, marsh, and some uplands provide habitat for waterfowl.

Shorebirds and Wading Birds

Several species are common in the intertidal areas of Lower Sherman Island. Some of these shorebird and wading bird species are winter migrants; others are year-round residents. Although habitat for each species may include only a limited range of conditions in one or a few land cover types, the shorebird and wading bird guilds use a wide range of areas within several land cover types. Representative species of the shorebird and wading bird guilds include great blue heron (*Ardea herodias*), great egret (*Ardea alba*), western sandpiper (*Calidris mauri*), and long-billed dowitcher (*Limnodromus scolopaceus*).

Herons and egrets are common year-round residents that breed in rookeries throughout the Delta. Most of these rookeries include mixed species, mainly great blue heron, great egret, and black-crowned night-heron (*Nycticorax nycticorax*). No wading bird rookeries, however, are known from the wildlife area.

Riparian, marsh, and open water at the LSIWA provide habitat for species of shorebirds and wading birds.

Neotropical Migratory Birds

Many species of neotropical migratory birds migrate through or breed in the Delta, including the LSIWA. Neotropical migratory birds are species that breed in North America and winter in Central and South America. Representative species that breed and/or migrate through the area include western kingbird (*Tyrannus verticalis*), western wood-pewee (*Contopus sordidulus*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), Bullock's oriole (*Icterus bullockii*), Wilson's warbler (*Wilsonia pusilla*), and yellow warbler (*Dendroica petechia*).

Raptors

A variety of wintering and/or breeding raptors utilize the Delta, including red-tailed hawk (*Buteo jamaicensis*), white-tailed kite (*Elanus leucurus*), short-eared owl (*Asio flammeus*), and northern harrier (*Circus cyaneus*). Most of these raptors use grasslands and other open areas for foraging, and riparian areas for cover or nesting, and may occur at the wildlife area.

Cavity-nesting Birds

Cavity-nesting birds, such as kestrels, tree swallows, and wood ducks (*Aix sponsa*) may use the wildlife area. Swallows are summer migrants, occurring in the wildlife area from late winter to early fall (February–October), with peak abundance generally in June and July. Post-breeding flocks of swallows may occur in the late summer, particularly when flying insect populations associated with marshes are abundant.

Upland Game Birds

Grassland and other uplands in the wildlife area may provide habitat for several upland game birds of interest to hunters. The primary upland game bird species that utilizes the wildlife area is mourning dove (*Zenaida macroura*).

Other Wildlife Species

The upland grassland and disturbed areas at the LSIWA have the potential to support several common mammal species, such as black-tailed jack rabbit (*Lepus californicus*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), California ground squirrel (*Spermophilus beecheyi*), California vole (*Microtus californicus*), western harvest mouse (*Reithrodontomys megalotis*), house mouse (*Mus musculus*), Botta's pocket gopher (*Thomomys bottae*), Virginia opossum (*Dedelphis virginiana*), feral cats (*Felis domesticus*), Norway rat (*Rattus norvegicus*), and possibly coyote (*Canis latrans*) and red or gray foxes (*Vulpes vulpes*, *Urocyon cinereoargenteus*).

Marsh vegetation at the wildlife area likely supports muskrat (*Ondatra zibethicus*) and American beaver (*Castor canadensis*), and may support northern river otter (*Lutra canadensis*), or American mink (*Mustela vision*).

Common reptile and amphibian species most likely found in and around the LSIWA include western fence lizard (*Sceloporus occidentalis*), common garter snake (*Thamnophis sirtalis*), western rattlesnake (*Crotalis viridis*), gopher snake (*Pituophis melanoleucus*), Pacific tree frog (*Hyla regilla*), western toad (*Bufo boreas*), bullfrog (*Rana catesbeiana*), and possibly red-eared slider turtles (*Chrysemys scripta*).

Aquatic areas of LSIWA provide foraging habitat for several species of bats, however, suitable roosting habitat may be lacking.

SPECIAL-STATUS WILDLIFE SPECIES

Three special-status wildlife species have been documented at the LSIWA: saltmarsh common yellowthroat (*Geothlypis trichas sinusa*), Suisun song sparrow (*Melospiza melodia maxillaries*), and double-crested cormorant (*Phalacrocorax auritas*). Saltmarsh common yellowthroat and Suisun song sparrow use marsh vegetation on Lower Sherman Island; a breeding colony of double-crested has been documented adjacent to the wildlife area on Donlon Island, and the birds forage in the open water of Sherman Lake.

The presence of other special-status wildlife species, however, cannot be discounted because biological surveys for these species have not been conducted in the wildlife area. An additional 27 special-status wildlife species could potentially use habitat at the LSIWA. These species include one invertebrate (valley elderberry longhorn beetle [*Desmocerus californicus dimorphus*]), three reptiles (silvery legless lizard [*Anniella pulchra pulchra*], giant garter snake [*Thamnophis gigas*], and northwestern pond turtle [*Actinemys marmorata marmorata*]), two mammals (salt-marsh harvest mouse [*Reithrodontomys raviventris*] and ringtail [*Bassariscus astutus*]), and sixteen birds. Special-status bird species that could occur at the LSIWA include:

- white pelican (*Pelecanus erythrorhynchos*),
- rookeries of wading birds (great blue heron [*Ardea herodias*], great egret [*Ardea alba*], snowy egret [*Egretta thula*], and black-crowned night-heron [*Nycticorax nycticorax*]),
- several raptors (including white-tailed kite [*Elanus leucurus*], Swainson’s hawk [*Buteo swainsoni*], northern harrier [*Circus cyanus*], and American peregrine falcon [*Falco peregrinus anatum*]),
- California black and California clapper rails (*Laterallus jamaicensis coturniculus* and *Rallus longirostris*, respectively),
- Greater sandhill crane (*Grus Canadensis*),
- Long-billed curlew (*Numenius americanus*)
- California least and black terns (*Sterna antillarum browni* and *Chlidonias niger*, respectively),
- Western Burrowing and short-eared owls (*Athene cunicularia* and *Asio flammeus*),
- Loggerhead shrike (*Lanius ludovicianus*),
- California horned lark (*Eremophila alpestris actia*),
- Yellow warbler (*Dendroica petechia Brewsteri*), and
- Tricolored blackbird (*Agelaius tricolor*).

CULTURAL RESOURCES

Native Americans would have actively exploited the resources of the area. Long-term habitation in the marshes would not have occurred although temporary or seasonal hunting or gathering camps likely would have been established on some of the higher ground. Such task-specific sites, if they were established on Lower Sherman Island, may still exist or may have been destroyed by extensive historic-era manipulation of the landscape.

Although the first long-term European settler of Sherman Island arrived in 1855, actual reclamation of the island for agricultural purposes did not begin until 1869 when 14,000 acres were leveed in. Extensive levee and canal systems were designed to drain what were otherwise perennially submerged areas. Initial levees were fairly small (e.g., 4 feet high and 12 feet at the base) and proved inadequate mostly owing to the local unstable peat soils. Although several years of profitable farming was conducted in the early 1870s, on January 9th of 1872 the first major indication that the early levee system was unsuited to the region came when two hundred feet of levee on the Sacramento River side of the island failed, completely flooding the island. The continued reclamation and preservation of Sherman Island had cost $500,000 by early 1874 but repeated massive flood episodes throughout the early 1870s resulted in Lower Sherman Island being completely abandoned as an agricultural venture by 1875.

Despite the long recorded history of Lower Sherman Island and the extensive historic-era activities associated with land reclamation and agriculture in the area, few cultural resources other than significant landscape features have been recorded. A record search conducted through the North Central Information Center (NCIC) of the California Historical Resources Information System showed that only the actual levee system encompassing Sherman Island and Lower Sherman Island has been documented as part of a 1997 cultural resources investigation related to a levee improvement project (Orlins 1997). However, a number of shipwrecks or abandoned vessels of unknown age have been noted just to the southeast of the intersection of Mayberry Slough and the Mayberry Cut, and at the southeastern end of Cabin Slough at Kimball Island.

In addition to the levee system itself and the remains of the abandoned vessels, verbal communication with Tim Arts (Department of Boating and Waterways) indicates that at least one house in the Cabin Slough area may date to the agricultural era of Lower Sherman Island. However, additional research would be necessary to confirm the general age and potential significance of the building or buildings.

PUBLIC USE

LSIWA has a long history of public use beginning decades before the area came under the management of the Department, particularly hunting and fishing. Those two activities are the focus of most public use today. Other recreation uses include wildlife observation and photography, windsports, and powered and non-powered boating. Regarding non-recreation public uses, LSIWA has been the site of environmental research. No commercial activities are based in LSIWA, although guided fishing trips may spend time in the area, and a gas pipeline crosses the west side of the area.

Recreational activities at LSIWA are constrained by the relative inaccessibility, aside from access by boat. Never-the-less, LSIWA receives substantial amounts of recreational use focused primarily on hunting and fishing and, in the County-operated Sherman Island Public Access Facility, wind sports such as boardsailing and kite surfing. Other activities include motorized pleasure boating, non-motorized boating, camping, wildlife observation.

HUNTING

Waterfowl hunting is one of the major uses of LSIWA during the October through January season. The area is open to all and there is no fee to hunt. Waterfowl hunting is the primary form of hunting at the LSIWA, but the Fish and Game Code specifies that coots, moorhens, pheasants, doves, and rabbits may also be hunted.

A hunting group active in LSIWA for many years is the Lower Sherman Island Duck Hunter's Association. The Association was not founded until approximately1990 but some members of the group have many years of experience hunting at LSIWA and in some cases a multi-generational family history of hunting in the area.

This long established use of the area for duck hunting included the construction of duck blinds, which continued until recent years. The Lower Sherman Island Duck Hunter's Association has agreed with the Department to not construct new blinds in LSIWA but is permitted to maintain existing blinds. These are generally wood or metal frame structures onto which cut native vegetation is laid. Hunters also use boat-mounted blinds.

FISHING

Several sources of information for Delta anglers direct them to Lower Sherman Island as one of the most productive places for both striped bass and black bass fishing in the Delta. Sherman Lake is also listed by some sources as one of the best Delta locations to catch catfish.

Fishing occurs year round at LSIWA. Striped bass fishing is most popular in the fall, winter and spring, coinciding with the fish migration, but resident fish are caught during the summer. Black bass fishing is most popular in the spring and fall, although bass fishing occurs year-round. Summer is the most popular time for anglers to pursue catfish.

The best seasons for sturgeon are generally winter and spring, but these fish are usually caught in the deeper waters of the large rivers and sloughs and in downstream Suisun and San Pablo Bays, rather than in the more shallow Sherman Lake.

As a result of the generally poor access from land, there is relatively little shore angling in the LSIWA, although it is possible at areas around the Sherman Island Public Access Facility. Most of Sherman Lake is not accessible except by boat.

The level of angling activity is not known. However, informal observations by Department staff suggest that the level of activity is substantial. Several factors contribute to a potential for a high level of angling activity: good fishing conditions; angler's knowledge and publicizing of the area; easy boat access from both the Sherman Island Public Access Facility and from the Sacramento and San Joaquin Rivers; the presence of boat ramps, marinas, and fishing charters in nearby communities such as Oakley, Antioch, Pittsburg and Rio Vista; and frequent fishing tournament activity in the west Delta.

BOATING

Information on recreational boating activities unrelated to hunting and fishing (i.e., pleasure boating) at Sherman Lake is limited. However, boaters do use the area. Hunters and anglers report occasional use by water skiers, jet skiers, and others. The shallowness of the area and the presence of aquatic weeds and shoals reduce use of the area by pleasure boaters.

Berthing and ramps are available on the nearby portions of the San Joaquin River in Pittsburg, Antioch, and Oakley, at both public sites and private marinas. Marinas include Antioch Marina, Big Break Marina, Lauritzen Yacht Harbor, Lloyd's Holiday Harbor, New Bridge Marina, and San Joaquin Yacht Harbor. In addition to ramps at several of these marinas, boaters may use the Antioch Municipal Boat Ramp, directly across the river from LSIWA.

OTHER RECREATION ACTIVITIES

RV and tent camping is permitted at the Sherman Island Public Access Facility, although no formal campsites have been developed. There is space for about 20–30 RVs. No electricity or sewerage hookups are provided. The area receives substantial use for camping during the summer when sailboarding and kite-surfing conditions are good.

Wind-sport enthusiasts may use Sherman Lake, but the great majority launching from the small beach launch sites at the Sherman Island Public Assess Facility focus their activity on the Sacramento River and are within LSIWA only when starting and ending their activity on the water.

There are short trails through riparian scrub at the Sherman Island Public Access Facility used primarily by board sailors to reach the water. Boardwalks that have been constructed by hunters lead from sloughs to blinds constructed on ponds in the interior of the marsh.

Aside from the picnic sites at the Sherman Island Public Access Facility, there are no developed vantage points to view Sherman Lake from within the project site. Views of Sherman Lake are enjoyed from the adjacent Sherman Lake Resort and marina and the levee road leading to the marina.

Boaters using non-powered craft such as kayaks and canoes use Sherman Lake in low numbers. Some of these boaters launch from the Sherman Island Public Access Facility ramp and it is possible for others to cross into LSIWA from access points to the south on the San Joaquin River. However, crossing of the wide and tidally-influenced river would be expected to discourage most non-powered boaters. Sherman Lake within LSIWA is also subject to strong tidal flows, which may also discourage use by paddle-craft.

LSIWA provides opportunities for wildlife observation and photography, both from the Sherman Island Public Access Facility and from the water and old levee areas accessible only by boat.

RESEARCH ACTIVITY

LSIWA has been the site of several CALFED-sponsored and other research projects in recent years, as the scientific community has focused a tremendous amount of interest and effort on learning about the biological conditions and processes in the Delta and has investigated ecological restoration options. Examples of recent study topics include: effects of fire on a large areas of the marsh burned in 2004, tidal marsh sedimentation, and the process of natural marsh restoration in Sherman Lake since levees were breached several decades ago.

MANAGEMENT GOALS

In the LMP, the current and planned management of the LSIWA is described using the terminology that is part of the Department's standardized format for management plans. This terminology includes the terms element, goal, and task, which are defined below.

Element: refers to any biological unit, public use activity, or facility maintenance or management coordination program as defined below for which goals have been prepared and presented within this plan.

Goal: is a statement describing management and its intended long-term results for an element.

Task: an individual project or work element that implements the goals and is useful in planning operation and maintenance budgets.

This LMP contains 11 elements. These are:

- Riparian and upland ecosystems,
- Marsh ecosystems,
- Aquatic ecosystems
- Cultural resources,
- Authorized public use,
- Unauthorized public use,
- Facilities,
- Administration,
- Fire management,
- Scientific research and monitoring, and
- Management review and coordination.

For these elements, the LMP has 34 goals and 142 tasks. Table ES-1 lists these goals and tasks organized by element.

It is important to note that implementation of many of the tasks identified in the LMP is dependent upon the availability of the necessary staff and an adequate operations and maintenance budget. Thus, additional resources may be required to accomplish the tasks identified in the LMP.

OPERATIONS AND MAINTENANCE

Additional staffing and resources will be required to perform the tasks that described in this LMP. Currently, the LSIWA is not currently assigned specific staff time or budget. This LMP proposes to manage ecosystems of LSIWA at a level that is more intense than the past. Thus, it will require a commitment of additional budgetary resources if the goals of this plan are to be achieved.

To appropriately support the LSIWA and to perform the tasks identified in this LMP, a position assigned specifically to the LSIWA is proposed with additional support provided by other permanent Department staff augmented by seasonal labor. The staff and supporting labor required to implement this LMP is described in Chapter 5 *Operations and Maintenance*.

Increased day to day field operations will require 1 personnel year (PY) of a Wildlife Habitat Supervisor I position to be assigned specifically to the LSIWA. This individual will act as the Area Manager for the LSIWA, performing administration (including enforcement of provisions of cabin leases), and planning and coordination of management, as well as the basic communication, monitoring, and support functions that are required for operation and maintenance of the wildlife area. The individual will also assist and direct regular DFG staff, seasonal labor, and volunteers performing maintenance and other tasks required to implement this LMP.

Additional labor required to implement the tasks of this LMP include approximately 500 hours per year of support from Tractor Operators/Laborers, 300 hours per year of support from Wildlife Biologists, 300 hours per year of support from Fish and Game Wardens, and 40 per year of support from Archeologists. These staff will not be assigned specifically to the LSIWA; rather, Department staff will perform necessary tasks on an as-needed basis, and the cost of this labor will be budgeted as an operations and maintenance expense for the LSIWA.

In addition to this labor, initial additional equipment that would be required for implementation of this LMP will include:

- One operations vehicle (1/2 or ¾ ton 4wd pickup),
- One jet boat with trailer for patrol and operations, and
- Office space and equipment (computer, printer, phone, etc.) for the Area Manager.

Occasionally, other capital equipment will be required for a particular task. The use of this equipment will be an operations and maintenance expense.

FUTURE REVISIONS

To keep this LMP up to date, a process is required to accommodate minor revisions that may include the adoption of limited changes to the goals and tasks that are directed through adaptive management, by other scientific information, or by legislative direction. The minor revision may be prepared by the staff assigned to LSIWA or with other Department resources and requires approval by the Regional Manager.

Major revisions or a new LMP could occur, if new policy direction requires a procedure comparable to the LMP planning process. A major revision or new plan requires recommendation by the Regional Manager and approval by the Director of the Department.

A comprehensive review of the achievement of the goals of the LMP should be prepared every five years following the date of adoption. A status report documenting this review should be prepared by the Area Manager. It should be submitted to the Department's Lands and Facilities Branch for review and comment, approved by the Regional Manager, and submitted to the Director of the Department. This report should serve as a basis for revision of this LMP and appropriate adjustments to ongoing management practices.

ENVIRONMENTAL REVIEW

The management goals and tasks described in this LMP were evaluated for their potential impact on the environment in accordance with the provisions of the California Environmental Quality Act (CEQA). An Initial Study, which is included as Appendix B, was prepared in accordance with the State CEQA Guidelines. This Initial Study concluded that this LMP, as proposed, would not have a potentially significant impact on the environment. Accordingly, a Negative Declaration is proposed to document that the project will not have a significant impact on the environment.

This CEQA document analyzes impacts resulting from the programmatic implementation of this LMP. The details of specific projects that may be developed consistently with this LMP are not yet known. Any future projects that may involve environmental effects will need to be evaluated in light of the IS/ND to determine if additional project-specific CEQA analysis is necessary. Permits, consultations and/or approval actions may also be required to approve specific future projects. Examples of potential future permit requirements include the following:

- **U.S. Army Corps of Engineers (USACE) –** Section 404 of the Clean Water Act (CWA), permit for discharge of fill in waters of the U.S.; Section 10 Rivers and Harbors Act permit for work in navigable waters of the U.S.; approval of modification of USACE levees.

- **California Department of Fish and Game –** streambed alteration agreement (Section 1602 of Fish and Game Code);

- **California Department of Water Resources (State Reclamation Board) –** encroachment permit to work on or adjacent to levees and in designated floodways, approval/authorization of new or restored levees;

- **California State Lands Commission –** consultation/permit regarding possible use of or impacts to submerged lands, including surrounding in-channel islands and lands underlying rivers and streams; and

- **Regional Water Quality Control Board –** National Pollutant Discharge Elimination System construction stormwater permit (Notice of Intent to proceed under the statewide General Construction Permit), potential discharge permit for wastewater, general order for dewatering, CWA Section 401 certification if a Section 404 permit is required.

Table ES-1
Summary of Management Goals and Tasks of the Land Management Plan.

GOALS	TASKS
Biological Elements - Riparian and Upland Ecosystems	
Goal 1: Maintain and enhance habitat for special-status species	**Task 1.1**. Conduct surveys for salt-marsh harvest mouse, and other special-status animals and special-status plants that may be present in riparian and upland ecosystems at LSIWA.
	Task 1.2. Manage public use to minimize effects on habitat areas occupied by special-status species.

Table ES-1 Summary of Management Goals and Tasks of the Land Management Plan.	
GOALS	TASKS
	Task 1.3. Periodically visit populations of special-status plant species to assess overall habitat integrity and to detect changes in distribution and abundance, and to detect adverse effects of human use, erosion or nonnative species. **Task 1.4**. Develop and implement enhancement strategies that use natural processes to improve habitat for ground-nesting birds and special-status species using riparian and upland ecosystems at the LSIWA.
	Task 1.5. Ensure that all actions undertaken within riparian communities comply with the State and Federal Endangered Species Acts, Section 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations aimed at the protection of special-status species or their habitat.
Goal 2: Prevent the introduction and spread of invasive nonnative species.	**Task 2.1**. Monitor hot spots of introduction to enable early detection and rapid eradication of invasive species (e.g., sites along West Sherman Island Road, trails, near cabins, parking areas, etc.) **Task 2.2**. Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed. **Task 2.3**. Clean vehicles and clothing after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders). **Task 2.4**. Coordinate with and support regional control efforts, such as Team Arundo Del Norte and efforts coordinated by the Sacramento County Weed Management Area. **Task 2.5**. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program. **Task 2.6**. Apply pesticides in conformance with the Department's Pesticide Use Program, to ensure safe and effective pesticide use that minimizes adverse environmental effects.
Goal 3: Control and manage existing infestations of established invasive plant species.	**Task 3.1**. Identify nonnative plant species that have invaded and prioritize management of particular weed species based on their potential impacts to ecosystem functions and human uses (e.g., boat access) and infrastructure, and the feasibility and impacts of control; existing state and federal priorities should be followed where appropriate. **Task 3.2**. Determine appropriate prevention, eradication, and control options for priority weed species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative. **Task 3.3**. Implement appropriate prevention, eradication, and control options for priority weed species. **Task 3.4**. Coordinate with and support regional control efforts, such as Team Arundo Del Norte and efforts coordinated by the Sacramento County Weed Management Area. **Task 3.5**. Periodically evaluate effectiveness of control methods and adjust methods as needed.

Table ES-1 Summary of Management Goals and Tasks of the Land Management Plan.	
GOALS	TASKS
	Task 3.6. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program. **Task 3.7**. Apply pesticides in conformance with the Department's Pesticide Use Program, to ensure safe and effective pesticide use that minimizes adverse environmental effects.
Goal 4: Restore degraded and disturbed riparian and upland areas to conditions that provide desired ecological functions.	**Task 4.1**. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible riparian and upland restoration projects that would support the goals of this LMP, including review of existing documents and/or conduct of additional assessments (e.g., of physical and biological conditions). **Task 4.2**. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule. **Task 4.3**. Cooperate with the development and implementation of local and regional restoration plans for upland and riparian ecosystems by the Ecosystem Restoration Program of the California Bay-Delta Program and other programs that are consistent with the goals of this LMP.
Biological Elements – Marsh Ecosystems	
Marsh Goal 1: Maintain and enhance habitat for special-status species.	**Task 1.1.** Conduct surveys for California black rail, western pond turtle, giant garter snake, other special-status animals, and special-status plants that could be present in emergent marsh ecosystems at LSIWA. **Task 1.2**. Manage public use to minimize effects on areas occupied by special-status species. **Task 1.3**. Periodically visit populations of special-status plant species to assess overall habitat integrity and to detect changes in distribution and abundance, and to detect adverse effects of human use, erosion or nonnative species. **Task 1.4**. Develop and implement enhancement strategies that use natural processes (e.g., tidal action) to improve habitat for special-status species using marsh ecosystems at the LSIWA. **Task 1.5**. Ensure that all actions undertaken within marsh ecosystems comply with the State and Federal Endangered Species Acts, Section 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations.
Marsh Goal 2: Maintain and enhance habitat for waterfowl species.	**Task 2.1**. Monitor and assess fire and human use effects on habitat for waterfowl. **Task 2.2.** Support the development of Annual Habitat Work Plans by hunters to maintain and enhance habitat for game species. **Task 2.3.** Periodically evaluate the hunting program and regulations and recommend changes as warranted to maintain and enhance marsh habitats for waterfowl.
Marsh Goal 3: Prevent the introduction and spread of invasive nonnative species.	**Task 3.1.** Monitor hot spots of introduction to enable early detection and rapid eradication of new invasive species (e.g., sites along West Sherman Island Road, trails, near parking areas at the Sherman Island Public Access Facility, buildings at Cabin Slough).

Table ES-1 **Summary of Management Goals and Tasks of the Land Management Plan.**	
GOALS	TASKS
	Task 3.2. Develop and implement a plan for the removal of nonnative plant species from recreational home sites leased along Cabin Slough (as required by Section 1526.4 of the Fish and Game Code). **Task 3.3.** Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders). **Task 3.4.** Clean vehicles and clothing after leaving infested areas and before entering uninfested areas. **Task 3.5.** Detect and eradicate small populations of invasives. **Task 3.6.** Coordinate with and support regional control efforts (e.g., the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife). **Task 3.7.** Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.
Marsh Goal 4: Control and manage existing infestations of established invasive plant species.	**Task 4.1.** Identify nonnative plant species that have invaded and prioritize management of particular weed species based on potential impacts to ecosystem function, human uses and infrastructure, and feasibility and impacts of control; existing state and federal priorities should be followed where appropriate. **Task 4.2.** Determine appropriate prevention, eradication, and control options for priority weed species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative. **Task 4.3.** Implement appropriate prevention, eradication, and control options for priority weed species. **Task 4.4.** Coordinate with and support regional control efforts (e.g., the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife). **Task 4.5.** Periodically evaluate effectiveness of control methods and adjust methods as needed. **Task 4.6.** Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.
Marsh Goal 5: Restore degraded and disturbed areas (e.g., wetlands in northwestern corner of Lower Sherman Island) to conditions that provide desired ecological functions.	**Task 5.1.** Evaluate opportunities, constraints, and potential restoration benefits to identify feasible marsh restoration projects that would support the goals of this LMP, including review of existing documents and/or conduct of additional assessments of physical and biological conditions. **Task 5.2.** Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule. **Task 5.3.** Cooperate with development and implementation of local and regional restoration plans for marsh and other wetland ecosystems by the CALFED Ecosystem Restoration Program and other programs that are consistent with the goals of this LMP.

Table ES-1 Summary of Management Goals and Tasks of the Land Management Plan.	
GOALS	TASKS
Biological Elements - Aquatic Ecosystems	
Goal 1: Maintain and enhance habitat for special-status species.	**Task 1.1.** Monitor use of aquatic ecosystems at LSIWA by special-status aquatic species. **Task 1.2.** Improve habitat for special-status aquatic species using aquatic ecosystems at the LSIWA.
	Task 1.3. Ensure that all actions undertaken at LSI wildlife area comply with the State and Federal Endangered Species Acts, Sections 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations aimed at the protection of special-status species or their habitat.
Goal 2: Maintain and enhance habitat for native and nonnative sport fish species.	**Task 2.1.** Monitor and assess human use, invasive nonnative species, and other effects on habitat for sport fish species. **Task 2.2.** Periodically evaluate angling use and regulations and recommend changes as warranted to maintain and enhance aquatic habitat for sport fish species.
Goal 3: Prevent the introduction and spread of invasive nonnative species.	**Task 3.1.** Monitor hot spots of introduction to enable early detection and rapid eradication of invasive species (e.g., the County-operated boat launch). **Task 3.2.** Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed. **Task 3.3.** Clean boats and vehicles after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders). **Task 3.4.** Coordinate with and support regional control efforts, such as the Department of Boating and Waterways (DBW) Aquatic Pest Control Program. **Task 3.5.** Provide education and outreach to support control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.
Goal 4: Control and manage existing infestations of established invasive plant species.	**Task 4.1.** Prioritize management of particular invasive plant species based on potential impacts to ecosystem function, human use and infrastructure, and feasibility and impacts of control; existing state and federal priorities should be followed where appropriate. **Task 4.2.** Determine appropriate prevention, eradication, and control options for high priority invasive plant species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative. **Task 4.3.** Implement appropriate prevention, eradication, and control options for high priority invasive species. **Task 4.4.** Coordinate with and support regional control efforts (e.g., on-going efforts by the DBW to control water hyacinth). **Task 4.5.** Periodically evaluate effectiveness of control methods and adjust methods as needed. **Task 4.6.** Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.

Table ES-1 Summary of Management Goals and Tasks of the Land Management Plan.	
GOALS	TASKS
Goal 5: Restore degraded aquatic ecosystems to conditions that provide desired ecological functions.	**Task 5.1.** Cooperate with development and implementation of local and regional restoration plans for aquatic ecosystems by the CALFED Ecosystem Restoration Program and other programs that are consistent with the goals of this LMP. **Task 5.2.** Identify other opportunities to restore aquatic ecosystems at LSIWA.
	Task 5.3. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.
Cultural Resources Element	
Cultural Resources Goal 1: Catalog and preserve all significant prehistoric, historic-era, or present-day Native American cultural resources that documentary and/or field investigations identify within the LSIWA.	**Task 1.1.** Conduct cultural resource surveys as necessary prior to ground-disturbing activities, and prepare an "inadvertent discovery plan" to be utilized during implementation of any project involving ground-disturbance. The inadvertent discovery plan shall refer to and outline state law regarding the discovery of human remains and include a requirement to consult with a qualified archaeologist in the case of a discovery of cultural resources or human remains during ground-disturbing activities. **Task 1.2.** If cultural resources are found during surveys or excavation, complete and submit resource documentation to the California Historical Resources Information System. If these resources are potentially eligible for listing on the National Register of Historic Places and/or the California Register of Historical Resources, submit evaluations of these resources to the State Historic Preservation Officer and the Office of Historic Preservation. **Task 1.3.** When facility improvements or restoration efforts are proposed that may affect significant cultural resources, consult the CEQA guidelines and/or Section 106 of the National Historic Preservation Act (if federal involvement) for guidance on compliance with regulations.
	Task 1.4. Support efforts to document the history of human activities at the LSIWA.
Authorized Public Use Element	
Goal 1: Support compatible public uses through public outreach, signage, and regulations.	**Task 1.1.** Inform users regarding <u>the wildlife area's boundaries and</u> compatible public uses by providing signage at major access points to the LSIWA and on the Department's web site. **Task 1.2.** Include a contact person's name, phone number and email at the Department for questions, comments, and suggestions regarding compatible uses of the LSIWA. **Task 1.3.** Periodically conduct reviews of public uses of the LSIWA and evaluate rules, regulations, guidelines and materials to ensure compatibility of public uses.
Goal 2: Provide long-term opportunities for hunting and increase opportunities for wildlife-dependent recreation.	**Task 2.1.** Coordinate with non-profit groups (e.g., Lower Sherman Island Duck Hunter's Association and California Waterfowl Association) that promote wildlife-dependent recreational or hunting opportunities that can provide additional support to the Department's management of the LSIWA. **Task 2.2.** Identify potential conflicts with other recreational uses and resolve such conflicts.

Table ES-1 Summary of Management Goals and Tasks of the Land Management Plan.	
GOALS	TASKS
	Task 2.3. Inform the public of times and locations where hunting is allowed and of all other restrictions and applicable regulations through outreach, signage, and the Department's website. **Task 2.4.** Monitor or supervise hunting activities as needed. **Task 2.5.** Periodically evaluate the hunting program and regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.
Goal 3: Provide long-term opportunities for fishing.	**Task 3.1.** Coordinate with non-profit groups that promote fishing opportunities that can provide additional support to the Department's management of the LSIWA. **Task 3.2.** Identify potential conflicts with other recreational uses and resolve such conflicts. **Task 3.3.** Inform the public of dates and locations where fishing is allowed and of all other restrictions and applicable regulations through outreach, signage, and the Department's website. **Task 3.4.** Monitor or supervise fishing activities as needed. **Task 3.5.** Periodically evaluate the fishing program and regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.
Goal 4: Manage water surfaces and use areas to accommodate a variety of different user groups and minimize competition and conflicts among users.	**Task 4.1.** Encourage boater safety through monitoring and enforcement of regulations, including the 5 mph speed limit and proper disposal of wastes. **Task 4.2.** Periodically evaluate management of water surfaces and associated regulations to identify changes that are warranted to maintain consistency with the goals of this LMP. **Task 4.3.** Post signs with boating regulations at major access points.
Goal 5: Support use of the LSIWA for environmental education.	**Task 5.1.** Provide staff assistance, interpretive materials, and provision of permits for environmental education activities. **Task 5.2.** Encourage all environmental education and natural resource interpretation (informal education) users to incorporate the Department's guidelines for natural resource education messages in their field environmental education activities, curriculums, and interpretive programs, both on and off-site.
Goal 6: Evaluate requests by Native Americans for use of the wildlife area for activities such as gathering native plant materials for cultural purposes.	**Task 6.1.** Work with native peoples requesting access to determine the purpose and need for access and/or collections within the LSIWA based on applicable laws and treaties related to tribal use of state properties. **Task 6.2.** Develop access plans and issue permits for native peoples that are compatible with the goals of the LMP. Any authorization for access would identify species, limits, locations, seasons, and include standard liability clauses.
Goal 7: Make the public aware of potential risks in order to encourage safe use of LSIWA.	**Task 7.1.** Identify areas where warning signs or marker buoys are needed. **Task 7.2.** Subject to funding, install warning signs or marker buoys at identified locations.
Unauthorized Public Use Element	
Goal 1: Discourage dumping of trash or waste within the LSIWA.	**Task 1.1.** Remove existing rubbish and unwanted materials. **Task 1.2.** Establish a regular monitoring and removal program.

Table ES-1 Summary of Management Goals and Tasks of the Land Management Plan.	
GOALS	TASKS
	Task 1.3. Ensure that removed materials are taken to an appropriate and approved disposal site. **Task 1.4.** Use signage to discourage dumping (e.g., post signs regulations regarding and penalties for dumping at locations of repeated dumping).
Goal 2: Prevent unauthorized use of the wildlife area.	**Task 2.1.** Patrol the wildlife area and enforce regulations that prohibit unauthorized uses. **Task 2.2.** Use signage and written notifications to foster cooperation. **Task 2.3.** Issue citations and/or pursue legal action when voluntary cooperation cannot be obtained. **Task 2.4.** Enforce laws and request assistance from the County Sheriff as necessary to enforce laws. **Task 2.5.** Identify locations where illegal uses of state lands are occurring or have occurred. **Task 2.6.** Provide written notification to violators illegally using the LSIWA and establish a process and timeline for the removal of unauthorized buildings, blinds, fencing, docks, landscaping, or other forms of unauthorized appropriation of state property. **Task 2.7.** Seek remediation from unauthorized users for unauthorized appropriation of state property. **Task 2.8.** Restore ecosystems damaged by unauthorized uses as necessary.
Facilities Element	
Goal 1: Ensure implementation of all provisions of cabin leases.	**Task 1.1.** Enforce all provisions of cabin leases including removal of non-native plants, and maintenance and removal of structures.
Goal 2: Remove remnants of recent human activity (e.g., abandoned structures), provided that such remnants have no historical or management value.	**Task 2.1.** Inventory remains of recent human activity. **Task 2.2.** Assess the value of existing structures as habitat. **Task 2.3.** Identify structures that may have management or historic value. **Task 2.4.** Remove all improvements with no management or historic value.
Goal 3: Add, improve, and maintain signage that identifies accessible boundaries of the LSIWA, informs the public of laws and regulations applicable to the wildlife area, and provides interpretive and safety information.	**Task 3.1.** Install a Kiosk or bulletin board with wildlife area maps and Title 14 regulations, interpretive material, and safety information. **Task 3.2.** Start monitoring and maintenance schedule for all signage. **Task 3.3.** Inventory existing boundary signage, and install new signs where necessary.
Goal 4: Effectively manage existing structures for resource protection, safety, and prevention of unauthorized uses.	**Task 4.1.** Regularly monitor the condition and use of existing structures. **Task 4.2.** Take actions as needed to keep desired structures in good repair.
Administration Element	
Goal 1: Maintain current data on the	**Task 1.1.** Regularly update GIS data sources as information becomes available.

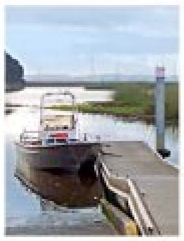
Table ES-1 Summary of Management Goals and Tasks of the Land Management Plan.	
GOALS	TASKS
management and resources of the reserve.	**Task 1.2.** Maintain accurate financial records regarding expenditures, staff, maintenance, and other administrative duties. **Task 1.3.** Administer renewal, modification, and termination of cabin leases as necessary. **Task 1.4.** Work with hunters to develop Annual Habitat Work Plans. **Task 1.5.** Document facilities needs in Department maintenance and capital outlay database. **Task 1.6.** Conduct annual monitoring and reporting of the wildlife area (e.g., condition of signs, structures, etc.)
Fire Management Element	
Goal 1: Develop and implement wildfire plan for LSIWA.	**Task 1.1.** Meet at least annually with representatives of the California Department of Forestry and Fire Protection, and local fire districts, to discuss fire-related issues relevant to LSIWA, including vegetation management, recent fires on the LSIWA, current contact information and procedures. **Task 1.2.** Coordinate with the California Department of Forestry and Fire Prevention, and local fire districts, to develop a wildland fire response plan for LSIWA. **Task 1.3.** Design and implement vegetation management activities in fire breaks at Cabin Slough and the Sherman Island Public Access Facility as necessary **Task 1.4.** Review cabin leases to determine consistency with fire management tasks, and revise as necessary. **Task 1.5.** Train a DFG biologist to serve the role of Resource Specialist or Agency Representative through the Incident Command System (ICS). **Task 1.6.** As part of Incident Command System (ICS), make available a local plant, wildlife and fisheries specialist from the Department's staff to provide advice during fires that threaten wildlife habitat at LSIWA. **Task 1.7.** Following fire or fire suppression, implement emergency revegetation, mechanical, and structural measures within those previously defined critical areas that were affected.
Scientific Research and Monitoring Element	
Goal 1: Support appropriate scientific research and encourage or conduct research that contributes to management goals of the LSIWA.	**Task 1.1.** Review and evaluate proposed research projects utilizing the following criteria. A. Potential for research results to improve management of the LSIWA or other wildlife areas; B. Potential conflicts between the research and compatible public uses; C. Potential conflicts between the research and any biological goals stated in this plan; D. Potential contribution of the research to science and society; and E. Potential for the research to interfere with or preclude certain types of future research at the LSIWA. **Task 1.2.** Provide letters or permits to researchers specifying dates and times of authorized access, and information on regulations and area restrictions. **Task 1.3.** Require that researchers provide copies of data and/or published papers, and contact researchers to ensure this requirement is fulfilled.

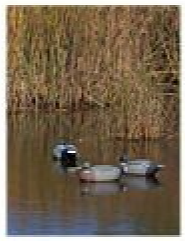
Table ES-1 **Summary of Management Goals and Tasks of the Land Management Plan.**	
GOALS	TASKS
	Task 1.4. Encourage long-term studies of bank erosion, water quality, special-status species populations, and other topics that could potentially inform management of the wildlife area. **Task 1.5**. Conduct high priority surveys, including surveys for salt-marsh harvest mouse, Suisun song sparrow, and California black rail.
Management Review and Coordination Element	
Goal 1: Ensure regulations and management practices at LSIWA support attainment of LMP goals.	**Task 1.1.** Review, and as necessary revise, regulations and management practices at the LSIWA to be consistent with and to support attainment of the goals of this LMP.
Goal 2: Coordinate with federal, state and local agencies regarding plans and projects that may affect habitats at LSIWA.	**Task 2.1.** Review, coordinate, and provide comments and recommendations on federal, state, local government plans, special plans, and proposed projects as appropriate for the purpose of determining the consistency of such plans with the goals of the Department's management plans. **Task 2.2.** Collaborate with the Department of Boating and Waterways (DBW) regarding nonnative invasive plants at the LSIWA and Delta recreational planning. **Task 2.3.** Collaborate with the Delta Protection Commission regarding Delta recreational planning. **Task 2.4.** Coordinate with the Sacramento County Health Department and the State Water Resources Control Board to ensure cabins continue to comply with septic system and water quality regulations **Task 2.5.** Coordinate with the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife. **Task 2.6.** Collaborate with or submit proposals for CALFED-funded projects that could contribute both to the attainment of this LMP's goals and to attainment of CALFED goals, objectives, targets, and milestones. **Task 2.7.** Support the implementation of research, monitoring, and restoration actions compatible with the goals of this LMP by CALFED implementing agencies.
Goal 3: Coordinate with other law enforcement agencies.	**Task 3.1.** Meet regularly with law enforcement staff from County Sheriff Departments and other agencies as appropriate to coordinate law enforcement activities and explore options for cooperative programs. **Task 3.2.** Pursue joint funding requests with other law enforcement entities to address law enforcement concerns
Goal 4: Coordinate with local public service agencies including the Sacramento-Yolo Mosquito and Vector Control District.	**Task 4.1.** In consultation with the Sacramento-Yolo Mosquito and Vector Control District, develop and implement a mosquito control plan that applies best management practices and any other necessary management practices. **Task 4.2.** Communicate regularly with local mosquito and vector control agencies, and coordinate reasonable mosquito and vector control activities consistent with the mosquito control plan and the goals of this LMP.
Goal 5: Maintain relationships with neighbors and tenants to address management issues.	**Task 5.1.** Meet or correspond with adjacent landowners and tenants as needed to maintain communication about the management needs of the LSIWA, access needs of adjacent landowners, and convey useful information regarding activities.

Table ES-1
Summary of Management Goals and Tasks of the Land Management Plan.

GOALS	TASKS
	Task 5.2. Collaborate with Sacramento County Parks regarding management of the Sherman Island Public Access Facility and maintenance of the riprap along West Sherman Island Road, and provision of additional facilities, electricity, and potable water at Sherman Island Public Access Facility. **Task 5.3.** Collaborate with the Department of Water Resources regarding management of the Donlon Island area, and regarding its possible inclusion in the LSIWA.

1 INTRODUCTION





FINAL LAND MANAGEMENT PLAN

1 INTRODUCTION

The Lower Sherman Island Wildlife Area (LSIWA) (Exhibit 1) occupies roughly 3,100 acres, primarily marsh and open water, at the confluence of the Sacramento and San Joaquin Rivers in the western Sacramento–San Joaquin River Delta (Delta). Originally covered by marsh and riparian vegetation, this island was converted to agriculture in the nineteenth century, following the construction of levees and drains. When drained and exposed to air, the fertile marsh soils, composed in large part of plant materials, were literally consumed by microbes, progressively lowering the island's elevation. Consequently, if a levee failure occurred it would not only inundate the island, but also leave behind a "lake." Draining this lake would be costly and difficult. Following a series of levee failures in the early 1900s, the island was abandoned. Open water (Sherman Lake) still covers much of the wildlife area, and marsh has reclaimed much of the remainder. This extensive tract of natural vegetation and Delta waters provides diverse and valuable wildlife habitats and related recreational opportunities and is integral to the functioning and human use of the Delta.

This land management plan (LMP) represents the commitment of the California Department of Fish and Game (Department) to manage the important resources of the LSIWA in accordance with the laws of the United States and the State of California, incorporating the best available scientific information. It also incorporates the commitment of the Department to coordinate and cooperate with wildlife area neighbors, other local interests, and other conservation entities that are active in the Delta.

1.1 MISSION OF THE DEPARTMENT

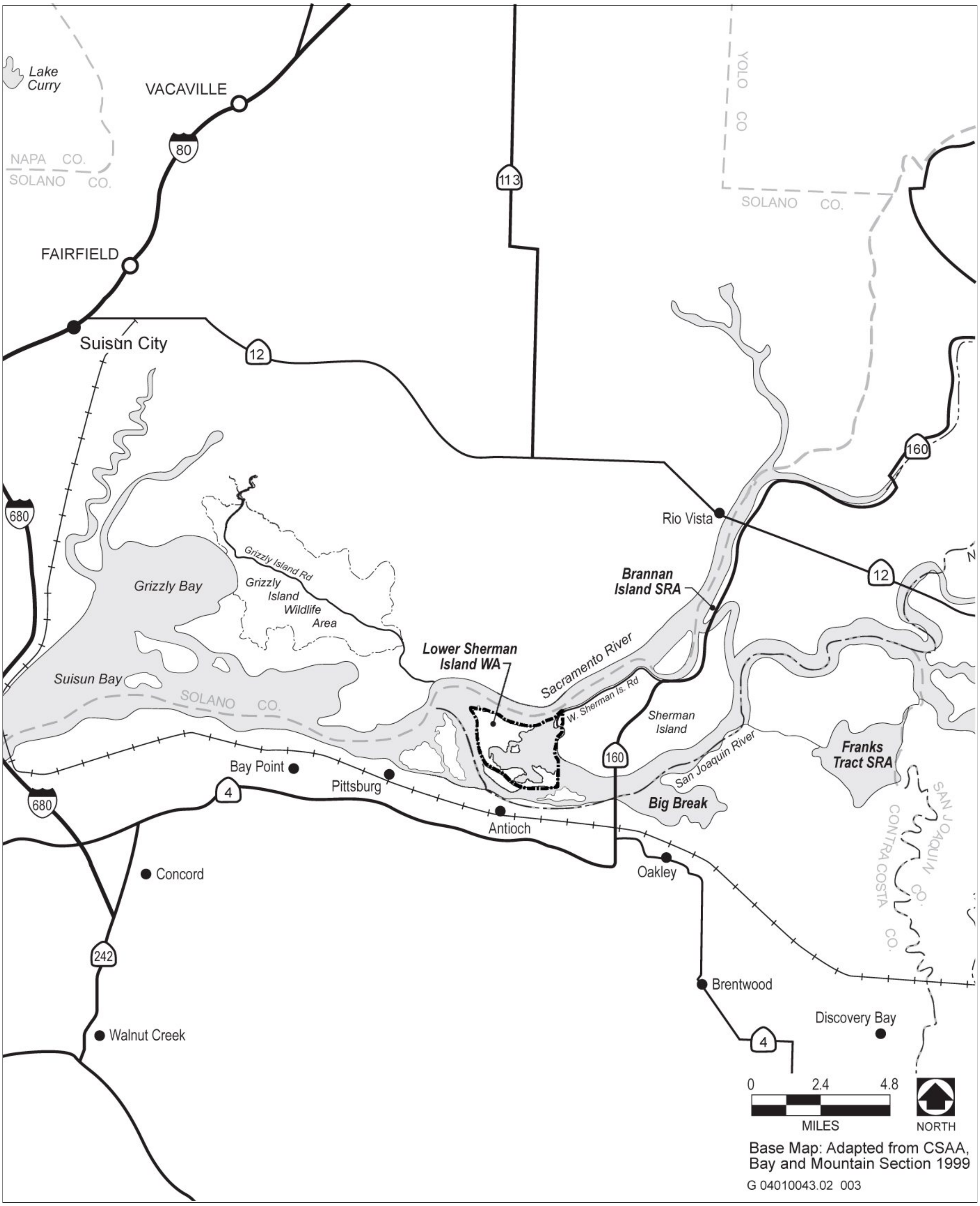
The Department, as part of the Resources Agency of the State of California, has the following mission to guide its planning and operations: "The mission of the Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public."

Thus, the Department manages fish, wildlife, and plant species and natural communities for their intrinsic and ecological value and their benefits to people. This management includes the goal of habitat protection and maintenance in an amount and quality sufficient to ensure the survival of all species and natural communities and the diversified use of fish and wildlife, including recreational, commercial, scientific, and educational uses.

1.2 PURPOSE OF WILDLIFE AREAS

Some of the state's most important sites for wildlife have been designated as wildlife areas. These lands provide habitat for a wide array of plant and animal species, including many listed as special-status species. Included in this system is the LSIWA. Consistent with its mission, the Department administers more than 100 state wildlife areas composed of approximately 650,000 acres of wildlife habitat. These areas are scattered throughout the state, with most located in central and northern California. The state owns approximately two-thirds of this acreage, while the remainder is managed under agreements with other public agencies. The Department manages these wildlife areas for the following purpose: "To protect and enhance habitat for wildlife species, and to provide the public with compatible, wildlife-related recreational uses."

Although this is the general purpose for which wildlife areas are managed, wildlife areas differ in their environmental and management settings and in the purpose and history of their acquisition. These differences are the basis of the specific goals that guide the management of individual wildlife areas. Therefore, this plan describes the purpose and history of acquisition of the LSIWA (following in this chapter), the management and environmental setting of the LSIWA (in Chapters 2 and 3), and the management goals and associated tasks (in Chapter 4).



Regional Map **Exhibit 1-1**

1.3 PURPOSE OF ACQUISITION

The LSIWA property was acquired to establish a public hunting and fishing area. In 1944, the Department assumed management of this property from the California Department of Finance (DOF) for "the purpose of establishing a public shooting ground." Subsequently, in 1958, the California Fish and Game Commission voted to acquire ownership of this property and "establish the area as a public hunting and fishing area" (California Fish and Game Commission 1958).

1.4 ACQUISITION HISTORY

In 1920, DOF acquired the lower portion of Sherman Island (which was the land that would become the LSIWA) from the Sacramento and San Joaquin Drainage District for the sum of $1. A condition was placed on the title, however, that the land was "to be used for the deposit of waste, or spoil bank material excavated from the Sacramento River for the purpose of channel enlargement, in accordance with the plan of flood control heretofore adopted by the State of California…." Other uses compatible with the deposition of dredged materials also were allowed.

DOF retained control and ownership of this land until 1944, when it transferred management control of the site, but not the title, to the California Fish and Game Commission. The agreement transferred control of the property to the commission for the purpose of establishing and maintaining a public shooting ground. This agreement contained a restriction similar to the condition that had previously been placed on the title by the Sacramento and San Joaquin Drainage District—namely, that the property would at all times be subject to full and complete use for flood control and reclamation purposes.

During the 1950s, DOF and the Department considered transferring ownership of the property to the Department. In 1957, the Department completed a proposed management plan for the property (DFG 1957). That proposed management plan concluded with the following recommendations for management of the site:

- Establish land access.
- Provide a boat launching ramp with sanitary facilities and parking.
- Work out a lease program or long-term eviction plan to solve the squatter problem, and give no consideration to establishing additional privately owned facilities.
- Serve notice and establish regulations to ensure that the area is not to be used as a private duck club by any individual or group, and enforce the ruling.
- Provide for public hunting use of the area through a permit system.
- Encourage angling use of the area year-round, and provide for adequate protection of anglers during hunting seasons by establishing an area closed to all use except access to either hunting or fishing areas.
- Attempt to work out a new agreement with DOF to remove objectionable restrictions in the present agreement.

The Department's interest in establishing a wildlife area at Lower Sherman Island, and its proposed management, generated substantial local opposition from the Pittsburg and Antioch area. In 1958, the Pittsburg City Council passed a resolution opposing establishment of the wildlife area (City of Pittsburg 1958). The Department subsequently met twice with hunters, anglers, and others interested in Lower Sherman Island. On July 7, 1958, the Department met with a committee representing local duck hunters, anglers, cabin owners, water sports groups, and marina owners. At this meeting, a general agreement was reached, and based on that agreement, the

Department recommended that the California Fish and Game Commission adopt the following policies for management of Lower Sherman Island:

- The Department would accept full control of Lower Sherman Island from DOF and establish the area as a public hunting and fishing area.

- Spoiling and borrowing of materials should be terminated or controlled to the advantage of the Department's operation of the island.

- The commission would approve the development of a public boat launch.

- No further building of cabins would be allowed on the island, but firm, 10-year transferable leases would be negotiated with the present cabin owners. After the initial 10-year period, such leases would be renewed automatically or could be terminated upon 120 days' notice from the Department when it has definite plans for development of the area.

- Public hunting would be allowed by annual permit with no limit as to the number of permits issued and no restrictions as to the number of decoys or days of shooting.

- No special restrictions would be placed on fishing unless conflicts of use develop that make such regulations necessary.

- Boating and water sports regulations would be worked out with local boating and water sports groups, the County of Sacramento, and the Department as necessary to prevent water sports from interfering unduly with the primary hunting and fishing interests of the area.

The California Fish and Game Commission unanimously approved these recommended policies for management of the property at Lower Sherman Island, with the understanding that a wildlife area at Lower Sherman Island would be self-sustaining (California Fish and Game Commission 1958). (At this meeting of the commission, the Department said that it planned to patrol and police the area with its present personnel and equipment and that annual operating costs could be covered by hunting fees and cabin site leases.)

In 1960, DOF transferred title to the Lower Sherman Island area to the California Fish and Game Commission. This transaction was not recorded, however, until 1963.

1.5 PURPOSE OF LAND MANAGEMENT PLAN

The purpose of this LMP is to:

1. guide management of habitats, species, and programs described in the LMP to achieve the Department's mission to protect and enhance wildlife values;

2. serve as a guide for appropriate public uses of the LSIWA;

3. serve as a descriptive inventory of fish, wildlife, and native plant habitats that occur on and species that use the LSIWA;

4. provide an overview of the property's operation and maintenance and of the personnel requirements associated with implementing management goals (this LMP also serves as a budget planning aid for annual regional budget preparation); and

5. present the environmental documentation necessary for compliance with state and federal statutes and regulations, provide a description of potentially significant environmental impacts that may occur during plan management, and identify mitigation measures to avoid or lessen these impacts.

1.6 THE PLANNING PROCESS

The planning process was guided by the general policy parameters that direct the Department, including compliance with all state and federal laws. The Department's mission, the purpose of wildlife areas, the purpose and history of the acquisition of Lower Sherman Island, and the purposes of land management plans, as stated in this chapter, provided broad direction for the development of this plan. Finally, the objectives of the California Bay-Delta Program (CALFED) were considered in developing this plan. CALFED is an important partnership to which the Department is committed, and in the Delta, the Department is an implementing agency for the CALFED Ecosystem Restoration Program.

With this broad guidance, the plan has been developed from a compilation of the best available data, additional site-specific analyses, and public input. Public input has been obtained through 10 interviews with knowledgeable individuals and stakeholders, two public comment meetings, and a number of public comment letters. A summary of public outreach efforts is attached as **Appendix A**.

1.7 ENVIRONMENTAL ANALYSIS

An environmental analysis pursuant to the California Environmental Quality Act (CEQA) has been conducted concurrently with plan development to identify the potential environmental impacts of operating the LSIWA under the provisions of this LMP. As described in the initial study/negative declaration (IS/ND) prepared for the plan under CEQA, implementing the plan would not have a significant impact on the environment. The IS/ND is included as **Appendix B**.

1.8 ORGANIZATION OF THIS LAND MANAGEMENT PLAN

This LMP is organized as follows:

- **Chapter 1, "Introduction,"** summarizes the purpose of the acquisition, acquisition history, purpose of the land management plan, and planning process.

- **Chapter 2, "Property Description and Management Setting,"** describes the geographical setting; property boundaries and easements; existing infrastructure; and management setting, including legal constraints, existing agreements, and planning influences and considerations. This chapter (along with Chapter 3) also serves as the environmental setting of the IS/ND.

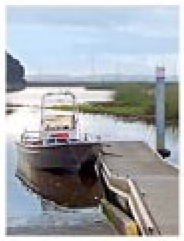
- **Chapter 3, "Environmental Setting,"** describes existing resource conditions and serves as the environmental setting of the IS/ND.

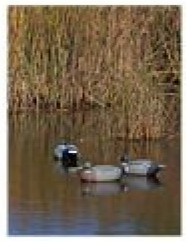
- **Chapter 4, "Management Goals,"** describes the basis for resource management at LSIWA and identifies management goals and tasks. This chapter serves as the project description necessary for performing environmental review pursuant to CEQA.

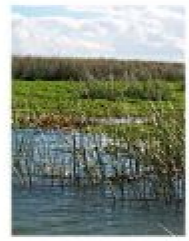
- **Chapter 5, "Operations and Maintenance,"** summarizes the number of existing staff employed at the property and any additional requirements for personnel; estimates operations and maintenance costs associated with management of the property; and identifies potential funding sources. This chapter is intended to guide budget preparation and work plans for the property.

- **Chapter 6, "Future Revisions,"** describes the process by which this LMP would be revised, if needed, so that it continues to guide management of the LSIWA.
- **Chapter 7, "Agency Roles and Document Preparers,"** lists the individuals who prepared this LMP.
- **Chapter 8, "References and Personal Communications,"** lists the sources of information cited throughout this LMP.
- **Appendix A, "Public Outreach Summary,"** includes a summary of public outreach efforts, interview notes, and responses to public comments.
- **Appendix B, "Environmental Review,"** presents the impact analysis, identifies mitigation measures, and includes other CEQA-required parts of an IS/ND that are not already integrated into other chapters of the LMP.
- **Appendix C, "Legal Description of Property and Operating Agreement for Lower Sherman Island Public Access Facility,"** provides the legal description of the property and of the agreement between the Department and Sacramento County for operation of the boat-launch facility at Lower Sherman Island.
- **Appendix D, "Lower Sherman Island Wildlife Area–Related Conservation Measures, Targets, and Programmatic Actions from the CALFED Ecosystem Restoration Program Plan and Multi-Species Conservation Strategy,"** presents the verbatim CALFED conservation measures, targets, and programmatic actions relevant to issues addressed in the LSIWA LMP.
- **Appendix E, "Synthesis of Available Fisheries Data,"** summarizes available data from fish population monitoring at and in the vicinity of LSIWA.
- **Appendix F, "Vascular Plant Species Observed or Likely To Be Present at LSIWA,"** provides a list of plant species observed at LSIWA and a list of additional plant species that are likely to be present based on their occurrence in the vicinity of LSIWA and the presence of similar vegetation at LSIWA.
- **Appendix G, "Bird Species Observed or Likely To Be Present at LSIWA,"** provides a list of wildlife species observed at LSIWA and a list of additional wildlife species that are likely to be present based on their occurrence in the vicinity of LSIWA and the presence of similar species at LSIWA.
- **Appendix H, "Amphibian, Reptile, and Mammal Species Likely To Be Present at LSIWA,"** provides a list of amphibian, reptile, and mammal species that are likely to be present based on their occurrence in the vicinity of LSIWA and the presence of similar species at LSIWA and the habitats that exist at LSIWA.
- **Appendix I, "Studies Conducted at or in the Vicinity of the Lower Sherman Island Wildlife Area,"** provides a list of the studies that have collected data at or in the immediate vicinity of the Lower Sherman Island Wildlife Area.

2 Property Description and Management Setting







Final Land Management Plan

2 PROPERTY DESCRIPTION AND MANAGEMENT SETTING

2.1 GEOGRAPHICAL SETTING

The Lower Sherman Island Wildlife Area (LSIWA) is in the western Delta, at the southwestern tip of Sacramento County (Exhibit 2-1). It is located at the junction of the Sacramento and San Joaquin Rivers, and for this reason, Lower Sherman Island was originally known as Dos Rios Island. It is bordered by Mayberry Slough, Sherman Island, and Donlon Island on the east; the Sacramento River on the north; Kimball Island on the southwest; and the San Joaquin River on the south (Exhibit 2-2).

The LSIWA is accessible only by boat, except where Sacramento County operates the Sherman Island Public Access Facility. This facility, located in the northeastern corner of the LSIWA, is connected by West Sherman Island Road to State Route (SR) 160. To reach the LSIWA from the north, at the junction of SR 160 and SR 12 (near Rio Vista), turn south onto SR 160; shortly after crossing Three Mile Slough Bridge, turn right onto Sherman Island Road (where SR 160 drops off the levee), and follow West Sherman Island Road to the Lower Sherman Island Public Access Facility. To reach the LSIWA from the south, at the intersection of SR 4 and SR 160 in Antioch, turn north onto SR 160 and drive over the Antioch Bridge; where SR 160 rises onto the levee, turn left onto West Sherman Island Road, and follow it to the Lower Sherman Island Public Access Facility.

2.2 ADJACENT LAND USES

The LSIWA is almost entirely surrounded by tidal and subtidal lands owned by the State Lands Commission. Most surrounding areas are used for recreation, navigation, resource protection, or agriculture. The LSIWA is adjacent to Sherman, Donlon, and Kimball Islands. Sherman Island is owned by the California Department of Water Resources (DWR) and is primarily under agricultural use, with scattered residential and boat docking facilities. Farther north across the Sacramento River is agricultural land in Solano County. This area is designated for water-dependent industrial uses, but has not been developed. Donlon Island, also owned by DWR, is an open space area, most of which is submerged; the remaining areas are dominated by marsh vegetation. Donlon Island was flooded in 1937, but a portion of it has since been filled with dredged materials. Uses on Donlon Island are navigation, recreation, and resource protection. Kimball Island is owned by Wildlands, Inc., and is used as a wetland mitigation bank.

2.3 PROPERTY BOUNDARIES AND EASEMENTS

The LSIWA consists of all land and open water within the historic levees west of Mayberry Slough and Mayberry Cut. When Lower Sherman Island was leveed, drained, and converted to agriculture, the landowners in this area belonged to a single reclamation district (Reclamation District 50). After repeated levee failures in the early 1900s, the levee system was abandoned, and the state acquired the entire reclamation district for $1. This history is reflected in the wording of the legal property description, which is included in Appendix C. The property's boundaries are described as follows:

> All that certain parcel or tract of real property situated, lying and being portions of T 2 N, R 1 E; T 2 N, R 2 E; T 3 N, Range 1 East and T 3 N, R 2 E; said parcel being all of Sherman Island lying west of Mayberry Slough; said tract being also Subdivisions "A", "B", "C", "D", "E", "F" and "G", as said subdivisions are shown on the official map entitled "Map showing subdivisions of the lands of Dos Rios Reclamation Company, Sherman Island, Sacramento County, California", filed in the office of the County Recorder of Sacramento County; in Book 8 of Maps; said parcel containing 3,250 acres more or less, being known also as Reclamation District Number 50, lying at the confluence of Sacramento and San Joaquin River in the County of Sacramento, State of California.

When DOF transferred ownership of the property to the Department, it reserved the right to deposit and remove dredged materials from the site. The following text from the Agreement for the Transfer of Control and Possession of State Owned Lands signed by the Department, DOF, and the Reclamation Board (Sacramento County Recorder's Office 1963) describes this right:

> "a right of way and easement at such time or times as they may desire to deposit or waste earth or other material upon the above-described real property in connection with any flood control, reclamation or navigation project and also at such time or times as they may desire to excavate and remove earth or other material therefrom in connection with such purposes …"

In 1972, an additional easement was placed on the property for the construction, operation, and maintenance of an 8-inch natural gas line that was installed that same year. This easement, shown in Exhibit 2-2, extends across Lower Sherman Island from the Sacramento to the San Joaquin River. It is approximately 8,200 feet long and 100 feet wide. A map showing this easement is included in Appendix C.

The LSIWA also includes two additional, small areas of tidal and subtidal land leased from the State Lands Commission. The first of these is 0.21 acre along the access road to the boat launch where rock riprap was placed to protect the road along the Sacramento River. This land was leased in 1980 for 49 years. The second, 14.64 acres along Cabin Slough, was leased in 1981 for 49 years. This area includes all the docks and facilities along Cabin Slough that are associated with the cabins leased from the Department. The intent of this lease from the State Lands Commission was to simplify the Department's administration of the cabin leases.

2.4 EXISTING INFRASTRUCTURE

2.4.1 ROADS

There is one road in the northeast corner of the LSIWA. It runs from West Sherman Island Road at the wildlife area's eastern boundary to the boat launch and associated facilities operated by Sacramento County. This road, along with the boat launch and associated facilities, has been leased by the Department to the County under a 25-year operating agreement that began in 1999. This agreement is described in more detail in Section 2.4.4, "Lower Sherman Island Public Access Site."

2.4.2 LEVEES

The LSIWA is bordered by levees along the Sacramento and San Joaquin Rivers and along Mayberry Cut. Construction of these levees began in 1869. The levees were made from blocks of peat cut from marsh soil and still held together by the roots and stems of the marsh plants; these blocks were carried and set by hand. By 1870, 300 Chinese laborers had been contracted to build levees on Sherman Island (Antioch Ledger 1870). The original levees were 16–20 feet wide at the base, 7–8 feet high, and 4 feet across at the top. The levees were repeatedly repaired and modified until Lower Sherman Island was abandoned in the early 1900s (sometime before 1919). The remnants of these levees persist today and are covered with a dense growth of riparian vegetation.

2.4.3 GAS LINE

In 1972, an easement was granted to Dow Chemical Company to install an 8-inch natural gas pipeline across Lower Sherman Island, and the pipeline was installed that year. It runs north-south across the western portion of the LSIWA (Exhibit 2-2) and is buried approximately 3 feet below the marsh surface. This gas line is operated and maintained by Calpine.

Source: DWR 2004, DFG 2005

Study Area Aerial **Exhibit 2-1**

Source: DFG 2006, CA Resources Agency 1972

Lower Sherman Island Wildlife Area USGS Topo Map **Exhibit 2-2**

2.4.4 SHERMAN ISLAND PUBLIC ACCESS FACILITY

Formal public access and a boat launch were first provided by the County of Sacramento and the Department in 1966. From 1966 until 1999, maintenance and operation were provided by the County of Sacramento under an operating agreement with the Department. The Department also funded improvements in 1979 and 1983 to provide erosion protection and to repair washouts on the access road.

During the early 1970s, use of the Sherman Island Public Access Facility increased substantially, and both resources and facilities were degraded. Most of this use was for camping and recreational use unrelated to boating or wildlife-associated uses, including camping, off-road vehicle use, and recreational target shooting (as noted by Warden Donald McCloskey, “It is sometimes very difficult to convince these people to stop shooting”) (McCloskey 1973).

Thus, regulations were adopted in 1976 to limit non-wildlife related recreation. These regulations included prohibited overnight camping (except at the parking area during waterfowl season), littering, off-road operation of motor vehicles, and open fires. Although these regulations improved conditions, public use remained high, and a need for new and additional facilities developed.

In 1999, the California Department of Boating and Waterways (DBW), the County of Sacramento, and the Department entered into an agreement to rehabilitate previous facilities. The current boat ramp, boarding float, parking areas, lighting, entrance gate, access road, and public restrooms are the result of that collaborative project. These facilities are part of the Sherman Island Public Access Facility, which is operated by the County of Sacramento through an agreement with the Department.

2.4.5 CABINS AND OTHER STRUCTURES

Since 1930, individuals from nearby communities have constructed cabins and docking facilities on Lower Sherman Island, particularly along the levee adjacent to Cabin Slough. Many were loosely constructed and served as temporary shelters for hunters and anglers. Gradually, the structures were improved, and many became year-round or seasonal residences. In 1957, an estimated 15–20 of these cabins were located on higher areas remaining from the old levee system (DFG 1957). Almost all were along Cabin Slough. In 1980, there were 35 leases: 33 for lots along Cabin Slough and two on the north side of the island.

After the LSIWA was established, the Department created a subdivision map along Cabin Slough, and the California Fish and Game Code was amended to allow for and specify the terms of cabin leases at LSIWA. (The terms of these leases are described in Section 2.5.1, “Existing Agreements and Leases.”) The first leases for existing cabins and docks were signed in 1966. In 1991, there were 34 leases, and in 2005 there were 15. On 2002 aerial photographs, 28 buildings were visible, and all were along Cabin Slough. These included both maintained and abandoned structures. Additional structures also may be present beneath planted or naturally occurring trees (and thus not be visible on the aerial photographs examined).

Most of these cabins had flush toilets with lines extending into the marsh. Some pit toilets also were used. In the late 1970s, the Sacramento County Department of Health contacted the Department, seeking to have permitted septic systems installed or plumbing removed from the cabins. By 1980, the Sacramento County Department of Health had worked with some cabin owners to install approved septic systems, and the other cabin owners had removed their plumbing. Approved septic systems consisted of septic tanks built from concrete blocks and short leach fields.

Docking facilities also were modified to conform to applicable laws. In 1968, there were 14 docks, and by 1980, there were 34. These were modified as necessary and authorized through a U.S. Army Corps of Engineers (USACE) permit in 1980. On 2002 aerial photographs, approximately 20 docks were visible, primarily along Cabin Slough. These include both maintained and abandoned structures.

2.5 MANAGEMENT SETTING

2.5.1 EXISTING AGREEMENTS AND LEASES

The LSIWA is managed by the Department's Bay-Delta Region (Region III). In addition to the two small areas of tidal and subtidal lands that the Department leases from the State Lands Commission and a gas line easement (as described in Section 2.3, "Property Boundaries and Easements"), existing agreements at the LSIWA include an operating agreement with the County of Sacramento regarding the operation and maintenance of the Sherman Island Public Access Facility, cabin leases along Cabin Slough, and Annual Habitat Work Plans developed with individual hunters.

In 1999, the Department and the County of Sacramento entered into a 25-year operating agreement for the Sherman Island Public Access Facility. Under this agreement, the County maintains and operates these facilities for sport fishing, other wildlife-related, or other appropriate recreational activities. This agreement requires the county to make necessary and reasonable repairs to keep facilities in a safe and useable condition, clean, and free of accumulations of litter, garbage, or debris. It also requires the county to allow public access except when it is necessary to close the area for maintenance, public safety, security, or protection of the facilities. The agreement allows the county to charge a vehicle entrance fee and to enter into concession agreements, provided that any revenues are used solely for the operation and maintenance of the Sherman Island Public Access Facility.

The Department currently leases 15 cabins along Cabin Slough to private individuals. The major provisions of these leases are described in Section 1526.4 of the California Fish and Game Code and include the following:

- Leases are between the Department and an individual person, partnership, or any affiliated group of two or more persons.
- A lease may be extended for the natural life of any person who was a leaseholder in January 1, 1991, but will expire upon the death of the last individual who was a leaseholder on January 1, 1991.
- If the lease is violated, it may be terminated by the Department within 30 days of the receipt of the Department of notice of the violation.
- Public access to navigable waters adjacent to the leased properties is required.
- The introduction and cultivation of nonnative plant species are prohibited, and existing nonnative plant species must be removed according to a plan developed by the Department.
- The lessee must provide the Department with proof that buildings and all other structures and facilities will be removed and the area returned to a natural condition upon termination of the lease.
- The Department and county employees have the right to inspect the property for the purpose of enforcing these conditions.
- Regarding these leases, the California Fish and Game Code (Section 1526.4) requires the Department to:
  - develop a plan for the removal of nonnative plants,
  - annually review all leases and charge a fair market rate for those leases of land, and
  - use all proceeds for the purpose of enforcing and monitoring the terms of the leases and managing the LSIWA.

The vegetation at roughly 20 of about 50 sites with waterways or artificial ponds is modified each year to maintain suitable conditions for waterfowl hunting. These modifications are guided by a work plan (i.e., Annual Habitat Work Plan) developed each year between the Department and the hunters performing the work. These work plans contain a volunteer service agreement and a description of the work to be performed, including:

- location of work,
- description of proposed work,
- size of project,
- reason for work, and
- vegetation to be removed.

These habitat modifications consist primarily of cutting tules, cattails, and other plants back away from trails and blinds and removing vegetation that has grown in the ponds. This work has been done with hand tools and gas-powered cutting tools.

2.5.2 PLANNING INFLUENCES AND CONSIDERATIONS

The following land use, ecosystem restoration, and resource management plans were considered in the development of this LMP and influenced its content:

- *Sacramento County General Plan*,
- *Land Use and Resource Management Plan for the Primary Zone of the Delta*,
- *Master Recreation Strategy for the Delta*,
- *North American Waterfowl Management Plan*,
- *Multi-Species Conservation Strategy (MSCS) and Ecosystem Restoration Program Plan (ERRP) of the CALFED Bay-Delta Program*, and
- *1995 Water Quality Control Plan for the Sacramento River and San Joaquin River Basins* and draft recommendations for total maximum daily load (TMDL) of mercury and methylmercury.

These plans are described are described in detail below.

SACRAMENTO COUNTY GENERAL PLAN

State agencies are exempt (as established by *Hall vs. City of Taft* [1952] 47 Cal.2d177) from complying with local or county plans, policies, or zoning regulations. Nevertheless, the Department considers all local plans in its management decisions. State agencies also 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, the Department takes into account local land use policies and regulations when making land use planning decisions.

The LSIWA is located in Sacramento County, so the General Plan for Sacramento County was considered in the development of this LMP. The general plan was most recently adopted in 1993 (County of Sacramento 1993); however, portions of the plan are currently being updated (County of Sacramento 2006). The 1993 General Plan Land Use Diagram identifies Sherman Island and Sherman Lake with the Recreation designation and Lower Sherman Island with the Natural Preserve designation. The Recreation designation allows for active public recreational uses. The purpose of the Natural Preserve designation is to identify critical natural habitat for priority resource protection. The designation includes riparian valley oak woodland and permanent or seasonal marshes with outstanding wildlife value, the extent of which has declined greatly throughout the Central Valley during the twentieth century. This designation includes both public and privately owned land (Sacramento County 1993). This LMP is consistent with the *1993 County of Sacramento General Plan*.

LAND USE AND RESOURCE MANAGEMENT PLAN FOR THE PRIMARY ZONE OF THE DELTA

The Delta Protection Commission (DPC) was created by the California Legislature in 1992 with the goal of developing regional policies for the Delta to protect and enhance the existing land uses in the Primary Zone: agriculture, wildlife habitat, and recreation. The LSIWA is in the Primary Zone. Working closely with local communities and local governments, the DPC adopted its *Land Use and Resource Management Plan for the Primary Zone of the Delta* (regional plan) in 1995. Local government incorporation of the policies and one regulation in the DPC regional plan was completed in 1998. In 2000, the DPC became a permanent state agency. The policies in the regional plan were adopted as regulations in 2000 and approved by Office of Administrative Law on May 8, 2001.

The DPC's *Land Use and Resource Management Plan for the Primary Zone of the Delta* contains the following policies and recommendations, which may be applicable to the LSIWA (Delta Protection Commission 1995):

- **Environment Policy P-3:** Land managed primarily for wildlife habitat shall be managed to provide several interrelated habitats. Delta-wide habitat needs should be addressed in development of any wildlife habitat plan. Appropriate programs, such as "Coordinated Resource Management and Planning" and "Natural Community Conservation Planning," should ensure full participation by local government and property owner representatives.

- **Land Use Policy P-2:** Local government General Plans and zoning codes shall continue to strongly promote agriculture as the primary land use in the Primary Zone; recreation land uses shall be supported in appropriate locations and where the recreation uses do not conflict with agricultural land uses or other beneficial uses, such as waterside habitat.

- **Recreation and Access Recommendations R-6:** State and federal projects in the Primary and Secondary Zones should include appropriate recreation and/or public access components to the extent consistent with project purposes and available funding. State and federal agencies should consider a private or user group improvements on publicly owned lands to provide facilities.

This LMP is consistent with these policies and recommendations.

MASTER RECREATION STRATEGY FOR THE DELTA

The DPC is also developing a master recreation strategy for the Delta. The purpose of this strategy is to guide decision making regarding development and use of recreation facilities over the next 15 years. The aquatic-related recreation portion of this strategy has been completed and is presented in *Summary Report for the Delta Recreation Master Strategy: Aquatic Resources Focus*. In the report, the Delta is divided into six zones, and for each, existing facilities are described and additional facilities are proposed.

Proposed facilities (i.e., strategy components) include:

- gateways,
- additional transient facility sites that are not associated with existing marinas,
- windsurfing sites,
- waterskiing sites,

- boat-in destination sites (either land based or buoy field based),
- nonmotorized boat trail use areas, and
- enhanced wildlife/habitat areas.

The LSIWA is included in the Delta Breezeway zone and either already provides (e.g., windsurfing site, enhanced wildlife/habitat area) or could provide (e.g., a boat-in destination site) several of the types of facilities proposed for this zone. In addition, the strategy for the Delta Breezeway zone specifically mentions LSIWA as a potential site for new boat-in destination sites. Consequently, management of, and projects at, the LSIWA could contribute substantially to the implementation of this strategy.

NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

The *North American Waterfowl Management Plan* (NAWMP) is an international agreement that provides a broad framework for waterfowl conservation and management in North America. It identifies population objectives for key species and establishes habitat goals to sustain these populations. In the United States, the North American Wetlands Conservation Act appropriates funds for implementation of the NAWMP.

The NAWMP seeks to restore and maintain the diversity, abundance, and distribution of waterfowl that existed during 1970–1979. Population objectives for 20 species of ducks, 18 species or subspecies of geese divided into 27 management populations, and two species of swans are identified. The NAWMP further seeks to ensure that sufficient habitat exists to support 62 million breeding ducks, a fall flight of 100 million ducks, and 6 million wintering geese and swans. The NAWMP is updated at 5-year intervals.

In the NAWMP, broad recommendations are made for wetland and upland habitat protection, restoration, and enhancement; duck harvest; overall waterfowl population management; subsistence hunting; and research. The major focus, however, is on ducks and their habitat. Two of the NAWMP's seven habitat objectives relate to the general maintenance or rehabilitation of 34 major waterfowl habitats. Five of the seven priority objectives are specifically focused on seven habitat areas (six in the United States, one in Canada) of the highest international priority. These seven areas are the objects of the initial joint ventures, which will receive priority planning and funding.

The Central Valley of California is one of these seven priority areas. Within the priority areas, mallards, northern pintails, and American black ducks receive special attention where appropriate. The major strategy for implementing the NAWMP is to establish specific habitat joint ventures where agencies and private organizations collectively pool their resources to address waterfowl habitat problems. Each joint venture will develop implementation plans to address specific needs of each area.

Central Valley Habitat Joint Venture

The California Central Valley Habitat Joint Venture (CVHJV) was formally established by a working agreement signed in July 1988. The CVHJV's Implementation Board comprises representatives from the California Waterfowl Association, Defenders of Wildlife, Ducks Unlimited, National Audubon Society, Waterfowl Habitat Owners Alliance, and The Nature Conservancy guides the CVHJV. Technical assistance and advice are provided to the Implementation Board by the Department, U.S. Fish and Wildlife Service, California Department of Food and Agriculture, and other organizations and agencies.

The goal of the CVHJV is to "protect, maintain, and restore habitat to increase waterfowl populations to desired levels in the Central Valley of California consistent with other objectives of the NAWMP." Six objectives were developed by the Implementation Board to achieve this goal:

1. Protect 80,000 additional acres of existing wetlands through acquisition of fee-title or perpetual conservation easements.

2. Secure an incremental, firm 402,450-acre-foot water supply that is of suitable quality and is delivered in a timely manner for use by national wildlife refuges, state wildlife areas, and the Grasslands Resource Conservation District (GRCD).

3. Secure Central Valley Project (CVP) power for national wildlife refuges, state wildlife areas, GRCD, and other public and private lands dedicated to wetland management.

4. Increase wetland areas by 120,000 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easement.

5. Enhance wetland habitats on 291,555 acres of public and private lands.

6. Enhance waterfowl habitat on 443,000 acres of agricultural lands.

Upon completion of the CVHJV objectives, the Central Valley will support 4.7 million wintering ducks, including 2.8 million pintails.

The CVHJV is updating the Implementation Plan. The new plan will include goals for the conservation of breeding and wintering waterfowl, breeding and wintering shorebirds, grassland and riparian birds, and other water birds. This LMP for the LSIWA includes goals and tasks contribute to the CVHJV's habitat restoration goals.

CALIFORNIA BAY-DELTA PROGRAM'S MULTI-SPECIES CONSERVATION STRATEGY AND ECOSYSTEM RESTORATION PROGRAM PLAN

The California Bay-Delta Program is a cooperative effort of state and federal agencies working with local communities to improve the quality and reliability of California's water supplies and to enhance and restore the ecosystems of the Delta and the San Francisco Bay and their watersheds. The established mission of the CALFED Program is "to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System" (CALFED 2000a).

The CALFED Program is intended to be a balanced, comprehensive approach to reduce conflicts over limited water supplies and to address the program's four objectives: water supply reliability, water quality, levee system integrity, and ecosystem restoration. It targets the San Francisco Bay, Delta, Sacramento Valley, and San Joaquin Valley. The program in California is guided by the California Bay-Delta Authority, which was established through Senate Bill 1653 in 2002. The bill established the California Bay-Delta Authority to provide a permanent governance structure for the collaborative state-federal effort that began in 1994. The director of the California Department of Fish and Game is a member of the authority, and the Department is an implementing agency for a number of programs, including CALFED's Environmental Restoration Program and Environmental Water Account and Watershed Program.

In August 2000, the CALFED Program issued a programmatic record of decision (ROD) that set forth a 30-year plan to address ecosystem condition and water reliability problems in the Bay-Delta area. The ROD identified specific investments and actions over the first 7 years (Stage 1) to meet program goals. The CALFED Final Programmatic EIS/EIR and the ROD provide background information and programmatic guidance for management, restoration planning, and mitigation that were considered during development of this LMP.

The Multi-Species Conservation Strategy (MSCS) and the Ecosystem Restoration Program Plan (ERPP) (both appendices to the ROD) are particularly relevant to the management of the LSIWA because they contain a comprehensive set of conservation measures, programmatic actions, and targets intended to guide conservation efforts in the central and western Delta. Many of these measures and actions could be applicable at LSIWA, and the Department's management of LSIWA could contribute to attainment of these targets. A summary of MSCS conservation measures and ERPP programmatic actions and targets potentially applicable to LSIWA is included as **Appendix D**. These conservation measures, programmatic actions, and targets were considered in the development of this LMP; consequently, this LMP is consistent with them.

The California Bay-Delta Authority is developing a Delta Regional Ecosystem Restoration Implementation Plan (DRERIP) that is intended to guide the implementation of the California Bay-Delta Program's Ecosystem Restoration Program Plan. The DRERIP will refine the planning foundation specific to the Delta; refine existing Delta-specific restoration actions; and provide Delta-specific implementation guidance, program tracking, performance evaluation, and adaptive management feedback. Its completion is anticipated in 2006.

WATER QUALITY CONTROL PLAN FOR THE SACRAMENTO AND SAN JOAQUIN RIVER BASINS

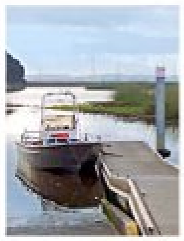
The preparation and adoption of water quality control plans (basin plans) is required by the California Water Code (Section 13240) and supported by the federal Clean Water Act. In California, these basin plans are prepared and adopted by regional water quality control boards. For the waters in a specified area, basin plans designate beneficial uses to be protected, water quality objectives to protect those uses, and a program for achieving those objectives.

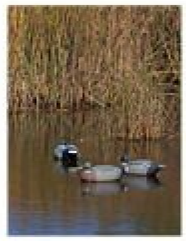
The LSIWA is in the area covered by the basin plan for the Sacramento and San Joaquin River basins (Central Valley Regional Water Board 1998). The management and restoration of marsh and aquatic ecosystems at LSIWA could potentially affect attainment of water quality standards. Potential effects on the basin plan's water quality objectives and associated implementation program were considered in the development of this LMP to ensure the LMP's consistency with the basin plan.

An amendment to this plan that will address mercury and methylmercury contamination is being developed. In 1990, the Central Valley Regional Water Quality Control Board (Central Valley Regional Water Board) determined that mercury was impairing beneficial uses of the Delta's waters because fish had elevated levels of mercury that posed a risk for human and wildlife that consumed the fish. Consequently, the regional water board has been developing a TMDL for methylmercury and total mercury in the Sacramento-San Joaquin Delta Estuary (Central Valley Regional Water Board 2005). The basin plan for the Sacramento and San Joaquin River basins will be amended to include these TMDLs and an associated implementing program.

The draft recommendations for the mercury and methylmercury TMDLs were considered in the development of this LMP. These recommendations include draft numeric targets. To meet the draft numeric targets, methylmercury concentrations in waters of the western Delta would need to be reduced by 28%, and to attain this target, exports of methylmercury from sediments in the western Delta's wetlands would need to remain constant or decrease (Central Valley Regional Water Board 2005). Thus, in the development of this LMP, it was assumed that the TMDL for methylmercury and its associated implementation program will have a substantial influence on wetland restoration projects at LSIWA.

3 ENVIRONMENTAL SETTING





FINAL LAND MANAGEMENT PLAN

3.1 GEOLOGY, SOILS, TOPOGRAPHY, AND CLIMATE

3.1.1 GEOLOGY

GENERAL DESCRIPTION

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.

The Delta, including the LSIWA, is in the Great (Central) Valley Geomorphic Province. This geomorphic province is a valley trough that extends more than 400 miles from north to south and consists of the Sacramento and the San Joaquin Valleys. The San Joaquin Valley is composed of the San Joaquin River basin, drained by the San Joaquin River from the south, and the Tulare basin, a hydrologically closed basin that is drained only during extremely wet periods. The Sacramento Valley is drained by the Sacramento River from the north. The confluence of these two major river systems and lesser streams and systems forms the inland Delta, which is drained through Suisun Bay and the narrow Carquinez Strait to San Pablo and San Francisco Bays and eventually into the Pacific Ocean (CALFED 2000a).

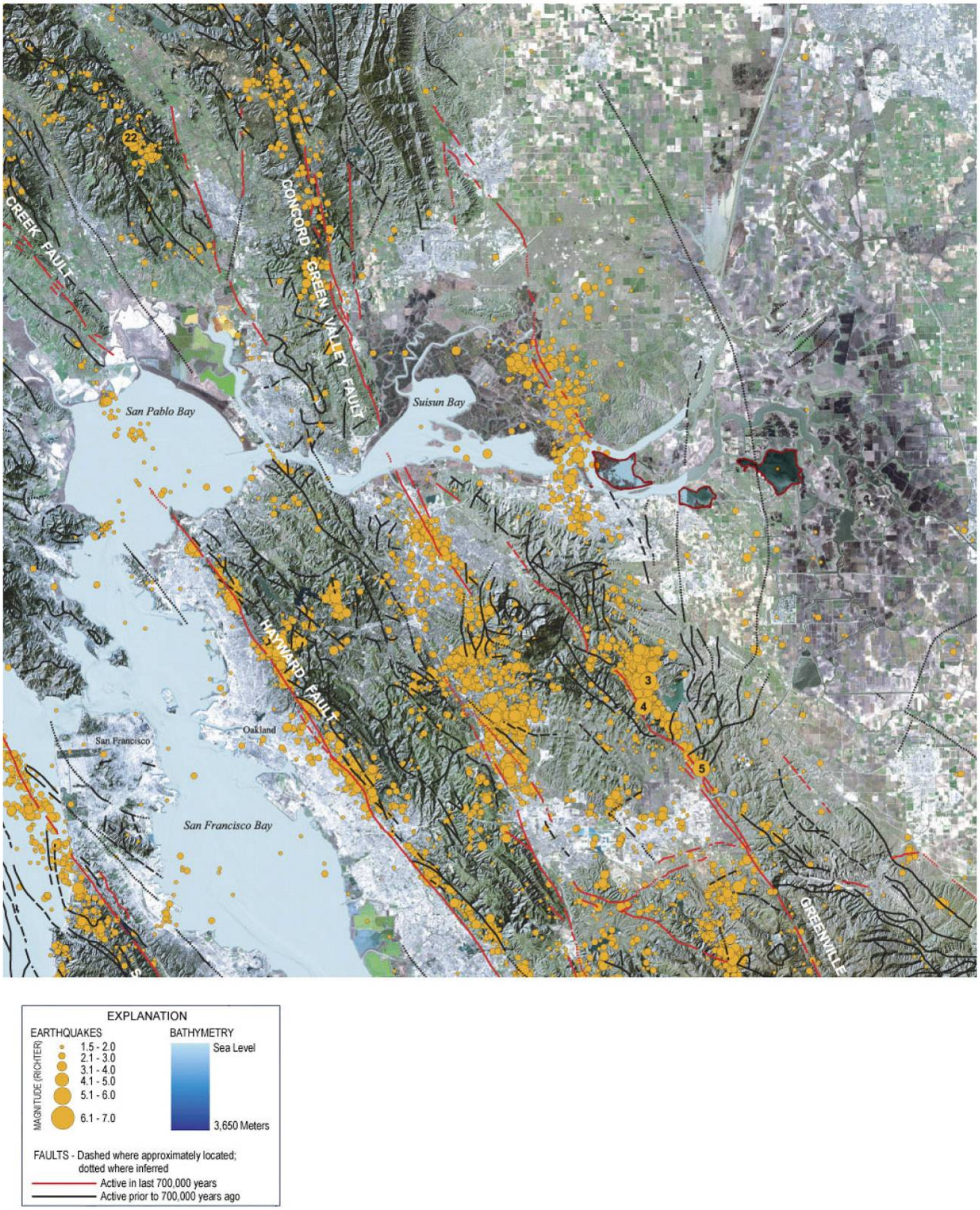
Originally, the Delta was part of the inland sea of Tertiary and post-Tertiary times, but during the Post-Pleistocene, the Delta became filled with many islands formed by waters moving through this region. During flooding, sediments were deposited along the islands’ shores, forming natural levees. Each island’s interior subsided, and seasonal ponds provided an ideal environment for tule (Scirpus spp.). These tule marshes have formed significant peat deposits throughout the Delta (Center for Design Research 1988).

As a result of these geomorphic processes, much of the Delta is underlain by sedimentary bedrock overlain by thick deposits of alluvial sediments. The deepest portion of these surficial deposits consists of a complex mixture of coarse sand and gravel bed-load deposits, sand- and silt-sized overbank deposits, and silt- and clay-sized backwater deposits. The most recent deposits are generally dark colored, often highly organic, and of mixed lithologic composition and origin. The recent sediments along the eastern margin of the Delta are derived mostly from metamorphic sources in the Sierra Nevada foothills, whereas the sediments along the western edge of the Delta are derived from the uplifted Tertiary sedimentary rocks of the Coast Ranges.

SEISMIC RISK

The Delta is exposed to seismic risk because of its proximity to the San Andreas fault system. This fault system includes the San Andreas, Hayward, Calaveras, Rogers Creek, Antioch, Green Valley–Concord, and Greenville faults. All of these faults have been active historically (Exhibit 3.1-1).

A study assessing the probability of earthquakes in the San Francisco Bay Area was released in 2003 by Working Group 2002. Led by the U.S. Geological Survey (USGS), the working group consists of scientists from USGS, the California Geological Survey, major universities, and private companies. The study accounts for changes in the understanding of earthquake science, as well as new ideas about modeling. The results indicate that the Bay Area is highly likely to have a damaging earthquake: a 62% probability for one or more events of M6.7 or higher between 2003 and 2032. The Hayward–Rodgers Creek system is estimated to have a probability of 27%, the highest probability of the Bay Area faults (Exhibit 3.1-2) (BSL 2004).



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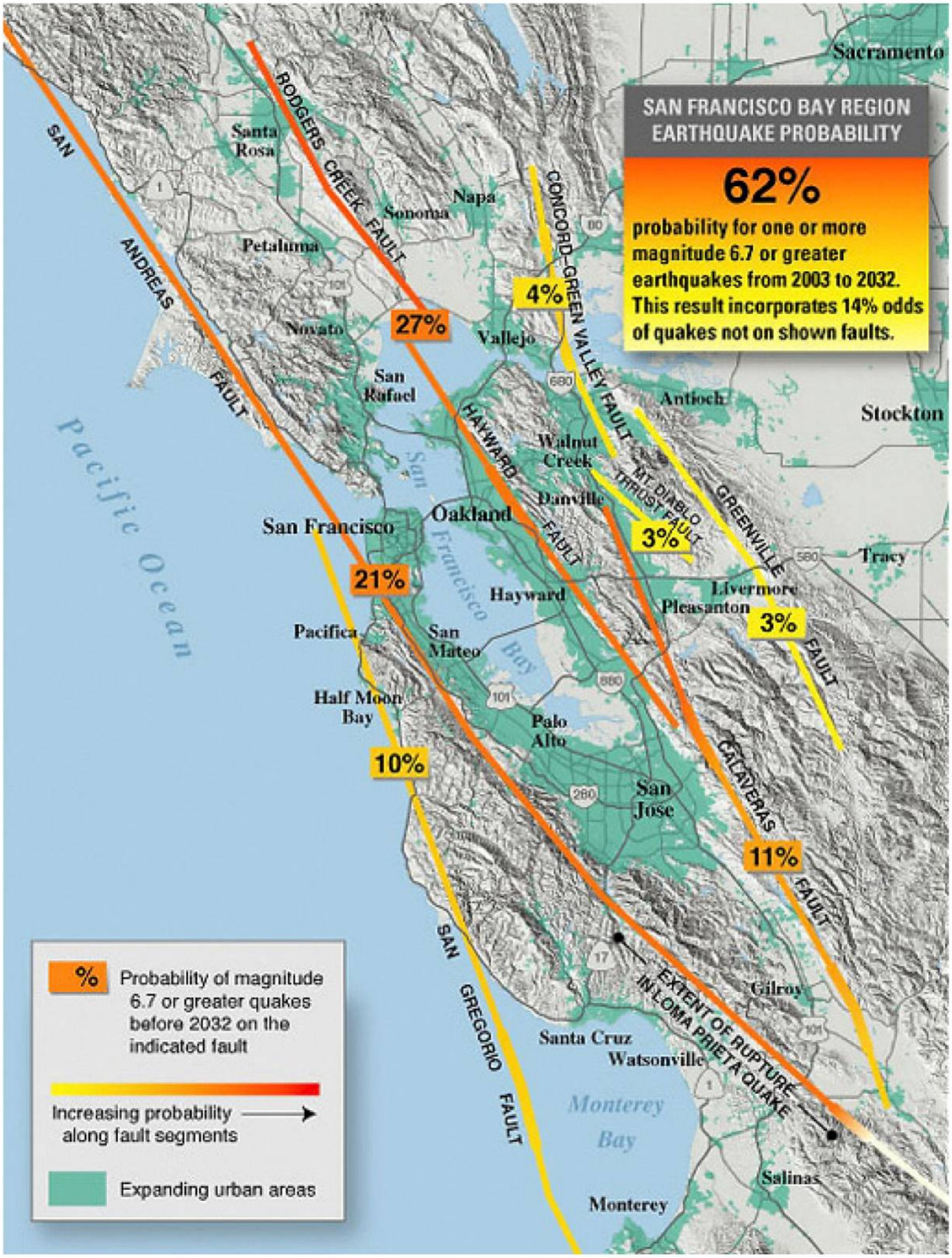
Source: USGS 2004

Earthquakes and Faults of the San Francisco Bay-Delta **Exhibit 3.1-1**



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Source: Berkeley Seismological Lab 2002

San Francisco Bay Region Earthquake Probability **Exhibit 3.1-2**

The LSIWA is in a region of relatively low seismic activity compared to the San Francisco Bay Area. The major strike-slip faults in the Bay Area (San Andres, Hayward, and Calaveras Faults) are located more than 16 miles from the Delta region. The less active Green Valley and Marsh Creek–Clayton Faults are more than 9 miles from the Delta region. Small but significant local faults are situated in the Delta region (CALFED 2000b). Many geologists theorize that a "hidden" major blind-thrust fault runs through the western Delta (i.e., the Coast Range Central Valley Fault) (Abrahamson et al. 2000).

Three active faults lie in the area of the LSIWA and are capable of producing strong seismic shocks. Buried under recent alluvium, the northwest-trending Midland fault zone is a major subsurface feature. Drill holes from gas fields indicate that the latest movement in this zone occurred in Eocene times. The California Division of Mines and Geology considers the possibility that the Vacaville earthquake of 1892 originated along this fault. The Antioch fault, running north/south through the city of Antioch, is very active and has produced nine earthquakes between 1962 and 1971, ranging from 2.5 to 5.0 on the Richter scale. There has been no historical activity on the Tracy–Stockton fault to the southwest; however, the possibility of seismic activity here is not discounted. The Greenville fault near the city of Livermore produced significant seismic activity in 1980, registering quakes of 5.5 and 5.8 on the Richter scale (Center for Design Research 1988). No historical earthquake damage has ever been recorded in the Delta. The highest recorded shaking is up to 0.08g in the west Delta and 0.05g in the east Delta (Knittweis 2000).

The likelihood of a significant seismic event in the next 50 years is high (about the same probability as a 100-year flood event) (Mount 2004). CALFED's Seismic Vulnerability Sub-Team of the Levees and Channels Technical Team predicted that an earthquake with a magnitude of 6.0 (Richter Magnitude) has a 25% chance of occurring in the next 50 years.

Seismic vulnerability is highest at the western edge of the Delta because of poor levee embankment and foundation soils and a higher exposure to seismic shaking in the San Andreas fault system (CALFED 2000b). The following effects could result from seismic shock:

- liquefaction of levees or foundation soils, especially where depth to groundwater is shallow;
- compaction and settlement of levees or foundation soils;
- lateral spreading of levees or foundation soils;
- slumping, lurching, or ground cracking of levees; and
- erosion or topping of levees by seiches (Center for Design Research 1988).

Historical information indicates that little damage to Delta levees has been caused by historical earthquakes. No report could be found to indicate that an island or tract had been flooded owing to an earthquake-induced levee failure. Furthermore, no report could be found to indicate that significant damage had ever been induced by earthquake shaking.

This lack of severe earthquake-induced levee damage corresponds to the fact that no significant earthquake motion has been sustained in the Delta area since construction of the levee system approximately a century ago (CALFED 2000b). Therefore, the lack of historical damage should not lead, necessarily, to a conclusion that the levee system is not vulnerable to moderate-to-strong earthquake shaking.

Because the levee system of Lower Sherman Island is already breached, and much of the LSIWA is already inundated, the earthquakes would not result in the catastrophic changes that could occur at other Delta islands. Earthquakes could, however, damage facilities, cabins, and the gas line and could alter connectivity of Sherman Lake to adjacent waters.

3.1.2 SOILS

GENERAL DESCRIPTION

Soils in the LSIWA reflect its original land cover, which consisted mostly of tule marsh vegetation and riparian forest vegetation, and deposition of dredged materials. Known soils in the LSIWA consist of Fluvaquents, 0–2% slopes, frequently flooded; Medisaprists, 0–2% slopes, frequently flooded; and Xeropsamments, 1–15% slopes (Tugel 1993) (Exhibit 3.1-3). Fluvaquents are very deep, very poorly drained soils that formed in alluvium and are stratified with hydrophytic plant remains. Medisaprists consist of very deep, very poorly drained organic soils in tidal marshes. These soils formed in hydrophytic plant remains stratified with alluvium derived from mixed rock sources. They are regularly inundated by tidal water. Xeropsamments consist of very deep, moderately well drained to excessively drained soils in areas of dredge piles that have been deposited on floodplains and natural levees. These soils formed in recently dredged material removed from the bottom of channels (Tugel 1993).

The northwest portion of Lower Sherman Island has an extensive area of dredged materials because this portion of the island was used for the deposition and borrow of dredged materials from the early 1900s until as recently as the 1960s. In the Delta, dredged materials contain pesticides, mercury, and high concentrations of salts.

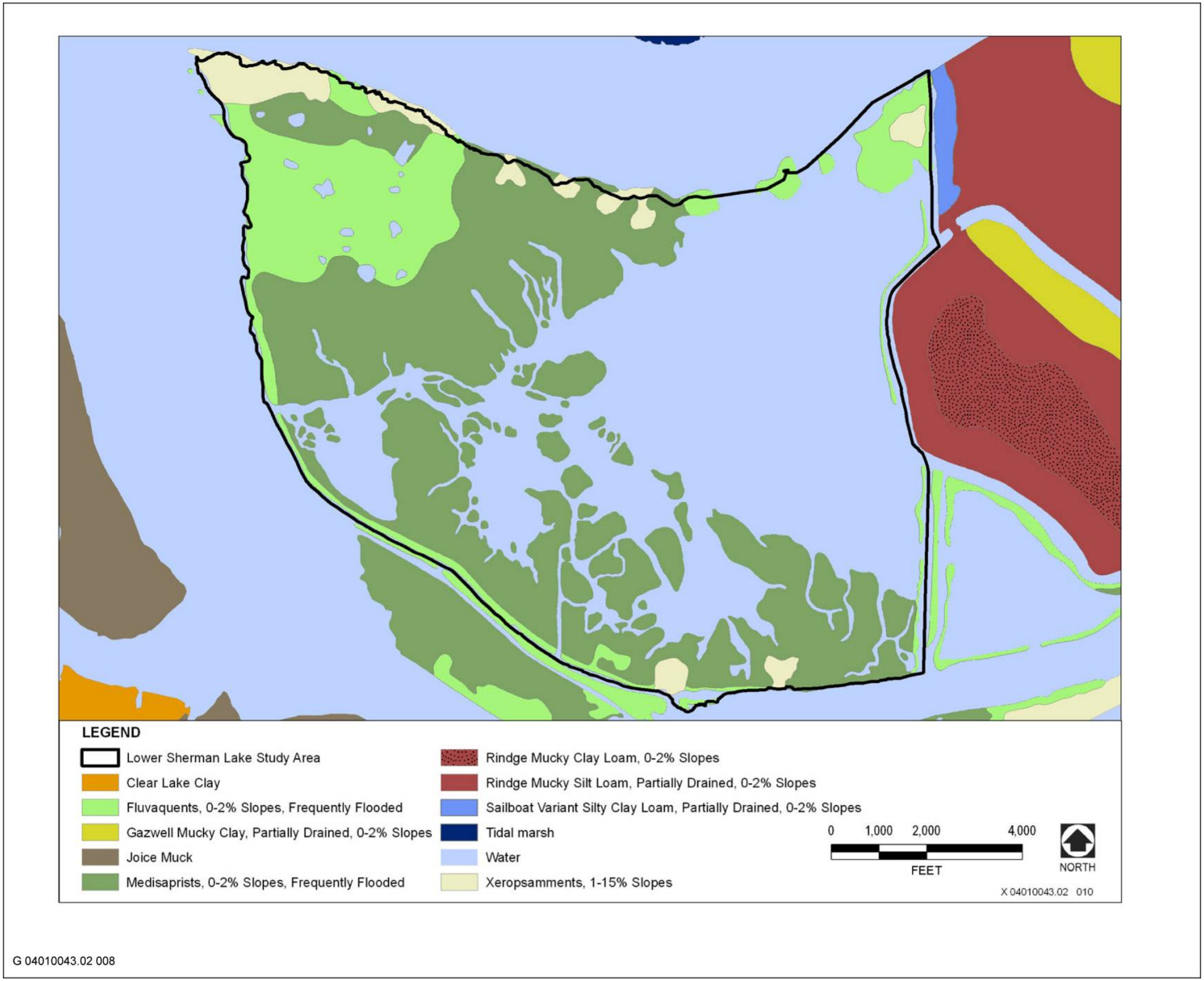
SOIL SUBSIDENCE

Soil subsidence had a major influence on the current topography of the LSIWA. The following discussion describes the causes of soil subsidence, as well as ongoing subsidence and accretion at LSIWA.

Delta islands, including Lower Sherman Island, were reclaimed for agricultural use because of their fertile soils. This reclamation entailed constructing levees and drains. Conversion of Delta wetlands to farmlands began in 1850, when the federal government transferred ownership of “swamp and overflow” lands to the states. Substantial reclamation was accomplished between 1880 and 1920 (CALFED 2000a). Lower Sherman Island was reclaimed during the 1880s.

Following reclamation, drained Delta lands began to subside (CALFED 2000a). Subsidence, as it relates to Delta islands, refers to the falling level of the land surface that results primarily from the oxidation of peat soil. This oxidation occurs because microbes decompose organic matter in the presence of oxygen, which is at relatively high levels in drained soils. Because organic matter (from marsh plants) accounts for a large portion of the volume of peat soils, this consumption of organic matter by microbes reduces soil volume. Other processes contributing to subsidence include shrinkage, wind erosion, tectonic movement, compaction, consolidation (gas withdrawal), burning, and export of peat (Center for Design Research 1988).

At LSIWA, elevations were reduced during the period when the soils of Lower Sherman Island were drained and exposed to the atmosphere. When levees were first constructed on the island in the 1870s, the difference between the water level in the channel and the island surfaces was probably less than 5 feet. Subsidence occurred from reclamation of the island until it became permanently inundated following levee failures before 1920. The subsequent submergence of Lower Sherman Island has created waterlogged and anaerobic soil conditions, and accumulation of organic materials has resumed. The rate of accumulation, however, is relatively slow. Currently, the area beneath Sherman Lake is between 1 and 10 feet below sea level, and annual increases in elevation attributable to the deposition of plant materials and sediment are probably less than 1 inch per year and may be negligible in a large portion of the inundated area (Simenstad et al.1999).



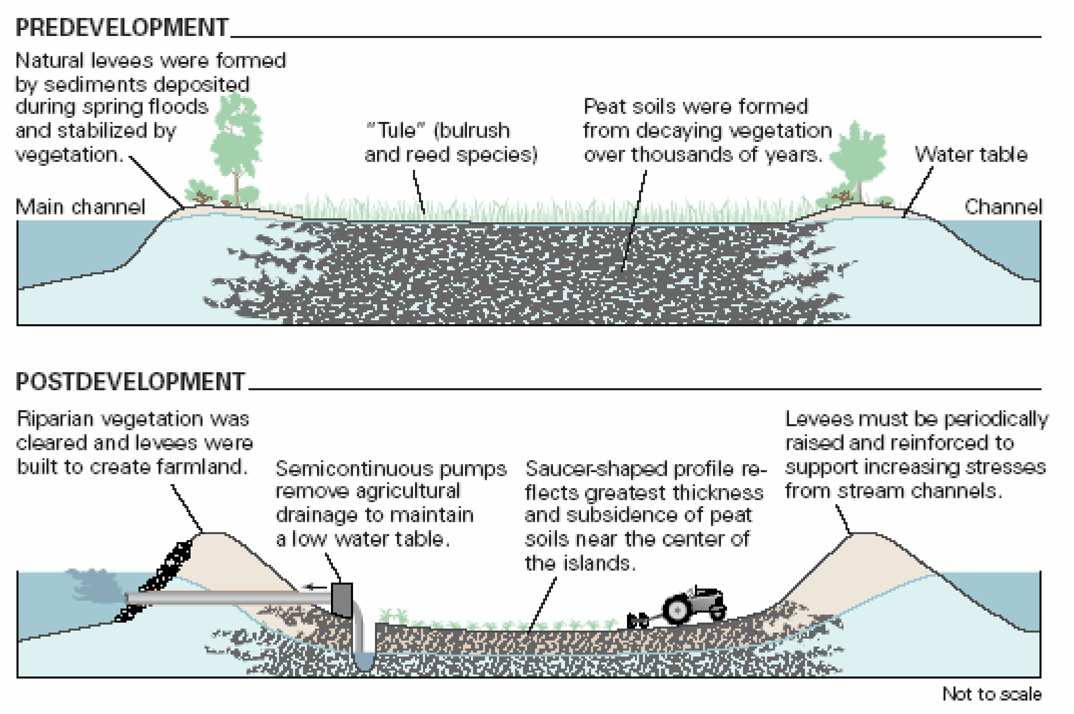
Source: SSURGO 1998

Soils of the Lower Sherman Island Wildlife Area

Exhibit 3.1-3

3.1.3 TOPOGRAPHY

At LSIWA, much of the area that was once reclaimed as agricultural land now lies beneath Sherman Lake (Exhibit 3.1-4). This “lake” is an area of open water partially bounded by Lower Sherman Island and Sherman Island and connected to the Sacramento and San Joaquin Rivers by Mayberry Slough, Mayberry Cut, and breaks in the historic levee system. Bathymetric data for Sherman Lake have been compiled by USGS (USGS 2004). The western side of Sherman Lake is shallow (most of the area is less than 3 feet deep during low tide), whereas the eastern third of the lake is generally deeper (up to 12 feet). Throughout the western portion of Sherman Lake and extending into the adjacent marshes of Lower Sherman Island, dendritic systems of channels have developed. One of these channel networks extends from a levee break on the western side of Lower Sherman Island across to Sherman Lake. There are also several linear artificial channels. These channels were not present on historical photographs taken in 1937. Most connect dendritic channels to ponds maintained for duck hunting.



Source: USGS 2000

Process of Subsidence **Exhibit 3.1-4**

There are no specific data on sedimentation in Sherman Lake; however, the BREACH project (University of Washington 2002) provides sedimentation rates for breached island sites that may be applicable. An investigation of breached island evolution found that large open water areas such as Sherman Lake may have reached equilibrium because sedimentation may be limited by long fetches and high wind–wave action.

Topographic data for areas above shoreline elevation (approximately +4.0 feet National Geodetic Vertical Datum [NGVD]) surrounding Lower Sherman Lake are available from USGS (2002). Along the northern shore of Lower Sherman Island, and particularly in the northwestern portion of the island, are higher elevations of +10–16 feet NGVD. The historic levee system provides a narrow band of ground with a higher elevation; it is on this higher ground that the cabins along Cabin Slough have been constructed.

It would also be instructive to assess historical erosion rates at shorelines in and around Lower Sherman Island as a means to assess potential erosion. Banks along the northwestern shoreline of the island have been eroding. Steep, unvegetated, undercut, or clumping sections of bank are common in this area. Photographs of the gas line taken in the early 1970s showed roughly 10–20 feet of exposed pipeline at the bank edge. Because substantial erosion has occurred along that section of the shoreline, there is currently more than 40 feet of exposed pipeline (Delaney, pers. comm., 2006).

3.1.4 CLIMATE

WINDS

Prevailing winds in the Delta are from the west in the Carquinez Straits, particularly during summer. During summer and fall months, high pressure offshore, coupled with thermal low pressure in the Central Valley caused by high inland temperatures, sets up a pressure pattern that draws marine air eastward through the Carquinez Straits almost every day. The wind is strongest in the afternoon because that is when the pressure gradient between the east Pacific high and the thermal low is greatest. Afternoon wind speeds of 15–20 mph are common throughout the straits region. Annual average wind speeds are 8.2 mph in Martinez and 9.5–10 mph farther east.

Sometimes, the pressure gradient reverses and flow from the east occurs. Typically, for this reversal to occur, high pressure is centered over the Great Basin or the Pacific Northwest, setting up an east-to-west or northeast-to-southwest pressure gradient. These high-pressure periods have low wind speeds and shallow mixing depths, thereby allowing the localized emissions to build up. The air mass from the east is warmer, thereby increasing photochemical activity, and contains more pollutants than the usual cool, clean marine air from the west. During winter, easterly flow through the Carquinez Strait is more common. Between storms, with the high-pressure system no longer offshore, high pressure over inland areas causes easterly flow into the Bay Area through the Carquinez Strait.

TEMPERATURE

Near LSIWA, Martinez and Antioch average daily maximum temperatures (in Fahrenheit) range from the mid-50s in winter to high 80s in summer (National Climatic Data Center 2004). Average minimum temperatures range from the high 30s to low 40s in winter and mid-50s in summer. Frosts occur in most years.

INVERSIONS

A primary factor in air quality is the mixing depth or the vertical dimension available for dilution of contaminant sources near the ground. Over the Bay Area, the frequent occurrence of temperature inversions limits this mixing depth and consequently limits the availability of air for dilution. A temperature inversion may be described as a layer or layers of warmer air over cooler air.

Several types of temperature inversions are important. The strong inversions typical of summer are formed by subsidence, the heating of downward-moving air in the high-pressure anticyclone over the western Pacific. The surface inversions typical of winter are formed by radiation as air is cooled in contact with the earth's cold surface at night. Although there is a prevalent type of temperature inversion related to season, both inversion mechanisms may operate at any time of the year. At times, surface inversions formed by radiational cooling may reinforce the subsidence inversion aloft, particularly in fall and winter. The thick, strong inversion resulting in this case is especially effective in trapping pollutants.

In the morning, the seasonal variations are most dramatic. From June through September, there are only 2 days, on average, with no inversion below 5,000 feet. March and April have fewer morning inversions. The occurrence of surface inversions is highest from October through January, when the characteristic radiation inversion predominates. A wide cluster of cases between 500 and 2,500 feet dominates from May through September, when the summer subsidence inversion over the marine layer dominates. There is substantial day-to-day variability in the depth of the marine layer.

PRECIPITATION

The Delta area climate is characterized by moderately wet winters and dry summers. Winter rains (December through March) account for about 75% of the average annual rainfall; about 90% of the annual total rainfall is received from November through April. From June 15 to September 22, normal rainfall is typically less than 1/10 inch. Annual precipitation amounts show great differences in short distances. Annual totals exceed 40 inches in the mountains and are less than 15 inches in the sheltered or "shadowed" valleys. The frequency of winter rain is more uniform, however, with 10 days per month (December through March) being typical.

Rainfall amounts at LSIWA are probably between those at Antioch and Martinez. In Antioch, the annual rainfall averages only 13 inches, whereas in Martinez, annual rainfall is nearly 20 inches on average (National Climatic Data Center 2004). The lower amount at Antioch is attributable to the rain shadow effects of Mt. Diablo and the surrounding high terrain southwest of Antioch. More than 90% of rainfall at Antioch and Martinez occurs during October through April.

During rainy periods, ventilation and vertical mixing are usually high; consequently, pollution levels are low. However, there are frequent winter dry periods lasting more than 1 week. It is during these dry periods that pollution can develop.

EFFECTS OF METEOROLOGY ON DELTA HYDRODYNAMICS

Variations in atmospheric pressure and wind can significantly affect water-surface elevations and flows in the Delta (Oltmann 1998, cited in Burau et al. 1999). An increase in atmospheric pressure results in a lowering of water levels and a "draining" of the Delta; a decrease in atmospheric pressure results in raising water levels and a "filling" of the Delta. Changes in atmospheric pressure are often accompanied by increased wind speeds that also can alter water levels and flows in Delta channels (Burau et al. 1999). Although wind-driven currents are generally weaker than tidal currents, wind-generated waves probably play an important role in sediment resuspension and vertical mixing.

An example of atmospheric pressure and wind influence on Delta hydrodynamics was documented on December 12, 1995, when a drop in atmospheric pressure and sustained westerly winds resulted in the elimination of the daily low high tide and the associated ebb flow throughout the Delta (Burau et al. 1999).

GLOBAL WARMING TRENDS

In its conservation planning, the Department addresses the effects of climate change on the perpetuation of species (California Environmental Protection Agency 2006a). Anthropogenic warming of Earth's oceans and atmosphere (National Research Council 2001) and regional warming of the Bay-Delta estuary and its watershed have the potential to greatly affect the current state and function of flooded islands in the Delta (California Environmental Protection Agency 2006).

Globally, temperatures have risen an average of nearly 1^{o}C over the past century, and substantial further increases are projected in just a few decades. Conservative estimates of a 2^{o}C increase in California temperatures and a 50-centimeter rise in sea level are projected in the next 100 years. The seasonal timing of Delta inflows and the corresponding patterns of water salinity in the Delta also would likely change. Such changes would profoundly alter the state's hydrology (Knowles and Cayan 2002), affecting the Central Valley watershed, Bay–Delta estuary, and ecological function of Delta islands.

Additional information is needed regarding global warming and its potential effects on restoration efforts and overall management of the Delta. Changes in sea level, precipitation, snowpack, and seasonal runoff have the potential to greatly alter the current state of the LSIWA; in particular, the land area above the intertidal zone (i.e., upland and riparian ecosystems) will be reduced, perhaps substantially.

3.2 WATER RESOURCES

3.2.1 HYDRODYNAMICS

Delta hydrodynamics consist of the physical effects of freshwater inflows, tidal action, and movement of water in Delta channels. Because tidal inflows are approximately equivalent to tidal outflows during each daily tidal cycle, tributary inflows and export pumping are the principal variables that define the range of hydrodynamic conditions in the Delta. The Sacramento River contributes about 77% of the freshwater flows; the San Joaquin River contributes roughly 15%; and east side streams provide the remainder. On average, 10% of the Delta inflow is withdrawn for local use, 30% is withdrawn for export by the Central Valley Project and State Water Project, and the remaining 60% provides outflow to the San Francisco Bay ecosystem (CALFED 2000c).

Tidal changes strongly influence Delta channel conditions twice daily by changing water surface elevation, current velocity, and flow direction. The effects of ocean tides on Delta hydrodynamic conditions are modified by freshwater inflow and diversion rates. The extent of tidal influence depends on the tidal prism volume relative to river discharge at a particular Delta location. Delta channels are generally less than 30 feet deep unless dredged and vary in width from less than 100 feet to over 1 mile. Some channels are edged with aquatic and riparian vegetation, but most are bordered by steep banks of mud or riprapped levees (DeHaven and Weinrich 1988). Vegetation is generally removed from channel margins to improve flow conveyance and facilitate levee maintenance. Cross-sectional areas and lengths of channels determine divisions of flow when tidal flows can move into more than one channel. Volume determines the change in stage corresponding to a tidal inflow or outflow at a channel location. Tidal flushing at a location can be estimated as the tidal flow divided by the volume.

Water levels, or stage, vary greatly during each tidal cycle, from less than 1 foot on the San Joaquin River near Interstate 5 to more than 5 feet near Pittsburg. Tidal effects are more intense in the western Delta, but even in the central Delta, water surface elevation can vary by more than 5 feet during one tidal cycle. Over the long-term period, the highest minimum stage typically occurs in February and is about 0.1 foot below mean sea level (msl). However, during dry and critical years, the highest minimum stage typically occurs in April and is considerably lower than wet year types at about 0.6 foot below msl. The long-term seasonally lowest minimum stages typically occur in August-September at about 0.8 foot below msl. Tidally influenced channel velocities throughout the Delta during the non-winter stormflow seasons can range from -2 feet per second (fps) to more than +3 fps (with negative figures indicating upstream flood tide flow). Tidal effects are not uniform from day to day. There is a distinct pattern of tidal variations within a lunar month. The tidal range is greatest during “spring” tides and smallest during “neap” tides. The mean tide elevation may also change slightly during the spring-neap lunar cycle. This adds a net “tidal outflow” component to daily Delta outflow estimates.

Stage data in the Sherman Lake area is available from the Interagency Ecological Program (IEP) (IEP 2004). Sacramento River (RSAC-075). Table 3.2-1 shows tidal characteristics near Sherman Lake.

Table 3.2-1
Tidal Characteristics Near Lower Sherman Lake

Tidal Plane	Feet Above Mean Lower Low Water	Elevation (NGVD)
Mean Higher High Water	+3.84	+2.85
Mean High Water	+3.35	+2.39
Mean Tide Level	+1.97	+0.98
Mean Low Water	+0.59	-0.39
Mean Lower Low Water	+0.0	-0.98

Source: University of Washington Wetland Ecosystem Team 2002

There is a difference between the times that the tidal wave front propagates in the Sacramento River channel and the San Joaquin River channel (EDAW 2005). The difference occurs as a result of the larger tidal prism volume occupied by the Sacramento River channel and the fact that the distance up the channels to Sherman Lake is greater in the San Joaquin River than the Sacramento River. Consequently, stage levels at any point in time are different between the north side of the island and the south side of the island. Field measurements of drift and velocity profiles within Sherman Lake identified that there was considerable flow of water from the Sacramento River to the San Joaquin River through the east side of the lake. Flow was not as great through the west side of the lake that is more enclosed by remnant levees.

3.2.2 WATER QUALITY

This section describes salinity, organic carbon, mercury, and other water quality conditions in the vicinity of LSI and in the greater Sacramento-San Joaquin River drainages and Bay-Delta. Each of these categories is discussed in detail below.

SALINITY

Salinity concentrations in Delta waters affect agricultural, industrial, and municipal water supply beneficial uses, as well as habitat quality for aquatic life in the Delta.

General Salinity Conditions

The salinity of surface waters is measured by several different parameters. Salinity is a measure of the mass fraction of salts (routinely reported with either of the equivalent terms parts per thousand [ppt] or practical salinity units [PSUs]), whereas total dissolved solids (TDS) is a measure of the concentration of salts (measured in mg/L). Ocean water generally averages about 35 PSUs; brackish estuarine conditions are typically defined by salinities in the range of 5 to 10 PSUs. Electrical conductivity (EC) is a measurement of the ionic activity of water and is relied upon as a simple analytical measurement that is closely correlated with salinity and TDS concentrations in water in most naturally-occurring waters. For Delta waters, 1 EC unit is considered equivalent to a TDS of 0.64 mg/L. Two equivalent units are routinely used to report EC values, micromhos per centimeter (µmhos/cm) and microSiemens per centimeter (µS/cm). EC represents the ability of water to carry an electrical current and varies according to the number and type of ions in the water (the higher the ions and corresponding salts, the higher the EC).

Along with EC and TDS, the specific anions chloride and bromide are of concern in the Delta due to their importance in drinking water quality. Bromide is a specific anion that primarily enters the Delta from ocean water and tidal exchange and is a particular concern because it is a factor in trihalomathane (THM) and bromate formation caused by specific drinking water disinfection processes. Bromide is present in seawater at a relatively constant fraction of 0.003 to 0.004 on a weight basis. Chloride is a specific ion subject to regulation for its potential to adversely impair aesthetic taste and odor in drinking water supplies, and agricultural water uses. The concentration of bromide and chloride are not necessarily perfectly correlated (i.e., linear relationship) to EC or TDS concentrations. For example, water sources that have been influenced by seawater intrusion to a greater degree may have a relatively greater proportion of bromide content than water influenced by the Sacramento River having very low bromide content.

Salinity concentrations within the Delta are primarily a function of the location of high-salt content ocean water with daily tidal action, freshwater inflow to the Delta, and the hydrodynamic processes in the Delta channels that govern channel flow conditions and mixing of water sources with variable salt content. During winter and early spring, freshwater inflows to the Delta are usually above the minimum required to control salinity. However, at least for a few months in summer and fall of most years when freshwater inflows to the Delta have declined, Delta salinity conditions must be carefully monitored and controlled. Broad-scale salinity control actions are taken in the Delta because its channels are at or below sea level and unless repelled by continuous seaward flow of fresh water, seawater can advance into the western Delta and adversely affect compliance with water quality objectives and beneficial uses provided by Delta water resources.

Additional factors contributing to problematic Delta salinity conditions include the San Joaquin River inflow, in-Delta agricultural drainage, other miscellaneous inputs (e.g., municipal wastewater, urban runoff, connate groundwater), and evapotranspiration. San Joaquin River inflows are particularly influential to salinity conditions in the southern Delta after winter rainfall and runoff from the Sierra Mountains have ceased and the river is influenced primarily by agricultural drainage return flows from the San Joaquin Valley floor. High concentrations of salts are carried by the San Joaquin River into the Delta and much of the salt load represents recirculation and increased salt content of water diverted to the San Joaquin valley via the CVP Delta Mendota Canal. Salinity problems in the western Delta result primarily from the incursion of saline water from the San Francisco Bay when freshwater inflow from the Delta to the Bay is low. However, it should be noted that compared to historical conditions, Delta salinity during low-flow periods is much lower since the construction of the major dams on Delta tributaries in the Sierra Mountains and foothills, which allow storage and fresh-water releases during the summer to repel tidal seawater intrusion.

During medium or high Delta outflows, EC levels generally are lower than during low Delta outflows. Consequently, Delta salinity conditions exhibit pronounced seasonal trends in response to freshwater inflows during the winter and low-flow summer and fall conditions when freshwater inflows have declined. The lowest routine concentrations of chloride typically occur in spring and early summer (March through July). Similarly, wet/above-normal water years have lower EC and bromide concentrations than critical (dry) water years. Elevated salinity conditions within Delta channels occur mainly during years of below-normal runoff (California Bay-Delta Authority 2003).

Salinity Conditions at Sherman Lake

Because Sherman Lake lies between the Sacramento and San Joaquin rivers, it is influenced by salinity patterns of both rivers. However, the range of salinity conditions in Sherman Lake can generally be represented by the range of conditions in the San Joaquin River at Antioch. At Antioch salinity ranges from fresh in the winter high inflow periods to brackish with EC ranging up to about 8,000 to 10,000 µS/cm during summer (EDAW 2005). During wet years such as 1995 and 1998, however, summer low flow conditions can still have relatively low EC concentrations considered to be representative of a freshwater ecosystem.

ORGANIC CARBON

In aquatic ecosystems, organic carbon is a complex mixture of different compounds. Although organic carbon is considered a “contaminant” for drinking water supplies, it is a vital nutrient for the Delta’s aquatic ecosystem. In the Delta, organic carbon originates from several sources, including tidal wetlands.

Organic carbon negatively affects the quality of drinking water (CALFED 2000c, DWR 1994). Treating Delta water to meet drinking water standards requires, among other things, simultaneous disinfection for pathogens and minimization of disinfection byproducts (DBPs), many of which are suspected carcinogens. Disinfection byproducts result when chlorine or ozone react with some forms of dissolved organic carbon (DOC), under some circumstances particulate organic carbon (POC), and bromide (discussed above), all of which are present in significant concentrations in Delta waters. Thus, export of organic carbon from tidal wetlands in the Delta might have negative effects on water quality for those people using the Delta as a source of drinking water.

Organic carbon influences, if not governs, many aspects of the biology and chemistry of aquatic ecosystems (Wetzel 2001). Because it is an energy source, organic carbon frequently regulates biotic processes such as bacterial productivity which in turn influences dissolved oxygen concentrations, food-web structure, and microbially-mediated biogeochemical transformations (Wetzel 2001).

Organic carbon in the Sacramento-San Joaquin Delta originates from a number of sources including tributary inflows (i.e., Sacramento River, San Joaquin River, Yolo Bypass, and eastside streams), in-Delta primary production, and Delta island drainage return flows. Organic carbon is typically divided into two categories: DOC and particulate organic carbon POC. Dissolved organic carbon is defined as that which can pass through a 0.45-µm filter; particulate organic carbon is retained by the filter. The combination of DOC and POC is referred to as total organic carbon (TOC).

There are a variety of sources of organic carbon to the Delta including both production within the Delta (autochthonous), production transported into the Delta from rivers, land, and atmosphere (allochthonous), and exchange with the ocean (transport sources) (Table 3.2-2) (Jassby 1992, Jassby et al. 1993, Brown 2003). The primary source of the Delta's organic carbon is organic carbon produced in the watershed and transported to the Delta by rivers (Jassby and Cloern 2000). The next largest source is organic carbon produced by phytoplankton in the Delta.

Table 3.2-2
Sources of Organic Carbon to the Sacramento-San Joaquin Delta

Source		
Unidirectional Sources		
	Autochthonous Sources	
		Phytoplankton
		Benthic microalgae
		Seagrasses
		Microalgae
		Photosynthetic bacteria
	Allochthonous Sources	
		Delta discharge
		Tidal marsh export
		Point source discharges
		Surface runoff
		Atmospheric deposition
		Oil Spills
		Groundwater
Exchange Processes		
		Circulation and mixing
		Dredging activity
		Biotic transport
Source: Jassby 1992		

With regard to the Delta's ecosystems, the large value of riverine inputs is somewhat misleading because both riverine inputs and phytoplankton production vary, and much organic matter transported by rivers is not available to organisms as food (i.e., bioavailable). Riverine inputs (which are dominated by the Sacramento River) have substantial interannual avariability, are episodic, and are influenced by events when a significant quantity of the Sacramento River's water flows through the Yolo Bypass (Sobczak et al. 2002). Organic carbon produced by phytoplankton can be comparable to riverine sources during summer, and can exceed riverine inputs during the spring and summer of years with little rainfall (Jassby et al. 2002).

Riverine sources of POC and DOC also are less available to aquatic organisms. The combination of metabolic losses, recalcitrance of detrital POC, and short residence time may minimize the importance of riverine sources of organic carbon to Delta consumers (Jassby and Cloern 2000). In fact, it appears that the dissolved and detrital particulate organic carbon delivered to the Delta does not enter the planktonic food web to a significant degree (Sobczak et al. 2002).

Rather, recent studies in the Delta indicate that phytoplankton production is the dominant food supply to the planktonic food web (Jassby and Cloern 2000; Müller-Solger et al. 2002; Sobczak et al. 2002). The increasing understanding of the relative importance of phytoplankton primary production in the carbon budget of the Delta may be particularly important in guiding new research and in evaluating the benefits of various management actions (e.g., Jassby et al. 2002, Jassby and Cloern 2000; Lucas et al. 2002).

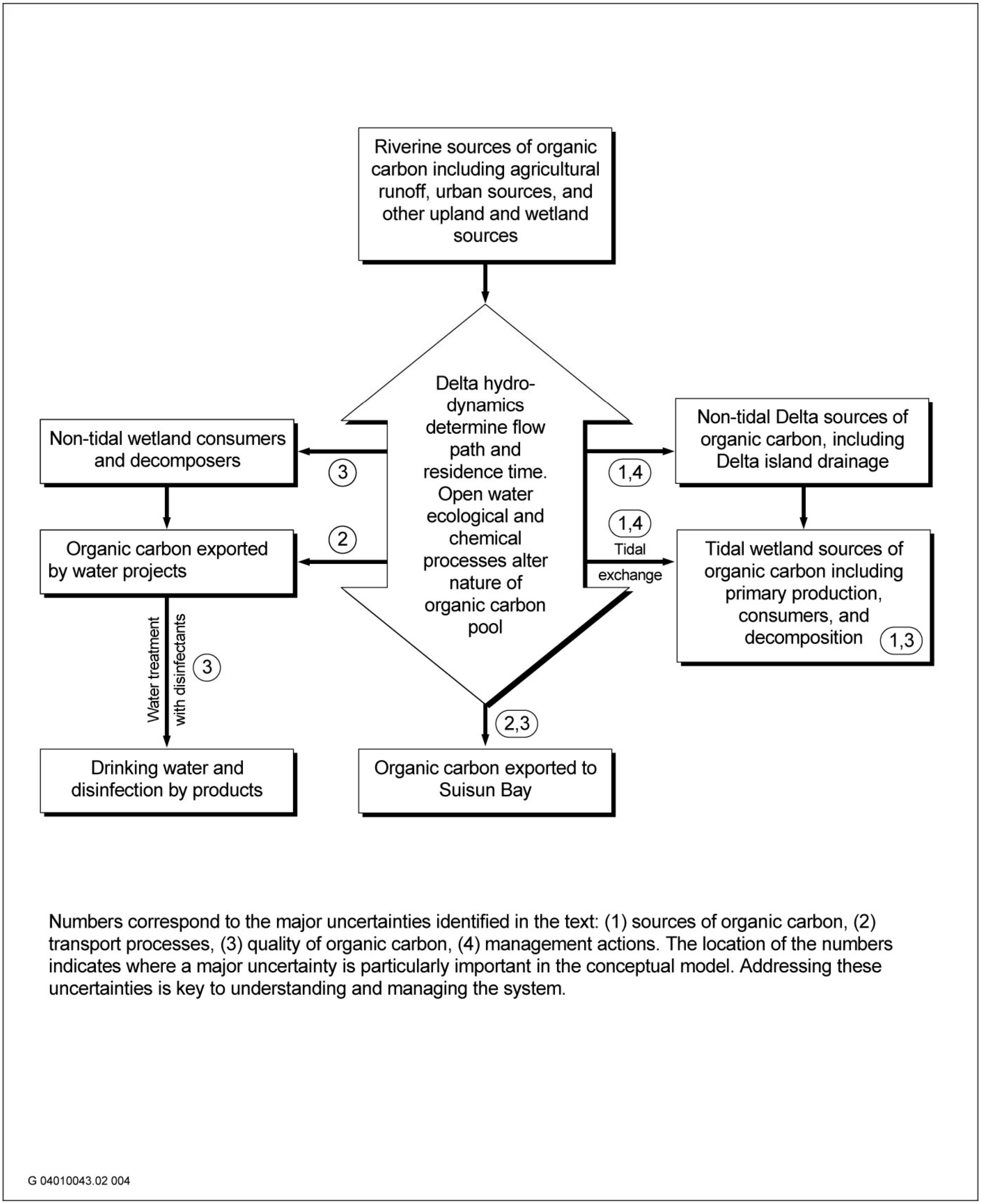
Agricultural drainage from the peat soils of the Delta's levee-protected islands, and export of organic carbon from marshes, are also important sources of organic carbon within the Delta. The Delta's peat soils consist largely of partially decomposed plant materials, and thus are rich in organic matter. Of approximately 738,000 acres of islands and channels making up the Delta today, about 250,000 acres are rich in organic matter. (In some cases, decayed vegetation has formed peat soils over 30-feet deep.) These organic-rich soils result in irrigated agricultural drainage that can exhibit very high DOC concentrations (DWR 1994 cited in DWR 2003a and 2003b) because organic matter is then carried off the islands as water from irrigation, rainfall, flooding, and seepage passes through the soil (DWR 2003a and 2003b). Consequently, this drainage adds almost as much organic carbon to Delta waterways as does production of carbon by phytoplankton (Jassby et al. 2002).

Organic carbon is produced and modified in, and exported from, tidal marshes like those at the LSIWA. Sources of organic carbon and processes that modify organic carbon within tidal wetlands and flooded islands are especially complex and dynamic. For example, tidal wetland export may result primarily from processes that occur at marsh margins (Jassby and Cloern 2000). If this is the case, then the interior areas of large patches of tidal marsh (such as at Lower Sherman Island) may contribute little organic carbon to Delta waterways, and edge-to-area relationships may be extremely important in predicting the flux of organic carbon from existing and restored tidal wetlands. Also, superficially similar, geographically proximate areas at flooded islands (like Lower Sherman Lake) can function very differently; this variability is likely due in part to the influences of adjacent tidal and riverine channels (Lucas *et al.* 2002).

Brown (2003) developed a simple conceptual model of the processes that determined the quality and quantity of organic carbon exports from the Delta (Exhibit 3.2-1). This model illustrates POC and DOC entering and exiting tidal wetlands during water exchanges related to the tidal cycle. Organic carbon imported into tidal wetlands and organic carbon generated in marshes through photosynthesis by plants and algae can enter the food web or undergo various transformations within the wetland environment. These internal processes may change the chemical or biological nature of the organic carbon and organic carbon may be exported from the wetlands to adjacent river channels in a variety of forms ranging from passively transported DOC to biomass in the tissues of organisms (Brown 2003).

Any contribution of tidal wetland organic carbon to DBPs in drinking water depends not only on the character of the organic carbon produced, but also on the location of the tidal wetlands and hydrodynamic conditions. Additional ecological and chemical processes occur in the channels, possibly changing the chemical composition and quantity of the exported organic carbon. Tidal water exchange will result in some portion of the organic carbon cycling between channels and tidal wetlands more than once. Flooded islands, such as Sherman Lake, can also result in different mixing regimes that further complicate the movement and form of organic carbon. These processes will likely result in the relative importance of organic carbon from tidal wetlands varying regionally and with flow conditions (Brown 2003).

Specific information on the carbon processes at LSIWA is lacking. As discussed above, superficially similar, geographically proximate flooded island habitats can function very differently. Therefore, it is difficult and perhaps would be overly speculative to characterize carbon processes in Sherman Lake with existing information. However, modeling and experiments similar to those performed by Lucas *et al.* (2002) could be applied to Sherman Lake to provide a better understanding of site-specific hydrodynamic transport and biological processes that greatly affect carbon dynamics.



Source: Brown 2003

Conceptual Model of Organic Carbon Process in the Sacramento-San Joaquin Delta **Exhibit 3.2-1**

MERCURY

Overview of Mercury Cycling

Mercury is a highly toxic element that is found both naturally and as an introduced contaminant in the environment. Mercury contamination is widespread in sediments and waters of the Delta, including at LSIWA; this is in large part a legacy of mercury mining in the Inner Coast Ranges and of the California gold mining era when mercury was used in the gold refining process (Domagalski 1996).

The ecological and human health implications of mercury contamination are determined by the likelihood of exposure, the form of mercury present (some forms are more toxic than others), and the geochemical and ecological factors that influence how mercury moves and changes form in the environment.

Elemental mercury (Hg), inorganic mercury (as in cinnabar, HgS), and methylmercury (CH_3Hg and (CH_3) 2Hg) are the three most important forms of mercury in natural aquatic environments. Most mercury is released into the environment as inorganic mercury, which is primarily bound to sediment particles and organic substances; in this form, it may not be available for direct uptake by aquatic organisms. However, methylmercury, an extremely harmful form of mercury, is readily taken up by aquatic plants, fish, and wildlife; it has been demonstrated to bioaccumulate and transfer through the food web (Beckvar et al. 1996).

Methylmercury is formed by sulfate-reducing bacteria (Wetzel 2001). The methylation of mercury is influenced by the availability of inorganic mercury, oxygen concentration, pH, oxidation-reduction potential, presence of sulfate and sulfide, type and concentrations of complexing inorganic and organic agents, salinity, and organic carbon (Blum and Batrha 1980; Jackson 1989; Parks et al. 1989; Winfrey and Rudd 1990; Beckvar et al. 1996; Gill et al. 2002). These conditions and the biological productivity of methylating microbes are also affected by seasonal changes in temperature, nutrient supply, oxygen supply, and hydrodynamics (changes in suspended sediment concentrations and flow rates).

Most methylmercury is produced by sulfate-reducing bacteria under anoxic and reducing conditions (Gilmour et al. 1992 cited in Heim et al. 2003). Therefore, factors that increase sulfate reduction rates, such as high water temperature, and high availability of organic carbon are likely to increase the production of methylmercury (Compeau and Bartha 1985, Gilmour et al. 1992 cited in Heim et al. 2003).

The most important sites of microbial methylation in the Delta are expected to be in sediments, wetlands, and seasonally inundated, vegetated habitats that provide the necessary conditions for sulfate-reducing bacteria (St. Louis et al. 1994, Hurley et al. 1995, Kelly et al. 1997, Gilmour et al. 1998 cited in Wiener et al. 2003).

Within the Delta, marshes seem to be more significant sites of methylmercury production than open-water sediments. Slotten *et al.* (2003) found that sediment methylmercury concentrations and methylmercury to total mercury ratios were significantly greater in highly vegetated marsh habitats as compared to adjacent Delta channel and mudflat environments. Methylation potential experiments showed that flooded wetland sediments exhibited 2-30 times greater potential to produce methylmercury than aquatic sediments of adjacent channels and flats.

In addition to marshes, Heim et al. (2003) identified farmed wetlands as an important source of methylmercury as the percent coverage of this habitat type was large with respect to the total area of the Delta and the methylmercury concentrations were measured to be relatively high compared to other habitat types (see Table 3.2-3).

Heim et al.'s (2003) investigation of wetlands to determine if methylation potentials were higher in the interior than adjacent waterways demonstrated clear patterns in both methylmercury concentrations and the methylmercury to total mercury ratios. Methylmercury concentrations at the interior of all marsh areas studied were higher than concentrations at the exterior of the marshes. In addition, the methylmercury to total mercury ratios were highest at the interior of the wetlands studied.

Table 3.2-3
Methylmercury Concentrations by Habitat Type in the Bay-Delta

Habitat Type	Area (sq. km.)	Methylmercury (ng/g-1)
Upland	3,751	0.19 ± 0.03
Riparian Woodland	41	0.24 ± 0.08
Mudflats	3	0.50 ± 0.32
Open Water	238	0.54 ± 0.06
Seasonal Wetlands	167	0.55 ± 0.06
Framed Wetlands	1,447	0.71 ± 0.20
Lakes and Ponds	35	1.26 ± 0.43
Marsh	51	1.46 ± 0.35
Total	**5,733**	

Source: Heim *et al.* 2003

Other studies have shown that newly flooded wetlands and reservoirs experience an increase in methylmercury production (Bodaly et al. 1993, Kelly et al. 1995, Kelly et al. 1997 cited in Heim et al. 2003). Kelly et al. (1997 cited in Heim et al. 2003) concluded that the large increases in methylmercury concentrations were a result of increased net production of methylmercury, rather than release of methylmercury that was in the wetland prior to flooding. The increase in methylmercury at these newly flooded areas was likely linked to increased microbial activity in response to a change in environmental conditions. Three changes in environmental conditions likely to stimulate methylation of mercury are: 1) sudden death of vegetation supplying a large amount of organic carbon to become available for decomposition, 2) high decomposition leading to an increase in anaerobic habitat, and 3) mercury methylation stimulated by increased temperature.

Recent research shows that there is still much to learn about methylmercury production and export processes from wetlands. Recent studies in the Delta indicate that some wetlands import and some export methylmercury (Stephenson, pers. comm., 2006). Two almost identical wetlands on Twichell Island that differ in depth and channel structure produce very different amounts of methylmercury (Stephenson, pers. comm., 2006). Biological findings indicate no distinct localized increase in net methylmercury bioaccumulation in wetlands versus adjacent upland areas within Delta subregions (Slotten et al. 2003). Some of the most well developed, highly vegetated wetland tracts have exhibited reduced levels of localized net mercury bioaccumulation (Slotten et al. 2003).

Additionally, recent findings on methylmercury production rates suggest that there may be an inverse relationship between environmental conditions that support high concentrations of biologically available mercury (e.g., relatively clean inorganic sediments [typically not associated with wetlands]) and those that support high sulfate reduction rates (e.g., oxic-anoxic sediment interface with relatively high amounts of organic material [typically associated with wetlands]) (Marvin-DiPasquale, pers. comm., 2005). These results suggest that wetland restoration may result in localized mercury bioaccumulation at levels similar to, but not necessarily greater than, levels within their surrounding subregion.

Bioaccumulation

Methylation of mercury is the key step in the entrance of mercury into food chains. Nearly 100% of the mercury that bioaccumulates in fish tissue is methylated. Mercury accumulates in an organism when the rate of uptake exceeds the rate of elimination. Although all forms of mercury can accumulate to some degree, methylmercury accumulates to a greater extent than other forms of mercury. Inorganic mercury can also be absorbed but is generally taken up at a slower rate and with lower efficiency than is methylmercury. Elimination of methylmercury takes place very slowly resulting in tissue half-lives (i.e., the time in which half of the mercury in the tissue is eliminated) ranging from months to years. Elimination of methylmercury from fish is so slow that long-term reductions of mercury concentrations in fish are often due mainly to growth of the fish. By comparison, other mercury compounds are eliminated relatively quickly resulting in reduced levels of accumulation (EPA 1997). Inorganic mercury, in contrast to methylmercury, is not readily transferred through successive trophic levels and does not biomagnify in food webs.

Methylmercury production and accumulation in the freshwater ecosystem is an efficient process for accumulating mercury that can then be ingested by fish-eating (piscivores) birds, animals, and people. In addition, methylmercury generally comprises a relatively greater percentage of the total mercury content at higher trophic levels. Accordingly, mercury exposure and accumulation is of particular concern for animals at the highest trophic levels in aquatic food webs and for animals and humans that feed on these organisms (EPA 1997).

Methylmercury readily crosses biological membranes and accumulates to concentrations in aquatic organisms that vastly exceed concentrations in ambient surface waters; for example, concentrations in fish commonly exceed those in the water in which they reside by a factor of more than 100. Concentrations of methylmercury in fish increase with increasing age or size, because of the very slow rate of elimination relative to the rate of uptake (Wiener et al. 2003).

Biomagnification of methylmercury in aquatic food webs has been widely documented, and patterns of biomagnification are similar even in aquatic systems that are different in ecosystem characteristics, mercury source, and intensity of pollution (Wiener et al. 2003). The concentration of methylmercury increases up the food web from water and lower trophic levels to fish and piscivores, and the fraction of mercury present as methylmercury also increases with increasing trophic level through fish. The fraction of mercury present as methyl mercury can vary greatly in organisms, such as aquatic macroinvertebrates, in trophic levels below fish. The abundance of methylmercury in the lower trophic levels is strongly correlated with the supply of methylmercury. In fish within a given trophic level, spatial variation in mercury levels is also strongly influenced by variation in the net production of methylmercury and its entry into the base of the food web. Concentrations of methylmercury in fish increase with increasing trophic position, and variation in trophic position accounts for much of the local variation in mercury tissue concentrations, both within and among species within a given water body. Thus, ecological factors, such as feeding relations and food-chain length, can strongly affect methylmercury exposure in biota atop aquatic food webs (Wiener et al. 2003).

The food chain pathway of methylmercury through larger, piscivorous fish is of primary importance in consumption-related toxicity to higher order consumers, including humans (Jones and Slotten 1996). Concentrations of methylmercury (quantified as total mercury) in several species of fish sampled from the Bay-Delta and tributary streams exceed 0.3 mg/kg (parts per million) wet weight (Slotton et al. 2000, 2002, Davis et al. 2003 cited in Wiener et al. 2003), a fish-tissue criterion established by the EPA for the protection of humans who eat noncommercial fish. The U.S. Fish and Wildlife Service recently completed an assessment on the 0.3 mg/kg methylmercury criterion for tissue concentrations proposed by EPA in 2001 that indicated the criterion may not be adequately protective for wildlife from bioaccumulation and biomagnification up the food chain (USFWS 2003).

Within a given species of fish or aquatic macroinvertebrate, there is substantial spatial variation in concentrations of methylmercury in the Delta (Slotton et al. 2000, 2002, Davis et al. 2003 cited in Wiener et al. 2003), reflecting uncertainties regarding the influence of mercury sources, methylating environments, and other, unidentified processes or factors.

Mercury research from the Delta and tributaries consistently indicates that sediment methylmercury concentrations, methylmercury formation and demethylation, organism uptake and bioaccumulation, and mass flux of methylmercury transfer from sediment to water are highly dynamic processes that can vary considerably, depending on the land use/community type (e.g., wetlands/marsh, agriculture, open water), location in the region, and a host of other factors (e.g., hydrologic factors, salinity, pH, temperature, organic matter, temporal-seasonal conditions) (Jones and Slotten 1996, Foe 2002, Gill et al. 2002, Stephenson et al. 2002, Choe and Gill 2003, Choe et al. 2003, Davis et al. 2003, Foe et al. 2003, Heim et al. 2003, Slotten et al. 2003, Wiener et al. 2003).

Human Health Concerns

The concern for human health stems primarily from mercury exposure through consumption of contaminated sport fish. Mercury is a neurotoxicant, and in humans is particularly hazardous for fetuses and children as their nervous systems develop. Mercury can cause many types of problems in children, including mental impairment, impaired coordination, and other developmental abnormalities. In adults, mercury has neurotoxic effects that include decrements in motor skills and sensory ability at comparatively low doses, to tremors, inability to walk, convulsions, and death at extremely high exposures (OEHHA 1994a). The U.S. Food and Drug Administration (FDA) action level, by which the California Office of Health Hazard Assessment (OEHHA) establishes fish consumption advisories, is 1.0 mg/kg as methylmercury. OEHHA uses EPA's national recommended water quality criterion of 0.3 mg/kg methylmercury as a screening value.

In 1970, a human health advisory was issued for the Delta advising pregnant women and children not to consume striped bass. The advisory was revised in 1993 upon review of more mercury data for striped bass. The revised advisory included size specific consumption advice for adults, children under 15 years, and pregnant women. Recent studies in the Bay-Delta watershed have continued to find mercury concentrations of potential human health concern in several popular sport fish species. Extensive sampling was conducted in San Francisco Bay in 1994 and 1997 (SFBRWQCB 1995 cited in Davis *et al.* 2003). In response to the 1994 results, an interim fish consumption advisory was issued for the Delta, largely due to concern over human exposure to methylmercury (OEHHA 1994b).

Studies of mercury contamination in sport fish have also been conducted in freshwater portions of the Delta and its watershed. Sport fish sampling was conducted throughout much of the Delta (the "Delta Study") in the summer of 1998 (Davis *et al.* 2000 cited in Davis *et al.* 2003). This sampling focused on largemouth bass and white catfish, which had average mercury concentrations in composite samples from the Delta of 0.29 mg/kg wet weight and 0.27 mg/kg wet weight, respectively. Sport fish were also sampled in the Sacramento River under the Sacramento River Watershed Program (Larry Walker Associates 1999 cited in Davis *et al.* 2003) and in the San Joaquin River as part of the Delta Study. Average mercury concentrations in Sacramento River largemouth bass (0.65 mg/kg wet weight) and white catfish (0.43 mg/kg wet) were higher than the concentrations in these species in the Delta. The average concentration in San Joaquin River largemouth bass (0.49 mg/kg wet weight) was also elevated relative to the Delta. Overall, the freshwater sampling has detected concentrations that are frequently above the mercury screening value and generally similar to those for which consumption advice has been issued for the Delta (Davis *et al.* 2003).

Mercury and Methylmercury TMDLs

In 1990, the Central Valley Regional Water Quality Control Board (Central Valley Regional Water Board) determined that mercury was impairing beneficial uses of the Delta's waters because fish had elevated levels of mercury that posed a risk for human and wildlife that consumed the fish. Consequently, the regional water board has been developing a TMDL for methylmercury and total mercury in the Sacramento-San Joaquin Delta Estuary (Central Valley Regional Water Board 2005). The basin plan for the Sacramento and San Joaquin River basins will be amended to include these TMDLs and an associated implementing program.

The draft recommendations for the mercury and methylmercury TMDLs include draft numeric targets. To meet the draft numeric targets, methylmercury concentrations in waters of the western Delta would need to be reduced by 28%; this will require exports of methylmercury from sediments in the western Delta's wetlands to remain constant or decrease (Central Valley Regional Water Board 2005).

Currently, mercury is entering the waters and food web of Sherman Lake and the adjacent marshes of Lower Sherman Island. Aqueous methylmercury concentrations in paired inflowing and outflowing tidal water indicate that Sherman Island is a net source for aqueous methylmercury to surrounding waterways (EDAW 2005). Also, bioaccumulated concentrations of mercury in Corbicula clams at Sherman Island are relatively high compared to sites throughout the entire Delta (as are other sites in the western Delta) (Slotten 2001). Bioaccumulated concentrations in inland silversides are comparable or lower compared to many of the surrounding sites in the western Delta (Slotten 2001). Thus, in the development of this LMP, it was assumed that the TMDL for methylmercury and its associated implementation program will have a substantial influence on wetland restoration projects at LSIWA.

OTHER WATER QUALITY ISSUES

In addition to the water quality issues discussed above, the Delta is affected by several other elements, compounds, and general issues. Other existing water quality problems of the Delta may be generally placed in the categories of toxic materials, suspended sediments and turbidity, eutrophication and associated dissolved oxygen fluctuations, and bacteria. Each of these broad categories is discussed briefly below.

Toxic Chemicals

Toxic chemicals have impaired water quality in many Delta waterways. High concentrations of some metals from point and nonpoint sources appear to be ubiquitous in the Delta. In addition to mercury (discussed above), high levels of other metals (i.e., copper, cadmium, and lead) in Delta waters are also of concern. Additionally, in localized areas of the Delta (e.g., near Big Break and Sherman Lake, and in Mormon Slough), fish tissues contain elevated levels of dioxin as a result of industrial discharges (SWRCB 1999).

Pesticides are found throughout the waters and bottom sediments of the Delta. High levels of chlordane, toxaphene, and DDT from agricultural discharges impair aquatic life throughout the Delta. The more persistent chlorinated hydrocarbon pesticides are consistently found throughout the system at higher levels than the less persistent organophosphate compounds. The sediments having the highest pesticide content are found in the western Delta (including the LSIWA). Pesticides have concentrated in aquatic life in the Delta, and the long-term effects are unknown. The effects of intermittent exposure of toxic pesticide levels in water and of long-term exposure to these compounds and combinations of them are likewise unknown (SWRCB 1999).

Suspended Sediments

Suspended sediments (silts, clays, and organic matter) are abundant in the Delta and cause turbidity throughout the region. Most of these sediments enter the tidal system with the flow of the major tributary rivers. Some enriched areas are turbid as a result of planktonic algal populations, but inorganic turbidity tends to suppress algal populations in much of the Delta. Continuous dredging operations to maintain deep channels for shipping have contributed to turbidity problems and are a factor in the temporary destruction of bottom organisms through displacement and suffocation (SWRCB 1999).

Eutrophication and Dissolved Oxygen

The most serious enrichment problems in the Delta (which can lead to eutrophication and low dissolved oxygen) are found upstream of the wildlife area along the lower San Joaquin River near Stockton and in certain localized areas receiving waste discharges but having little or no net freshwater flow. Low dissolved oxygen levels result in these areas mainly in late summer and coincide with low river flows and high temperatures (SWRCB 1999).

However, in summer, extensive growth of blue-green algae and aquatic plants can contribute a considerable quantity of organic matter to shallow, dead-end sloughs; this may reduce the level of dissolved oxygen in these locations (SWRCB 1999). Most channels at the wildlife area are clogged with such plant growth.

Bacteria

The bacteriological quality of Delta waters, as measured by the presence of coliform bacteria, varies depending upon proximity of waste discharges and significant land runoff. Regionally, the highest concentrations of coliform organisms are generally found in the western Delta. However, locally, high concentrations often can be found in the vicinity of waste discharges.

High concentrations of coliform bacteria are unlikely at LSIWA if the septic systems of cabins are maintained in conformance with the standards of the Sacramento County Department of Health and Human Services. Most cabins on Lower Sherman Island are "dry camps" that have no plumbing. Those cabins with plumbing discharge waste water and sewage into septic systems installed in the 1980s in coordination with the Sacramento County Department of Health and Human Services; thus, waste discharges from these cabins are unlikely to produce locally high concentrations of bacteria. The Sherman Island Public Access Facility does not have running water.

3.3 BIOLOGICAL RESOURCES OF AQUATIC ECOSYSTEMS

3.3.1 AQUATIC COMMUNITIES AND FOOD WEB

The Bay-Delta is a complex estuarine ecosystem; it is an area of transition between inland sources of freshwater and saltwater from the ocean. Along the salinity gradient extending from the Golden Gate upstream into the western and central Delta and tributaries, the species composition of the aquatic community changes dramatically, although the basic functional relationships among organisms (e.g., predator-prey, etc.) remain similar throughout the system. The Bay-Delta's aquatic communities are conceptually portrayed in Exhibit 3.3-1, which emphasizes the basic feeding relationships among community components and identifies some of more important species of the Bay-Delta ecosystem.

The primary energy input to aquatic ecosystems is solar radiation, which is used along with nutrients, by the primary producers (e.g., phytoplankton, vascular plants, and macroalgae) to convert inorganic carbon and nutrients to organic matter through photosynthesis. Zooplankton (e.g., copepods, cladocerans, mysid shrimp), prey on the phytoplankton. Vascular plants and macroalgae are grazed on and also produce detritus, which is decomposed by microbes and consumed by detritivores (e.g., polychaete worms, amphipods, cladocerans, and a diverse group of other fish and macroinvertebrates). The primary consumers are in turn preyed upon by secondary consumers, consisting mainly of a variety of invertebrates (e.g., polychaete worms, snails, copepods, mysid shrimp, bay shrimp, and crabs) and fish (e.g., delta smelt [*Hypomesus transpacificus*], threadfin and American shad [*Dorosoma petenense* and *Alosa sapidissima*], gobies, sculpin, juvenile chinook salmon [*Oncorhynchus tshawytscha*], and a variety of other resident and migratory fish species). These in turn are preyed on by top consumers, such as fish (e.g., striped bass [*Morone saxatilis*], catfish, sturgeon [*Acipenser* spp.], largemouth bass [*Micropterus salmoides*], and Sacramento pikeminnow [*Ptychocheilus grandis*]), birds, and humans. The role of a species in the food web may be different at different lifestages, or it may utilize various levels of the food web simultaneously.

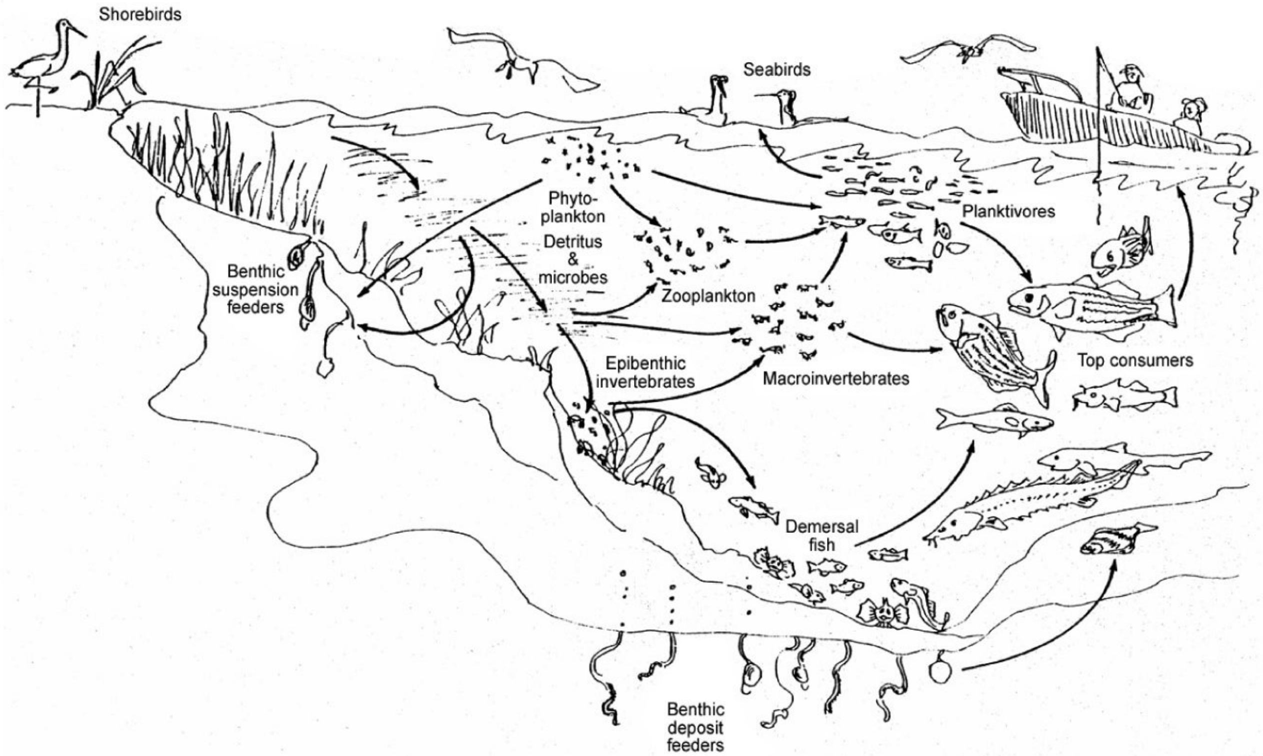
This section briefly discusses the major components of the Bay-Delta aquatic community, including phytoplankton, zooplankton, benthic macroinvertebrates, fish, shrimp, and crabs. Information on aquatic vegetation, which represents an important feature of the aquatic ecosystem, is discussed in Section 3.3.2, "Aquatic Vegetation." Though the discussion in this section is generalized for the Delta, it describes the general structure and function of the aquatic communities and food web at LSIWA.

PHYTOPLANKTON

Phytoplankton are small photosynthetic organisms that form the base of the aquatic food web in the Sacramento-San Joaquin Delta. They are usually microscopic in size and consist of single cells or chains of cells. Major groups of phytoplankton in the estuary include diatoms, dinoflagellates, and cryptomonads (Herbold et al. 1992).

Abundance of phytoplankton varies seasonally, and from year to year. Typically, their abundance is low during winter, increasing substantially during the spring and summer months, followed by a reduction in abundance during the fall. Factors affecting abundance of phytoplankton include seasonal patterns of solar radiation, seasonal water temperatures, availability of nutrients, current patterns and residence time, and salinity gradients. Turbidity, suspended sediments, and water depth also affect availability of sunlight and the abundance of phytoplankton, particularly in the shallow open waters of Sherman Lake, where sediment resuspension rates are high.

In addition to physical factors, consumption by animals also affects phytoplankton abundance. Consumption by benthic grazing herbivores, including the recently introduced Asian clam (*Potamocorbula amurensis*) and the freshwater clam (*Corbicula fluminea*), can be particularly important (Lucas et al. 2002). For example, in Suisun Bay, a substantial decrease in phytoplankton abundance has occurred since 1986; the decrease is associated with and maybe a result of the introduction of the Asian clam, and has raised concerns regarding the Asian clam's affect on zooplankton abundance.



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Source: CDF 1964; PG&E 1982

The Bay-Delta Aquatic Community and Primary Food Web **Exhibit 3.3-1**

The seasonal and interannual patterns in phytoplankton abundance affect the abundance of other aquatic organisms. The seasonal abundance (standing crop) of copepods, cladocerans, and other open water herbivores closely follows the seasonal cycle of phytoplankton abundance. Juvenile survival and growth of many fish species such as striped bass and threadfin shad largely depends on the quality and quantity of phytoplankton and/or associated zooplankton available as food.

ZOOPLANKTON

Zooplankton are microscopic and macroscopic animals that are planktonic (free-floating) or weak swimming fish and invertebrates. Some are permanent members of the plankton and are known as holoplankton. Others, such as eggs, larvae, and juveniles of benthic invertebrates and fish, are members of the plankton only during early lifestages and are known as meroplankton. A number of zooplankton species have been introduced into the estuary (Kimmerer 1998) through ballast water discharges from commercial shipping and have impacted native species inhabiting the estuary.

Zooplankton are primary consumers and are at the center of the estuarine food web; therefore, they are not only important to lower trophic levels upon which they feed (e.g., phytoplankton, detritus), but also to the higher trophic levels for which they serve as prey (e.g., fish and macroinvertebrates). Zooplankton include herbivores, which forage mainly on phytoplankton, and detritivores that feed on detritus and microbes. Zooplankton are primarily suspension feeders and include small macroinvertebrates such as calanoid copepods and cladocerans but also include fish and macroinvertebrate eggs and larvae, including delta smelt larvae, threadfin shad, and striped bass eggs and larvae, crabs, and bay shrimp.

The abundance and distribution of zooplankton varies substantially in response to seasonal cycles and environmental factors such as salinity gradients and river flow and tidal currents. Seasonal variations in zooplankton abundance are determined by temperature or photoperiod, seasonal cycles of phytoplankton, and Delta inflow and outflow (Kimmerer 2002a, 2002b). Zooplankton biomass tends to be highest in the Delta during spring and early summer. Salinity is one of the major factors affecting the distribution and abundance of zooplankton as evidenced by the changes in species composition that occur within various regions of the Delta. In the low-salinity regions of Suisun Bay and the western Delta the primary zooplankton are calanoid copepods (*Eurytemora affinis* and *A. clausi*) and the opossum shrimp (*Neomysis mercedis*). The cladocerans (*Daphnia pulex* and *D. parvula*), and calanoid copepods are the primary, zooplankton species occurring within freshwater portions of the central Delta.

The distribution and abundance of zooplankton are substantially affected by the availability of food. Physical and chemical conditions that promote phytoplankton productivity (warm temperatures, high solar radiation, high nutrients, slow-moving water, low turbidity and suspended sediment concentrations, shallow waters, etc.) indirectly promote the productivity of zooplankton. Water body configuration and bathymetry also indirectly affect phytoplankton productivity and therefore, zooplankton productivity. The shallow areas of Suisun Bay are highly productive, as are many of the shallow slow-moving open and backwater areas further upstream within the central Delta. The location of the saltwater and freshwater mixing zone during the spring also influences the abundance of both phytoplankton and zooplankton in the estuary. When the mixing zone is located in the shallow portions of Suisun Bay the abundance of both phytoplankton and zooplankton increases. When the mixing zone is upstream in the deeper channels of the lower Sacramento and lower San Joaquin Rivers and central Delta in response to reduced freshwater inflow that occurs during drought conditions, productivity and abundance of both phytoplankton and zooplankton is reduced.

The abundance of several important zooplankton species inhabiting the Delta has decreased substantially over the past several decades. The most dramatic change occurred with the introduction of the Asian clam in 1986 (Kimmerer and Orsi 1996). The Asian clam plays a significant role in grazing of zooplankton, consuming not only diatoms but also nauplii of the copepod (*Eurytemora affinis*), which is a dominant species in the Delta, and other holoplanktonic and meroplanktonic invertebrates (Carlton et al. 1990). At the time of the invasion, the copepod (*Pseudodiaptomus forbesi*), the mysid (*Acanthomysis* spp.) and amphipods became abundant in the regions formerly occupied by *E. affinis* (Kimmerer and Orsi 1996; Kimmerer et al. 1999). The introduction of nonnative fish and invertebrates such as the Asian clam has been identified as a major factor affecting the abundance and species composition of zooplankton, and the fish and macroinvertebrate community in general, within the Sacramento-San Joaquin Delta.

BENTHIC AND EPIBENTHIC MACROINVERTEBRATES

As adults, benthic macroinvertebrates typically live within the top 12 inches of sediment on the Bay-Delta floor. Adult epibenthic macroinvertebrates typically live on the sediment surface. However, larvae of many benthic and epibenthic invertebrates live in the open water as components of the zooplankton. Within the western Delta, benthic and epibenthic species include bay shrimp, opossum shrimp and amphipods (which are crustaceans), polychaetes and oligochaetes (which are segmented worms), and clams.

Many of the more common benthic species that inhabit the Sacramento-San Joaquin Delta are not native to the region but have been transported and introduced into the estuary through the discharge of ballast water from commercial ships, or on the shells of oysters brought from the East Coast for commercial farming in the late 19th century (Carlton 1979). Today, over 40% of the individuals comprising the benthic community in a given area of the Delta can be nonindigenous species (Carlton 1979; Cohen 2000). For example, all but two of the benthic mollusks (i.e., oysters and clams) are introduced. Many of these introduced species may serve ecological functions similar to native species that they may have displaced; however, some species may be detrimental to the desired functions of the aquatic ecosystem of the Delta.

Characteristics of the benthic and epibenthic macroinvertebrate community are influenced by a variety of physical and water quality conditions, the most important being flow velocities, substrate characteristics, and salinity gradients (Thompson et al. 2000). The factors most affecting the abundance and species composition of the benthic community from year to year are the volume of flow through the Delta, local runoff, and pollution (Nichols and Pamatmat 1988; Herbold et al. 1992). Lower outflows are associated with lower phytoplankton biomass and hence lower productivity during periods of low flow. High outflows lead to lower salinities, which especially affects species abundance and composition in shallow areas where animals are exposed to less saline surface water.

Benthic communities are also influenced by disturbances such as dredging and filling activities. Sediment grain-size distributions show that sandy sediments persist in areas of high current velocities such as the channel areas (Rubin and McCulloch 1979), while finer sediments settle in areas of lower current velocity such as in the shoals and small channels (Krone 1979) and in the shallow open water habitat in flooded islands such as Sherman Lake. Benthic and epibenthic invertebrate populations are generally most abundant in areas having reduced water velocities, fine-grained sediments, and relatively stable benthic environments (little sediment resuspension, movement or disturbance, slow rates of accretion or depletion of sediments). In deeper water channels, and high velocity areas characterized by sand and coarse substrate with substantial daily, seasonal or interannual substrate movement and accretions and depletions, benthic and epibenthic macroinvertebrate communities characteristically have reduced species diversity and abundance.

Patterns of reproduction and the availability of colonists can also have a profound effect on benthic community recovery following disturbance (Hanson et al. 2004). Polychaete worms, bivalve mollusks, crabs and shrimp recruit by small larval stages that can be planktonic and capable of dispersal over large geographic areas, or by larger crawl-away larvae that remain near the bottom and the adult habitat (Hanson et al. 2004). Amphipods and other similar crustaceans brood their young until they are small juveniles that disperse much like crawl-away larvae. In some species, the adults are the dispersal stage and the first colonists after disturbance. Benthic macroinvertebrates typically have high fecundity and dispersal mechanisms that facilitate colonization of habitat within the estuarine environment.

PREDATION BY FISH

Fish species may utilize the Delta for any or all of their life history stages. They may have planktonic, epibenthic (demersal), and pelagic (open water) life histories. The majority of fish species (e.g., delta smelt, threadfin shad, striped bass, gobies, etc.) inhabiting the estuary have planktonic larval stages; as plankton they feed on zooplankton and in some cases phytoplankton (Moyle 2002). Many of these species forage on plankton during the larval and early juvenile lifestages, and then as juveniles and adults become predators that are more selective and feed on large invertebrates and fish. Demersal fish such as sturgeon, gobies, sculpin, and striped bass, are planktivorous as larvae, but begin to feed on epibenthic invertebrates and fish as juveniles (Moyle 2002, Baxter et al. 1999). Many smaller fish including delta smelt and threadfin shad are planktivorous throughout their lives (Moyle 2002).

Some estuarine fish do not rely on plankton as a major food source at any lifestage. The live-bearing tule perch, for example, predominantly feed on epibenthic invertebrates, such as mollusks, crustaceans, and polychaetes throughout their life (Moyle 2002). Sturgeon feed on benthic and epibenthic invertebrates by shoveling through the substrate, and feed on fish and large invertebrates in the water column. Many freshwater fish such as juvenile chinook salmon prey primarily on benthic and drifting insect larvae and crustaceans (Moyle 2002), because zooplankton abundance is low in the swifter flowing freshwater sloughs and rivers.

3.3.2 AQUATIC VEGETATION

SUMMARY OF ECOLOGY

Aquatic vegetation consists of submerged plants generally rooted in the substrate, whose stems may partially extend above the water surface (e.g., during flowering) and floating plants that are generally not rooted in the substrate. This section focuses on vascular plants because of their dominance of aquatic vegetation at LSIWA.

Submersed plants generally die back to their stem bases, rhizomes and/or to other over-wintering vegetative structures (e.g., turions) as water temperatures drop in the late fall. Throughout spring and summer, active growth increases stem biomass (i.e., standing crop) to a peak in early fall. Though these plants flower and produce seed, reproduction via vegetative propagules (e.g., turions, specialized buds and stem fragments) is their primary means of reproduction. Light availability (which decreases with depth), turbidity, and shade cast by over-topping vegetation, can restrict submerged plants to relatively shallow areas. In the Delta (which has turbid waters), most submerged vegetation appears to be restricted to areas < 5–10 feet in depth. Velocity may contribute to this depth restriction. Native species of submersed plants include coontail (*Ceratophyllum demersum*), common elodea (*Elodea canadensis*), waterbuttercup (*Ranunculus aquatilis*) and pondweeds (*Potamogeton* species). Nonnative species include curlyleaf pondweed (*Potamogeton crispus*), egeria (*Egeria densa*), parrotfeather (*Myriophyllum aquaticum*), and Eurasian milfoil (*Myriophyllum spicatum*). No special-status, submerged plant species have been recorded from aquatic habitats in the vicinity of LSIWA; however, suitable habitat for eel-grass pondweed (*Potamogeton zosteriformis*) may exist at the wildlife area. Eel-grass pondweed is rare in California but more common elsewhere, and thus is on list 2 of the California Native Plant Society's Inventory of Rare and Endangered Plants (CNPS 2006).

Most floating plants also depend primarily upon vegetative reproduction. The growth rate of most species, and consequently their abundance, increases in late spring and summer, and then diminishes in late fall to early spring. Species also produce overwintering buds, spores, and seeds. In the Delta, native species of floating plants include duckweeds (*Lemna* and *Spirodela* species) and mosquito ferns (*Azolla* species). In addition, the nonnative water hyacinth (*Eichhornia crassipes*) is widespread and abundant. No special-status, floating plant species have been recorded from aquatic habitats in the vicinity of LSIWA (CNDDB 2005; CNPS 2006).

Species Associations at LSIWA

Open water at Sherman Lake and along the Sacramento and San Joaquin Rivers supports submerged and floating aquatic vegetation, and also may be unvegetated. The boundaries for vegetated areas within open water vary seasonally in extent and presence, and it is difficult to distinguish aquatic habitat signatures on aerial photographs without the aid of spectral analysis. Therefore, areas mapped as open-water habitat for this report include submerged, and some floating, aquatic vegetation. Along some channels, however, a mosaic of floating and marsh vegetation is evident and distinguishable from adjacent water and marsh because of its distinct boundaries.

Submerged Aquatic Vegetation

Submerged aquatic vegetation within the open water area of Sherman Lake is dominated by the nonnative species egeria. Egeria also dominates submerged vegetation along the shallower margins of the Sacramento and San Joaquin rivers, however the native species fennel-leaf pondweed (*Potamogeton pectinatus*) also dominates patches along the western shore of Lower Sherman Island.

Floating Aquatic Vegetation

Large expanses of open water at Sherman Lake are dominated by the invasive nonnative species water hyacinth. This plant readily forms dense, interconnected mats that drift along the water's surface. Its thick, waxy leaves are held upright above the water surface on bulbous, air-filled stalks (Bossard et al. 2000). Its ecology and control are described in the following section, *Assessment of Invasive Plant Issues*.

Assessment of Invasive Plant Issues

Several problematic invasive species are present in the Delta's aquatic vegetation. These include curlyleaf pondweed, egeria, parrotfeather, Eurasian milfoil and water hyacinth. In addition to these species, in the future, hydrilla (*Hydrilla verticillata*) also could become abundant in the region. Any of these species could be present at LSIWA or could become established there in the future. Egeria and water hyacinth are the current dominants of aquatic vegetation at Sherman Lake, and their ecology and control are described below.

Egeria

Egeria (*Egeria densa*) also is a submerged aquatic with roots in the substrate and leafy stems that extend through the water column to the surface (Hoshovsky and Anderson 2000; DiTomaso and Healy 2003). No seed are produced in California (because only male plants are present). New plants are formed from stem fragments. During winter, new shoots are initiated from the stem bases (Getsinger and Dillon 1984; Haramoto and Ikusima 1988). In spring, these grow to the water surface, and active growth continues into fall. During active growth, new stems are initiated from the base of the shoot system, branches off of existing shoots are formed, and older shoots fragment or die back. In late fall, the plants die back to the base of their stems.

In its native range, egeria is a species of still, shallow water (< 6 feet), but in California, and elsewhere it has been introduced, it occurs across a somewhat wider range of depths (in some cases in water up to 23 feet deep) and frequently occurs in flowing water (Cook and Urmi-Konig 1984). Temperature, light availability, turbidity, and velocity all strongly affect its growth and survival, and thus the settings in which it is found. Growth of egeria diminishes substantially below 50–59ºF and above 77–86ºF (Barko and Smart 1981; Cook and Urmi-Konig 1984; DiTomaso and Healy 2003).

Shade reduces growth, but even at 5% of full daylight egeria can grow and develop a canopy (Barko and Smart 1981; Getsinger and Dillon 1984; Haramoto and Ikusima 1988). Egeria can grow in turbid water (Tanner et al. 1993), but the turbidity reduces light availability, and this limits its growth in deeper water. In the turbid water typically encountered at LSIWA, egeria's growth probably is severely limited below 5–10 feet. This would not necessarily prevent stems from being rooted at such depths, however, because elongating stems would be growing into higher light levels as they extend towards the water surface. Thus, stems would need sufficient stored energy to facilitate such growth, but this would be the case when established plants expanded into deeper water.

Water flow at even moderate velocities (> 0.7 feet per second) may fragment some stems, reducing growth and survival (Schutten and Davy 2000). However, egeria's growth form is very plastic and can adjust to its physical setting, and thus reduce its propensity to fragment. Nonetheless, high water velocities, and wind and wave action, appear to limit the distribution and abundance of egeria in the Delta (EDAW et al. 2005).

Other factors affecting egeria growth and survival in the Delta include salinity and exposure during low tides. Egeria can tolerate salinity levels of 10–12 parts per million (ppm) for short durations (e.g., a few days). Extended periods of increased salinity, however, may cause large die-offs (EDAW et al. 2005). Egeria can not survive in areas exposed for long durations during low tides because it desiccates with prolonged exposure to air.

At LSIWA, egeria dominated approximately 590 acres in 2000 (approximately 30% of the area of open water), and 25% in 1997 and 32% in 1999 (RTC 2004). It currently impedes boat access to portions of the wildlife area, particularly at low tide, and it may be adversely affecting water quality through its production of organic carbon. Egeria has also been documented to diminish habitat quality for native species by displacing native flora and providing habitat for nonnative predator fish species including striped bass, which feed on delta smelt and juvenile chinook salmon (Grimaldo et al. 2004; Brown 2003).

Control of established patches of egeria is difficult. Mechanical removal efforts do not eradicate the plant and produce large numbers of fragments that may establish elsewhere as new plants. In addition, vertebrates can be removed or otherwise harmed during mechanical removal of aquatic weeds (Booms 1999; DBW 2000). Herbicide applications are more effective; herbicides that may effectively control egeria and are permitted in California for application in aquatic habitats include diquat, acrolein, and fluridone (San Francisco Estuary Institute 2003). However, herbicide applications are not without problems. Dense stands of aquatic plants and moving water both complicate and tend to reduce the success of herbicide applications. Furthermore, the site may be continually re-colonized by surviving plants and by stem fragments from upstream sites. Drawdowns of the water level to expose and dessicate plants have been effective for controlling Eurasian milfoil (Goldsby and Sanders 1977; Poovey and Kay 1998) and may be an effective control method for egeria, but it is not feasible at LSIWA.

Water Hyacinth

Water hyacinth (*Eichhornia crassipes*) is one of the world's most problematic weeds (Godfrey 2000b). It is a floating plant that also survives on moist substrates in marshes and along channels. Water hyacinth reproduces vegetatively (from short lateral stems called stolons) and from seed. In the Delta, water hyacinth grows year-round (though slowly in winter, and frost can damage leaves and stems) and it reproduces throughout summer and fall (Penfound and Earle 1948; Owens and Madsen 1995). Seeds may remain dormant for years, or germinate in spring on exposed sediments along shorelines or on floating mats of vegetation (Penfound and Earle 1948; DiTomaso and Healy 2003). When temperatures are warm, growth rates can be extremely high, and result in a doubling of plant biomass in under a week (DiTomaso and Healy 2003). Throughout spring and summer, mats of water hyacinth may expand laterally at over 2 feet per month (Penfound and Earle 1948). As a result, dense mats of water hyacinth can clog small or still channels, forming a continuous layer of vegetation from a meter above the water surface to nearly a meter below the surface (i.e., the depth to which its roots extend). This has occurred in some channels at LSIWA.

Mechanical and biological control have been unsuccessful. But, repeated mechanical harvesting can reduce and maintain biomass at a lower level. (However, vertebrates can be removed or otherwise harmed during mechanical removal of aquatic weeds [Booms 1999; DBW 2000].) Drawdown of the water level could cause dessication and death of water hyacinth (as it does for submerged aquatics); however exposure and drying would need to be prolonged and dry out the substrate as water hyacinth can survive when exposed on a moist substrate. This is not feasible at LSIWA.

3.3.3 FISHERIES

San Francisco Bay, Suisun Bay, and the western and central Delta (Bay–Delta) are habitat to a diverse assemblage of freshwater, marine, and estuarine organisms. The biological environment is a complex community of plants and animals inhabiting the saltwater, estuarine (brackish-water), and freshwater habitats within the Bay–Delta estuary. This section provides a summary of information available on the common fish populations inhabiting the Bay–Delta, with an emphasis on flooded island shallow-water habitat in the western Delta, because a wide range of these habitats occur at or in the vicinity of the LSIWA, and because Sherman Lake provides some of the most important flooded island habitat shallow-water habitat in the Delta.

Numerous fish species, including game and special-status species use aquatic habitats at the LSIWA including striped bass (*Morone saxatilis*), Sacramento splittail (*Pogonichthys macrolepidotus*), delta smelt (*Hypomesus transpacificus*), white catfish (*Ameiurus catus*), carp (*Cyprinus carpio*), largemouth bass (*Micropterus salmoides*), steelhead (*Oncorhynchus mykiss*), chinook salmon, white (*Acipenser transmontanus*) and green sturgeon (*Acipenser medirostris*), and American shad (*Alosa sapidissima*). These species, and numerous other fish species, use sough and cuts, shallow channel and shoal areas, deep river channels/levee breaches, and open water habitats at the LSIWA.

AQUATIC HABITATS

Suisun Bay and to a lesser extent the western Delta are characteristic of the upstream estuarine transition zone that separates the upstream freshwater Delta from the downstream saltwater bays. Suisun Bay and the western Delta, including the LSIWA, contain several aquatic habitats, including sloughs and cuts, shallow channel and shoal areas, the main river channels, and open-water aquatic habitats. Together, these habitats support a large and diverse aquatic community (Table 3.3-1), which includes several recreationally important species of fish. The following sections briefly describe these major habitats within the vicinity of Sherman Lake.

Table 3.3-1
Fish Species Collected in Suisun Bay and Central Delta Fishery Sampling

Common Name	Scientific Name	Common Name	Scientific Name
American shad	*Alosa sapidissima*	Pacific staghorn sculpin	*Leptocottus armatus*
Arrow goby	*Clevelandia ios*	Pacific tomcod	*Microgadus proximus*
Arrow/Cheekspot goby	n/a	Plainfin midshipman	*Porichthys notatus*
Bay goby	*Lepidogobius lepidus*	Prickly sculpin	*Cottus asper*
Bay pipefish	*Syngnathus Zeptorhynchus*	Redear sunfish	*Lepomis microlophus*
Bearded goby	*Barbulifer ceuthoecus*	River lamprey	*Lampetra ayersii*
Bigscale logperch	*Percina macrolepida*	Sacramento pikeminnow	*Ptychocheilus grandis*
Black bullhead	*Ameiurus melas*	Sacramento sucker	*Catostomus occidentalis*
Black crappie	*Pomoxis negromaculatus*	Shimofuri goby	*Tridentiger bifasciatus*
Bluegill	*Lepomis macrochirus*	Shiner perch	*Cymatogaster aggregata*
Brown bullhead	*Ameiurus nebulosus*	Speckled sanddab	*Citharichthys stigmaeus*
California halibut	*Paralichthys californicus*	Splittail	*Pogonichthys macrolepidotus*
Chameleon goby	*Tridentiger trigonocephalus*	Starry flounder	*Platichthys stellatus*
Channel catfish	*Ictalurus punctatus*	Steelhead trout	*Oncorhynchus mykiss*
Cheekspot goby	*Ilypnus gilberti*	Striped bass	*Morone saxatilis*

Table 3.3-1 Fish Species Collected in Suisun Bay and Central Delta Fishery Sampling			
Common Name	Scientific Name	Common Name	Scientific Name
Chinook salmon	*Oncorhynchus tshawytscha*	Surf smelt	*Hypomesus pretiosus*
Common carp	*Cyprinus carpio*	Threadfin shad	*Dorosoma petenense*
Delta smelt	*Hypomesus transpacificus*	Threespine stickleback	*Gasterosteus aculeatus*
English sole	*Pleuronectes vetulus*	Tule perch	*Hysterocarpus traski*
Goby type II	n/a	Unidentified fish	n/a
Golden shiner	*Notemigonus crysoleucas*	Unidentified goby	n/a
Goldfish	*Carassius auratus*	Unidentified minnow	n/a
Green sturgeon	*Acipenser medirostris*	Unidentified smelt	n/a
Inland silverside	*Menidia beryllina*	Unidentified sunfish	n/a
Jacksmelt	*Atherinopsis californiensis*	Wakasagi	*Hypomesus nipponensis*
Largemouth bass	*Micropterus salmoides*	Western mosquitofish	*Gambusia afinis*
Longfin smelt	*Spirinchus thaleichthys*	White catfish	*Ameiurus catus*
Longjaw mudsucker	*Gillichthys mirabilis*	White crappie	*Pomoxis annularis*
Northern anchovy	*Engraulis mordax*	White croaker	*Genyonemus lineatus*
Pacific herring	*Clupea pallasi*	White sturgeon	*Acipenser transmontanus*
Pacific lamprey	*Lampetra tridentata*	Yellowfin goby	*Acanthogobiusflavimanus*
Source: CDFG unpublished data			

Sloughs and Cuts

There are many sloughs and cuts within the Sacramento-San Joaquin Delta. Numerous human-made inlets have been excavated as harbors and marinas for recreational boat moorages within the Delta. Siltation and reduced water depth in many of these areas have adversely affected navigation and require periodic maintenance dredging. Stands of emergent vegetation, particularly cattails (*Typha* spp.) and tules (*Scirpus* spp.), border many of these cuts and sloughs. Sherman Lake has a public boat ramp and small marina. In addition, there are many sloughs and cuts within Sherman Lake.

Common invertebrates that inhabit Delta sloughs and cuts include amphipods, shrimp, polychaetes (e.g., marine worms), and small bivalves (e.g., clams). Fish commonly found in the area include threadfin shad (*Dorosoma petenense*), striped bass, Sacramento splittail, delta smelt, tule perch (*Hysterocarpus traski*), Sacramento pikeminnow (*Ptychocheilus grandis*), white catfish (*Ameiurus catus*), yellowfin goby (*Acanthogobius flavimanus*), carp (*Cyprinus carpio*), and largemouth bass. In addition, the calm waters and shelter afforded by many of the cuts and sloughs attract early life stages of many fish species.

Shallow Channel and Shoal Areas

The area between the shore and deepwater ship channels is characterized by water depth less than 10 feet, a mud and silt or mud–sand bottom, and reduced tidal and river currents. Smaller channels are characterized by water depths less than 6 feet with a silt and mud substrate. Areas within the interior open waters of Sherman Lake are characterized as shallow shoal-type habitat. Many areas adjacent to the shoals and channels are bordered by tules.

Large numbers of small crustaceans, particularly mysid shrimp (*Mysis* spp), bay shrimp (*Palaemon macrodactylus* and *Cragon* spp.), and amphipods inhabit the shallow-water area in and adjacent to the LSIWA.

These invertebrates serve as an important food supply for young-of-the-year striped bass, juvenile chinook salmon (*Oncorhynchus tshawytscha*), and other young fish. The shallow shoal areas serve as a foraging and rearing area for juvenile striped bass and chinook salmon, in addition to a variety of other resident and migratory species. Other fish found inhabiting shallow channel and shoal areas include threespine stickleback (*Gasterosteus aculeatus*), tule perch, Sacramento pikeminnow, gobies, inland silversides (*Menidia beryllina*), starry flounder (*Platichthys stellatus*), Sacramento splittail, delta smelt, carp, white catfish, and largemouth bass.

Deep River Channels/Levee Breaches

River channels are characterized by depths of more than 10 feet and strong tidal and river currents, typically 1.1–1.5 feet per second (ft/sec) or more. The lower Sacramento and San Joaquin rivers adjacent to Sherman Lake are also deep-water, maintained, navigational shipping channels with water depths typically ranging from 40 to 60 feet within the channel. The river bottom in areas where water velocities are high is generally composed of sand. This is typical of the scour that occurs as a result of high tidal current velocities within the deeper levee breaches and within the navigational shipping channels. Finer silt and other sediments occur in areas adjacent to the main channel or levee breaches in areas where water velocities are reduced. Invertebrates, which inhabit these channels, include bottom-dwelling polychaetes, amphipods, bivalves, and shrimp. These higher velocity areas also serve as habitat for larger predatory fish, such as striped bass, that prey on smaller fish as they pass in and out of levee breaches and higher-velocity river channels.

Open Water

The open waters of the Delta serve as migratory routes for several species of anadromous fish whose adults swim upstream to the freshwater reaches of the tributary rivers to spawn and whose juveniles return downstream to the ocean. These fish include steelhead, chinook salmon, white, and green sturgeon, striped bass, and American shad. In addition, the open water habitat within Sherman Lake supports populations of resident species including largemouth bass, Sacramento pikeminnow, white catfish, and threadfin shad.

Aquatic Habitat Function and Use

Fish, shrimp, and crabs use habitats within the Delta for a number of functions including, but not limited to:

- Adult and juvenile foraging,
- Spawning,
- Egg incubation and larval development,
- Juvenile nursery areas, and
- Migratory corridors.

Species use of aquatic habitats for any of these functions may vary in response to a suite of factors, and many of these factors may vary daily, seasonally, and annually.

The aquatic environment is dynamic, varying in response to factors such as the magnitude of freshwater inflow from the Sacramento and San Joaquin river systems and other tributaries and resultant changes in salinity gradients, wind and tidally driven current patterns, seasonal variation in water temperatures, and a variety of other physical and biological processes. The habitat use and functions of areas within the Delta vary in response to these physical factors as well as to differences in life history characteristics and habitat requirements for the wide variety of fish and macroinvertebrates inhabiting the Delta. It may, therefore, be possible to predict whether a species is likely to utilize a site, and to predict what that use might be under a given set of circumstances. However, in an ecosystem where conditions such as salinity and freshwater flow may change rapidly and somewhat unpredictably, it may be difficult to predict the distribution and abundance of aquatic species with precision. The Department's fishery studies provide general insight into how many aquatic species may respond to some of the varying conditions in the Delta's aquatic habitats.

Baxter et al. (1999) described the geographic distribution of various fish, shrimp, and crabs inhabiting the estuary and their response to seasonal and geographic variation in salinity gradients and water temperature. The geographic distribution of many of these species is determined, in large part, by salinity tolerance and preference. Within the Delta, fresh water and salt water mix, forming a dynamic and productive estuarine habitat characterized by a wide range of salinities, both geographically and seasonally. The geographic distribution and habitat usage patterns for the fish, shrimp, and crabs, which may vary by different life stages of the species, reflect in large part the response to these salinity conditions and other physical habitat conditions, including water depths, substrate, availability of suitable cover, and other factors.

Baxter et al. (1999) categorized the fish, shrimp, and crabs inhabiting the Delta based on three life history strategies, including:

- Species that reside in the Delta year-round;
- Species that seasonally inhabit the Delta, typically as foraging, spawning, or juvenile nursery habitat; and
- Anadromous or migratory species that move through the estuary during passage to or from freshwater and coastal marine habitats. The vast majority of anadromous fish species, including chinook salmon, steelhead, striped bass, American shad, and sturgeon, migrate through the Delta and the Sacramento and San Joaquin rivers during their upstream and downstream migrations.

Among the seasonal inhabitants, many species use the Delta as a spawning area and/or juvenile nursery habitat on either an obligatory or nonobligatory basis (Baxter et al. 1999). For obligate species, reproduction and rearing of juveniles occurs almost exclusively within a bay or estuarine environment. Baxter et al. (1999) identifies Pacific herring (*Clupea pallasi*), jacksmelt (*Atherinopsis californiensis*), and many surfperch as examples of obligate species that migrate into the Delta to reproduce. Other estuarine obligate species such as starry flounder and bay shrimp reproduce in coastal marine waters, with larvae and/or early juvenile life stages migrating into the estuary to rear.

Nonobligate species may inhabit the estuary during any given year. The presence of nonobligate species varies substantially from one year to the next within the Delta. Nonobligate species include Dungeness crab (*Cancer magister*), brown rockfish (*Sebastes auriculatus*), and English sole (*Pleuronectes vetulus*), which reproduce in the ocean and enter the estuary as small juveniles for rearing (Baxter et al. 1999). These species are typically found in the more marine areas of the estuary and are generally not abundant upstream in the Western Delta.

Opportunistic species use the Delta as an extension of their habitat based on the suitability of environmental conditions. Baxter et al. (1999) notes that several freshwater or low-saline species, such as white catfish and threadfin shad, may opportunistically use habitats within the western Delta during periods of high freshwater outflow from the river systems that result in lower salinity and more suitable habitat conditions for these species further downstream in the system.

Anadromous species, such as chinook salmon and steelhead, spawn within freshwater portions of rivers and creeks tributary to the Delta. Juvenile rearing habitat for these species is also primarily within the freshwater or low-saline portions of the system. Juvenile chinook salmon and steelhead emigrate from freshwater habitat and move downstream through the estuary, which is used primarily as a migratory corridor and short-term foraging habitat, as they move into coastal waters for rearing. The LSIWA and adjacent regions in Suisun Bay and the western Delta serve as foraging habitat for salmon fry during rearing in the Delta and as smolts migrate downstream from the tributary river systems. Adult chinook salmon and steelhead subsequently migrate back upstream to spawn, again using the Delta as a migratory corridor. Other anadromous species, such as striped bass, have high salinity tolerance and inhabit freshwater, estuarine, and marine waters for an extended time as both juveniles and adults. Juvenile and adult striped bass reside year-round within the Delta, including Sherman Lake.

Habitat use by various species of fish, shrimp, and crabs in the estuary has been categorized by Baxter et al. (1999). Because the Delta serves as a critical element of the habitat for resident species and species that use the system as an obligate nursery, changes in habitat quality or availability may have a great effect on these species populations. Year-class strength for these species is dependent, in part, on habitat conditions within the Delta. Species that use the Delta as a nonobligate nursery area or on an opportunistic basis would be expected to have year-class strength affected to a lesser degree by variation in habitat quality and availability within the Delta that might be affected by changes in habitat conditions and/or habitat enhancement projects at LSIWA or elsewhere in the Delta. Changes in habitat quality and availability within the Delta may affect all of these species in various ways, and the significance of potential habitat alterations as a result of aquatic habitat enhancement projects needs to be assessed, in part, based on the life-history strategies and habitat usage patterns and functions associated with the Delta.

A wide range of life-history strategies and habitat requirements characterize fish, shrimp, and crabs inhabiting the Delta (Moyle 2002; Baxter et al. 1999). As noted previously, habitat requirements of the various species and their life-history stages are determined by a variety of factors including:

- Salinity gradients,
- Seasonal variation in water temperature conditions,
- Variation in water depth,
- Substrate,
- Variation in water velocity and current patterns, and
- Availability of foraging and cover habitat and physical structures such as pilings and emergent vegetation, high velocity areas adjacent to levee breaches and deep-water channel habitat, and riprap, which provide foraging areas and shelter and cover.

Species functional habitat use in the Delta, including LSIWA, varies in response to these physical habitat features and the life history of the species (Baxter et al. 1999; CDFG unpublished data; Hanson unpublished data). Species such as chinook salmon and steelhead use the Delta as a temporary foraging and migratory corridor during juvenile emigration from freshwater rearing areas to coastal marine waters and again as adults migrate from coastal marine waters upstream to freshwater spawning habitat (Moyle 2002).

The abundance (density) of various species within an area provides important information on the values, uses, and functions of various habitats for different life stages of a species. For example, high abundance of a species or life stage within a specific area suggests that physical and chemical habitat characteristics (e.g., water depth, substrate, salinity, temperature, availability of prey, and availability of cover and shelter) are being met for that species during the time they occupy that habitat. Information on seasonal abundance patterns within an area can be used, in combination with information on the life-history characteristics of the species, to help identify the functional use of different habitats for activities such as adult foraging, spawning and egg incubation, larval dispersal, juvenile nursery and rearing, seasonal migration patterns, and other habitat functions (Hanson et al. 2004). Available data were examined from the Department's fishery sampling program, and other fishery studies, to provide information on habitat use by various species and life stages in Suisun Bay and the Delta in the vicinity of LSIWA.

In addition to fishery sampling conducted by the Department, information is available on habitat use and function for various fish species within the Sacramento-San Joaquin Delta, including in the vicinity of LSIWA. Information on fish spawning and the occurrence of larval fish (ichthyoplankton) in the estuary has been compiled by several investigators, including Wang (1986). Information is also available from fishery surveys conducted in

Suisun Bay and the Delta by USFWS, California Department of Water Resources (DWR), US Bureau of Reclamation (Reclamation), and others.

Recreational anglers and commercial party boats that fish in Suisun Bay and the Delta, including Sherman Lake, provide anecdotal information on habitat function for species such as adult striped bass, white sturgeon, largemouth bass, and other species. Catch data provides information useful in evaluating habitat use and function in the area for adult and subadult life stages of various fish, which are not effectively sampled using conventional fishery collection techniques (e.g., otter trawl and midwater trawl sampling). Information from these various sources can then be used collectively as part of the scientific foundation for determining potential effects of aquatic habitat enhancement projects at LSIWA and in the Delta on habitat use and function and species occurrence within the area.

The Delta is characterized by a diverse assemblage of physical habitats that function in a variety of ways that meet the life-history requirements of various aquatic species. Information and knowledge regarding the habitat requirements (e.g., preferred substrate, preferred water depths, salinity ranges, temperature ranges, etc.) and life history strategies and habitat usage patterns provide an important foundation for understanding the habitat functions of the estuary. Information on habitat function and use for these various species and life stages provides a useful framework for evaluating the potential beneficial effects resulting from habitat enhancement projects that could be developed for LSIWA.

ESSENTIAL FISH HABITATS

The Suisun Bay, and the western and central Delta, including Sherman Lake, has been designated as Essential Fish Habitat (EFH) by the Pacific Fisheries Management Council (PFMC) to protect and enhance habitat for coastal marine fish and macroinvertebrate species that support commercial fisheries. The amended Magnuson–Stevens Fishery Conservation and Management Act, also known as the Sustainable Fisheries Act (Public Law 104-297), requires all federal agencies to consult with the Secretary of Commerce on activities or proposed activities authorized, funded, or undertaken that may adversely affect EFH of commercially managed marine and anadromous fish species (Office of Habitat Conservation 1999). The EFH provisions of the Sustainable Fisheries Act are designed to protect fishery habitat from being lost as a result of disturbance and degradation. The act requires that EFH must be identified for all species federally managed under PFMC. PFMC is responsible for managing commercial fisheries resources along the coasts of Washington, Oregon, and California. Managed species are covered under three fisheries management plans:

- Pacific Groundfish Fishery Management Plan,
- Coastal Pelagic Fishery Management Plan, and
- Pacific Salmon Fishery Management Plan.

The *Groundfish Fishery Management Plan* defines the aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem. The groundfish fishery EFH includes all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California seaward to the boundary of the U.S. exclusive economic zone. The Coastal Pelagic Fishery Management Plan east-west boundary of EFH is defined to be all marine and estuarine waters from the shoreline along the coast of California, Oregon, and Washington offshore to the limits of the exclusive economic zone and above the thermocline where sea surface temperatures range between 10 and 26°C (44 to 79°F). (http://swr.nmfs.noaa.gov/hcd/cpsefh.pdf). Under the *Pacific Coast Salmon Fishery Management Plan*, the entire San Francisco Bay–Delta estuary (including Sherman Lake) has been designated as EFH for spring-, fall-, late fall- and winter-run Central Valley chinook salmon (Pacific salmon). These areas serve as a migratory corridor, holding area, and rearing habitat for adult and juvenile salmon.

CRITICAL HABITAT

The Sacramento and San Joaquin Rivers and the Delta serve as a migration corridor for anadromous salmonids, which have been listed for protection under the California and/or federal Endangered Species Acts. Listed salmonids that occur seasonally in the Delta in the vicinity of the LSIWA include winter-run chinook salmon, spring-run chinook salmon, and steelhead trout. The Sacramento River and Delta are designated as critical habitat by National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) for winter-run chinook salmon. These areas also were designated as critical habitat for spring-run chinook salmon and steelhead; however, the designation has been suspended pending further review. The Delta, including Sherman Lake, has also been designated as critical habitat by USFWS for delta smelt.

SPECIAL-STATUS FISH SPECIES

The Delta, including Sherman Lake and waters in the vicinity of LSIWA, serves as habitat for a variety of special-status fish species, several of which have been listed for protection under the federal and/or California Endangered Species Acts. Data from the Department's fishery surveys were analyzed to assess the occurrence (e.g., presence or absence) and relative abundance of selected species within the western Delta. Central Valley steelhead trout are present seasonally within the Delta. Green sturgeon inhabit Suisun Bay and the Delta. Delta smelt and juvenile chinook salmon identified as winter-run and spring-run chinook salmon have been collected within Suisun Bay and the Delta, including in the vicinity of LSIWA. Longfin smelt, and Sacramento splittail, which have been identified as State Species of Special Concern, also inhabit Suisun Bay and the Delta.

Data on the occurrence of special-status species in the Department surveys provide a technical basis for assessing occurrence of protected and special-status fish within the Delta. However, each sampling method has limitations; each samples for a particular suite of fish and none of the methods appear to effectively sample for large fish, such as adult white and green sturgeon, although otter trawls captured some individuals (juveniles) of these species.

Chinook salmon, (winter-run, federally- and state-listed as endangered; Central Valley fall/late-fall-run, a federal species of concern and California species of special concern; and spring-run, federally- and state-listed as threatened), steelhead (Central Valley ESU, federally and State listed as threatened), and green sturgeon (proposed federal threatened listing) use the Delta in the vicinity of LSIWA as a migratory corridor. In addition, delta smelt, (federally and State listed as threatened) and Sacramento splittail, (California species of special concern and formerly a federally threatened species) have been documented within the waters of Suisun Bay and the Delta, including in the vicinity of LSIWA. Suisun Bay and the Delta, including Sherman Lake, are in the area designated as EFH for managed species, including Pacific salmon.

Suisun Bay and the Delta in the vicinity of LSIWA provide habitat for a variety of resident and migratory fish species (Table 3.3-1). Sampling results from fishery monitoring programs conducted by the Department, USFWS, DWR, USBR, and others provide information on species composition, seasonal patterns in abundance, and geographic distribution of fish in the estuary. Results of fishery monitoring in the estuary have documented the occurrence of delta smelt, winter-run chinook salmon, spring-run chinook salmon, steelhead, and green sturgeon seasonally within the area. In addition, fishery studies have shown that fall-run/late-fall-run chinook salmon also inhabit the area seasonally. The following is a brief discussion of the status, life history, and other factors affecting population abundance and status of the protected fish species that seasonally inhabit Suisun Bay and the central Delta in the vicinity of Sherman Lake. Although fall-run/late-fall-run chinook salmon have not been listed for protection under either the California or federal Endangered Species Acts, they are included as part of this discussion of the Delta fishery community because of their inclusion in Essential Fish Habitat (EFH) for Pacific salmon.

Delta Smelt

Delta smelt were formally listed as threatened under the federal Endangered Species Act on March 5, 1993 (59 FR 440). On December 19, 1994 (59 FR 65256), USWFS designated critical habitat. Delta smelt were also listed as threatened under California Endangered Species Act in 1993.

Delta smelt are endemic to the Sacramento–San Joaquin Delta estuary. Delta smelt inhabit the freshwater portions of the Delta and Sacramento and San Joaquin rivers and the low-salinity portions of Suisun Bay and typically have a 1-year lifecycle, although a small percentage of the adults may live to year two. Adult delta smelt migrate upstream into channels and sloughs of the eastern Delta during fall and winter in preparation for spawning. Delta smelt live their entire life cycle in the Sacramento–San Joaquin Delta. USFWS has prepared a recovery plan for delta smelt (USFWS 1996) that identifies criteria for evaluating the status of the delta smelt population. These criteria include annual indices of abundance and geographic distribution in the estuary as determined through the Department's fall mid-water trawl surveys. Indices of abundance and geographic distribution of delta smelt have improved in recent years. USFWS continues to evaluate the available scientific information regarding the status of delta smelt and the performance of various management actions designed to improve protection, reduce mortality, and enhance habitat quality and availability for delta smelt within the estuary.

Life History

Delta smelt is a short-lived estuarine species endemic to the Sacramento–San Joaquin Delta. Adult delta smelt typically range in length from approximately 60 to 70 mm (standard length), although some individuals have been reported to be as large as 100–120 mm (Moyle 2002). Juvenile and adult delta smelt typically inhabit open waters of the western and central Delta and Suisun Bay, including the vicinity of LSIWA. Delta smelt inhabit shallow-water areas (typically less than 3 m (9 ft) deep at lower low water); however juvenile and adult delta smelt also occur in the deeper channel areas (Hanson, unpublished data). Juvenile and adult delta smelt are generally found to the lower reaches of the Sacramento River downstream of Rio Vista, the San Joaquin River downstream of Mossdale, and in Suisun Bay, where salinity typically ranges from approximately 2 to 7 parts per thousand (ppt).

During fall and winter, adult delta smelt migrate upstream into the freshwater channels and sloughs of the central Delta and lower reaches of the Sacramento and San Joaquin Rivers in preparation for spawning. Spawning occurs between January and July; peak spawning occurs during April through mid-May (Moyle 2002). Spawning occurs in shallow edge waters in Delta channels and sloughs, such as Cache, Lindsey, and Barker Sloughs, and the lower reaches of the Sacramento River. Delta smelt have adhesive eggs that are broadcast over the bottom and other hard substrates, including rocks, woody material, and aquatic vegetation (Wang 1986). Eggs remain attached to the substrate during incubation. After hatching, the larval (planktonic) delta smelt drift downstream with river and tidal currents. Larval delta smelt feed on zooplankton during spring and early summer. As the larval and early juvenile delta smelt grow, they are distributed further downstream in low-salinity habitats of the central Delta and Suisun Bay, where they continue to develop through summer and fall (USFWS 2004).

Factors Affecting Abundance

A variety of environmental and biological factors affect the abundance of delta smelt within the estuary (USFWS 1996, 2004; Moyle 2002). These factors include changes in the seasonal timing and magnitude of freshwater inflow to the Delta, entrainment of larval, juvenile, and adult delta smelt into numerous unscreened water diversions located throughout the Delta, in addition to entrainment and salvage mortality at the State Water Project (SWP) and Central Valley Project (CVP) water export facilities (USFWS 1996, 2004). Changes in the species composition and abundance of zooplankton, thought to be in response to competition with introduced zooplankton species, affect food availability for delta smelt (Moyle 2002). Predation by striped bass, largemouth bass, and a number of other fish species inhabiting the estuary is also a source of mortality for Delta smelt (USFWS 1996, 2004). In response to seasonal and interannual variability in hydrologic conditions in the estuary, toxic substances, interbreeding with introduced wagasaki smelt (*Hypomesus nipponensis*), and variation in the quality and availability of low-salinity habitat in the Delta and Suisun Bay may also affect the population abundance of delta smelt (USFWS 1996, 2004).

Status in Suisun Bay and the Western Delta

Larval, juvenile, and adult Delta smelt are most abundant in the western Delta and Suisun Bay in the vicinity of Sherman Lake during spring, summer, and fall (CDFG unpublished data). Adult delta smelt potentially spawn in the central Delta, lower rivers, and Suisun Bay (e.g., Suisun Marsh) during late winter and spring. Delta smelt larvae occur within Suisun Bay and the Delta during spring (CDFG unpublished data). As a result of their life history and geographic distribution, delta smelt may occur seasonally within Sherman Lake as eggs, larvae, juveniles, and adults. Delta smelt seasonally inhabiting the open waters within Sherman Lake may be vulnerable to an increased risk of predation mortality from striped bass, largemouth bass, and other predatory fish. The presence of large dense egeria beds throughout the open water of Sherman Lake may exacerbate this potential problem (Grimaldo et al. 2004; Brown 2003).

Restoration efforts that increase habitat complexity, provide additional refuge and shelter habitat, and reduce dense egeria beds could increase spawning and rearing habitat and significantly reduce predation rates in Sherman Lake habitats.

Sacramento River Winter-run Chinook Salmon

The Sacramento River winter-run chinook salmon was formally listed as threatened in November 1990 (55 FR 46515), and was reclassified as endangered under the federal Endangered Species Act on January 4, 1994 (59 FR 440). Winter-run chinook salmon are also listed as a endangered species under the California Endangered Species Act. On June 16, 1993 (58 FR 33212), NMFS designated critical habitat for the winter-run chinook salmon. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 9,329 square miles in California.

Winter-run chinook salmon historically migrated into the upper tributaries of the Sacramento River for spawning and juvenile rearing (Moyle 2002). With the construction of Shasta and Keswick dams, winter-run salmon no longer had access to historic spawning habitat within the upper watersheds (NMFS 1997). As a result of migration blockage, spawning and juvenile rearing habitat for winter-run chinook is limited to the main-stem Sacramento River downstream of Keswick Dam. During the mid-1960s, adult winter-run chinook salmon returns to the Sacramento River were relatively high (up to approximately 80,000 returning adults; NMFS 1997). However, the population declined substantially during the 1970s and 1980s. The population decline continued until 1991, when the adult winter-run chinook salmon population returning to the Sacramento River was estimated to be less than 200 fish (NMFS 1997). As a result of the substantial decline in abundance, the species was listed as endangered under both the California and federal Endangered Species Acts. During the mid- and late 1990s, the numbers of adult winter-run chinook salmon returning to the Sacramento River gradually increased and the trend of increasing abundance has continued. Approximately 8,200 adult winter-run chinook salmon returned to the river to spawn in 2001, 7,400 adults in 2002, and 8,200 adults in 2003 (CDFG unpublished data). As with other chinook salmon stocks, NMFS continues to evaluate the status of the winter-run chinook salmon population and the effectiveness of various management actions implemented in the Sacramento River, Delta, and ocean to provide improved protection and reduced mortality for winter-run chinook salmon, in addition to providing enhanced habitat quality and availability for spawning and juvenile rearing (NMFS 2003). NMFS has prepared a draft recovery plan for winter-run chinook salmon (NMFS 1997).

Life History

Winter-run chinook salmon are an anadromous species spending 1–3 years in the ocean before migrating upstream to the Sacramento River to spawn (Moyle 2002). The majority of adult winter-run chinook salmon returning to spawn are 3-year-olds; however, the adult population also includes 2-year-old and 4-year-old chinook salmon (NMFS 1997). Adult winter-run salmon migrate upstream through San Francisco Bay, Suisun Bay, and the Delta during winter and early spring, with peak migration occurring during March (Moyle 2002). Adult winter-run chinook salmon migrate upstream in the Sacramento River; the majority of adults spawn in the reach upstream of Red Bluff. Winter-run chinook salmon spawn within the main stem of the Sacramento River in areas where gravel substrate, water temperatures, and water velocities are suitable.

Spawning occurs during the spring and summer (mid-April through August; Moyle 2002). Egg incubation continues through fall. Juvenile winter-run chinook salmon rear within the Sacramento River throughout the year, feeding primarily on aquatic insects. Juvenile winter-run salmon (smolts) migrate downstream through the lower reaches of the Sacramento River, Delta, Suisun Bay, and San Francisco Bay during winter and early spring (December through May) as they migrate from the freshwater spawning and juvenile rearing areas into the coastal marine waters of the Pacific Ocean. The Sacramento River mainstem is the primary upstream and downstream migration corridor for winter-run chinook salmon. Juvenile winter-run chinook salmon may migrate from the Sacramento River into the central Delta, passing into the Delta through the Delta Cross-channel, Georgiana Slough, or Three Mile Slough, during their downstream migration. The migration timing of juvenile winter-run chinook salmon varies in and among years in response to a variety of factors, including increases in river flow and turbidity resulting from winter storms.

Factors Affecting Abundance

A variety of environmental and biological factors have been identified that affect the abundance, mortality, and population dynamics of winter-run chinook salmon. One primary factor that has affected population abundance of winter-run chinook salmon is loss of access to historic spawning and juvenile rearing habitat in the upper reaches of the Sacramento River and its tributaries as a result of the migration barrier caused by Shasta and Keswick dams. Operation of the Red Bluff Diversion Dam, which impedes adult upstream migration and increases vulnerability of juvenile winter-run chinook salmon to predation mortality, has been identified as a factor affecting mortality within the river. In recent years, changes to Red Bluff Diversion Dam gate operations have been made to provide improved access for upstream and downstream migrating winter-run chinook salmon. Water temperature within the mainstem Sacramento River is also a factor affecting incubating eggs, holding adults, and growth and survival of juvenile winter-run chinook salmon rearing in the upper Sacramento River. Modifications to Shasta Reservoir storage and operations and water temperature management have been implemented in recent years to improve water temperature conditions in the upper reaches of the Sacramento River. Juvenile winter-run chinook salmon are also vulnerable to entrainment at many unscreened water diversions along the Sacramento River and in the Delta, in addition to entrainment and salvage mortality at the SWP and CVP export facilities.

Changes in habitat quality and availability for spawning and juvenile rearing, exposure to contaminants and acid mine drainage, predation mortality by Sacramento pikeminnow, striped bass, largemouth bass, and other predators, and competition and interactions with hatchery-produced chinook salmon are all factors affecting winter-run chinook salmon abundance. In addition, subadult and adult winter-run chinook salmon are vulnerable to recreational and commercial fishing, ocean survival is affected by climatic and oceanographic conditions, and adults are vulnerable to predation mortality by marine mammals.

A number of changes have been made to improve the survival and habitat conditions for winter-run chinook salmon. Modifications have been made to reservoir operations for instream flow and temperature management and to operation of the Red Bluff diversion gate, and several large previously unscreened water diversions have been equipped with positive-barrier fish screens. Changes to ocean salmon fishing regulations and modifications to SWP and CVP export operations have also improved the survival of both adult and juvenile winter-run chinook salmon. These changes in management, in combination with favorable hydrologic and oceanographic conditions in recent years, are thought to have contributed to the trend of increasing abundance of adult winter-run chinook salmon returning to the upper Sacramento River to spawn since the mid-1990s.

Status in Suisun Bay and the Western Delta

Adult and juvenile winter-run chinook salmon primarily migrate upstream and downstream within the main-stem Sacramento River. Juvenile winter-run chinook salmon may migrate from the Sacramento River to the central Delta during their downstream migration and may also inhabit Sherman Lake as a temporary foraging area and migration pathway during the winter and early spring migration period. The occurrence of juvenile winter-run chinook salmon in Suisun Bay and the Delta would be expected to occur during late fall through early spring when Delta water temperatures would be suitable for juvenile winter-run chinook salmon migration.

Because winter-run chinook salmon do not spawn within Suisun Bay or the Delta, there is no probability that habitat enhancement projects at Sherman Lake would adversely or beneficially affect winter-run chinook salmon spawning or egg incubation. However, restoration efforts that increase habitat complexity, provide additional refuge and shelter habitat, and reduce dense egeria beds could improve rearing habitat and significantly reduce juvenile salmon predation rates in Sherman Lake habitats.

Central Valley Spring-run Chinook Salmon

NMFS listed Central Valley spring-run chinook salmon as threatened on September 16, 1999 (50 FR 50394). Spring-run chinook salmon are also listed as a threatened species under the California Endangered Species Act.

Spring-run chinook salmon were historically widely distributed and abundant within the Sacramento and San Joaquin river systems (Yoshiyama et al. 1998). Spring-run chinook salmon historically migrated upstream into the upper reaches of the main-stem rivers and tributaries for spawning and juvenile rearing (Moyle 2002). Construction of major dams and reservoirs on these river systems eliminated access to the upper reaches for spawning and juvenile rearing, and completely eliminated the spring-run chinook salmon population from the San Joaquin River system (Moyle 2002). Spring-run chinook salmon abundance has declined substantially (NMFS 2003), and the geographic distribution of the species in the Central Valley has also declined substantially. Spring-run spawning and juvenile rearing currently occur consistently in only a small fraction of their previous geographic distribution, including populations inhabiting Deer, Mill, and Butte creeks, the main-stem Sacramento River, several other local tributaries on an intermittent basis, and the lower Feather River (Moyle 2002). Recent genetic studies show that spring-run chinook salmon returning to the lower Feather River are genetically similar to fall-run chinook salmon. Hybridization between spring-run and fall-run chinook salmon, particularly on the Feather River where both stocks are produced within the Feather River hatchery, is a factor affecting the status of the spring-run chinook salmon population (CDWR 2004). NMFS is in the process of developing a recovery plan for Central Valley spring-run chinook salmon.

Life History

Spring-run chinook salmon are an anadromous species, spawning in freshwater and spending a portion of their life cycle in the Pacific Ocean. Adult spring-run chinook salmon migrate upstream into the Sacramento River system during the spring months, but are sexually immature (Moyle 2002). Adult spring-run chinook salmon hold in deep cold pools in rivers and tributaries over the summer months before spawning (Moyle 2002). Spawning occurs during late summer and early fall (late August through October) in areas characterized by suitable spawning gravels, water temperatures, and water velocities (Bjorn and Reiser 1991). Eggs incubate in the gravel nests (redds), emerging as fry during late fall and winter. A portion of the fry appear to migrate downstream soon after emerging, where they rear in the lower river channels, and potentially within Suisun Bay and the western Delta, during winter and spring. After emergence, a portion of the spring-run chinook salmon fry remain resident in the creeks and rear for approximately 1 year (Moyle 2002). The juvenile spring-run chinook salmon that remain in the creeks migrate downstream as yearlings primarily during the late fall, winter and early spring with peak yearling migration occurring in November (Hill and Weber 1999). The downstream migration of both spring-run chinook salmon fry and yearlings during late fall and winter typically coincides with increased flow and turbidity associated with winter stormwater runoff.

Factors Affecting Abundance

A variety of environmental and biological factors have been identified that affect the abundance, mortality, and population dynamics of spring-run chinook salmon. A primary factor that has affected population abundance of spring-run chinook salmon has been the loss of access to historic spawning and juvenile rearing habitat in the upper Sacramento River and its tributaries and the San Joaquin River as a result of migration barriers caused by construction of major dams and reservoirs (Yoshiyama et al. 1998; Moyle 2002). Operation of the Red Bluff Diversion Dam, which impedes adult upstream migration and increases vulnerability of juvenile spring-run chinook salmon to predation mortality, is a factor affecting mortality within the river. Water temperature within the rivers and creeks is also a factor affecting incubating eggs, holding adults, and growth and survival of juvenile spring-run chinook salmon. Juvenile spring-run chinook salmon are also vulnerable to entrainment at many unscreened water diversions along the Sacramento River and in the Delta, in addition to entrainment and salvage mortality at the SWP and CVP export facilities. Changes in habitat quality and availability for spawning and juvenile rearing, exposure to contaminants, predation mortality by Sacramento pikeminnow, striped bass, largemouth bass, and other predators, and competition and interactions with hatchery-produced chinook salmon are all factors affecting spring-run chinook salmon abundance. In addition, subadult and adult spring-run chinook salmon are vulnerable to recreational and commercial fishing, ocean survival is affected by climatic and oceanographic conditions, and adults are vulnerable to predation mortality by marine mammals (NMFS 2003).

A number of changes have been made to improve the survival and habitat conditions for spring-run chinook salmon. Several large previously unscreened water diversions have been equipped with positive-barrier fish screens. Changes to ocean salmon fishing regulations, and modifications to SWP and CVP export operations have also been made to improve the survival of adult and juvenile spring-run chinook salmon. Improvements in fish-passage facilities have also improved migration and access to Butte Creek. These changes and management actions, in combination with favorable hydrologic and oceanographic conditions in recent years, are thought to have contributed to the trend of increasing abundance of adult spring-run chinook salmon returning to spawn in Butte Creek and other habitats in the upper Sacramento River system in recent years.

Status in Suisun Bay and the Western Delta

Adult and juvenile spring-run chinook salmon primarily migrate upstream and downstream in the main-stem Sacramento River. Juvenile spring-run chinook salmon may migrate from the Sacramento River to the central Delta during their downstream migration and may also use Suisun Bay and the Delta as temporary foraging areas and migration pathways during winter and early spring migration. Juvenile spring-run chinook salmon occur in Suisun Bay and the Delta during late fall through early spring, when water temperatures in the Delta would be suitable for juvenile spring-run chinook salmon migration.

Because spring-run chinook salmon do not spawn in Suisun Bay or the Delta, there is no probability that habitat enhancement projects at Sherman Lake would adversely or beneficially affect spring-run chinook salmon spawning or egg incubation. However, restoration efforts that increase habitat complexity, provide additional refuge and shelter habitat, and reduce dense egeria beds could improve rearing habitat and significantly reduce juvenile salmon predation rates in Sherman Lake habitats.

CENTRAL VALLEY STEELHEAD

On March 19, 1998, NMFS listed the Central Valley steelhead as threatened (63 FR 13347). Steelhead are not listed for protection under the California Endangered Species Act, but are identified as a Species of Concern.

Central Valley steelhead historically migrated upstream to the high gradient upper reaches of Central Valley streams and rivers for spawning and juvenile rearing. Construction of dams and impoundments on most Central Valley rivers has created impassable barriers to upstream migration and substantially reduced the geographic distribution of steelhead. Although quantitative estimates of the number of adult steelhead returning to Central

Valley streams to spawn are not available, anecdotal information and observations indicate that population abundance is low. Steelhead distribution is currently restricted to the main-stem Sacramento River downstream of Keswick Dam, the Feather River downstream of Oroville Dam, the American River downstream of Nimbus Dam, the Mokelumne River downstream of Comanche Dam, and a number of smaller tributaries to the Sacramento River system, Delta, and San Francisco Bay. The Central Valley steelhead population is composed of both naturally spawning steelhead and steelhead produced in hatcheries. NMFS continues to evaluate the status of steelhead and to develop a recovery plan for the species.

Life History

Central Valley steelhead, like chinook salmon, are anadromous. Adult steelhead spawn in fresh water, and the juveniles migrate to the Pacific Ocean where they reside for a period of years before returning to the river system to spawn. Steelhead that do not migrate to the ocean, but spend their entire life in fresh water, are known as resident rainbow trout.

Adult steelhead migrate upstream during fall and winter (September through approximately February) with steelhead migration into the upper Sacramento River typically occurring during fall, and adults migrate into lower tributaries typically during the fall and winter. Steelhead spawn in areas characterized by clean spawning gravels, cold-water temperatures, and moderately high velocity. Spawning typically occurs during winter and spring (December–April); the majority of spawning activity occurs during January through March. Unlike chinook salmon that die after spawning, adult steelhead may migrate downstream after spawning and return to spawn in subsequent years.

Steelhead spawn by creating a depression in the spawning gravels where eggs are deposited and fertilized (redd). The eggs incubate within the redd for a variable period, which is dependent on water temperature. After hatching, the young steelhead emerge from the gravel redd as fry. The young steelhead rear in the stream system, foraging on insects for 1–2 or more years before migrating to the ocean. After rearing within the stream, the juvenile steelhead undergo a physiological transformation (smolting) that allows the juvenile steelhead to migrate from the freshwater rearing areas downstream to coastal marine waters. Downstream migration of steelhead smolts typically occurs during late winter and early spring (January–May). The seasonal timing of downstream migration of steelhead smolts may vary in response to a variety of environmental and physiological factors, including changes in water temperature, changes in stream flow, and increased turbidity resulting from stormwater runoff. The juvenile steelhead rear in the coastal marine waters for approximately 2–3 years before returning to their natal stream as spawning adults.

The steelhead life cycle is characterized by a high degree of flexibility (plasticity) in the duration of both their freshwater and marine rearing phases. The steelhead life cycle is adapted to respond to environmental variability in stream hydrology and other environmental conditions.

Factors Affecting Abundance

Factors affecting steelhead abundance are similar to those described for winter-run and spring-run chinook salmon. A primary factor affecting population abundance of steelhead has been the loss of access to historic spawning and juvenile rearing habitat in the upper reaches of the Sacramento River and its tributaries and the San Joaquin River as a result of the migration barriers caused by construction of major dams and reservoirs. Water temperature in the rivers and creeks, particularly during summer and early fall, is also a factor affecting growth and survival of juvenile steelhead. Juvenile steelhead are vulnerable to entrainment at many unscreened water diversions along the Sacramento River and in the Delta, in addition to entrainment and salvage mortality at the SWP and CVP export facilities. Changes in habitat quality and availability for spawning and juvenile rearing, exposure to contaminants, predation mortality, passage barriers and impediments to migration, changes in land-use practices, and competition and interactions with hatchery-produced steelhead are all factors affecting steelhead abundance. Unlike chinook salmon, steelhead are not vulnerable to recreational and commercial ocean fishing, although steelhead support a small inland recreational fishery for hatchery-produced fish. Ocean survival is affected by climatic and oceanographic conditions, and adults are vulnerable to predation mortality by marine mammals.

A number of changes have improved the survival and habitat conditions for steelhead. Several large previously unscreened water diversions have been equipped with positive-barrier fish screens. Improvements to fish-passage facilities have also improved migration and access to spawning and juvenile rearing habitat.

Status in Suisun Bay and the Western Delta

Adult and juvenile steelhead primarily migrate upstream and downstream in the main-stem Sacramento River, passing Sherman Lake. Juvenile steelhead migrate from the Sacramento River and its tributaries through the central Delta, Suisun Bay, and San Francisco Bay during the winter and early spring migration. Steelhead do not spawn in Suisun Bay or the Delta; however juvenile steelhead may temporarily forage in Suisun Bay and the Delta during emigration, and hence they would potentially be present in the vicinity of the LSIWA during the seasonal migration period. Juvenile steelhead occur in Suisun Bay and the Delta during the winter and early spring migration, when water temperatures in the Delta would be suitable for juvenile steelhead migration.

Although the majority of adult steelhead migrate upstream in the main-stem Sacramento River, there is a probability that adults migrate through the central Delta and would be present seasonally in the vicinity of Sherman Lake. The occurrence of adult steelhead within the Delta, and potentially within Sherman Lake, would be limited to the winter and early spring adult upstream migration.

Because steelhead do not spawn in Suisun Bay or the Delta, there is no probability that habitat-enhancement projects at LSIWA would adversely or beneficially affect steelhead spawning or egg incubation. Restoration efforts that increase habitat complexity, provide additional refuge and shelter habitat, and reduce dense egeria beds could improve rearing habitat and significantly reduce juvenile steelhead predation rates in Sherman Lake habitats.

Central Valley Fall-run Chinook Salmon

Fall-run chinook salmon are the most abundant species of Pacific Salmon inhabiting the Sacramento and San Joaquin river systems. Fall-run chinook salmon are not listed for protection under the California or federal Endangered Species Acts. In addition to fall-run chinook salmon, the group of Pacific Salmon comprises late-fall-run chinook salmon (which are not listed under either the California or federal Endangered Species Act), and spring-run chinook salmon and winter-run chinook salmon, which are discussed above. Although fall-run and late fall-run chinook salmon are not listed for protection under the Endangered Species Act, they are included in this analysis because they occur seasonally in Suisun Bay and the central Delta in the vicinity of the LSIWA, which is located in the area identified as EFH for Pacific salmon.

NMFS proposed in 1998 that Central Valley fall-run and late-fall-run chinook salmon be listed under the Federal Endangered Species Act as a threatened species. Based on further analysis and public comment, NMFS decided that fall-run and late-fall-run chinook salmon did not warrant listing; they remain as a species of concern.

Although fall-run and late-fall-run chinook salmon inhabit a number of watersheds in the Central Valley for spawning and juvenile rearing, the largest populations occur within the main-stem Sacramento River, Feather River, Yuba River, American River, Mokelumne River, Merced River, Tuolumne River, and Stanislaus River. Fall-run chinook salmon, in addition to spawning in these river systems, are also produced in fish hatcheries on the Sacramento River, Feather River, American River, Mokelumne River, and Merced River. Hatchery operations are intended to mitigate for the loss of access to upstream spawning and juvenile rearing habitat resulting from construction of dams and reservoirs in the Central Valley in addition to producing fall-run chinook salmon as part of the ocean salmon enhancement program to support commercial and recreational ocean salmon fisheries. Fall-run chinook salmon also support an inland recreational fishery.

Life History

Fall-run chinook salmon are anadromous with spawning and juvenile rearing occurring within freshwater rivers and streams and juvenile and adult rearing occurring within coastal marine waters. Adult fall-run chinook salmon migrate from the coastal marine waters upstream through San Francisco Bay, Suisun Bay, and the central Delta during late summer and early fall (approximately late July through early December). Adult fall-run chinook salmon migrate upstream to areas characterized by suitable spawning conditions, which include the availability of clean spawning gravels, cold water (considered be less than 56ºF) and relatively high water velocities. Fall-run chinook salmon spawning is similar to that described for other chinook salmon, with the creation of redds where eggs are deposited and incubate. Fall-run chinook salmon spawning occurs from October through December with the greatest spawning activity occurring typically in November and early December.

The success of fall-run chinook salmon spawning is dependent, in part, on seasonal water temperatures. After incubating and hatching, the young salmon emerge from the gravel redd as fry. A portion of the fry population migrates downstream soon after emergence, where they rear in the lower river channels, western and central Delta including areas adjacent to Sherman Lake during spring. The remaining juvenile salmon continue to rear in the upstream stream systems through spring, until they are physiologically adapted to migration into saltwater (smolting), which typically takes place from April through early June. A small proportion of the fall-run chinook salmon juveniles may, in some systems, rear through summer and fall migrating downstream during fall, winter, or early spring as yearlings.

The juvenile and adult chinook salmon rear within coastal marine waters, foraging on fish and macroinvertebrates (e.g., northern anchovy, Pacific herring, squid, krill, etc.), until they reach maturation. Adult chinook salmon spawn at ages ranging from approximately 2 to 5 years; the majority of adult fall-run chinook salmon returning at age 3. Chinook salmon, unlike steelhead, die after spawning.

Late fall-run chinook salmon have a similar life history, as described for other Pacific salmon.

Factors Affecting Abundance

A variety of environmental and biological factors affect reproductive success, mortality, and population dynamics of fall-run and late-fall-run chinook salmon. The loss of access to historic spawning and juvenile rearing areas as a result of the construction of dams and reservoirs on many of the Central Valley river systems is a factor affecting population abundance. In addition, exposure to seasonal water temperatures during both the upstream migration of adults and downstream migration of juveniles, changes in instream flows resulting from reservoir operations, degradation of the quality and availability of suitable spawning habitat and juvenile rearing areas, and the effects of hatchery operations on chinook salmon have been identified as important factors affecting abundance. Juvenile chinook salmon are also susceptible to entrainment at unscreened water diversions, losses resulting from salvage and handling at the SWP and CVP export facilities, predation mortality by native and nonnative fish species, interannual variability in hydrologic conditions in streams and rivers, and variability in ocean rearing conditions have also been identified. Concern has also been expressed regarding the effects of contaminant exposure, and impediments and barriers to upstream and downstream migration. Ocean commercial and recreational angler harvest, and inland recreational harvest, are also factors affecting population abundance.

Management practices have been altered to regulate commercial and recreational angler harvest, improve instream flow conditions, improve water temperature management downstream of reservoirs, improve quality and availability of spawning and juvenile rearing habitat, and improve fish passage facilities at a number of existing migration impediments and barriers. Management changes also address concerns regarding contaminant exposure, the success of fish handling and salvage at the SWP and CVP export facilities, and a number of water diversions on the Sacramento and San Joaquin river systems have been equipped with positive barrier fish screens designed to reduce or eliminate juvenile salmon entrainment mortality. These management changes, in combination with recent favorable hydrology and ocean rearing conditions contribute to an increasing trend in adult fall-run chinook salmon abundance in the ocean and Central Valley river systems.

Status in Suisun Bay and the Western Delta

Adult and juvenile chinook salmon primarily migrate upstream and downstream within the mainstem Sacramento and San Joaquin Rivers although both adult and juvenile chinook salmon also migrate through central Delta channels. Juvenile chinook salmon, particularly in the fry stage (generally 1.5 to 3 inches) may rear in Suisun Bay and the western and central Delta, including at Sherman Lake, and they forage along channel and shoreline margins and lower velocity backwater habitats. Juvenile fall-run chinook salmon in the Delta occur during late winter (fry) through early spring (smolts) when water temperatures in the Delta would be suitable for juvenile chinook salmon migration.

Because fall-run and late-fall-run chinook salmon do not spawn in Suisun Bay or the central Delta, there is no probability that habitat enhancement projects within Sherman Lake would adversely or beneficially affect chinook salmon spawning or egg incubation. Habitat enhancement projects at Sherman Lake could, however, greatly affect habitat quality for rearing juveniles. Restoration efforts could increase overall food supply, reduce predation through additional predator refuge and shelter habitat (e.g., complex habitat).

Green Sturgeon

On April 6, 2005, NMFS proposed a threatened status listing for the southern distinct population segment (DPS) of North American green sturgeon (70 FR 17386).

In North America, green sturgeon is found from Ensenada, Mexico, to Southeast Alaska. Green sturgeon is not abundant in any estuaries along the Pacific coast, although they are caught incidentally in the estuaries by the white sturgeon fishery. Like all sturgeon species it is anadromous, but it is also the most marine-oriented of the sturgeon species (NMFS 2005).

Life History

Green sturgeon are thought to spawn every three to five years (Tracy 1990). Their spawning period is March to July, with a peak in mid-April to mid-June (Moyle et al. 1992). Mature males range from ages 15 to 30 years old, while mature females range from ages 17 to 40 years old. Most of the spawning males are 17–18 years old, while most of the spawning females are 27–28 years old (NMFS 2005). However, younger green sturgeon have sexual differentiated gonads and can be artificially induced to produce sperm and eggs (Cech et al. 2000).

Green sturgeon spawning occurs in deep pools or holes in large, turbulent river mainstems (Moyle et al. 1992). Specific spawning habitat preferences are unclear, but are likely large cobbles, but can range from clean sand to bedrock. Eggs are likely broadcast over the large cobble substrate where they settle into the space between the cobbles. Green sturgeon females produce 60,000-140,000 eggs (Moyle et al. 1992), and they are the largest egg mean diameter (4.34 mm) of any sturgeon (Cech et al. 2000). The large egg size provides larger yolk stores for the nourishment of embryos, resulting in more viable larvae. However, this is balanced by a lower fecundity. The adhesiveness of green sturgeon eggs is lower than that of white sturgeon (Deng 2000), and it is possible that the eggs may not attach to the substrate after fertilization, but become trapped in crevices and gravel where development starts. Temperatures above 20° C are lethal to green sturgeon embryos and temperatures below 11° C or above 19° C will lead to reduced growth (Cech et al. 2000).

Green sturgeon spawning has only been documented in the Klamath, Sacramento (Moyle et al. 1992, CDFG 2002) and Rogue (Erickson et al. 2001) rivers during recent times. In the Sacramento River, green sturgeon spawn in late spring and early summer above Hamilton City, and perhaps as far upstream as Keswick Dam (CDFG 2002). Green sturgeon occur in the upper river, particularly around the Red Bluff Diversion Dam (RBDD), and the opening of the RBDD gates to improve winter-run chinook passage is believed to have provided substantial increases in green sturgeon spawning habitat (NMFS 2005).

First feeding occurs at 10 days post hatch, and metamorphosis to juveniles is complete at 45 days. Juveniles appear to spend one to three years in freshwater before they enter the ocean (Nakamoto et al. 1995).

Little is known about green sturgeon feeding other than general information. Adults captured in the Delta are benthic feeders on invertebrates including shrimp, mollusks, amphipods, and even small fish (Houston 1988, Moyle et al. 1992). Juveniles in the Delta feed on opossum shrimp, Neomysis mercedis, and Corophium amphipods. One green sturgeon from the Sacramento-San Joaquin estuary was examined in Fall 2001 and the most common prey were opisthobranch mollusks (Philline sp.), but there were also one bay shrimp (Crangon sp.) and overbite clams (Potamocorbula amurensis).

Factors Affecting Abundance

The principal factor affecting abundance of green sturgeon is the reduction of available spawning habitat due to the construction of barriers along the Sacramento and Feather Rivers. Other factors include insufficient flow rates, increased water temperatures, water diversions, introduction of nonnative species, poaching, pesticide and heavy metal contamination, and local fishing (NMFS 2005).

Status in Suisun Bay and the Western Delta

Adult and juvenile green sturgeon primarily migrate upstream and downstream within the mainstem Sacramento River although both adult and juvenile green sturgeon also migrate through central Delta channels. Juvenile green sturgeon may rear in Suisun Bay and the western and central Delta, including at Sherman Lake.

Because green sturgeon do not spawn in Suisun Bay or the central Delta, there is no probability that habitat enhancement projects within Sherman Lake would adversely or beneficially affect green sturgeon spawning or egg incubation. Habitat enhancement projects at Sherman Lake could, however, greatly affect habitat quality for rearing juveniles. Restoration efforts could increase overall food supply and reduce predation through additional predator refuge and shelter habitat.

GAME FISH SPECIES

Throughout the Sacramento-San Joaquin Delta game fish species are an important component of resource management. Not only do these species fill an important biological component, they are also of economic importance. With the exception of white sturgeon, primary game fish species of interest in the LSIWA are nonnative.

Striped bass, white sturgeon, white catfish (*Ameiurus catus*), channel catfish (*Ictalurus punctatus*), largemouth bass (*Micropterus salmoides*), and various sunfishes are among the most common fishes caught in the sport fishery in the Delta, Suisun Marsh, riverine backwaters, and other Delta waters. Although this fishery is poorly documented, it is probably the largest sport fishery in central California in terms of people engaged in it and in terms of numbers of fish caught. These fishes and associated anglers are always going to be part of the environment and deserve support of the management agencies (CALFED 2000a,d). However, habitat improvements that favor native fishes discussed above (e.g., removal of dense egeria beds), may not favor nonnative game fishes.

Factors that may limit the warmwater game fishes ability to contribute to a healthy Delta ecosystem is the degradation and loss of existing aquatic habitat as a result of channel dredging, levee stabilization, and increased channel velocities.

Striped bass

The striped bass is an important nonnative anadromous sport fish with high recreation value. It also plays an important role as a top predator in the Bay-Delta and its watershed. Striped bass were introduced into the Bay-Delta from the east coast of the United States in 1879. For the past century, they have been an important sport fish, commercial fish, and top predator within the Bay-Delta and upstream rivers. They adapted well to the complex habitat conditions of the estuary and remain one of the premier sport fish of LSIWA and the larger Delta.

Life History

Striped bass typically begin spawning in the spring when the water temperature reaches 58 F. Most spawning occurs between 61 and 69 F, and the spawning period usually extends from April to mid June. They spawn in fresh water where there is moderate to swift current upstream of LSIWA. The section of the Sacramento River from Courtland to Colusa has been identified as an important spawning area (CDFG 2003; CALFED 2000a,d).

Female striped bass usually spawn for the first time when they are about 5 years old and 24 inches long. Many males mature as two years old and only approximately 11 inches long; most males are mature at age three. A 5 pound female spawns approximately 200,000 eggs in one season and a 12 pound fish is capable of producing up to about one million eggs. Eggs are only slightly heavier than water and thus with moderate current are held suspended while developing. Larval bass are hatched in about two days with the length of time depending upon the temperature. Warmer water results in faster egg development CDFG 2003).

Juvenile rearing habitats include sloughs, river channels, and bays of the western Delta and Suisun Bay. In wet years young fish rearing habitat extends into San Pablo Bay and adjacent tidal sloughs and marshes. Yearling striped bass are found throughout the Bay and Delta. Adult striped bass are widely distributed from the ocean to the rivers (CDFG 2003; CALFED 2000d).

Crustaceans and fish make up the bulk of the striped bass diet. As they grow, striped bass start adding larger items to their diet. Anchovies, shiner perch, shrimp, and herring are among the items taken in quantity. In the upstream river areas, striped bass young and threadfin shad are often taken.

Food habit studies that have been conducted by numerous investigators indicate that chinook salmon are not an important component in the diet of striped bass, although, at times, young salmon, primarily fall-run, have constituted a substantial part. The studies reveal that, except at localized sites and structures, striped bass are less likely to eat salmon in Suisun Bay and the Delta than in the rivers above the Delta. The greater vulnerability of salmon in the river may be a result of the greater clarity and the smaller width of the waterways. In many areas, bank protection activities, such as maintaining levees and riprapping, have removed important shaded riverine aquatic (SRA) habitat and eliminated escape cover needed by young native fish.

Factors Affecting Abundance

Major factors that limit striped bass are managed outflows, water diversions, spawning and rearing habitat, legal and illegal harvest, predation and competition from nonnative fishes, and reduce survival from contaminants in the water. Decline in the Delta is attributed primarily to toxic substances and to entrainment of young in water diversion structures (Hassler 1988).

The number of adult striped bass and young produced each year has declined dramatically over the past several decades. In addition to the low survival of young fish and their low entry into the adult spawning population, mortality rates of adults have increased despite reduced harvest rates in the sport fishery. The higher mortality rates are particularly evident in older adults, and may be a result of effects of toxins, poaching, marine mammal predation, or combinations of these and other factors.

Other factors possibly contributing to the decline and low abundance of striped bass include toxins that reduce survival of young bass or their food supply, competition or predation by recently established nonnative fishes such as gobies, or poor food production caused by the influx of Asia clams.

White Sturgeon

The white sturgeon is an important native anadromous sport fish with high recreational and ecological value. White sturgeon are native to Central Valley rivers and the Bay-Delta and represent an important component of the historic native fish fauna. Throughout recorded history, white sturgeon have been the dominant sturgeon populations in the Bay- Delta system. White sturgeon support a valuable sport fishery at LSIWA and more generally in the Bay, Delta, and Sacramento River basin (CALFED 2000a, d).

Life History

White sturgeon rear in the Sacramento-San Joaquin estuary and spawn in the Sacramento and San Joaquin rivers and their major tributaries. Sturgeon may leave the Bay-Delta and move along the coast to as far as Alaska. Populations of white sturgeon are found in many of the larger rivers from California north to British Columbia.

In California, spawning is believed to occur between mid-March and early June (Moyle 2002) at intervals of 4 to 11 years. Larvae hatch from eggs in approximately 1 to 2 weeks. Males may reach sexual maturity in about 9 years, females in 13–16 years (Wydoski and Whitney 1979).

Sturgeon are generally bottom feeders and both adults and juveniles feed on benthic macroinvertebrates and small fish. Young feed mostly on the larvae of aquatic insects, crustaceans, and mollusks. A significant portion of the diet of larger sturgeon consists of fish. White sturgeon have been feeding on Asian clams in Suisun Bay, which may indicate a very important ecological role that could feed back through food web productivity of the Bay-Delta. Sturgeon predation may limit clam abundance and therefore potentially decrease the loss of plankton to clam feeding. The clams also accumulate contaminants, which may pose a long-term problem for sturgeon feeding heavily on clams.

Factors Affecting Abundance

Major factors that limit sturgeon populations in the Bay-Delta are adequate streamflows for attracting adults to spawning areas in rivers and transporting young to nursery areas, illegal and legal harvest, and entrainment into water diversions.

Food availability, toxic substances, and competition and predation are among the factors influencing the abundance of sturgeon. Sturgeon are long lived (e.g., some live over 50 years) and may concentrate pollutants in body tissue from eating contaminated prey over long periods. Harvesting by sport fishers also affects abundance of the adult populations. Illegal harvest (poaching) also reduces the adult population.

Losses of sturgeon young into water diversions reduce sturgeon productivity. However, relative to other species, the percentage of the sturgeon population caught in diversions is low.

Channel Catfish

Originally found in the Mississippi River system, channel catfish were successfully introduced into California waters in the 1940s. Although white catfish does well in many muddy, dirt bottom lakes, it prefers a clear warm water lake with a sandy bottom. Channel catfish are the most active of the catfish and they grow quite large. Some fish reach 18 to 19 inches at age 4. Their large size and excellent eating qualities make them prized sport fish in the Delta (CALFED 2000d; CDFG 2003).

Life History

Channel catfish spawning occurs in the spring when water temperatures are between 70º and 85°F, although 80°F seems to be optimal. Nests are built in secluded, semidarkened sites, and the males vigorously guard both the eggs and the newly-hatched young (CDFG 2003).

Channel catfish grow and bite best when the water temperature is above 70ºF but will tolerate lower temperatures. They feed on insects, fish, and small amounts of plant material. Like other catfish, channel catfish feed most actively at dusk and at night (CDFG 2003).

Channel catfish prefer large rivers and lowland lakes with fairly clean bottoms of sandy gravel or boulders; however, they have adapted to a wide range of environmental conditions. They generally spend days in deep holes, under logs or other shelter, and feed in shallow water at night. Channel catfish are omnivorous. Juvenile fish eat insects with some small fish and plant seeds in their diet. Larger adult fish feed primarily of fish. Growth rates are highest when water temperatures are 70 F or warmer (CDFG 2003).

Factors Affecting Abundance

Losses to Delta diversions (e.g., hundreds of small agricultural diversions, Central Valley Project and State Water Project export pumps, and Pacific Gas & Electric power generation facilities) may reduce species abundance through direct entrainment or indirect effects on the prey of channel catfish. Food availability, toxic substances, and competition and predation are among the factors influencing abundance of channel catfish. In addition, harvest of channel catfish for food and bait by sport anglers may affect abundance (CALFED 2000d).

White Catfish

Originally native to the coastal river systems of the eastern United States, white catfish were planted near Stockton in 1874. From this one introduction, white catfish have spread throughout the state. This catfish is abundant in central and northern California and is found in most suitable warmwater areas there. About 95% of the catfish caught in the Sacramento-San Joaquin Delta are white catfish. It was introduced into the San Joaquin River near Stockton in 1874, from the Raritan River, New Jersey.

This catfish is most common in slow-moving rivers and in lakes with mud bottoms. White catfish feed mostly on the bottom where they eat other fish and aquatic insects. They prefer warm water and only spawn in water above 70 degrees F. White catfish feed most actively at dusk and through the night.

Life History

White catfish inhabit a variety of fresh or slightly brackish waters, usually preferring water 70ºF or warmer. They do well in both large reservoirs and small ponds, as well as large, slow rivers in both fresh and brackish water. As with most catfish, they are mainly carnivorous; fish, insects, crustaceans, mollusks, and frogs contribute to their diet. Some fish eggs are also taken (CDFG 2003).

White catfish in California generally attain sexual maturity when they reach 7 or 8 inches long, generally in their third or fourth year of life. Spawning takes place in the summer when water temperatures reach 70ºF. Spawning age and size for white catfish is highly variable and occurs from April through June. Nest sites are typically located in cave-like structures, like muskrat burrows, log jams, and undercut banks. The nest is actively guarded by the male. The eggs hatch in about six to ten days with the young actively swimming about two days after hatching (CDFG 2003).

Factors Affecting Abundance

Losses to Delta diversions may reduce species abundance through direct entrainment or indirect effects on the prey of white catfish. Food availability, toxic substances, and competition and predation are among the factors influencing abundance of white catfish species. In addition, harvest of white catfish for food and bait by sport anglers may affect abundance (CALFED 2000d).

Largemouth Bass

The largemouth bass was first introduced into California waters in 1870s and has since spread to suitable habitats throughout the State. The largemouth bass prefers warm, slow moving waters with low turbidity. Within the Delta the largemouth bass tends to inhabit sloughs and backwaters with large quantities of aquatic cover and submerged objects.

Life History

Spawning for largemouth bass occurs in the second or third year of life when water temperatures reach 14 to 16 degrees C in April and continues through June. Nests are shallow substrate depressions located in about one to two meters of water near submerged objects. Eggs are adhesive and hatch within two to five days after being fertilized. The nest and eggs are actively protected by the male until sac-fry emerge from nest in about five to eight days.

Factors Affecting Abundance

Food availability, toxic substances, and competition and predation are among the factors influencing abundance of largemouth bass. In addition, harvest of many largemouth bass for food and bait by sport anglers may affect abundance (CALFED 2000d).

RESTORATION CONSIDERATIONS

Throughout the Delta, functional tidal marsh with dendritic channel networks provide rare remnant habitat for special-status species such as juvenile chinook salmon and delta smelt (potential spawning habitat). Additionally, they also provide ecological goods and services for aquatic ecosystems, such as primary productivity that serves as food for species throughout the aquatic food web. Most of these aquatic habitats in the Delta have been dramatically altered since European colonization and there is a general recognition that the declines in native fishes have been associated with many changes in the Delta, including the loss of tidal wetlands (Bennett and Moyle 1996). While returning the aquatic ecosystem to their presettlement condition is not feasible, restoring a sufficient level of pre-historic ecosystem structure and function to benefit native species may be possible.

As opposed to many locations throughout the Delta, the tidal marsh and dendritic channel networks throughout the lower portions of the LSIWA have not been modified to a point that precludes or limits restoration. Many of the important ecological attributes and processes associated with this habitat type, while modestly altered and/or muted, appear to still provide significant function and value. The primary limiting factor diminishing this habitat value to native species is likely associated with the dense stands of egeria growing in the open water of Sherman Lake located adjacent to the mouths of the dendrite channels.

Dense stands of egeria have been documented to diminish overall habitat quality for native fish species through changes in physical habitat structure (Grimaldo and Hymanson 1999; Grimaldo et al. 2004; Brown 2003). In Sherman Lake and in the Delta in general, the presence of egeria is particularly important because dense beds of this alien submerged aquatic vegetation support a distinctive assemblage of native and alien fishes. In particular, largemouth bass associated with the edges of the macrophyte beds may prey upon native species at a greater rate than the native and alien predators present in open water (Brown 2003). Brown (2003) developed conceptual models to illustrate that in the absence of dense egeria beds, fishes are more capable of exploiting marsh plains and tidal channels for feeding or predator avoidance through movement in and out of these habitats with the tides. The primary food sources likely to be exploited by fishes in these situations are chironomid larvae, pupae, and adults. Other invertebrates abundant within these habitats will also be exploited. Additional egeria-related mechanisms that adversely affect aquatic habitat for native species include changes in water temperature, water clarity, and diurnal dissolved oxygen concentrations (Grimaldo and Hymanson 1999; Grimaldo et al. 2004; Brown 2003).

Because of the existing perceived high quality of the tidal marsh and dendritic channel network habitat and adverse habitat altering mechanisms associated with egeria growing in the adjacent open water, aquatic habitat restoration considerations for LSIWA should be centered on control of the existing egeria beds throughout the open water of Sherman Lake. These efforts would be directed toward maximizing habitat value of the marsh plain and dendritic channels for native fish. Efforts should be especially focused on limiting egeria beds adjacent to tidal channel mouths. Management of egeria through chemical treatments appears to be the most effective control method employed throughout the Delta and may be the only feasible method for control in LSIWA.

Because egeria has been documented as a primary limiting factor associated with tidal wetland restoration and native fish recovery, management and control efforts should be monitored to determine fish response to changes in habitat structure. Monitoring data would be valuable in informing future adaptive management of LSIWA and could be applied to wetland restoration and enhancement projects throughout the Delta.

3.4 BIOLOGICAL RESOURCES OF RIPARIAN, MARSH, AND UPLAND ECOSYSTEMS

3.4.1 VEGETATION

For riparian, marsh, and upland ecosystems, this section provides a description of the status and ecology of its vegetation, the species associations occurring at the LSIWA, an assessment of invasive plants potentially affecting the ecosystem and a summary of restoration considerations. It also includes a review of the special-status species potentially-growing at the wildlife area. The major vegetation types at the wildlife area are mapped in Exhibit 3.4-1 and Table 3.4-1 lists that corresponding categories in the major vegetation classifications in use for the Delta.

Table 3.4-1
Correspondence of Mapped Vegetation Types with Other Vegetation Classifications

Mapped Vegetation Type	Corresponding Categories in:		
	Sawyer & Keeler-Wolf[1]	WHR[2]	ERPP[3]
Open water	-	Riverine	Delta sloughs Nontidal perennial aquatic habitat
Floating aquatic vegetation	-	-	-
Emergent tidal marsh	Bulrush series Bulrush-cattail series Cattail series Common reed series Giant reed series	Fresh emergent wetland	Fresh emergent wetland (tidal)
Riparian scrub/woodland	Arroyo willow series Black willow series Narrowleaf willow series Fremont cottonwood series Mixed willow series	Valley-foothill riparian	Riparian
Grassland	California annual grassland series	Annual grassland	-
Developed/disturbed	-	Urban	-

Notes:
1 Based on Sawyer and Keeler-Wolf 1995
2 Based on DFG 2002
3 Based on CALFED 2000a

RIPARIAN ECOSYSTEMS

Status

Riparian habitat in the Delta has been significantly reduced by stream channelization, altered hydraulics, livestock grazing, and direct loss of habitat to agriculture and urban development (Riparian Habitat Joint Venture 2000, CALFED 2000e). Estimates place the loss of riparian forests in the Central Valley at 92–97%, with the remaining riparian forests frequently of relatively poor quality (Hunter et al. 1999; CALFED 2000e; Jones & Stokes 2002). Similarly, in the Delta, the current amount of scrub and woodland riparian vegetation may be at less then 5% of historical levels (CALFED 2000a). This loss of riparian vegetation represents not only a loss of riparian habitat but a reduction in shaded riverine aquatic (SRA) habitat, and in inputs of woody debris and organic matter to aquatic ecosystems (Knight and Bottorff 1984)

Summary of Ecology

Over fifteen native species of deciduous trees and shrubs occur in the riparian forests, woodlands and scrubs of the Central Valley and Sacramento-San Joaquin Delta (Conard et al. 1980; Sawyer and Keeler-Wolf 1995). Flow regime, disturbance and species attributes determine the species composition and physical structure of this woody vegetation. Though flow regime influences the dispersal, establishment, growth and survival of all the woody riparian species, Fremont's cottonwood (*Populus fremontii*) and the willow species (*Salix* species) are particularly dependent upon specific hydrologic events for their recruitment. During seed release, flows must be high enough to disperse seed to surfaces where scouring by subsequent flows does not occur, yet not so high that seedlings desiccate after flows recede, and flows must recede gradually to enable germination and seedling establishment while the substrate is still moist (Mahoney and Rood 1998; Shafroth et al. 1998; Scott et al. 2000). Fremont's cottonwood and willow species are rapidly growing, shade intolerant and relatively short-lived (Burns and Honkala 1990; Sudworth 1908; Strahan 1984). Within 10–20 years, initially shrubby thickets have reached 10–40 feet in height. Other species, such as Oregon ash (*Fraxinus latifolia*) and valley oak (*Quercus lobata*), establish concurrently or subsequent to the willows and cottonwood, grow more slowly but are more tolerant of shade, and are longer-lived (Burns and Honkala 1990; Tu 2000). In the absence of frequent disturbance, these species enter the canopy, particularly after 50 years, as mortality of willows and cottonwood frees space. Conversely, frequent disturbance prevents the transition to mature mixed riparian or valley oak forests.

None of the native woody species of the Central Valley's riparian areas germinates and establishes seedlings underwater, and all tolerate inundation during the dormant season (i.e., late fall to early spring). Tolerance of inundation during the growing season varies among species and with most species capable of withstanding a prolonged period of inundation if at least a portion of their foliage is above the water surface.

Riparian trees and shrubs are readily top-killed by fire (valley oak is somewhat more resistant to fire); however, most species will produce new shoots from the base of their previous trunk or from their roots. Important consequences of frequent fire can include shifts in species composition, more open vegetation, and an absence of larger trees (which are important habitat components for some species of wildlife).

Plant Species Associations in Riparian Ecosystems at LSIWA

At LSIWA, there is approximately 92 acres of riparian scrub/woodland. This riparian vegetation is primarily along the historic levees above elevations that support tidal marsh. However, marsh and riparian vegetation often intergrades.

The riparian vegetation is characterized by narrow linear strips of trees and shrubs, in single-to multiple-story canopies. Tree canopies are often continuous and can attain heights of 30 feet or more. Native woody plant species occurring in riparian vegetation at LSIWA include Fremont cottonwood, Goodding's black willow (*Salix gooddingii*), arroyo willow (*Salix lasiolepis*), shining willow (*S. lucida*), sandbar willow (*Salix exigua*), red alder (*Alnus rubra*), and California rose (*Rosa californica*). Much of this vegetation type is infested with the invasive nonnative, Himalayan blackberry (*Rubus discolor*), which commonly creates dense, impenetrable thickets along levee surfaces. The understory is generally sparsely vegetated with grasses, sedges, and rushes. Some areas may be characterized as scrub, consisting primarily of shrubs and short trees such as sandbar willow, arroyo willow, and red alder, whereas other areas are characterized by stands of shrubs and trees.

In addition to Himalayan blackberry, several invasive non-native species may be present in riparian scrub/woodland at LSIWA. These species, and their ecology and control, are discussed in the following section.

Source: EDAW 2006

Vegetation of the Lower Sherman Island Wildlife Area **Exhibit 3.4-1**

Assessment of Invasive Plant Issues in Riparian Ecosystems

In the Delta, riparian areas are frequently dominated by nonnative invasive species, particularly along levees and berms. The most abundant of these are giant reed (*Arundo donax*), blue gum eucalyptus (*Eucalyptus globulus*), fennel (*Foeniculum vulgare*), black locust (*Robinia pseudoacacia*), Himalayan blackberry. However, a number of other species are locally problematic such as fig (*Ficus carica*) and tree-of-heaven (*Ailanthus altissima*). All of these species are either present at LSIWA or could be present in the future. Except for the locally problematic species, the ecology and control of each species is described in this section.

Several other species are likely to become problematic invaders of the Delta's riparian areas in the near future. Of these species, the two of greatest concern in the Delta are tamarisk (*Tamarix species*) and red sesbania (*Sesbania punicea*). Tamarisk is not currently a major problem in the Delta, but is a problem along some lowland California streams in the Central Valley and Interior Coast Ranges. Currently, biological control efforts are underway and initial results are promising. Therefore, tamarisk may not become a problem in the Delta. Red sesbania has been spreading rapidly in riparian areas in the Central Valley, and is now present at scattered locations in the Delta (Ondricek-Fallscheer 2003; Hunter and Platenkamp 2003). Its ecology and control are described later in this section.

Giant reed (*Arundo donax*) can form extremely dense stands (up to 25 feet high) in riparian areas (Dudley 2000; DiTomaso and Healy 2003). This species doesn't establish from seed in California. Its spread is entirely dependent upon the expansion of existing clumps through the growth of new shoots from rhizomes (i.e., horizontal below-ground stems), layering of existing shoots, and from the rooting of fragments of shoots dispersed along waterways. Giant reed can produce new shoots at any time of year, and can grow year-round, though growth is sensitive to temperature; during cold weather, growth rates are slower and culms may partially die-back or even be damaged by frosts. The species can tolerate periods of inundation and of dry soil conditions. Giant reed can be controlled through repeated herbicide application. However, early detection and eradication of clumps is important to avoid expensive removal costs.

Bermuda grass (*Cynadon dactylon*) is a perennial grass whose long rhizomes (below-ground stems) produce above-ground shoots (Burton and Hanna 2000). It regenerates from seeds and its rhizomes. (Even small fragments of rhizomes can give rise to new plants.) The species germinates as the soil warms in spring, and established plants grow best at temperatures above 75ºF. Bermuda grass is more drought resistant than most grasses and forbs of seasonal wetlands. However, it is sensitive to cold temperatures; it grows little at temperatures of 43–48ºF, and temperatures of 27–28ºF kill leaves and above-ground stems. When actively growing, Bermuda grass tolerates inundation for several days, but is damaged by prolonged submergence, and makes little growth on water-logged soils.

Blue gum eucalyptus is a large, long-lived tree that can dominate patches of upland (and upland) vegetation. Trees grow rapidly, and removal costs increase concurrently. By their fifth year, trees generally begin to produce seeds; large numbers of seeds are produced in capsules. Following disturbances (such as fire) numerous seedlings may establish (Boyd 2000). Blue gum eucalyptus sprouts from the stem base after its shoots are cut or burned. Thus, to kill eucalyptus, herbicide is usually applied to the cut surface of stumps immediately following removal of the shoot.

Fennel is a perennial, tap-rooted, herb from 3–10 feet high that can form dense stands in disturbed open sites in riparian areas, along levees, and in seasonal wetlands (Klinger 2000). Fennel seed are produced from late spring to fall, can germinate at most times of year, and also can persist in the soil for years. On established plants, the production of new stems and active growth begins in late winter and continues until fall, when most stems die back. The plants can be dug out (though this creates conditions favorable for seedling establishment) or controlled chemically. While the species tolerates periodic inundation, it is not clear if it can survive prolonged inundation.

Black locust is a deciduous tree widely distributed along levees and in riparian areas of the Delta (Hunter 2000). It produces seed that accumulate in a dormant soil seedbank, and germinate after disturbance (Olsen 1974). Seedlings and saplings are not tolerant of shade (Burns and Honkala 1990; Huntley 1990). Trees will produce new shoots from their roots sometimes resulting in thickets of black locust. In California and elsewhere, this species does not seem to spread rapidly or invade large areas of natural vegetation, and is probably only problematic in areas near mature trees. Black locust can be controlled by applying herbicide to cut stumps or injecting it into stems.

Himalayan blackberry is an evergreen woody vine forming dense thickets to 10 feet high (Hoshovsky 2000). Currently, it is the most abundant shrub in riparian areas of the Central Valley and the Delta (Hunter et al. 2003), and is the most abundant shrub at LSIWA. It tolerates a wide range of soils and survives periodic inundation. Though it grows in the relatively light shade cast by many narrow bands of riparian vegetation, the species is actually intolerant of heavy shade. Seeds germinate in late winter and early spring and require relatively open conditions for their survival. New stems are also formed from buds that develop on the roots of established plants. Clumps several meters in diameter can form in 2–3 years. Goats will eat blackberry, and are used for this purpose to clear vegetation along some levees in the Delta. Clumps also can be burned or cut; however, new stems will sprout from the roots unless the root system is dug out or herbicides are applied to resprouts.

Red sesbania is dispersed by water, and the seed can persist in a dormant state for years and germinate in response to abrasion of the seed coat (e.g., during disturbances) (Hunter and Platenkamp 2003). Though it doesn’t germinate and establish seedlings below water, it seems to tolerate inundation during the active growing season when at least some of the foliage is above the water surface. Red sesbania can establish in herbaceous vegetation, on open gravel bars, and in some stands of woody vegetation. It does not sprout stems from the root system when damaged, and a variety of control techniques appear to be effective, including uprooting and herbicide application.

Restoration and Enhancement Considerations

Several opportunities exist to enhance or restore riparian habitats at LSIWA. These opportunities include:

- Invasive plant removal and other vegetation management (e.g., plantings) along remnant levees;
- Restoration of riparian habitat in conjunction with removal of nonnative plants and abandoned buildings along Cabin Slough;
- Restoration of riparian habitats in conjunction with marsh enhancement/restoration; and
- Enhancement of riparian habitats at the Sherman Island Public Access Facility by controlling nonnative plants and animals, and limiting human disturbance in selected areas.

Most riparian vegetation at the wildlife area is along the remnant levees, and currently most of this vegetation is dominated by Himalayan blackberry, and the riparian vegetation also contains infestations of Arundo, and other nonnative, invasive species. Larger trees (e.g., cottonwoods) are relatively few and patchy in their distribution. These three attributes (dominance by Himalayan blackberry, scattered infestations of invasive plants, and scarcity of larger trees) limit the diversity and wildlife habitat value of the riparian vegetation at LSIWA. While it is probably infeasible to eradicate Himalayan blackberry, removal of patches, in concert with plantings of riparian trees and shrubs, would add diversity and wildlife habitat values. Removal of patches of other invasive plants would preempt their future spread within the wildlife area.

The wildlife area’s remnant levees provide an opportunity to establish large riparian trees, a limited resource in the Delta. Along maintained levees there are concerns that large trees would remove and destabilize sections of levee when uprooted. Thus, larger tree species are unlikely to be planted along maintained levees; and thus, the nest sites, SAR habitat, cavities, and cover that these trees would provide is likely to remain scarce along the

Delta's waterways. Because Lower Sherman Island is a flooded island, the consequences of damaging its remnant levees are minimal, while the potential benefits are greater than at most sites because of the proximity to extensive marsh and open water. Suitable large tree species may include Fremont cottonwood, sycamore (*Platanus racemosa*), Oregon ash, and black willow. (Fremont cottonwood and black willow currently grow at the wildlife area; Oregon ash and sycamore might also grow if planted, although soil salinity levels may be high for these species.)

The establishment of larger trees and patches of native-dominated riparian vegetation could be performed in conjunction with the removal of nonnative plantings and abandoned buildings along Cabin Slough. As described in Chapter 2, the California Fish and Game Code prohibits nonnative landscaping at the cabin sites, and requires the Department to develop a plan for their removal. This plan, and the removal of abandoned buildings described in Chapter 4, could incorporate the replacement of nonnative plants with native riparian vegetation.

The establishment of riparian scrub could be incorporated into marsh restoration or enhancement projects that involved modifications to existing tidal channels or the creation of new tidal channels. Low berms could be created along tidal channels (a by-product of excavating channels) and planted with native shrubs and vines to provide riparian scrub vegetation along channels through the marsh. Suitable plant species may include arroyo willow, shining willow, buttonwillow (*Cephalanthus occidentalus*), red osier dogwood (*Cornus sericea*), black twinberry (*Lonicera involucrata*), California rose, poison oak (*Toxicodendron diversilobum*), and California blackberry (*Rubus ursinus*).

Although riparian habitats at the Sherman Island Public Access Facility are heavily affected by human disturbance, nonnative animals (e.g., feral cats), and invasive plants, enhancement of these habitats would reduce the mortality of resident and migratory wildlife, and could prevent these habitats from being a source of additional nonnative species. Enhancement measures could include trapping and removal of abandoned cats, removal of new, small infestations of nonnative plant species, and exclusion of users from selected areas.

The planning of larger-scale restoration projects should give particular consideration to potential consequences of the project for water quality and conveyance of flood waters, potential effects of sea level rise on the project, and the inclusion of monitoring of wildlife use of restored habitats. If riparian restoration projects alter marsh or aquatic habitats, they have the potential to adversely affect water quality. Increases in the density or height of riparian vegetation can increase roughness, which in turn could decrease the conveyance of floodwaters. Sea level is rising and may alter restored habitats in the foreseeable future; in particular, riparian vegetation will be restricted to higher elevations than at present. These issues are important aspects of future conditions, and thus merit consideration during restoration planning and design.

Major restoration projects should include monitoring sufficient to support adaptive management of the project and of related restoration efforts. Ideally, monitored variables should allow evaluation of resulting habitat quality and quantity for target species and habitat use by target species. While such monitoring would be more costly, it also would provide understanding that would benefit the design and implementation of other restoration projects.

MARSH AND OTHER WETLAND ECOSYSTEMS

Status

Prior to 1850, the Delta was dominated by tidal wetlands, comprising about 87% of the area or 500 square miles (Atwater and Belknap 1980). Conversion to agriculture and other land use changes over the past century reduced the amount of emergent wetland and fragmented what was once nearly contiguous. In particular, diking and draining historic wetlands substantially reduced the amount of tidal emergent wetlands and sloughs (CALFED 2000a, e). Recent estimates indicate that about 95% of Delta tidal wetlands have been lost, along with a significant proportion of the associated tidal sloughs (The Bay Institute 1998, Jones & Stokes 2002).

Summary of Vegetation Ecology

The Delta's tidal wetlands are dominated by clonal perennial plants, particularly bulrushes (tules, *Scirpus* species), and to a lesser extent cattails (*Typha* species), common reed (*Phragmites australis*) and waterpepper (*Polygonum hydropiperoides*) (Hunter and Hart 2003a). Tules, cattails and giant reed are emergent macrophytes, large (up to 10 feet in height) rhizomatous plants rooted in the substrate with stems (culms) above the water surface.

Seedling establishment takes place on exposed surfaces, but clonal growth allows their subsequent occupancy of lower elevation sites (i.e., in the lower intertidal zone). Once emergent macrophytes establish on a site, their thick rhizomes, accumulating organic matter from abscised plant parts, and trapped sediment raise marsh elevation. However, in the absence of large inputs of sediments, this increase in elevation is very gradual (Simenstad et al. 1999). The growth of emergent macrophytes is reduced by submergence and by damage to their culms from wave action, thus vegetation dominated by emergent macrophytes is restricted to shallow water, typically <2 feet in depth (Coops et al. 1991, 1996).

During the growing season, substantial changes in above-ground biomass occur rapidly, particularly for deciduous species, such as softstem bulrush (*Scirpus acutus*) and cattails. For example, in cattails, materials are transported from the rhizomes (below-ground stems) into leaves in spring, and rapid growth continues until fall, when leaves senesce and materials are transported back to the rhizomes (Jervis 1969, Grace and Harrison 1986, Garver et al. 1988).

Marshes dominated by large deciduous species, such as cattails and softstem bulrush, also have a thick thatch layer of dead leaves and stems from the previous year; it has an annual cycle of increase in fall and gradual diminishment throughout the following winter, spring, and summer.

In marsh vegetation, vegetation structure and species richness are strongly influenced by disturbance (e.g., wave action, fire) and the range of elevations present at a site (Keddy 2000). Disturbance provides regeneration opportunities for annuals and short-lived perennials, provides the opportunity for additional species (also primarily clonal perennials) to colonize the site, and creates structural diversity. Disturbances at the LSIWA result from human uses and fires. Human uses include the clearing of trails, construction and use of blinds, and maintenance of ponds and clearing of vegetation to create open water. The diversity of native plant species in these areas is noticeably greater than in relatively undisturbed areas nearby. Fires occur frequently on Lower Sherman Island, along West Sherman Island Road (Bob Chambers, personal communication, 2005). Overall, these fires reduce thatch and above-ground biomass, and increase nutrient availability; this benefits annual and short-lived perennial species and increases the diversity of marsh vegetation (Vasey et al. 2005).

In the Delta's tidal wetlands, the cover of woody species and species richness (i.e., number of species) increase with elevation and dominance frequently shifts from California bulrush (*Scirpus californicus*) to softstem bulrush (Hunter and Hart 2003b; Hunter and Hart unpublished data; Hart et al. 2003). (Softstem bulrush is deciduous and California bulrush is evergreen; thus, these two species probably differ in their hydraulic roughness during the winter, and in the habitat they provide during winter and spring.)

At upper elevations, the species composition of tidal marshes changes from mid-elevations. Upper elevation marsh may support halophytes such as saltgrass (*Distichlis spicata*) and pickleweed (*Salicornia* species). A number of species typical of freshwater and saline marshes may grow together in these high marsh areas. Areas with higher soil salinities support pickleweed, saltgrass, fat-hen, and gumplant (*Grindelia humilus*). If salinity levels are lower in the high marsh areas, brass buttons (*Cotula coronopifolia*) and Baltic rush (*Juncus balticus*) may be more prevalent (Josselyn 1983). Alternatively, emergent wetlands may intergrade with the woody vegetation of adjacent riparian areas. Most woody plants in this transitional zone are shrubs and vines, including red osier dogwood, buttonbush, and willows. In the western Delta, a transition from mid-level marsh to woody vegetation is more common than the development of an upper elevation marsh dominated by halophytes.

At lower elevations, there is also a transitional zone between marsh and aquatic vegetation. In this zone, there are fewer species of emergent plants, tule stems are at a lower density and occasionally clumps of submerged aquatics exist. Also, a characteristic feature of this transition zone are floating mats of plants that are rooted in the substrate but have creeping stems that are prostrate on the water. Native plants in the marsh fringe with this growth form include creeping water primrose (both the native *Ludwigia peploides* subsp. *peploides* and the nonnative *L. p.* subsp. *montevidensis*), which has both native and non-native subspecies, and floating pennywort (*Hydrocotyle ranunculoides*). This floating fringe may be absent, or discontinuous and narrow (< 3 feet), or may extend out across the water surface for 3–12 feet with plants rooted in the substrate at the marsh edge, and floating as a mat over deeper water. Other, smaller species of pennywort (*Hydrocotyle umbellata*, *H. verticillata*) also grow at the marsh edge, but tend to be on exposed muddy banks and flats.

Salinity gradients also affect the species composition of marshes. Waters in the Delta generally have minimal salt concentrations, but brackish water occurs in the lower Delta in areas (like Lower Sherman Island) that are close to the Suisun Bay. Salinity levels in the soil are primarily driven by the interaction between the salinity concentration of tidal waters, local weather conditions, and the marsh vegetation itself (Atwater and Hedel 1976). The presence of a certain plant species within different marsh vegetation types is the result of individual physiological tolerances and interspecific competition (Josselyn 1983). In general, larger monocots inhabit the lowest marsh surfaces, which are inundated by most high tides, and surfaces at or above high-tide levels are dominated by broadleaf species and a few species of smaller monocots. Marshes flooded by fresh or brackish water support a more diverse assemblage of species that generally tolerate low-to-moderate salinity concentrations (Atwater and Hedel 1976).

The state's large water projects that dammed rivers and regulated flows have altered salinity gradients. The regulated flows of fresh water from the Sacramento and San Joaquin Rivers into the Delta reduced saltwater intrusion, thereby disrupting processes that supported brackish marshes (Atwater and Hedel 1976).

Processes Affecting Vegetation Establishment and Marsh Formation in the Delta

An interdisciplinary team headed by the University of Washington's (UW) School of Fisheries is studying the effects of breached levees in the Delta. The BREACH team consists of university researchers from UW and the University of New Orleans, consultants, and ecologists from the California Department of Water Resources (DWR). This research focuses in part on natural rates of wetland restoration within these flooded areas to provide a conceptual model of the development of freshwater tidal wetland on subsided islands with breached levees (Simensted et al. 2000). Natural sediment accumulation rates were measured for islands that had subsided from approximately 3.5 to 7.5 feet. Results indicate that accumulation rates vary considerably. In some areas of the Delta, sedimentation rates were relatively high (e.g., approximately 2 inches per year at Mildred Island and Rhode Island), but in large, open water areas it appears that sediment accumulation may be hindered by forces causing erosion, such as high-velocity waves.

At Sherman Lake, the large open-water habitat has persisted for over 60 years, and these areas may have reached a sort of open-water equilibrium where accumulation and erosion rates have become equal at an elevation significantly below the water's surface (see Section 3.1). Researchers also looked at what elevations, with respect to tide levels, were necessary for marsh vegetation to initially colonize and laterally expand. In general, researchers found that colonization of marsh vegetation requires higher elevations more so than lateral expansion. The median value for colonization was approximately +3.3 feet mean lower low water (MLLW), and lateral expansion averaged approximately –1 foot MLLW. The lowest value observed at the study sites for pioneer colonization was +1.3 feet MLLW, and lateral expansion occurred as low as –2 feet MLLW. However, these values were generated by data with significant levels of uncertainty, and additional research and monitoring are necessary to verify these results.

To assess lateral expansion rates, researchers performed a time series analysis of historical photographs. An assessment of Sherman Lake indicated that during a 57-year period, lateral marsh expansion occurred only in the most sheltered areas, and the highest expansion rates were approximately 5–10 feet/year. Researchers estimate that if this rate of expansion were to continue, it would take several hundred to thousand years for the open water area to become completely vegetated. Although vegetation reduces the potential for erosion and facilitates additional accumulation, these rates of lateral expansion are very slow. Marsh elevations at the breached study sites are significantly lower than those at reference sites, even though they have been vegetated for decades (Simenstad et al. 1999).

The Sherman Lake has deeply subsided soils, and it appears that it has reached some sort of open-water equilibrium and is not accumulating significant amounts of sediment. Evaluating the processes driving marsh formation is particularly important during restoration planning efforts, especially if particular species are targeted for restoration. The quality of habitat for a particular species can be strongly influenced by the presence of various plant species; therefore it is important that the factors responsible for different types of marsh formation and zonation patterns be incorporated into the restoration design process (Atwater and Hedel 1976).

Plant Species Associations in Marsh Ecosystems at LSIWA

Marsh vegetation was mapped as emergent marsh and as floating aquatic vegetation. Most emergent marsh is dominated by softstem bulrush, California bulrush, cattails, and common reed. In the northwestern portion of Lower Sherman Island, there is also a band of upper elevation marsh dominated by pickleweed and saltgrass.

Floating aquatic vegetation was mapped along major channels and the lower elevation fringe of marshes. It is actually a mosaic of scattered bulrushes and floating aquatic vegetation (consisting of creeping water primrose, floating pennywort, and water hyacinth) (Exhibit 3.4-1).

Assessment of Invasive Plant Issues in Marsh Ecosystems

Currently, there is little cover of non-native invasive species in marshes of the Delta, including at LSIWA. However, perennial pepperweed (*Lepidium latifolium*) has become abundant in the upper elevations of many marshes (including in upper elevation marsh and adjacent uplands in the northwestern portion of LSIWA); it is extremely difficult to eradicate. In the future, purple loosestrife (*Lythrum salicaria*) may be a problematic invader; elsewhere in the Delta it has established patches in the tidal zone. Other species create localized problems: water hyacinth will root in tidal marsh, and black locust, giant reed, and Himalayan blackberry shade or encroach on the tidal zone at the base of levees and berms (J. Hunter, personal observation). Also, several non-native species not generally considered invasive (such as dallisgrass [*Paspalum dilatatum*]) are abundant within the tidal zone and may be reducing available habitat for native species.

Himalayan blackberry is a concern in the transitional zone between marshes and adjacent riparian areas. This species is currently widespread in riparian and ruderal vegetation throughout the Delta, including at LSIWA; it rapidly occupies space and is difficult to eradicate. (See description in the riparian vegetation section.) The formation of dense thickets of Himalayan blackberry in this transitional zone displaces relatively diverse native vegetation of a variety of growth forms (including clonal herbaceous plants and deciduous woody shrubs and vines) and replaces it with a dense monoculture of an evergreen woody vine.

Perennial pepperweed is a clonal, perennial herb reaching 7 feet in height (Howald 2000). It grows in wetlands and mesic herbaceous vegetation in full sun. Seeds germinate from mid-winter through spring. Active above-ground growth continues until late fall when stems die back to their bases. New stems are produced in late winter and in spring both from the old stem bases and from the spreading root system. Perennial pepperweed can regenerate from fragments of its root system. Mechanical control, burning, and grazing have generally not been effective for controlling perennial pepperweed. However, lengthy periods of flooding during the active growing season (spring and summer) may kill perennial pepperweed, and flooding during late-winter and spring would prevent establishment from seed.

Purple loosestrife could become abundant within the Delta's tidal wetlands at mid- and upper elevations, as it has done in wetlands in other regions, but it is not currently abundant. This species produces annual stems from below-ground parts, and these stems make abundant seed that are both dispersed by water and form a persistent seed bank on-site (Mal et al. 1992). Growth of new stems and germination of seed begin in later spring. Thus, it grows best in sites that are moist but not inundated during late spring and summer. There are reports of purple loosestrife tolerating prolonged inundation and of it being damaged and killed by prolonged inundation. (To damage or kill purple loosestrife inundation may need to submerge all foliage and/or extend throughout much of the growing season, which would also damage or kill many other species). It is very competitive with other wetland species. In some cases, purple loosestrife has come to dominate a wetland site within 2 years.

Red sesbania also could become locally abundant at upper elevations, particularly following disturbance. It has established in marsh vegetation along the San Joaquin River, displaced herbaceous wetland vegetation along the American River, and is locally present in the Delta. (This species is discussed in the riparian vegetation section.)

Parrot feather (*Myriophyllum aquaticum*) invades the marsh fringe, and is established along both the Mokelumne and Cosumnes Rivers, and within many drains and irrigation canals and other waterways throughout the Delta. This species has a versatile growth form; while it is rooted in water (to 5 feet deep) and has submerged stems, its stems also emerge above the water surface, and it can grow on muddy banks (Godfrey 2000a; DiTomaso and Healy 2003). Like some native species it can form a floating mat along the marsh fringe. It does not produce seed in California (because only female plants are present), and thus spreads only by growth of rhizomes, and rooting of stem fragments. In fall, stems typically die back to their rhizomes. From late winter until fall, new shoots are produced from the rhizomes, grow up through the water column and emerge above the water surface. Control of parrot feather is difficult. Mechanical control efforts rarely remove all rhizomes, and new shoots form from those that remain. Herbicide applications can be effective; however, herbicide sprayed on above-water stems often weighs them down so that they fall onto the water surface, consequently washing off the herbicide.

Restoration and Enhancement Considerations

Several opportunities exist for marsh enhancement or restoration at LSIWA. These opportunities include:

- Eradication of perennial pepperweed from the upper marsh in the northwest portion of Lower Sherman Island;
- Use of fire to manage marsh vegetation;
- Reduction of excessive bank erosion along Lower Sherman Island's shoreline;
- Enhancement or creation of tidal channels to improve ecosystem processes or habitat values; and
- Creation of open tidal mudflats in the lower intertidal zone.

Perennial pepperweed in upper elevation marsh, perennial pepperweed displaces native vegetation, and replaces lower pickleweed and saltgrass with a tall, dense canopy, altering wildlife habitat. Currently, perennial pepperweed is currently locally abundant within the upper marsh and adjacent uplands, and its eradication would preclude further spread.

Fires currently occur in the marshes of Lower Sherman Island, and cause both beneficial and adverse effects in marsh ecosystems. These wild fires remove thatch, reduce the density of vegetation, and increase the diversity of marsh vegetation (Vasey et al. 2005). They also may aid the spread of some invasive plant species (such as Pampas grass), and have the potential to kill the shoots of riparian trees and shrubs. Prescribed burning could manage fires to increase beneficial effects on marsh diversity while avoiding adverse effects on riparian areas.

Extensive erosion, undercutting, and slumping of banks is occurring, reducing the area of riparian habitats along the levee remnants, possibly degrading bank habitats, and in the future possibly altering the island's hydrodynamics by cutting through the levee remnants and establishing new connections of the rivers to the interior marshes. Effective biotechnical techniques exist for reducing erosion along slough margins that may also be applicable in the relatively open, high wave energy conditions that exist along the shoreline of Lower Sherman Island (Hart and Hunter 2000). However, stabilizing these shorelines, and allowing dense vegetation to establish may adversely affect Mason's lilaeopsis or other populations that are largely confined to these eroding banks. These effects should be considered in developing an approach to reducing shoreline erosion.

The tidal marsh at Lower Sherman Island contains extensive interior areas that contain relatively few tidal channels. Creation or modification of tidal channels may enhance hydrodynamics, geomorphic processes, and wildlife habitats.

Currently, the lower intertidal zone is densely vegetated not only with bulrushes, but also with floating mats of creeping water primrose and floating pennywort. Creating persistent open areas within the lower intertidal would provide mudflats with better habitat for many shorebirds, than the current dense vegetation. The feasibility of such enhancement should be evaluated.

In planning marsh restoration projects, issues to be considered include the relationship of species distributions to elevation, potential effects of restoration on water quality, potential effects of sea level rise on the project, and the inclusion of monitoring of wildlife use of restored habitats.

In the Delta, the distribution and abundance of species is related to elevation. For example, *Scirpus acutus* is not as well suited as *Scirpus californicus* for growth at greater depths of inundation, halophytes may be confined to portions of the upper marsh, and woody plants may be abundant only at the highest elevations. Thus, heterogeneous topography, with a range of elevations, may be more effective in sustaining diverse marsh vegetation. Conversely, restoration of heterogeneous topography and a range of elevations may require a diverse mix of plant species.

Projects that alter marsh or aquatic ecosystems have the potential to adversely affect water quality. As described in Section 3-1, Sherman Lake exports methyl mercury to adjacent waters, and much of this methyl mercury originates in the marshes of Lower Sherman Island. Marsh restoration projects should not measurably increase these exports, or adversely affect other aspects of water quality.

Sea level is rising and may alter restored habitats in the foreseeable future. The change in sea level will alter the future conditions resulting from a restoration project. Ideally, projects should be designed to continue providing benefits with increased depth and duration of inundation.

The planning of larger-scale restoration projects should give particular consideration to the inclusion of monitoring of wildlife use of restored habitats. Major restoration projects should include monitoring sufficient to support adaptive management of the project and of related restoration efforts. Ideally, monitored variables should allow evaluation of resulting habitat quality and quantity for target species and habitat use by target species. While such monitoring would be more costly, it also would provide understanding that would benefit the design and implementation of other restoration projects.

UPLAND ECOSYSTEMS

Upland habitat within the study area consists of grassland and developed/disturbed areas. Although this upland vegetation accounts for <5% of the wildlife area's acreage, it provides important wildlife habitat and has a relatively high level of human use.

Summary of Ecology

Grassland

Though California's annual grasslands are dominated by a small number of nonnative annual grasses, this vegetation type includes a large number of native and nonnative species. Common species include wild oats (*Avena* species), brodiaeas (*Brodiaea* species), soft chess (*Bromus hordeaceus*), rip-gut brome (*Bromus diandrus*), filarees (*Erodium* species), doveweed (*Eremocarpus setigerus*), purple needlegrass (*Nasella pulchra*), tarweeds (such as *Madia* species), and clovers (*Trifolium* species). These species differ substantially in the timing and duration of germination, growth, and reproduction. As a consequence, grassland structure and species composition (and associated functions) vary substantially both throughout the growing season and from year to year.

Before the first fall rains, populations of perennial plants exist as tubers, tillers, bulbs, rhizomes, and dormant seed, while populations of annual plants are represented by dormant seed. Seed densities within the soil range from 10s to 1,000s per square foot (Heady 1966; Major and Pyott 1966; Bartolome 1976).

The annual cycle of growth, reproduction and senescence begins in the fall. Seeds begin to germinate after the first fall rains (Bartolome 1976). For some species such as filarees, almost all seed germinates immediately after the first rain. For other species, such as soft chess, germination continues for several weeks at the beginning of the growing season. There are also species that germinate throughout much of the growing season, such as hairy cat's ear (*Hypocharis radicata*), and there are species whose seed germinates in the spring, such as dove weed. Seedling density becomes high, as does subsequent mortality (Heady 1977; Bartolome 1976).

During winter, growth rates are low. In spring, plants undergo a period of rapid growth, the timing and duration of which differs between species (Bartolome 1976; Heady 1977; Savelle 1977). While no two species are identical in the timing of their growth and reproduction, several growth patterns are common among grassland species. Most perennials grow at slower rates over a longer period than do the annuals. For example, purple needlegrass grows earlier in the spring and for several weeks after annual grasses have senesced (Savelle 1977). Early within the season (during late winter and early spring), some annuals grow rapidly, reproduce, and senesce. These are typically species of smaller stature such as clovers. Many species undergo longer periods of growth that extend later into the growing season. These are generally larger (and taller) plants and include most of the dominant species, such as wild oats and rip-gut brome. These species often experience an abrupt end to their growing season due to drying soils and rising temperatures. Other annuals germinate much later, grow for considerably longer periods well into summer, and reproduce in summer. This group includes tarweeds, dove weed, and yellow starthistle (*Centaurea solstitialis*).

By summer's end, almost all above-ground biomass has died, and together with the remains of previous year's growth, it forms a mulch (i.e., a thatch layer) upon the surface. This thatch alters the environment experienced by seeds and seedlings. It reduces light, increases humidity, and alters the soil surface. Thinner thatch layers are more favorable to a variety of species than are thicker layers (Biswell 1956; Heady 1977; Corbin et al. 2004).

Developed/Disturbed

This habitat type is created by the removal of native vegetation through disturbances such as discing, grading, dredge material placement, and/or the replacement of native habitat with constructed features such as buildings and roads.

The ecology of vegetation in disturbed and developed areas is similar to that of grasslands, except for a greater importance of herbaceous perennial plants. Though seed germination, and seedling growth may occur in winter and early spring, the active growing season for established perennials is from late spring through to late fall. New stems are initiated in late winter or spring and active grow continues until late fall if sufficient moisture is available. For many species, dieback to stem bases or below-ground parts occurs in late fall (or earlier if the site becomes drier than they can tolerate). During the active growing season (late spring-fall), mechanical damage (e.g., trampling, mowing), herbicide applications, or prolonged inundation may damage or kill established plants of many species.

Plant Species Associations in Upland Ecosystems at LSIWA

Grasslands at the LSIWA are dominated by annual grasses, such as wild oats, soft chess, and annual ryegrass (*Lolium multiflorum*), but also include many perennial species that are also common in seasonal wetlands, such as prickly lettuce (*Lactuca serriola*), Bermuda grass, and curly dock (*Rumex crispus*). The grasslands also support invasive nonnative species, in particular Pampas grass (*Cortaderia selloana*) and perennial pepperweed.

Along the northwestern shoreline of Lower Sherman Island there are patches of grassland dominated by tufted hairgrass (*Deschampsia cespitosa* ssp. *holciformis*), a native perennial. This is one of the last representatives of this distinctive plant association in the Delta. (These small areas are mapped as inclusions within emergent marsh.)

The species composition of disturbed and developed areas at LSIWA is similar to that of grasslands and of riparian scrub, except a number of weedy species (such as prostrate knotweed [*Polygonum aviculare*]) are more common, and bare or sparsely vegetated areas are frequent. Some ornamental tree and shrub species may also occur in these areas, particularly along Cabin Slough.

Assessment of Invasive Species in Upland Ecosystems

In addition to perennial pepperweed and Bermuda grass, which were described in the riparian and marsh sections, respectively, Pampas grass is a potentially problematic invasive species that occurs in the grasslands of Lower Sherman Island. It is a perennial grass forming dense clumps up to over 6 feet in height. Pampas grass plants are functionally male or female, and one of each must be present on a site for seed production to occur. Seedling establishment generally occurs in sparsely vegetated areas in spring (DiTomaso 2000). Plants resprout after fire or being damaged mechanically. Thus, herbicides are usually used to kill mature Pampas grass plants; manual removal of seedlings, however, is effective (DiTomaso 2000).

Developed and disturbed areas are important as potential sources of new invasive species. High levels of human use can result in the establishment of new invasives that can subsequently spread into other vegetation types. For example, a Brazilian peppertree (*Schinus terebinthifolius*) has established in disturbed vegetation at the Sherman Island Pubic Access Facility. Brazilian peppertree is an invasive species of riparian habitats (and in Florida it invades marshes as well). This tree’s progeny could subsequently establish, and the species could become a problem in the area.

Restoration and Enhancement Considerations

Restoration and enhancement opportunities exist in upland ecosystems at LSIWA. These opportunities include:

- Control of invasive plants,
- Use of fire to manage vegetation, and
- Reduction of human disturbance in selected areas or during selected seasons.

Upland ecosystems at LSIWA are both degraded by invasive plants and are a source of invasive plants that can spread to marsh and riparian ecosystems, and to uplands outside of the wildlife area. Thus, eradication of invasive plants can both enhance upland ecosystems and prevent additional degradation.

Fires occur periodically on Lower Sherman Island; these wild fires remove thatch, reduce the density of vegetation, and may benefit plant diversity and wildlife habitat. They also may aid the spread of some invasive plant species (such as Pampas grass), and have the potential to kill the shoots of riparian trees and shrubs. Prescribed burning could manage fires to increase beneficial effects on plant diversity while avoiding adverse effects on riparian areas.

Recent research indicates that fire can be used to increase the importance of native species in annual grasslands (Corbin et al. 2004). However, considerable uncertainty remains regarding the effectiveness of particular management practices across the range of physical conditions and species assemblages present within annual grasslands.

Upland ecosystems at LSIWA provide refugia, roosting and nesting sites, and foraging habitat for a variety of wildlife species. High levels of human disturbance, or disturbance at particular times of year, may reduce those habitat values.

SPECIAL-STATUS PLANT SPECIES

The Delta is home to many special-status plant species, some of which are endemic. A list of special-status species potentially present at the LSIWA was developed by conducting a records search of the California Natural Diversity Data Base (CNDDB) (CNDDB 2006) within a 5-mile radius of the wildlife area (Exhibit 3.4-2, 3.4-3, and 3.4-4), and a review of other available information regarding similar habitats within the region, including data in the California Native Plant Society's (CNPS) on-line Inventory of Rare and Endangered Plants (CNPS 2006). Table 3.4-2 presents information on special-status plant species that are either known to occur or have potential to occur within the LSIWA.

Species with potential to occur at the wildlife area are associated with banks along shorelines, riparian areas, marshes, upper elevation marsh, and sandy substrates (such as stabilized dunes).

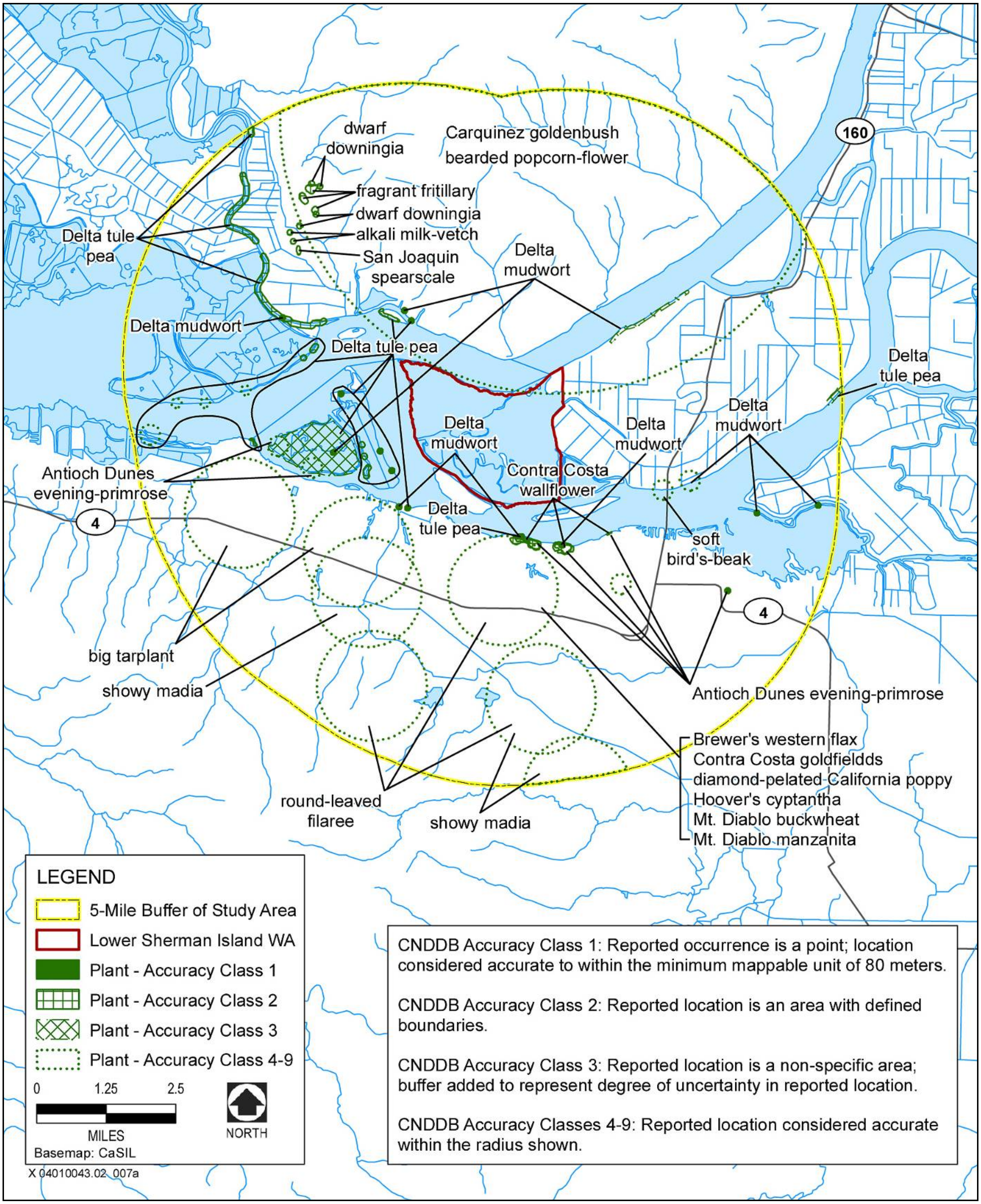
Suisun Marsh aster (*Aster lentus*) and Mason's lilaeopsis (*Lilaeopsis masonii*) grow along the shoreline of Lower Sherman Island (CNDDB 2005). There they grow on eroding banks and adjacent marsh of the intertidal zone. This is typical habitat for these species, and for Delta mudwort (*Limosella subulata*), rose-mallow (*Hibiscus lasiocarpus*), and Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*) as well. Areas along sloughs, tidal wetlands, riparian scrub, and banks and open flats within the tidal zone provide habitat for all four of these species.

Mason's lilaeopsis and Delta mudwort are diminutive (<10 inches), rhizomatous perennials that grow within the tidal zone on open sites along shores, at the toes of cut banks, and in marshes (Mason 1957, CNDDB 2005). Associated species include tules, cattails, rushes (*Juncus* sp.), marsh pennywort (*Hydrocotyle verticillata*), water-pimpernel (*Samolus parviflorus*), and smartweeds (*Polygonum* sp.). The decline of Mason's lilaeopsis and Delta mudwort populations has resulted primarily from habitat loss, altered hydrodynamics, installation of riprap and maintenance of levees, and accelerated erosion (resulting in part from boat wakes).

Suisun Marsh aster, a perennial reaching more than a meter in height, grows primarily within the tidal zone, in patches of one to several hundred stems. However, it often is away from the water's edge and within vegetation denser than vegetation surrounding Mason's lilaeopsis or Delta mudwort (CNDDB 2005). Associated species include tules, cattails, rushes, salt grass and vervain (*Verbena bonariensis*). The decline of Suisun aster populations has primarily been caused by habitat loss, installation of riprap and maintenance of levees, and competition from nonnative invasive plants.

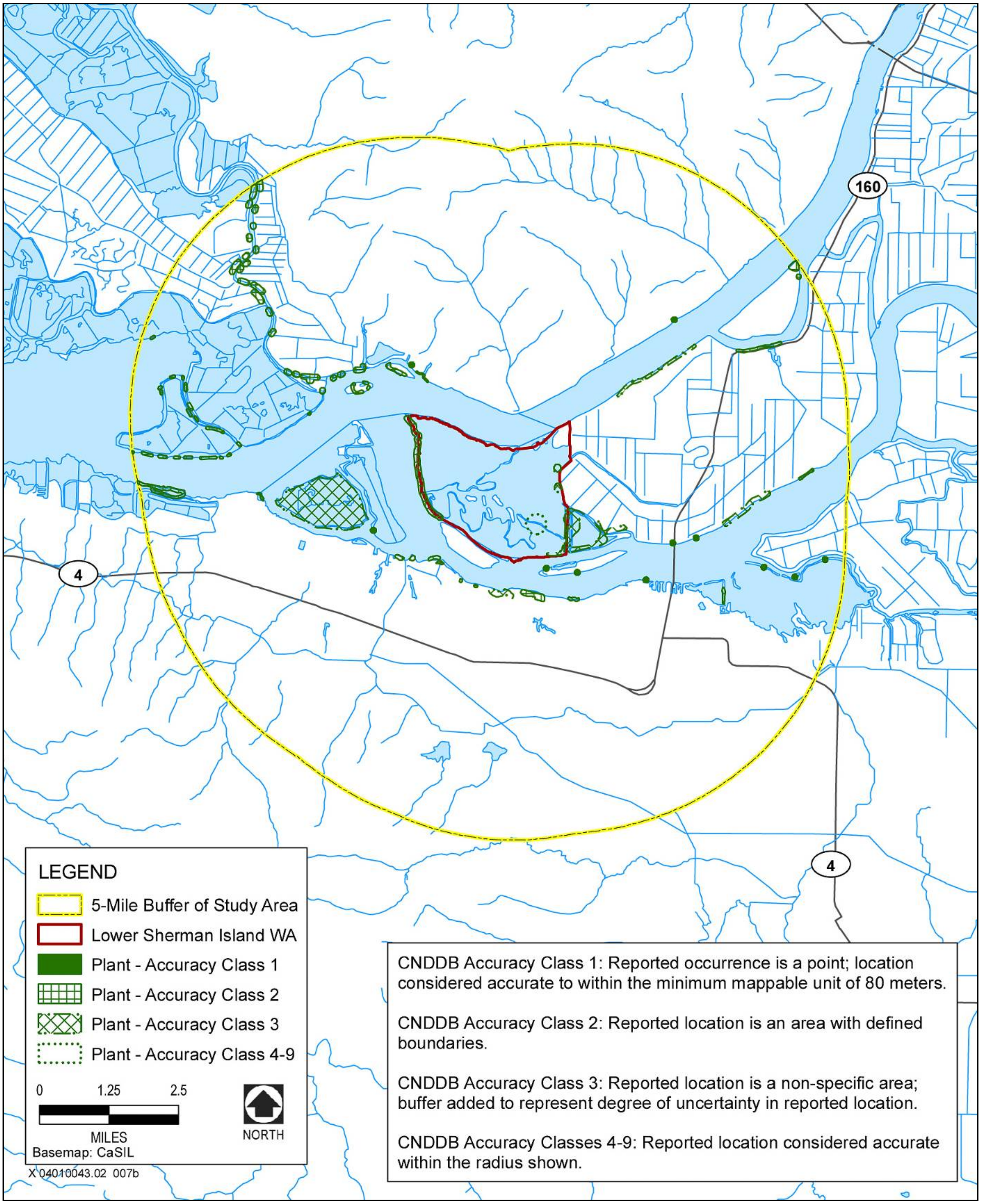
Rose-mallow also may grow along banks in the intertidal zone and within both riparian areas and marsh as well. It is an erect, rhizomatous perennial herb in the mallow family that flowers from June through September. It often occurs as widely scattered individuals or groups of several individuals. Associated species include cattail, bulrush, and willow species. The decline of rose-mallow populations has resulted primarily from habitat loss, installation of riprap and maintenance of levees, and altered hydrodynamics.

Delta tule pea, a perennial vine, typically grows above the tidal zone in riparian scrub or at the edges of riparian forest, although it also occurs in marsh vegetation (CNDDB 2005). As a result, associated species include not only tules, cattails, and rushes, but also willows (*Salix* species), buttonwillow, coyote brush (*Baccharis pilularis*), California rose, mugwort (*Artemisia douglasiana*), and blackberries (*Rubus* species). The decline of Delta tule pea populations has resulted primarily from habitat loss, installation of riprap and maintenance of levees, and competition from nonnative invasive plants.



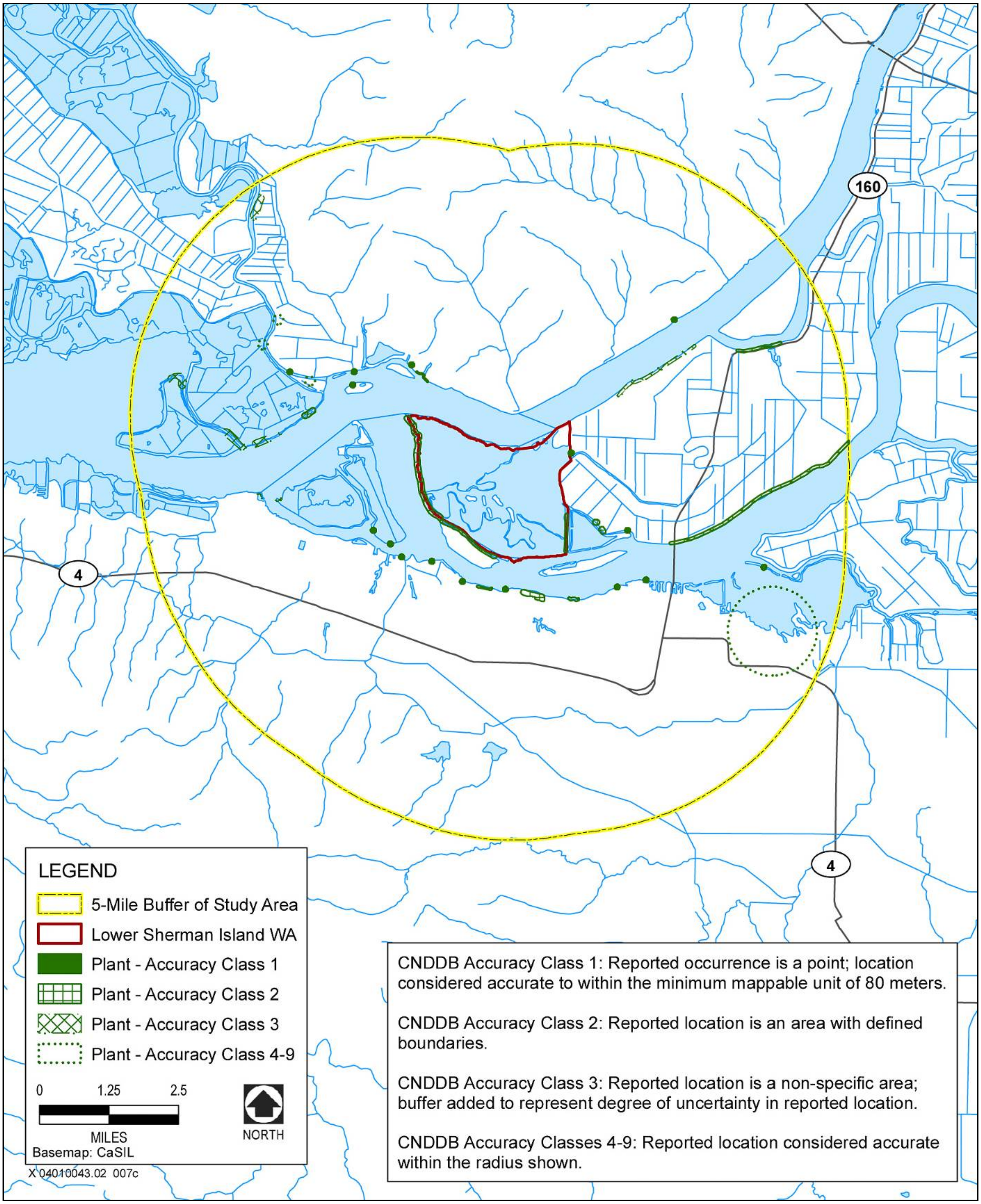
Source: CNDDB 2006

CNDDB Special-Status Plant Occurrences within 5 miles of the Lower Sherman Island Wildlife Area excluding Mason's Lilaeopsis and Suisun Marsh Aster **Exhibit 3.4-2**



Source: CNDDB 2006

CNDDB Occurrences of Mason's Lilaeopsis within 5 miles of the Lower Sherman Island Wildlife Area **Exhibit 3.4-3**



Source: CNDDB 2006

CNDDB Occurrences of Suisun Marsh Aster within 5 miles of the Lower Sherman Island Wildlife Area **Exhibit 3.4-4**

Table 3.4-2
Special-Status Plant Species With Potential to Occur at Franks Tract, Big Break, and Lower Sherman Lake

Species	Legal Status[1]	Habitat[2]	Blooming Period[3]	Potential to Occur4
Aster lentus Suisun Marsh aster	CNPS 1B	Endemic to San Joaquin Delta, generally occurs in marshes and swamps, often along sloughs, from 0 to 3 meters in elevation	May – Nov.	Known to occur at LSIWA from CNDDB records
Carex comosa Bristly sedge	CNPS 2	Coastal prairie, marshes and swamps, valley and foothill grassland, on lake margins and wet places, from 0 to 625 meters in elevation	May – Sept.	May occur, although not listed by CNDDB within 5 miles of the wildlife area
Cordylanthus mollis ssp. *mollis* Soft bird's beak	FE SR CNPS 1B	Coastal salt marsh, from 0 to 3 meters in elevation	July - Nov	May occur, and listed by CNDDB within 5 miles of the wildlife area
Erysimum capitatum ssp. *Angustatum* Contra Costa wallflower	FE CE CNPS 1B	Inland dunes, stabilized dunes of sand and clay near Antioch along the San Joaquin River, from 0 to 20 meters	Mar – July	May occur, and listed by CNDDB within 5 miles of the wildlife area
Hibiscus lasiocarpus Rose-mallow	CNPS 2	Freshwater marshes and swamps, generally found on wetted river banks and low peat islands in sloughs, known from the Sacramento, San Joaquin Delta watershed, from 0 to 120 meters in elevation.	Jun – Sept.	May occur, although not listed by CNDDB within 5 miles of the wildlife area
Laythrus jepsonii var. *jepsonii* Delta tule pea	CNPS 1B	Freshwater and brackish marshes, generally restricted to the Sacramento–San Joaquin Delta	May – (Sept.)	May occur, and listed by CNDDB within 5 miles of the wildlife area
Lilaeopsis masonii Mason's lilaeopsis	SR CNPS 1B	Freshwater and brackish marshes, riparian scrub, generally found in tidal zones, on depositional soils, from 0 to 10 meters in elevation	Apr. – Nov.	Known to occur at Lower Sherman Island from CNDDB records

Table 3.4-2 (Continued)
Special-Status Plant Species With Potential to Occur at Franks Tract, Big Break, and Lower Sherman Lake

Species	Legal Status[1]	Habitat[2]	Blooming Period[3]	Potential to Occur4
Limosella subulata Delta mudwort	CNPS 2	Riparian scrub, freshwater marsh, brackish marsh, generally on mud banks of the delta in marshy or scrubby riparian associations, from 0 to 3 meters in elevation	May – Aug.	May occur, and listed by CNDDB within 5 miles of the wildlife area
Oenothera deltoides ssp. *howellii* Antioch Dunes evening-primrose	FE CE CNPS 1B	Inland dunes, remnant river bluffs and sand dunes east of Antioch, occurs along river bluffs and in loose sand, known only from Contra Costa and Sacramento Counties, from 0 to 30 meters in elevation	Mar – Sept.	May occur, and listed by CNDDB within 5 miles of the wildlife area
Potomogeton zosteriformis Eel-grass pondweed	CNPS 2	Marshes and swamps, from 0 to 1,860 meters in elevation	Jun – July	May occur, although not listed by CNDDB within 5 miles of the wildlife area
Scutellaria galericulata Marsh skullcap	CNPS 2	Lower montane coniferous forest, meadows and seeps, marshes and swamps, wet places, from 0 to 2,100 meters in elevation	Jun – Sept.	May occur, although not listed by CNDDB within 5 miles of the wildlife area
Scutellaria lateriflora Blue skullcap	CNPS 2	Marshes and swamps, meadows and seeps, from 3 to 500 meters in elevation	July – Sept.	May occur, although not listed by CNDDB within 5 miles of the wildlife area

[1] Legal Status Definitions

U.S. Fish and Wildlife Service (USFWS) Federal Listing Categories

FE: Federally listed as endangered

California Department of Fish and Game (DFG) State Listing Categories

CE: State listed as endangered

CR: State listed as rare

California Native Plant Society (CNPS) Categories

1B: Plant species considered rare or endangered in California and elsewhere

2: Plants rare, threatened, or endangered in California but more common elsewhere

[2] Habitat descriptions are based on CNPS (2004), CNDDB (2005), and Hickman (1993)

[3] Blooming periods are based on CNPS (2004)

[4] Potential for occurrence based on CNDDB (2005) records, Vollmar Consulting (2000), and Center for Design Research (1988).

Marsh skullcap (*Scutellaria galericulata*) and blue skullcap (*Scutellaria lateriflora*) (CNDDB 2005) are rhizomatous perennial herbs in the mint family (Lamiaceae). Both species are widely distributed in wetlands across North America, but are rare in California. Marsh skullcap is known from just three sites in the Delta, and all were growing in tidal marsh vegetation. Blue skullcap is known from just one site (CNDDB 2005). The conversion of wetlands to other land uses may have contributed to the rarity of these species in the Sacramento-San Joaquin Delta.

Bristly sedge (*Carex comosa*) is a perennial herb of the sedge family (Cyperaceae). It grows on lake edges and other wet places in marshes and swamps across much of North America, but it is most abundant in the glaciated regions of Eastern North America (Flora of North America Editorial Committee 2002). Though widely distributed in North America, seven of eight documented populations in California have been extirpated (California Natural Diversity Database 2005). Therefore, there may be only one remaining population in California, which is in the Delta. This population grows on a steep bank in nontidal marsh (CNDDB 2005). The conversion of wetlands to other land uses may have contributed to the rarity of bristly sedge in the Sacramento-San Joaquin Delta.

Soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*) is a semiparasitic annual plant in the figwort family (Scrophulariaceae). It grows 10–16 inches tall and occurs in coastal salt marshes and brackish marshes (Hickman 1993). The species is restricted to a narrow tidal band, typically in a marsh's higher elevation zones (California Natural Diversity Database 2005). Associated species include salt grass, pickleweed, jaumea (*Jaumea carnosa*), and spearscale (*Atriplex triangularis*). The remaining populations range in size from a single individual to over 100,000 plants, and within populations the number of individuals fluctuates considerably from year to year, often by more than an order of magnitude. Conversion of wetlands to other land uses has contributed to the decline of soft bird's-beak. Current threats to the remaining populations include competition from non-native plants (in particular pepperweed, Lepidium latifolium), alteration of wetland hydrology (including trenching of wetlands for mosquito abatement and diking), grazing and trampling, and erosion (CNDDB 2005; CNPS 2006).

Antioch dunes evening primrose (*Oenothera deltoides* ssp. *howelli*) and Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum*) occur on loose sand, and semistabilized and stabilized dunes in the vicinity of Antioch Dunes National Wildlife Refuge (CNDDB 2005). Antioch dune evening primrose is a highly branched perennial herb of the evening primrose family, Onagraceae. It occurs in loose sand and semistabilized dunes, and requires freshly disturbed sand for the establishment and survival of succeeding generations. Contra Costa wallflower is an erect biennial herb of the mustard family, Brassicaceae. It grows in fine sand with some clay among grasses, shrubs, and other forbs on and near the tops of remnants of ecologically stabilized interior dunes.

The extent and quality of habitat for these Antioch dunes evening primrose and Contra Costa wallflower has declined substantially as a result of recent land use changes, and also because of human disturbance and the spread of nonnative invasive plants. Inland dunes are now restricted to 67 acres within the approved boundary of the Antioch Dunes National Wildlife Refuge, which includes 12 acres of land owned by the Pacific Gas and Electric Company (PG&E) and some lands on the adjoining properties owned by Kemwater North American Company and Georgia-Pacific (USFWS 2001). Though unlikely, sandy substrates in the northwestern portion of Lower Sherman Island may provide suitable habitat for these species.

For most of these special-status plant species, CALFED is implementing conservation measures that include restoration and preservation of habitat, invasive plant control, and population monitoring (CALFED 2000a,f). For soft bird's-beak, CALFED conservation measures also include establishing new populations. For Antioch dunes evening primrose and Contra Costa wallflower, CALFED conservation measures also include active management to enhance preserved habitat, surveys to identify potential sites at which to restore habitat, and coordination of conservation efforts with other programs. The enhancement and restoration opportunities for marsh and riparian ecosystems that were described earlier in the vegetation sections of this chapter would also restore and enhance habitat for special-status plant species.

3.4.2 WILDLIFE

The LSIWA is located at the western edge of the Delta. This area is transitional to the more saline water and soil conditions found in Suisun Marsh and the North Bay. Though the vegetation in general is similar to that of the northern and central Delta, halophytes, such as pickleweed, are more abundant, particularly in the upper elevations of marshes. Consequently, at the LSIWA, habitat exists for a wide variety of wildlife species, including both species characteristic of the Delta and some species more characteristic of Suisun Marsh.

This section provides a general description of the wildlife species that are likely present at the LSIWA, and a more detailed discussion of special-status species that occur, or could potentially occur, at the wildlife area and of nonnative invasive species that may be reducing habitat values.

GENERAL DESCRIPTION

Very little wildlife survey information is available that is specific to the LSIWA, although a few observations of note have been made, and a list of bird species observed during a restoration project on adjacent Donlon Island was published several years ago (England and Naley 1989). Draft species lists exist for the LSIWA (DFG 2006). However, rather than a list of known occurrences based on field observations, this list has been generated from the California Wildlife Habitat Relationships system (CWHR), a predictive model based on habitat type.

Based on the quality and diversity habitats present, the wildlife area undoubtedly provides important habitat for several guilds of bird species, and a number of common species of wildlife, which are described below.

Avian Guilds

The LSIWA lies within a central portion of the Pacific Flyway, the major pathway for migratory bird species on the West Coast. Many of the species that occur in the wildlife area are there only, or primarily, during the fall and winter months, when the Central Valley (including the Delta) becomes home to an abundance of migratory and wintering birds. The most conspicuous groups of wintering birds include waterfowl, shorebirds and wading birds, and raptors. Other groups that utilize the wildlife area include upland game species, cavity-nesting birds, and neotropical migratory birds.

Waterfowl

Because LSIWA is largely inundated, it is of significance for wintering waterfowl that migrate down the Pacific Flyway. These waterfowl populations are considered an important biological resource. They are of particular interest to hunters and bird watchers that use the wildlife area. Species that occur include northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), cinnamon and green-winged teal (*Anas cyanoptera* and *A. crecca*), lesser scaup (*Aythya affinis*), ring-necked duck (*Aythya collaris*), and white-fronted goose (*Anser albifrons*). Some species, such as mallard, gadwall, and Canada goose (*Branta canadensis*) may be year-round residents and breed locally in wetlands and nearby uplands. The number of waterfowl in the wildlife area is greatest during December–April.

Historical waterfowl wintering habitat areas have declined by approximately 95% in the larger region and, as a result of substantial losses of wetland and grassland habitats, waterfowl breeding populations have declined from historical levels. Therefore, wildlife areas are important for preservation of wintering and breeding waterfowl populations. At LSIWA, open water, marsh, and some uplands provide habitat for waterfowl.

Shorebirds and Wading Birds

Hundreds of thousands of shorebirds and wading birds annually migrate through, winter, or breed in the Delta. Several species are common in the intertidal areas of Lower Sherman Island. Some of these shorebird and wading bird species are winter migrants, limited to shallow water areas and shorelines; others are year-round residents. Although habitat for each species may include only a limited range of conditions in one or a few land cover types, the shorebird and wading bird guilds use a wide range of areas within several land cover types. These land cover types include perennial aquatic, tidal slough, seasonal and emergent wetland, midchannel island and shoal, riparian, and agricultural land cover. Representative species of the shorebird and wading bird guilds include great blue heron (*Ardea herodias*), great egret (*Ardea alba*), western sandpiper (*Calidris mauri*), and long-billed dowitcher (*Limnodromus scolopaceus*). Although Herons and egrets are common year-round residents throughout the wildlife area, no wading bird rookeries are known from the wildlife area.

These species are a significant component of the ecosystem and are of high interest to recreational bird watchers. There have been substantial losses of historic habitat used by these species, and available information suggests that population levels of many of these species are declining. Riparian, marsh, and open water at the LSIWA provide habitat for species of shorebirds and wading birds.

Neotropical Migratory Birds

Many species of neotropical migratory birds migrate through or breed in the Delta, including the LSIWA. Neotropical migratory birds are species that breed in North America and winter in Central and South America. Representative species that breed and/or migrate through the area include western kingbird (*Tyrannus verticalis*), western wood-pewee (*Contopus sordidulus*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), Bullock’s oriole (*Icterus bullockii*), Wilson’s warbler (*Wilsonia pusilla*), and yellow warbler (*Dendroica petechia*).

Population levels for many neotropical migratory birds are declining. Primary causes of these declines have been habitat loss and fragmentation, together with increased nest parasitism by cowbirds. Conservation of existing habitat and restoration of additional suitable wetland, riparian, and grassland habitats at the wildlife area would contribute to maintaining healthy neotropical migrant bird populations.

Raptors

A variety of wintering and/or breeding raptors utilize the Delta, including red-tailed hawk (*Buteo jamaicensis*), white-tailed kite (*Elanus leucurus*), rough-legged hawk (*Buteo lagopus*), ferruginous hawk (*Buteo regalis*), peregrine falcon (*Falco peregrinus anatum*), kestrel (*Falco sparverius*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), short-eared owl (*Asio flammeus*), and northern harrier (*Circus cyaneus*). Most of these raptors use grasslands and other open areas for foraging, and riparian areas for cover or nesting, and may occur at the wildlife area. Declines in their populations have been associated with habitat loss, and increased human disturbance, particularly of nests.

Cavity-nesting Birds

Cavity-nesting birds, such as kestrels, tree swallows, and wood ducks (*Aix sponsa*) may use the wildlife area.

Swallows are summer migrants, occurring in the wildlife area from late winter to early fall (February–October), with peak abundance generally in June and July. Post-breeding flocks of swallows may occur in the late summer, particularly when flying insect populations associated with marshes are abundant.

Lack of suitable nesting habitat often limits the local abundance of these species. Providing nesting boxes for these cavity-nesters benefits these species in the wildlife area.

Upland Game Birds

Grassland and other uplands in the wildlife area may provide habitat for several upland game birds of interest to hunters. The primary upland game bird species that utilizes the wildlife area is mourning dove (*Zenaida macroura*).

Other Wildlife Species

The upland grassland and disturbed areas at the LSIWA have the potential to support several common mammal species, such as black-tailed jack rabbit (*Lepus californicus*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), California ground squirrel (*Spermophilus beecheyi*), California vole (*Microtus californicus*), western harvest mouse (*Reithrodontomys megalotis*), house mouse (*Mus musculus*), Botta's pocket gopher (*Thomomys bottae*), Virginia opossum (*Dedelphis virginiana*), feral cats (*Felis domesticus*), Norway rat (*Rattus norvegicus*), and possibly coyote (*Canis latrans*) and red or gray foxes (*Vulpes vulpes, Urocyon cinereoargenteus*).

Marsh vegetation at the wildlife area likely supports muskrat (*Ondatra zibethicus*), and may support American beaver (*Castor canadensis*), northern river otter (*Lutra canadensis*), or American mink (*Mustela vision*). Common reptile and amphibian species most likely found in and around the LSIWA include western fence lizard (*Sceloporus occidentalis*), common garter snake (*Thamnophis sirtalis*), western rattlesnake (*Crotalis viridis*), gopher snake (*Pituophis melanoleucus*), Pacific tree frog (*Hyla regilla*), western toad (*Bufo boreas*), bullfrog (*Rana catesbeiana*), and possibly red-eared slider turtles (*Chrysemys scripta*).

Aquatic areas of LSIWA provide foraging habitat for several common and special-status species of bats, however, suitable roosting habitat may be lacking.

SPECIAL-STATUS WILDLIFE SPECIES

Special-status wildlife species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status wildlife species addressed in this section include:

- species listed as threatened or endangered under the state or federal Endangered Species Acts,
- species identified by USFWS or DFG as species of special concern,
- species fully protected in California under the California Fish and Game Code, and
- species identified as priorities for recovery under CALFED's Multi-Species Conservation Strategy (MSCS).

Table 3.4-3 includes 40 special-status wildlife species that are known or have potential to occur within 5 miles of the LSIWA. (Exhibit 3.4-5 displays the occurrences of these species within 5 miles of the wildlife area that have been recorded by the California Natural Diversity Database [CNDDB 2005].) The table also provides information on each species' regulatory status, habitat requirements, and potential for occurrence at the LSIWA.

For some of the species in Table 3.4-3, LSIWA does not contain suitable habitat, nor is suitable habitat likely to result from restoration efforts. The wildlife area could, however, provide habitat for 30 of the species listed in Table 3.4-3.

Although just a few of these special-status species have been recorded using the LSIWA in recent years, their presence cannot be discounted because biological surveys for these species have not been conducted in the wildlife area. Consequently, for each of these species the following text provides additional information regarding their life history, habitat requirements, and the likelihood of their presence. The reasons for population declines and general management and restoration actions are also described.

Table 3.4-3
Sensitive Wildlife Species with Potential to Occur in the Lower Sherman Island Wildlife Area

Species	Status[1] USFWS	Status[1] DFG	Status[1] MSCS	Habitat	Potential for Occurrence
Invertebrates					
Vernal pool tadpole shrimp *Lepidurus packardi*	E	--	m	Inhabit vernal pools which range from 2 m^2 to over 350,000 m^2.	Not expected to occur; although listed by CNDDB within 5 miles of LSIWA. Suitable habitat is not present.
Vernal pool fairy shrimp *Branchinecta lynchi*	T	--	m	Typically inhabit vernal pools less than 200 m^2 and less than 5 cm deep; they may also occur in larger, deeper pools.	Not expected to occur; although listed by CNDDB within 5 miles of LSIWA. Suitable habitat is not present.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T	--	R	Elderberry shrubs, primarily in riparian woodlands.	Could occur, although not listed within 5 miles by CNDDB. Elderberry bushes may be present but have not been observed at LSIWA.
Amphibians					
California tiger salamander *Ambystoma californiense*	T	SSC	m	In winter, breeds in vernal pools with a minimum 10-week inundation period. In summer, aestivates in grassland habitat, primarily in rodent burrows.	Not expected to occur, although listed by CNDDB within 5 miles of the project area. Suitable habitat is not present.
California red-legged frog *Rana aurora draytonii*	T	SSC	m	Cold ponds (including stockponds) with emergent and submergent vegetation, intermittent waters that lack fish and bullfrogs	Not expected to occur, although listed by CNDDB within 5 miles of the project area. Suitable habitat is not present.
Reptiles					
Silvery legless lizard *Anniella pulchra pulchra*	SSC	SSC	--	Associated with a variety of vegetation types on sandy soils with accessible moisture	Could occur; listed by CNDDB within 5 miles of LSIWA. Uplands of Lower Sherman Island may provide suitable habitat, but small area and isolation may preclude persistence of a population.
Giant garter snake *Thamnophis gigas*	T	T	r	Inhabits slow-moving streams, sloughs, ponds, marshes, flooded rice fields, irrigation and drainage ditches, and adjacent upland areas.	Could occur; listed by CNDDB within 5 miles of LSIWA. Marshes at LSIWA may provide suitable habitat, though Lower Sherman Island may be isolated from documented occurrences by the Sacramento and San Joaquin Rivers.
Western pond turtle *Actinemys marmorata marmorata*	SSC	SSC	m	Inhabits slow-moving streams, sloughs, ponds, irrigation and drainage ditches, and adjacent upland areas.	Could occur; listed by CNDDB within 5 miles of LSIWA. Suitable habitat is present.

Table 3.4-3
Sensitive Wildlife Species with Potential to Occur in the Lower Sherman Island Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Birds					
American white pelican *Pelecanus erythrorhynchos*	--	SSC	--	Forages in open water. Although individuals may be present year-round, this species does not breed in the Central Valley.	Could occur. Suitable foraging habitat is present.
Double-crested cormorant *Phalacrocorax auritas*	--	SSC	m	Aquatic habitats; nest sites include cliffs and trees; roosting and perching sites include cliffs, rocks, trees, and man-made structures	Could occur year-round, and listed by CNDDB as occurring at LSIWA. (A breeding colony has been present at Donlon Island adjacent to the wildlife area.)
Great blue heron *Ardea herodias* (Rookeries)	--	--	m	Nests colonially in tall trees. Forages in fresh and saline marshes, shallow open water, and occasionally in cropland or other low, open, upland habitats.	Likely forages in shallow water, marshes, and grassland at LSIWA. No breeding colonies (rookeries) are listed by CNDDB within 5 miles of LSIWA, nor are breeding colonies otherwise known to be at LSIWA, although the wildlife area may provide suitable nesting habitat.
Great egret *Ardea alba* (Rookeries)	--	--	m	Nests colonially in tall trees. Forages in fresh and saline marshes, shallow open water, and occasionally in cropland or other low, open, upland habitats.	Likely forages in shallow water, marshes, and grassland at LSIWA. No breeding colonies (rookeries) are listed by CNDDB within 5 miles of LSIWA, nor are breeding colonies otherwise known to be at LSIWA, although the wildlife area may provide suitable nesting habitat.
Snowy egret *Egretta thula* (Rookeries)	--	--	m	Nests colonially in dense marshes and low trees. Forages in fresh and saline marshes, shallow open water, and occasionally in cropland or other wet habitats.	Likely forages in shallow water, marshes, and grassland at LSIWA. No breeding colonies (rookeries) are listed by CNDDB within 5 miles of LSIWA, nor are breeding colonies otherwise known to be at LSIWA, although the wildlife area may provide suitable nesting habitat.
Black-crowned night-heron *Nycticorax nycticorax* (Rookeries)	--	--	M	Nests colonially in dense marshes and low trees. Forages in fresh and saline marshes, and in shallow open water at the edge of marsh vegetation.	Likely forages in shallow water, marshes, and grassland at LSIWA. No breeding colonies (rookeries) are listed by CNDDB within 5 miles of LSIWA, nor are breeding colonies otherwise known to be at LSIWA, although the wildlife area may provide suitable nesting habitat.

Table 3.4-3
Sensitive Wildlife Species with Potential to Occur in the Lower Sherman Island Wildlife Area

Species	Status [1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
White-tailed kite *Elanus leucurus*	SSC	FP	m	Nests in woodlands and isolated trees; forages in grasslands, shrublands and agricultural fields.	Could occur year-round, listed by CNDDB within 5 miles of LSIWA. Suitable nesting and foraging habitat is present at and near LSIWA.
Swainson's hawk *Buteo swainsoni*	SSC	T	r	Nests in riparian woodlands and isolated trees; forages in grasslands, shrublands and agricultural fields.	Could occur in late spring and summer; although not listed by CNDDB within 5 miles of LSIWA. Suitable nesting and foraging habitat is present at and near LSIWA.
Northern harrier *Circus cyanus*	--	SSC	m	Nests and forages in open habitats including marshes, grasslands, shrublands and agricultural fields.	Could occur year-round; although not listed within 5 miles by CNDDB, a northern harrier was observed on Lower Sherman Island on 11/4/05. Suitable nesting and foraging habitat is present.
Cooper's hawk *Accipter cooperii*	--	SSC	m	Nests and forages primarily in riparian woodlands and other wooded habitats.	May occur incidentally year-round. Riparian habitat in the project area is too open, and foraging too limited in extent, for this species to use the LSIWA extensively.
Sharp-shinned hawk *Accipiter striatus*	--	SSC	--	Winter visitor to the Delta; forages primarily in riparian woodlands and other wooded habitats.	May occur incidentally in winter. Riparian habitat in the project area is too open, and foraging habitat is too limited in extent, for this species to use the LSIWA extensively.
Merlin *Falco columbarius*	--	SSC	m	Winter visitor to the Delta; forages in a wide variety of vegetation, but primarily in open areas.	May occur incidentally in winter. Foraging habitat is too limited in extent, for this species to use the LSIWA extensively.
American peregrine falcon *Falco peregrinus anatum*	--	E/FP	m	Nests in forest and woodland vegetation. Forages in a wide variety of vegetation, but most frequently near water, where shorebirds and waterfowl are abundant.	Could occur year-round at LSIWA. Suitable foraging habitat is present. Suitable nesting habitat is not present.
California black rail *Laterallus jamaicensis coturniculus*	--	T/FP	r	Nests and forages in shallow marshes and wet meadows with fine-stemmed vegetation such as sedges, rushes and grasses, and with vegetated refugia during the highest tides.	Could occur year-round, and listed by CNDDB within 5 miles of LSIWA. At LSIWA, marshes and adjacent uplands may provide suitable habitat.

Table 3.4-3
Sensitive Wildlife Species with Potential to Occur in the Lower Sherman Island Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
California clapper rail *Rallus longirostris*	E	E/FP	m	Nests and forages in dense cordgrass and cattail marshes with vegetated refugia during the highest tides.	Could occur year-round, however, LSIWA is inland from the California clapper rail's near-coastal range, where it is restricted to saline and brackish cordgrass marshes. Clapper rail is not known to occur in the Central Valley or freshwater portions of the Delta.
Greater sandhill crane *Grus canadensis*	--	T/FP	r	Grassland, croplands with corn or rice stubble, and open wetlands	Could occur September–April; although not listed by CNDDB within 5 miles of LSIWA, the wildlife area may provide some suitable habitat.
Long-billed curlew *Numenius americanus*	--	SSC	m	Forages in wetland, mudflat, and croplands. Although individuals may be present throughout the year, this species does not breed within the Delta.	Could occur during fall and winter; LSIWA provides suitable foraging habitat.
Mountain plover *Charadrius montanus*	SSC	SSC	--	Winter visitor to the Delta. Forages in short grasslands, plowed agricultural fields and occasionally low, open sagebrush-steppe, usually where vegetation is sparse and trees are absent.	May occur incidentally in winter, although upland vegetation at LSIWA may provide only marginally suitable foraging habitat.
California least tern *Sterna antillarum browni*	E	E/FP	m	Feeds in shallow open water, in bays, and ocean; Nests in barren to sparsely vegetated, sandy to gravelly shores	Could occur May–October, and listed by CNDDB within 5 miles of LSIWA; the open water of Sherman Lake probably provides suitable foraging habitat, but the wildlife area does not contain suitable nesting habitat.
Black tern *Chlidonias niger*	--	SSC	m	Nests in emergent marsh vegetation. Forages for fish and insects over open water.	Could occur in summer, although not listed by CNDDB within 5 miles of LSIWA. Suitable habitat is present.
Western Burrowing owl *Athene cunicularia*	SSC	SSC	m	Nests and forages in grasslands, shrublands, deserts and agricultural fields, especially where ground squirrel burrows are present.	Could occur year-round; listed by CNDDB within 5 miles of LSIWA. Suitable foraging habitat is present, although no burrows large enough to support nesting owls were observed in the project area.
Short-eared owl *Asio flammeus*	--	SSC	m	Nests and forages in open habitats including marshes, grasslands, shrublands and agricultural fields.	Could occur year-round; listed by CNDDB within 5 miles of the LSIWA. Suitable nesting and foraging habitat is present.

Table 3.4-3
Sensitive Wildlife Species with Potential to Occur in the Lower Sherman Island Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Loggerhead shrike *Lanius ludovicianus*	SSC	SSC	--	Nests and forages in grasslands, agricultural fields, open woodlands and shrublands.	Could occur year-round, although not listed by CNDDB within 5 miles of LSIWA. Suitable nesting and foraging habitat is present.
California horned lark *Eremophila alpestris actia*	--	SSC	--	Nests and forages in open, sparse vegetation, including grasslands and fallow agricultural fields.	Could occur year-round, although not listed by CNDDB as occurring within 5 miles of LSIWA; the wildlife area may provide some suitable nesting and foraging habitat.
Yellow warbler *Dendroica petechia brewsteri*	--	SSC	r	Riparian forest and scrub	Could occur during April–September, although not listed by CNDDB within 5 miles of LSIWA, because riparian vegetation at the wildlife area could provide suitable habitat
Saltmarsh common yellowthroat *Geothlypis trichas sinusa*	SSC	SSC	r	Riparian forest and scrub, marsh, and grassland	Could occur year-round, listed by CNDDB as occurring at Lower Sherman Island. Marsh, riparian, and upland vegetation at the wildlife area provides suitable habitat.
Suisun song sparrow *Melospiza melodia maxillaris*		SSC	R	Brackish water marshes dominated by cattails, tules, and pickleweed	Could occur year-round, listed by CNDDB as occurring at Lower Sherman Island. At LSIWA, marshes provide suitable habitat.
Tricolored blackbird *Agelaius tricolor*	SSC	SSC	m	Nests colonially in tules, cattails, willows, thistles blackberries, and other dense vegetation. Forages in grasslands and agricultural fields.	Could occur year-round, although not listed by CNDDB within 5 miles of LSIWA. Suitable nesting and some foraging habitat is present.
Mammals					
Salt marsh harvest mouse *Reithrodontomys raviventris*	E	E/FP	r	Saline emergent marshes with low, dense cover of vegetation and higher elevation refugia	Could occur year-round, although not listed by CNDDB within 5 miles of LSIWA, and LSIWA is east of species current range; pickleweed dominated upper marsh on Lower Sherman Island may provide suitable habitat.
Ringtail *Bassariscus astutus*	--	FP	m	Riparian forest and scrub; nests in hollow trees, logs, abandoned burrows	Could occur year-round, although not listed by CNDDB within 5 miles of LSIWA; riparian vegetation on Lower Sherman Island may provide suitable habitat.
San Joaquin kit fox *Vulpes macrotis mutica*	E	T	m	Primarily grassland, and valley foothill hardwood habitats; home range sizes of 600–1,300 acres	Not expected to occur; although listed by CNDDB within 5 miles of LSIWA, suitable habitat is not present.

Species	Status [1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		

Table 3.4-3
Sensitive Wildlife Species with Potential to Occur in the Lower Sherman Island Wildlife Area

[1] Legal Status Definitions

U.S. Fish and Wildlife Service (USFWS):
- E Endangered (legally protected)
- T Threatened (legally protected)
- DT Recently delisted from threatened status
- SSC Species of Special Concern (no formal protection)

California Department of Fish and Game (DFG):
- E Endangered (legally protected)
- T Threatened (legally protected)
- FP Fully Protected (legally protected, no take allowed)
- SSC Species of Special Concern (no formal protection)

CALFED Multi-Species Conservation Strategy (MSCS)
- m Maintain: CALFED will take actions to maintain the species by improving habitat conditions where practicable and by avoiding, minimizing, and compensating for any adverse effects. This designation is less rigorous than “contribute to recovery,” and CALFED actions are expected to have minimal effects on the species.
- r Contribute to recovery: CALFED will make specific contributions to the species’ recovery; however, CALFED actions will have a limited effect on the species in a limited portion of its range.
- R Recovery: CALFED is expected to undertake all actions within the ERP ecological management zones and program scope necessary to recover the species so that its long-term survival in nature is assured.

Source: EDAW 2006

Valley Elderberry Longhorn Beetle

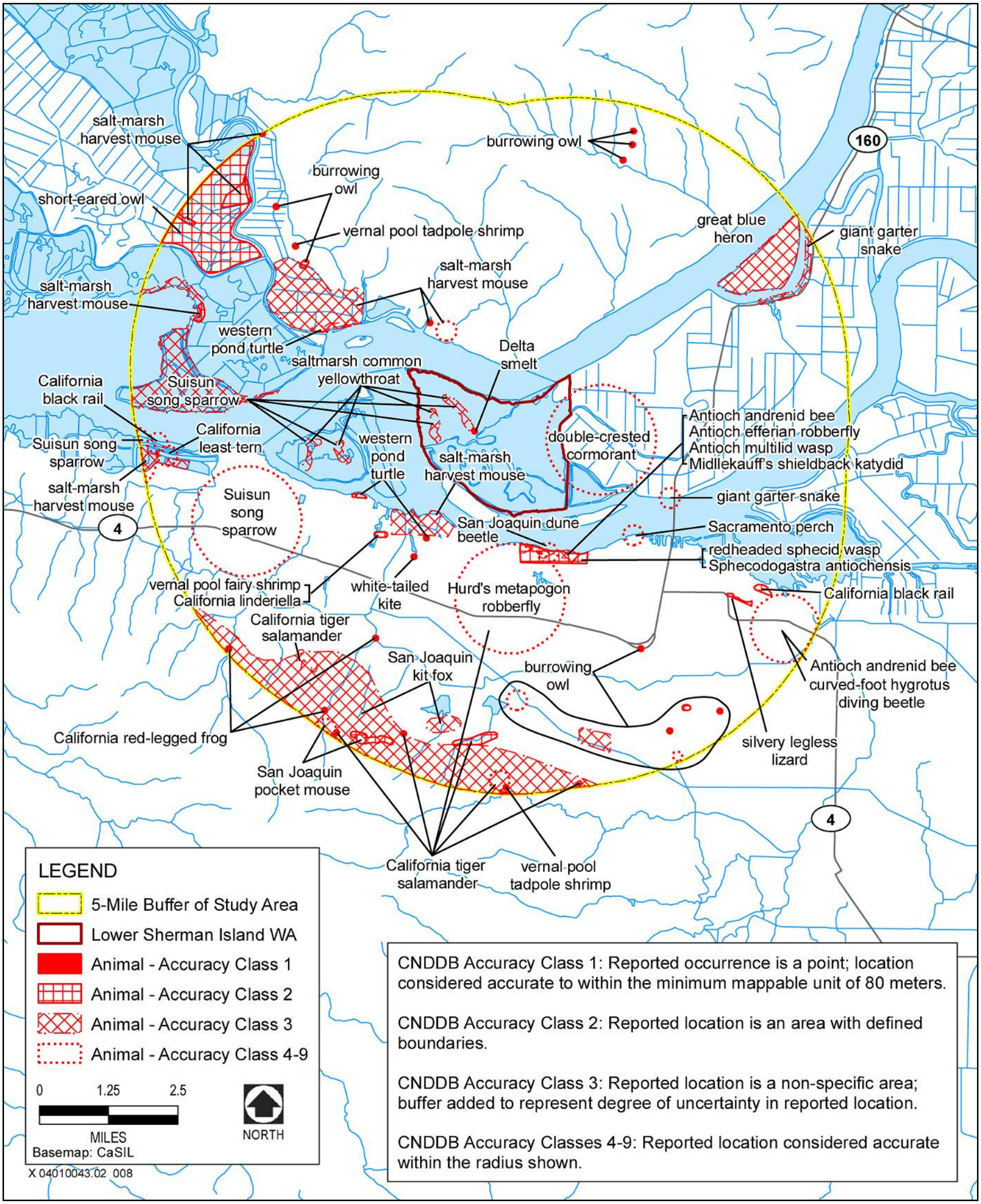
The valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*) is a federally listed threatened species closely associated with its host plant, elderberry (*Sambucus* species), a widely-distributed, riparian plant in the Central Valley and Delta. The distribution of VELB is much patchier and more limited (Entomologists estimate that the range of this beetle extends from Redding at the northern end of the Central Valley to the Bakersfield area in the south; and its range may extend into the western Delta.)

The distribution and populations of this species have declined substantially, primarily as a result of the loss, fragmentation, and degradation of habitat in its range (CALFED 2000e). Important factors contributing to habitat degradation include vegetation removal for maintenance of flood control, bank protection and other structures in riparian areas, and the drift of pesticides from nearby agricultural lands. Predation by the nonnative and highly invasive argentine ant (*Linepithema humile*) also adversely affects VELB populations (Huxel 2000).

Recovery of VELB in the Delta Sacramento-San Joaquin Delta will require the enhancement or restoration of riparian vegetation to provide suitable habitat, and the establishment of new populations. Thus, restoration of riparian areas and the ecosystem processes that sustain them is integral to the recovery of this species. The benefit of these restorations for recovery of the VELB would be increased by implementing restoration of riparian habitats in a manner that links isolated areas supporting existing VELB populations (CALFED 2000e).

VELB also would benefit from development and implementation of alternative designs for and maintenance of flood control, bank protection, and other structures that reduce their potential adverse effects on elderberries and riparian areas. Maintenance practices that would avoid and minimize effects on VELB include:

- Training workers and contractors to avoid damaging elderberry bushes,
- Mowing to reduce fire hazards but not within 5 feet of elderberry bushes,
- Not applying pesticides and herbicides within 100 feet of elderberry bushes, and
- Using fences and signs to reduce damage to elderberry bushes by humans (USFWS 1999a).



Source: CNDDB 2006

CNDDB Wildlife Occurrences with in 5 miles of the Lower Sherman Island Wildlife Area Exhibit 3.4-5

Suitable habitat for VELB may exist at the LSIWA. Though, elderberry is not included on the draft checklist of plant species (Appendix F), this checklist is preliminary and much of the wildlife area's riparian vegetation has not been surveyed for the presence of elderberry bushes. Even if elderberry is absent, restoration projects may be able to establish the species in riparian areas within the LSIWA.

Giant Garter Snake

The giant garter snake (*Thamnophis gigas*) lives in the Central Valley of California. It inhabits sloughs, low-gradient streams, marshes, ponds, small lakes, agricultural wetlands, and other waterways, where it feeds on small fish and frogs during the active season. They also use adjacent uplands, and may hibernate up to 800 feet from water (Hansen 1988). Along waterways, giant garter snakes may move considerable distances, (e.g., up to two miles in a single day [Hansen and Brode 1993]); consequently, the size of their home ranges varies widely.

Giant garter snakes require:

- Adequate water during the snake's active period (early spring through mid-fall) to provide a prey base and cover;
- Emergent, herbaceous wetland vegetation, such as cattail and bulrushes, for escape cover and foraging habitat;
- Upland habitat for basking, cover, and retreat sites; and
- Higher elevation uplands for cover and refuge from flood waters (USFWS 1999b).

Because most of the historic vegetation providing these habitat components has been lost, irrigation canals and ditches (especially canals with nearby vegetation), and rice fields now provide important replacement habitat for these species. Adjacent breeding and hibernating cover, however, is often lacking (CALFED 2000a,e).

Although the giant garter snake may have historically inhabited the once-extensive marshes of the Delta, suitable habitat is now extremely limited. In addition, many of the Delta waters support populations of introduced game fish that prey on juvenile giant garter snakes. Nonetheless, some off-shore islands, sloughs, and agricultural canals of the Delta still provide suitable habitat for the giant garter snake (IES 2000).

Populations of giant garter snake have declined, predominantly because of habitat loss. Other important factors contributing to the species' decline include fragmentation of remaining habitats, human disturbance, and mortality caused by machinery and motor vehicles, and predation by nonnative species (CALFED 2000e).

It is not known if the giant garter snake occurs at the LSIWA. Although basking sites may be limited, Lower Sherman Island does contain the other habitat components required by giant garter snake. Sherman Lake contains nonnative fish that prey on juvenile giant garter snakes, and bullfrogs also may be present in the marshes. Furthermore, the wildlife area is at the western edge of the species documented distribution, and giant garter snake has not been documented from the wildlife area. One giant garter snake was found in 1998 near Sherman and Decker Islands, but it is not known whether this snake represented a resident population in the western Delta or was washed into the Delta from high-water flows in the winter. Another garter snake was observed at the north end of the Antioch Bridge before the mid 1980s (IES 2000).

Enhancing existing habitat could benefit giant garter snakes using the LSIWA or could increase the likelihood of the species using the wildlife area in the future. Applicable management actions to enhance habitat (based on CALFED 2000a,f and RHJV 2004) could include:

- Maintain levees to minimize impacts of maintenance activities on giant garter snake and its habitat.
- Protect occupied areas from adverse effects associated with human recreation.

Restoration of habitat for giant garter snake at Lower Sherman Island also may benefit the species. General restoration recommendations for giant garter snake (based on those being implemented by CALFED [CALFED 2000a, CALFED 2000f]) include the restoration and of habitat to:

- Restore a mosaic of habitat features including canals, side channels, and backflow pools containing emergent vegetation to provide forage habitat and escape cover, and create dispersal corridors by linking habitat areas.

- Restore suitable adjacent upland to provide suitable habitat and reestablish connectivity between wetland and upland habitat areas, provide nest and hibernation sites, and provide refuge habitat during high tides and floods.

- Create buffer zones where none currently exist to improve habitat value.

Western Pond Turtle

The western pond turtle (*Actinemys marmorata*) is the only turtle native to much of the western United States, including the Central Valley. Although considered to be just one widely distributed species, it is likely that the pond turtle is a complex of closely related subspecies, each within a different region. It inhabits ponds, rivers, streams, lakes, marshes, and irrigation ditches with rocky or muddy bottoms. Dense cover and exposed basking sites are important components of its habitat. Also, adjacent uplands are used for reproduction and hibernation. Individual turtles may move up to 3 miles along and over 1000 feet away from waterways during their seasonal movements (Morey 2002).

The decline of the western pond turtle mostly can be attributed to habitat loss and degradation (CALFED 2000e). Historic habitat areas used by these species have been substantially reduced as a result of converting land for agriculture, urban, or industrial uses. Remaining habitat areas, particularly uplands adjacent to wetland and riparian areas, are largely fragmented. In addition to habitat loss and fragmentation, factors contributing to the decline of western pond turtle populations include some agricultural practices (e.g., discing, mowing, burning, and applying herbicides and rodenticides) that degrade habitat or cause mortality; introduced predatory fish that prey on juveniles and injure adults; and mortality caused by flooding of hibernation sites during heavy rains, floods, or for waterfowl management (CALFED 2000e).

Despite its region-wide decline, the western pond turtle continues to persist throughout much of the Delta. Western pond turtle is likely present at the LSIWA. It has been observed in the vicinity of the wildlife area, is highly mobile, and the wildlife area contains suitable habitat. Enhancing existing habitat could benefit the western pond turtles using LSIWA. Management actions to enhance habitat (based on CALFED 2000a,f) may include:

- Avoid or minimize activities that could result in the degradation of habitat.

- Limit management activities that disturb habitat (including disking, mowing, vegetation removal, and herbicide application).

- Minimize disturbances and other adverse effects resulting from recreational uses.

- Control nonnative animal species to the extent feasible.

- Coordinate management activities with other agencies and programs that could affect habitat.

Restoration of additional habitat also could benefit western pond turtles using the wildlife area. General restoration recommendations for western pond turtle (based on those being implemented by CALFED [CALFED 2000a,f]) include:

- Create canals, side channels, and backflow pools containing emergent vegetation to provide forage and cover habitat, and create dispersal corridors by linking habitat areas.

- Restore suitable adjacent upland habitat or modify land-use practices to render existing uplands as suitable habitat and reestablish connectivity between wetland and upland habitat areas, provide nest and hibernation sites, and provide refuge habitat during floods.

- Create buffer zones where none currently exist to improve habitat value.

Silvery Legless Lizard

The silvery legless lizard (*Anniella pulchra pulchra*) ranges from Antioch in Contra Costa County south through the Coast, Transverse, and Peninsular Ranges, along the western edge of the Sierra Nevada Mountains and parts of the San Joaquin Valley and Mojave Desert to El Consuelo in Baja California. The East Bay Regional Park District Legless Lizard Preserve is located east of the intersection of Highway 4 and Big Break Road north of Oakely. This is the only California Natural Diversity Database record for this species in the vicinity of LSIWA, but other occurrences are likely to exist within the area because of the presence of suitable habitat (JSA 2002).

Silvery legless lizards primarily inhabit areas with sandy or loose loamy soils, and sparse vegetation including beaches, stream terraces, and uplands. The sandy loam soils of stabilized dunes seem to be especially favorable habitat. The species is often found under or in close vicinity to logs, rocks, old boards, and the compacted debris of woodrat nests. Rocky soils or areas disturbed by agriculture, sand mining, or other human uses are not suitable for legless lizards. Soil moisture is essential for legless lizards to conserve energy at high temperatures; soil moisture also allows shedding to occur. Adult and juvenile lizards are insectivorous and subsist largely on larval insects (especially moths and beetles), adult beetles, termites, and spiders (JSA 2002).

Legless lizards are fossorial animals that construct burrows in loose sandy soil. They appear to be active mostly during the morning and evening, when they rest just beneath the surface of sunlight-warmed substrate. They may also be active on the surface at night when substrate temperatures remain warm for extended intervals. Known predators of legless lizards include ringneck snake (*Diadophis punctatus*), common king snake (*Lampropeltis getulus*), deer mouse (*Peromyscus maniculatus*), long-tailed weasel (*Mustela frenata*), domestic cat (*Felis sylvestris*), California thrasher (*Toxostomea redivivum*), American robin (*Turdus migratorius*), and loggerhead shrike (*Lanius ludovicianus*) (JSA 2002).

The legless lizard’s specialization for a fossorial existence in substrates with a high sand fraction makes it vulnerable to many types of habitat loss and disturbance. Besides habitat loss, factors adversely affecting legless lizard may include intensive livestock grazing, off-road vehicle activities, excessive recreational use of coastal dunes, predation by nonnative wildlife (e.g., feral cats), and the spread of nonnative plants that create conditions unsuitable for legless lizard (JSA 2002).

Actions to maintain, enhance, or restore habitat for legless lizard have not been proposed as part of the CALFED program, however, control of feral cats, and of non-native plant species that increase the cover and height of vegetation on sandy substrates, would benefit this species. Reduction of human disturbance also would likely benefit silvery legless lizard.

The northwestern portion of Lower Sherman Island does contain several acres of sandy soils with sparse vegetation that might be suitable for silvery legless lizard; however, these areas are primarily the result of deposition of dredge spoils, and are of relatively recent origin. Furthermore, as an island, the wildlife area may be isolated from nearby populations of silvery legless lizard. The recent origin of the potential habitat and its isolation reduce the likelihood that silvery legless lizard occurs at LSIWA.

American White Pelican

American white pelican (*Pelecanus erythrorhynchos*) visits the Delta from August through December. They forage for fish in open water, and probably forage in the open waters of Sherman Lake. They roost near on ground near the water's edge, and may roost at LSIWA. American white pelican does not nest in the Delta.

Enhancement or restoration of habitat that provides persistent, unvegetated areas with gradual slopes could provide roosting sites that may benefit American white pelicans using the wildlife area (Takekawa et al. 2000).

Double-Crested Cormorant

Cormorants are diving birds that feed mainly on fish. They nest in colonies, and the nests may be on the ground, in trees, or on man-made structures. A colony of double-crested cormorant (*Phalacrocorax auritas*) has been documented at Donlon Island, which is adjacent to the LSIWA.

When breeding, double-crested cormorants are sensitive to disturbance by humans. At the approach of humans, they will flee their nests, leaving the contents to scavenging gulls or crows (Ainley 2000). Consequently, avoiding or minimizing disturbances to this nesting colony during the nesting period (February-August) would be beneficial.

Restoration or enhancement of nesting habitat, and avoid and minimization of degradation of nesting habitat, would increase the likelihood that a double-crested cormorant rookery would establish within the wildlife area in the future.

Great Blue Heron, Great Egret, Snowy Egret, and Black-Crowned Night-Heron Rookeries

These four species are common foragers in marshes and shallow open water throughout the wildlife area. Great blue heron and great egret also may forage (though less frequently) in the wildlife area's grasslands, while snowy egret (*Egretta thula*) and black-crowned night-heron (*Nycticorax nycticorax*) are unlikely to forage in these upland habitats.

Although they do not currently nest on site, the larger trees in riparian areas on Lower Sherman Island may provide suitable nesting habitat. The eucalyptus trees on Lower Sherman Island were planted by the Department over 30 years ago to establish habitat for a rookery. Management of riparian, marsh, and upland vegetation to provide suitable conditions for wading bird nesting, and to avoid and minimization of degradation of potential nesting habitat, would increase the likelihood that a rookery would establish within the wildlife area in the future.

Should a rookery establish at the LSIWA, implementation of the following measures (based on CALFED 2000a,f) could help to minimize potential adverse effects related to human disturbance and nonnative predators (e.g., red fox):

- Avoid or minimize disturbances within 0.25 mile of active nesting colonies during the nesting period (February-August).

- Enhance or restore habitat adjacent to nesting colonies to create a buffer of natural vegetation that would protect colonies and provide foraging and nesting habitat.

- Control non-native predator populations.

White-Tailed Kite

White-tailed kites inhabit open lowland grassland, agricultural fields, riparian woodland, marshes, and scrub areas (Polite 2002a). They forage primarily on small rodents, which have highly variable populations. Some large shrubs or trees are required for nesting. Communal night roosts are common in winter. White-tailed kites forage in an area of approximately 2 square miles, but most foraging occurs within a mile of nests. After they are fledged, white-tailed kites disperse widely.

White-tailed kite populations have declined because of habitats have been lost, fragmented and degraded. In the Central Valley and Delta, most natural vegetation that provided habitat has been replaced with agricultural vegetation. In recent decades, “clean farming” techniques have reduced the prey base in many agricultural fields, reducing the value of agricultural lands as habitat. Human disturbance of nest sites also adversely affects white-tailed kite.

The LSIWA provides some nesting and foraging habitat for white-tailed kite; and several conservation measures (based on those being implemented by CALFED [CALFED 2000a,f]) may be applicable to the management of this habitat. These measures include:

- Avoid or minimize disturbances within 0.25 mile of active nest sites during the nesting period (February–September).
- Avoid the loss of traditional nesting trees.
- Restore or enhance habitat adjacent to occupied nesting habitat to create a buffer zone of natural vegetation.
- Manage habitats to maintain desirable rodent populations and minimize rodent control.

Swainson’s Hawk

Swainson’s hawk (*Buteo swainsoni*) typically breeds only in California during March through September and winters primarily in Mexico and Central and South America. However, about 30 hawks have been wintering in the Delta for several years (Estep 2001).

Swainson’s hawks begin to arrive in the Delta in March. Territories are usually established by April, and incubation and brooding continue through June. The young begin to fledge in July and remain with the parents for approximately 1 month following fledging or until the southern migration in early fall.

Swainson’s hawks typically nest in riparian areas, and prefer to nest in large trees with a panoramic view of foraging habitat. Foraging habitats are grasslands and agricultural fields that have accessible prey.

The area required for foraging depends on the season and agricultural activities; agricultural activities strongly influence prey abundance and accessibility. Swainson’s hawks’ highly active foraging behavior may result in birds traveling as far as 18 miles from a nesting site, and foraging ranges during the breeding season have been estimated to be 1,000 acres to almost 7,000 acres (Estep 1989).

The overall Swainson’s hawk population is considered to be smaller than its historic population size (Woodbridge 1998). To a large degree, the decline of the Swainson’s hawk can be attributed to the long-term, cumulative effects of riparian and wetland habitat conversion and degradation.

Measures to conserve the species have focused on the protection of occupied nesting habitat and the enhancement of agricultural lands to increase prey abundance and availability (CALFED 2000a,f).

Swainson’s hawk has not been documented at the LSIWA. Though riparian vegetation at LSIWA contains suitable nest trees, upland foraging habitat is limited; only about 55 acres of grassland exists at Lower Sherman Island. Although suitable foraging habitat exists north of the Sacramento River in Solano County (over half a mile away), the area of foraging habitat within 1–2 miles of Lower Sherman Island is limited, reducing the value of the island as a site for nesting habitat.

Should Swainson's hawks nest at LSIWA, several conservation measures (based on those being implemented by CALFED [CALFED 2000a,f]) may be applicable. These measures include:

- Establish buffer zones that eliminate human disturbance during nesting,
- Protect known nest sites from loss or degradation during the entire year,
- Manage foraging habitat to increase the abundance and availability of prey, including the provision of winter refuge for rodents, and the avoidance or minimization of actions to control rodents.

Northern Harrier

Northern harrier nests and forages in a variety of open habitats including marshes, grasslands, low shrublands, and agricultural fields. This raptor nests on the ground and preys on a variety of small animals, particularly small mammals (e.g., rabbits, mice, voles) and small birds. Its home ranges may include several hundred to over 1000 acres, and northern harriers may travel over 5 miles from their nests.

Habitat loss and human disturbance of nests has contributed to a decline in the size of northern harrier populations. Conservation measures recommended by CALFED include enhancing and restoring land near occupied habitat to provide a buffer from human disturbances and to increase foraging opportunities near nests (CALFED 2000a, 2000b).

The LSIWA provides some nesting and foraging habitat for northern harrier, and the species forages on Lower Sherman Island (John Hunter, personal observation, 2005). Any northern harriers nesting on Lower Sherman Island would benefit from management to avoid or minimize disturbances near active nest sites during the nesting period (April-August), and to enhance or restore habitat near nests to provide adjacent foraging habitat and to buffer nests from human disturbances (CALFED 2000a,f).

American Peregrine Falcon

American peregrine falcon forages primarily in mudflats and open water, where it preys upon waterfowl and shorebirds. Thus, the wildlife area provides suitable foraging habitat, particularly in the late summer months during shorebird migration. The species typically nests on cliffs, banks or man-made structures; the wildlife area provides no nesting habitat.

California Black Rail

In Suisun Marsh, San Francisco Bay, and the Delta, California black rail (*Laterallus jamaicensis coturniculus*) is associated with tidal and nontidal emergent wetlands, but also uses tidal and nontidal perennial aquatic habitats, dead-end and open-ended sloughs, seasonal wetlands, and midchannel islands and shoals. Many types of marsh vegetation, including those dominated by pickleweed, bulrushes, tules, and saltgrass, provide habitat for this species. Upland areas adjacent to marshes may provide nesting and escape cover during high tides and floods.

Within marshes, California black rail is a year-round resident with a small range of about an acre (Harvey 2002a). The species nests from mid-March through July. During the breeding season, in tidal marshes, black rails are often associated with networks of channels that provide protected routes for movement and foraging. During autumn, juveniles may disperse widely within the region (Trulio and Evens 2000).

The abundance and distribution of California black rail have declined substantially, primarily as a result of the loss, degradation, and fragmentation of its wetland habitats. (Fragmentation of marshes eliminates corridors between lower elevation marshes, upper elevation marshes, and uplands that are important for movement in response to tides and floodwaters.) Other factors that may adversely affect black rail populations include disturbance during its breeding period, contaminants, and excessive predation by nonnative species (Eddleman et al. 1994).

Marshes at LSIWA contain extensive areas of marsh that seem to provide suitable habitat for California black rail, and the species may be present at the wildlife area. Therefore, several measures for the conservation of black rails (based on those being implemented by CALFED [CALFED 2000a,f]) may be applicable at LSIWA. These measures include:

- Reduce boat wakes near nesting areas during March–June to levels necessary to prevent destruction of nests.
- Establish and enforce no motorized boating zones within 50 yards of California black rail nesting areas from March to June.
- Manage habitat to avoid or minimize impacts that could be associated with recreational uses.
- Control non-native predator populations in occupied habitat.
- Control invasive non-native marsh plants.
- Develop and implement alternatives to management practices that degrade the quality of black rail habitats.
- Coordinate management of habitat with other agencies and regional programs that could affect habitat.
- Restore and enhance habitats to improve tidal circulation, provide low-angle slopes at the upper edge of marshes, enhance connectivity between tidal sloughs and adjacent upland refugia, and provide buffers of wetland and perennial grassland adjacent to occupied nesting habitats to protect nesting pairs from adverse effects and provide suitable foraging habitat.

California Clapper Rail

California clapper rail (*Rallus longirostris*) is a year-round resident of saline emergent wetlands and brackish areas around San Francisco Bay and adjacent parts of the Delta. They feed on various invertebrates, fish, carrion, and opportunistically will take small birds (Alberston and Evens 2000). Foraging occurs along tidal sloughs and mud flats; upper elevations of marshes are used for nesting and high-tide refugia. Although territories may be larger (and overlapping), most activity occurs within an area of one to several acres (Albertson and Evens 2000, Harvey 2002b).

The California clapper rail breeds from March through August. The preferred breeding habitat is saline tidal marshes with pickleweed and Pacific cordgrass (*Spartina foliosa*), but California clapper rails also use brackish marsh areas with alkali bulrush (*Scirpus maritimus*) or saltmarsh bulrush (*Scirpus robustus*). They build platform nests concealed by a canopy of cordgrasses and pickleweed. Though some individuals disperse, most clapper rails do not move from the marsh in which they hatched (Albertson and Evens 2000).

The abundance and distribution of California clapper rail have declined substantially, primarily as a result of reclamation of habitat loss. Populations have also been adversely affected by contaminants, degradation of tidal salt marshes for waterfowl hunting and management, disturbance of nests by boat wakes, and predation by nonnative species, such as the Norway rat, red fox, and feral cats (Albertson and Evens 2000).

Clapper rails are not known to occur at LSIWA; and, although portions of LSIWA are similar to sites occupied by clapper rails in Suisun Marsh, the wildlife area may not support this species for the following reasons: (1) the LSIWA is east of the clapper rail's documented distribution and has marshes with less brackish conditions; (2) lower elevation marshes at LSIWA are densely vegetated with tules, cattails, and floating aquatic plants, whereas important foraging areas for clapper rails tend to be sparsely vegetated with exposed mud; and (3) the area of upper marsh dominated by pickleweed and saltgrass at LSIWA is small in area relative to sites with dense clapper rail populations.

Greater Sandhill Crane

The greater sandhill crane (*Grus Canadensis*) is found throughout most of the Central Valley in winter and nests in northeastern California and Oregon. Vegetation types used by the sandhill crane include seasonal and freshwater emergent wetlands, grasslands, and agricultural lands. Generally, crane wintering habitat consists of shallowly flooded grasslands that are used as loafing and roosting sites, and nearby agricultural areas that provide food sources that include rice, sorghum, barley, and corn.

The greater sandhill crane population has declined primarily as a result of loss of suitable wetland nesting habitats. Other major factors adversely affecting the species in the Delta include disturbance associated with human activities, illegal harvest, and predation.

Greater sandhill cranes are not known to use LSIWA. Grassland and adjacent marsh on Lower Sherman Island could provide habitat for roosting and loafing, but the wildlife area does not contain cropland that would provide food. Cropland providing waste grain does exist within several miles of the wildlife area, however.

If greater sandhill cranes are using the wildlife area, the species would benefit from management to avoid or minimize recreational uses that could disrupt crane habitat use patterns from October through March.

Long-Billed Curlew

Long-billed curlews forage in wetlands, mudflats, and irrigated or flooded croplands. They use adjacent uplands to roost. This species does not breed in the Delta, but non-breeding individuals may forage in the wildlife area throughout the year. Large aggregations of post-breeding birds may occur in late summer.

Enhancement or restoration of habitat that increases the area of mud flats or provides persistent, unvegetated areas with gradual slopes could provide roosting sites that may benefit long-billed curlews using the wildlife area (Takekawa et al. 2000).

California Least Tern

California least tern (*Sterna antillarum browni*) winters in Central America and in spring migrates to California where it breeds. California least tern nests in colonies on sandy or gravelly stretches of shoreline with sparse vegetation. They feed on a wide variety of small species of fish and other prey near the shore.

Human disturbance of nesting colonies, predation by nonnative species (e.g., feral cats, red fox), and contaminants have adversely affected the species and contributed to its decline.

The shallow open waters of the wildlife area provide potential foraging habitat. However, suitable nesting habitat is not present within the wildlife area, nor is there suitable nesting habitat on adjacent properties; the nearest documented nesting colony is 3 miles from the wildlife area. Therefore, the considerable distance that least terns would have to travel from nesting sites to reach the wildlife area may substantially reduce use of the wildlife area for foraging.

Black Tern

Black tern (*Childonias niger*) uses wetlands, open water, moist grasslands, and agricultural fields. In these habitats, it forages for insects by hovering, and often nests in dense wetland vegetation (Beedy 2002).

The black tern was once a common summer breeder and migrant throughout much of California (Grinnell and Miller 1944). The species has declined and now breeds only in the northeast (Siskiyou, Modoc, and Lassen Counties) and possibly the Central Valley, although in much-reduced numbers (Zeiner et al. 1990; Beedy 2002). From April to early June, and from August to mid-October, the black tern is a rare to common transient.

Habitat loss is probably the primary cause of the decline in black tern breeding in California, although pesticide pollution and other factors may also be important (Beedy 2002).

Conservation measures for this species focus on breeding black terns (e.g., establishment of buffers and other measures to reduce human disturbance, increasing foraging habitat near nests) (CALFED 2000a,f).

Though the LSIWA likely provides suitable habitat for black tern, the species would use the wildlife area only during migration, because it is not currently breeding within the region.

Western Burrowing Owl

Western burrowing owl (*Athene cunicularia*) typically inhabits open, dry, sparsely vegetated habitats, such as annual and perennial grasslands and agricultural areas. They can also use habitats in urban areas, such as vacant lots, airports, athletic fields, golf courses, and railroad corridors. Burrow availability is an important habitat attribute. Burrowing owls are capable of digging their own burrows in areas with soft soil, but they generally prefer to adopt those excavated by other animals, typically ground squirrels. In areas where burrows are scarce, they may use pipes, culverts, debris piles, and other artificial features.

Burrowing owls are year-round residents of the Delta. The owls often form diffuse colonies, with nest burrows from 50 to nearly 3000 feet apart (Haug et al. 1993). Surprisingly few data are available on home range size for this species (Haug et al. 1993). Published estimates vary from 0.05–1.86 square miles.

The decline in burrowing owl populations is primarily due to loss, fragmentation, and degradation of habitat. Ground squirrel control, and other activities that reduce the abundance or accessibility of prey degrades burrowing owl habitat. Other factors adversely affecting burrowing owls include human disturbance and predation by nonnative species (such as domestic cats). Although burrowing owls are tolerant of human activity outside of the breeding season, they have been shown to abandon nests if disturbed during incubation. In addition to nest abandonment, significant disturbances near owl nests may interfere with parental care and feeding of young in a way that reduces nest success.

Although it contains some suitable vegetation on sandy soils, the LSIWA may not contain sufficient suitable habitat to support a colony of burrowing owls. At the wildlife area, open, dry vegetation is limited to 55 acres of grassland and a portion of the 27 acres of developed or disturbed land. Furthermore, the quality of this habitat may be marginal for the species because vegetation is often dense and moderately high (2–3 feet), water tables may be close to the surface, and existing burrows may be scarce.

Short-Eared Owl

Short-eared owl is a winter visitor to the Delta, and may be present from September through April (Polite 2002b). They forage for small animals in a variety of open habitats including wetlands, grasslands, low shrublands, and agricultural fields. They use dense vegetation in grasslands, shrublands, and marshes for cover to rest and roost. The species does not nest in the Delta. Their home ranges may exceed 200 acres and probably vary with prey availability.

Short-eared owl populations have declined because of habitat loss, fragmentation, and degradation. Increased predation resulting from the spread of nonnative predators also may be contributing to population declines.

The LSIWA provides potential habitat for short-eared owl, but the short-eared owl's use of this habitat may be limited. Foraging habitat, however, may be restricted to the grasslands on Lower Sherman Island, which are limited in extent (approximately 55 acres) and separated from additional habitat by more than a half mile of open water. The limited area of foraging habitat and the distance to additional foraging habitat may limit the use of the wildlife area by short-eared owl.

Loggerhead Shrike

Loggerhead shrike nests and forages in grassland, shrub-steppe, open woodland/savannah, riparian, and agricultural habitats with scattered shrubs and trees. Special habitat features that improve shrike abundance, survival, and reproductive success are hunting perches, low nesting trees and shrubs, thorny vegetation, and/or barbed wire on which to impale their prey. Shrikes select a variety of prey including insects, reptiles, mammals, and birds.

The mean territory size of breeding loggerhead shrikes ranges from 2 to more than 40 acres, and loggerhead shrikes have been observed foraging up to a quarter mile from active nests (Yosef and Grubb 1992, Yosef 1996). Territory size varies with habitat quality, prey abundance and availability, and density of hunting perches. Shrikes are year-round residents in California, and breeding pairs disband in autumn to defend separate, adjacent, winter territories. As food availability decreases in winter, seasonal home ranges may increase substantially. Juvenile shrikes may move several miles from their natal territories to their fall territories.

Loggerhead shrikes have been adversely affected by the loss, fragmentation, and degradation of habitat. Though they will abandon nests if disturbed by humans during egg-laying or early in incubation, shrikes are generally tolerant of human activity near nests later in the breeding season, and nest abandonment is not generally a significant factor in nest failure (Collister 1994).

The LSIWA provides some habitat for loggerhead shrike, but the shrike's use of this habitat may be limited. Foraging habitat may be restricted to the grasslands on Lower Sherman Island, which are limited in extent (approximately 55 acres) and separated from additional habitat by more than a half mile of open water. The limited area of foraging habitat and the distance to additional foraging habitat may limit the use of the wildlife area by loggerhead shrike.

California Horned Lark

California horned lark (*Eremophila alpestris actia*) inhabits flat plains with short vegetation (often less than 10 centimeters high) or bare ground, and is found in both grassland and fallow agricultural habitats (Zeiner et al. 1990). California horned lark is a year-round resident in the Central Valley and Delta. Nesting territories range from 2 to 13 acres (Green 2002).

The grasslands on Lower Sherman Island may provide suitable habitat for California horned lark, but the acreage of this habitat is relatively small, and may limit use of the wildlife area by California horned lark. Much of the 55 acres of grassland on Lower Sherman Island has a dense cover of grasses and other herbaceous plants 2–3 feet in height, and thus may not be suitable for California horned lark. The acreage of habitat suitable for the species may not be sufficient to support nesting territories.

Yellow Warbler

As a Neotropical migrant, the yellow warbler inhabits California from April to October (Zeiner et al. 1990). During these months, the yellow warbler primarily uses underbrush of riparian woodlands for foraging and nesting. It forages for insects and spiders by gleaning and hovering in the crowns of trees and shrubs. Its nest is an open cup in a tree or shrub. The home range of yellow warbler is less than an acre.

Recently, breeding populations in valley areas have been declining as a result of destruction of riparian habitats as well as nest parasitism by brown-headed cowbird (*Moluthrus ater*) (Zeiner et al. 1990; RHJV 2004).

Riparian areas at LSIWA provide potential nesting and foraging habitat for yellow warbler. Restoring additional riparian vegetation, and enhancing existing habitat would increase the likelihood of yellow warbler nesting at LSIWA. Management actions to enhance habitat (based on CALFED 2000a,f, and RHJV 2004) may include:

- Avoid or minimize activities that could result in the degradation of habitat.
- Limit management activities that disturb riparian vegetation (including disking, mowing, vegetation removal, and herbicide application) to the nonbreeding season.
- During the breeding season, minimize disturbances to riparian areas resulting from recreational uses.
- Control nonnative plant species.
- Control nonnative animal species.
- Coordinate management activities with other agencies and programs that could affect habitat.

Saltmarsh Common Yellowthroat

Saltmarsh common yellowthroat (*Geothlypis trichas sinusa*) is one of several subspecies of the common yellowthroat (Terrill 2000). The species is primarily insectivorous and gleans insects from the ground and from vegetation. Associated plant species include cattails, tules, willow, and blackberries.

The historical distribution of the saltmarsh common yellowthroat included the San Francisco Bay Area from Tomales Bay and Suisun Marsh south to San Jose (Grinnell and Miller 1944). The species currently occurs throughout the year in Suisun Marsh.

During the breeding season, from March to July, saltmarsh common yellowthroats build nests in dense vegetation in fresh- or brackish-water marshes. Their territories are probably similar in size to other subspecies of common yellowthroat, which range in size from less than one to several acres (Green 2002).

Although the range for the yellowthroat has remained relatively stable, the total population of the subspecies has decreased. Loss of suitable habitat has been the main reason for the decline of this species, and brood parasitism by brown-headed cowbird has also negatively affected saltmarsh common yellowthroat.

Saltmarsh common yellowthroat has recently been documented as occurring at Lower Sherman Island (CNDDB 2006). The island's marshes may provide an extensive area of habitat suitable for this species.

Enhancing existing habitat could benefit saltmarsh common yellowthroat. Applicable management actions to enhance habitat (based on CALFED 2000a,f, and RHJV 2004) could include:

- Avoid or minimize activities that could result in the degradation of habitat.
- Limit management activities that disturb marsh vegetation (including disking, mowing, vegetation removal, and herbicide application) to the nonbreeding season.
- During the breeding season, minimize disturbances to marshes resulting from recreational uses.
- Control nonnative plant species.

- Control nonnative animal species.

- Coordinate management activities with other agencies and programs that could affect habitat.

Suisun Song Sparrow

Suisun song sparrow (*Melospiza melodia maxillaris*) lives only in and around the Suisun Marsh and Bay. The Suisun song sparrow is associated with saline emergent wetlands (Grinnell and Miller 1944).

The birds require appropriate vegetation for nesting, cover, and foraging. The species nests in dense vegetation close to the ground, and also uses dense vegetation for cover (Cogswell 2000, Granholm 2002). Though primarily insectivorous, song sparrows also consume seeds and fruits. In addition to food resources, each sparrow's territory also must contain permanent water or moisture in the form of tidal ebb and flow; frequently, territories are along channels Cogswell 2000). These territories are generally less than an acre in size. Within them, nesting occurs from late February through August. Most individuals disperse less than 200 m from the site at which they hatched to the site at which they breed; however, a small fraction of do individuals disperse much further.

Vegetation along levees and canals, and in managed marsh areas provide lower quality habitat than in less altered tidal marshes. Levees constructed in the sparrow's habitat are high enough above the surrounding marsh to allow the growth of upland plants. Many managed marshes are flooded seasonally and then drained or allowed to dry. Both of these alterations reduce habitat suitability.

The abundance and distribution of Suisun song sparrow have declined substantially, primarily as a result of reclamation of tidal saltmarshes. Other factors adversely affecting the species include degradation of tidal marshes, predation by nonnative predators, and disturbance resulting from maintenance of levees and other structures during the breeding period.

Restoration of tidal emergent wetlands in the Delta will help to recover this species by increasing the area of available habitat. Restoring associated higher elevation uplands would provide escape cover during high tides and flooding. Potential adverse effects of disturbance on breeding success could be reduced by conducting infrastructure maintenance activities in occupied habitat so that tidal marsh vegetation is disturbed as little as possible and adults are not disturbed during the breeding season.

Suisun song sparrow has recently been documented as occurring at Lower Sherman Island (CNDDB 2006). The island's marsh vegetation may provide an extensive area of suitable habitat.

Enhancing existing habitat could benefit Suisun song sparrow. Applicable management actions to enhance habitat (based on CALFED 2000a,f, and RHJV 2004) could include:

- Avoid or minimize activities that could result in the degradation of habitat.

- Limit management activities that disturb marsh vegetation (including disking, mowing, vegetation removal, and herbicide application) to the nonbreeding season.

- During the breeding season, minimize disturbances to marshes resulting from recreational uses.

- Control nonnative plant species.

- Control nonnative animal species.

- Coordinate management activities with other agencies and programs that could affect habitat.

Tricolored Blackbird

The tricolored blackbird (*Agelaius tricolor*) is commonly found in large flocks, foraging in marshes, rice fields, and wet meadows. The species nests in large colonies in marshes, silage and grain fields, and blackberries.

Tricolored blackbirds nest in small-to-large colonies (up to 50,000 individuals). They often return to the same nesting areas in subsequent years, but will occasionally relocate their breeding colonies if suitable habitat is available elsewhere. The tricolored blackbird breeds in large colonies near fresh water, preferably in emergent wetland with tall, dense cattails or tules, but also in thickets of willow, blackberry, and wild rose. Ideal breeding habitat for tricolored blackbird includes two elements: (1) dense nesting substrate (i.e., blackberry or aquatic emergent vegetation), which provides protection from predators, and (2) a large supply of insects within proximity to nests and occurring at the time of fledging (DeHaven 2000).

Tricolored blackbirds forage in large flocks and may travel up to 4 miles from nest or roost sites to forage. Tricolored blackbirds forage on the ground in croplands, grassy fields, flooded land, and along edges of ponds (Zeiner et al. 1990). In the Delta and Central Valley, foraging habitat consists primarily of pastures and certain types of agricultural fields. Tricolored blackbirds eat mostly insects, and selection of colony sites is primarily a function of proximity to concentrated insect food supplies (e.g., grasshoppers [Orthoptera], beetles and weevils [Coleoptera]) (Beedy and Hayworth 1991). In winter, tricolored blackbirds often leave the immediate vicinity of their nesting colonies and concentrate in huge roosts in marsh habitat (Grinnell and Miller 1944).

Tricolored blackbirds continue to breed throughout their historic range, although populations have declined within this range. The primary cause of this decline is probably habitat loss and fragmentation. Human disturbance of nesting colonies also adversely affects tricolored blackbirds.

Although the LSIWA contains extensive areas of marsh that could provide nesting habitat, the area of adjacent foraging habitat is limited to 55 acres of grassland, and small portions of other land cover types. This may not be a sufficient acreage to support a colony of nesting tricolored blackbirds; thus, nesting blackbirds may need to forage outside of the wildlife area. This need for additional travel would reduce the quality of nesting habitat at Lower Sherman Island, but probably would not make Lower Sherman Island’s marshes unsuitable for nesting blackbirds.

Should a colony of nesting tricolored blackbirds establish at the wildlife area, management to avoid or minimize disturbances near the colony should be implemented during the nesting period (mid-April-July).

Salt Marsh Harvest Mouse

At San Francisco Bay and Suisun Marsh, salt marsh harvest mouse (*Reithrodontomys raviventris*) occurs in the middle and upper elevations of saline and brackish marshes, and in adjacent grasslands (Shellhammer 2000). Preferred habitats are dominated by pickleweed and other halophytes. Adjacent upland areas provide refuge during extreme high tides and high outflow periods.

The decline of populations of salt marsh harvest mouse has resulted primarily from the loss, fragmentation (including the elimination or isolation of adjacent uplands), and degradation of habitat (Shellhammer 2000). Degradation of habitat has resulted from diking and management of wetlands, addition of fresh water from stormwater and sewer systems, and human disturbance. Other factors that may be contributing to the species’ decline include human disturbance of occupied habitat, adverse effects of contaminants, and predation by nonnative animals (e.g., red foxes, feral cats) (CALFED 2000e).

Salt marsh harvest mouse may occur at the LSIWA. Salt marsh harvest mouse has been documented within a mile of LSIWA both to the north across the Sacramento River in Solano County and to the south across the San Joaquin River in Contra Costa County (Exhibit 3.4-5). Some marsh vegetation at LSIWA may provide suitable habitat for salt marsh harvest mouse, particularly in the northwestern portion of Lower Sherman Island. In that portion of the island, the marsh's upper elevation zone is dominated by pickleweed and saltgrass, and is bordered by grassland.

Enhancement of habitat for salt marsh harvest mouse at Lower Sherman Island may benefit the species. Applicable management actions to enhance habitat (based on CALFED 2000a,f, and RHJV 2004) could include:

- Avoid or minimize activities that could result in the degradation of habitat.
- Control nonnative plant species.
- Control nonnative animal species.
- Coordinate management activities with other agencies and programs that could affect habitat.

Restoration of habitat for salt marsh harvest mouse at Lower Sherman Island also may benefit the species. General restoration recommendations for salt marsh harvest mouse (based on those being implemented by CALFED [CALFED 2000a,f]) include the restoration of habitat to:

- Improve tidal circulation,
- Provide low-angle slopes at the upper edge of marshes,
- Increase connectivity between tidal sloughs and adjacent upland refugia, and

- Provide buffers of wetland and perennial grassland adjacent to occupied nesting habitats to protect nesting pairs from adverse effects and provide suitable foraging habitat.

Ringtail

The ringtail (*Bassaricus astutus*) is a widely distributed but uncommon carnivore that lives in riparian areas throughout much of California. Its home range may be from 50 to over 1000 acres in size (Ahlborn 2002); its habitat requirements include access to permanent water, and cover provided by hollow trees, burrows, or other recesses. Raccoon, foxes, and coyote may both prey on ringtail and compete with it for food.

The riparian habitat on Lower Sherman Island may be too limited and isolated to support a population of ringtails.

INVASIVE NONNATIVE WILDLIFE SPECIES

Invasive, nonnative, wildlife species can cause detrimental effects on native wildlife. These impacts are among the most difficult to assess and treat. Nonnative terrestrial species can compete with native species for food and shelter, and can prey directly on native species. Such predators can have a major impact on the ability of natural areas to support wildlife, including threatened native species (CALFED 2000d). Bullfrogs, rats, house cats, and red fox are particularly problematic species that may be present at the LSIWA, and whose control would benefit native species.

The bullfrog is not native west of the Rockies, but has been successfully introduced throughout most of California, from Oregon to Mexico. Bullfrogs can establish and thrive in most permanent aquatic habitats that support emergent vegetation. Bullfrogs are particularly notorious for their voracious appetites. Bullfrogs feed on most vertebrates and invertebrates that can be seized and swallowed (CALFED 2000d). This species has contributed to the decline of numerous native Delta species, including the California red-legged frog, western pond turtle, and giant garter snake (Robins and Cain 2002).

Bullfrogs probably are present in the marshes of Lower Sherman Island. The most frequently recommended control measure is to periodically drain ponds or wetlands. This measure is not feasible at LSIWA, except perhaps at the ponds that are created and maintained by hunters. (These ponds may provide high quality habitat for bullfrogs.)

Two species of nonnative rats probably occur at LSIWA: black rat (*Rattus rattus*) and Norway rat (*Rattus norvegicus*). Both are highly social, nocturnal, omnivores that feed on seeds fruits, insects, eggs, birds, and garbage (Brylski 2002a, b). They differ, however, in their ecology. Black rats are agile climbers, and usually live and nest above ground in dense vegetation (Salmon et al. 2003). Thickets of Himalayan blackberry (which is dominants riparian understories at the LSIWA) can support high densities of black rats (Dutson 1973). Black rats may routinely travel over 300 feet while foraging (Salmon et al. 2003). Norway rats are less arboreal than black rats; their colonies dig extensive borrow systems, and they can be semi-aquatic (Brylski 2002b). Their home range sizes are relatively small (< 0.25 acres), and they rarely forage over areas greater than 1 acre.

These rats prey on nesting birds, compete with other wildlife (including muskrats), and also carry diseases that may be transmitted to humans. Populations of these species may be reduced by:

- Thinning of dense vegetation (e.g., reducing the acreage dominated by Himalayan blackberry); and
- Frequent collection of trash, and having tight-fitting covers on trash receptacles.

Trapping and poisoning rats is not a feasible control option for the wildlife area because of its costs and adverse effects on other species.

Housecats, both tame and feral, are major predators to bird and mammal populations in the Delta and Central Valley (CALFED 2000d). Housecats are regularly abandoned at the Lower Sherman Island Public Access Facility (Bob Chambers, personal communication, 2005). Prevention of cat abandonment, and the trapping and removal of abandoned cats would benefit wildlife in the vicinity of the Lower Sherman Island Public Access Facility. Domestic dogs (*Canis domesticus*) let loose in natural areas cause many of the same impacts as housecats. The implementation and enforcement of leash laws would reduce these effects.

Red fox was introduced in the Central Valley, and the species has spread to marshes throughout the Delta. It disturbs and preys upon many native wildlife species, such as the California black rail. If red fox is present on Lower Sherman Island, its control (or even its eradication) may be feasible because of the islands relatively small size and isolation.

3.5 CULTURAL RESOURCES

Human occupation in the Delta dates to thousands of years ago and important habitation sites are found in many regions where relatively high and dry terrain was favored by early Native American inhabitants. Although no early Native occupation of Lower Sherman Island has been recorded, the marshy setting with its diverse flora and fauna doubtless would have been a significant area for the gathering of plant and animal resources throughout the year.

To a certain extent, human intervention has shaped the present-day landscape of Lower Sherman Island more-so than natural forces. From the introduction of invasive plant species and wildlife to the building of levees and tilling of reclaimed land in the 19th and early 20th centuries, what may at first appear to be a pristine natural setting has in fact been largely created or at least influenced through artificial processes. In order to place this human impact into temporal and cultural perspective, a brief review of the sequence of Native and European occupation and their impacts on the landscape is presented below.

3.5.1 CULTURAL SETTING

NATIVE AMERICAN INHABITANTS

It is difficult to ascribe any single Native American group as having been the sole or primary occupants of the Lower Sherman Island area in prehistoric or ethnographic times. This is due to the fact that a number of tribes and cultures occupied the Delta region over centuries including the Miwok, Patwin, and Costanoan (Ohlone) peoples. However, all of these groups would have shared essentially similar material culture traits in the Sherman Island region and would have actively exploited the resources of the area. Long-term habitation in the marshes would not have occurred although temporary or seasonal hunting or gathering camps likely would have been established on some of the higher ground. Whether for fishing, hunting water fowl, or gathering local flora, such task-specific sites, if they were established on Lower Sherman Island, may still exist or may have been destroyed by extensive historic-era manipulation of the landscape.

EARLY EXPLORATION

Sherman Island and Lower Sherman Island are unusual from the historical perspective in that at least two known journals of Spanish explorers mention and describe the area as early as March of 1772 (Parachini and Parachini 1972). Father Juan Crespi, who was a member of an expedition into the interior of California to record the lay of the land and seek out new mission sites, described the confluence of the Sacramento and San Joaquin rivers and made this observation;

> "The inlet that we were following up, below the little pass…divides in two branches giving shape to a good sized island, each branch a quarter of a league wide, formed an island. We were then in 39° 13' north latitude and at the furthest point reached the water was without currents, as if held in a still pool; it appears to be very deep and was tested as fresh and very palatable."

Jose de Canizares, on similar interior expedition in the summer of 1775, also described the Sherman Island area in August of that year;

> "Rivers discharge into this bay as we found because, the salt water being left behind us, its fresh water could be drunk as if the rivers came into a lake. One of them comes from the east-northeast and the other, which is made up of quite small branches, flows from very low-lying country to the north-east through reed swamps and river islets, where the depth of water is not more than two fathoms. These Rivers have sand-bars at their mouths (as the lead told me) with half a fathom's depth. I judge them not navigable, chiefly because the second time I was exploring them I ran aground as much when in their midst as on the sand bars."

Reclamation and Settlement

Apart from the initial explorations and doubtless some un-documented forays in to the area by European trappers and traders, little non-Native occupation of the area seems to have occurred prior to the middle decades of the 19th century. In 1850, however, events were set in motion that would forever alter the physical and cultural landscape of Lower Sherman Island. In that year, the development of the Delta began when the federal Swamp and Overflow Land Act conveyed ownership of all swamp and overflow land, including Delta marshes, from the federal government to the recently-established State of California. Proceeds from the sale of property by the state were to go toward reclaiming the swamplands.

After 1850, the reclamation of otherwise un-tillable lands accelerated and in 1855, California passed the Reclamation District Act providing for sale of swamp and overflow lands at $1 per acre with payments over 5 years, and a 320-acre limit. Further legislation in the 1860s continued to encourage reclamation and by the early 1870s most of California's swampland was in private ownership (DWR 1995a).

Although Sherman Island itself saw its first long-term European settler arrive in 1855 (Robert Beasley), actual reclamation of the island for agricultural purposes did not begin until 1869 when 14,000 acres were leveed in. Extensive levee and canal systems were designed to drain what were otherwise perennially submerged areas. Initial levees were fairly small and measurements of 4 feet high and 12 feet at the base were thought to be adequate for protecting Delta lands from tides and river overflow, but that eventually proved inadequate mostly owing to the local unstable peat soils. Although several years of profitable farming was conducted in the early 1870s, on January 9th of 1872 the first major indication that the early levee system was unsuited to the region came when two hundred feet of levee on the Sacramento River side of the island failed, completely flooding the island. The continued reclamation and preservation of Sherman Island had cost $500,000 by early 1874 but repeated massive flood episodes throughout the early 1870s resulted in Lower Sherman Island being completely abandoned as an agricultural venture by 1875 and today much of the land has been largely returned to its natural state. Much of the remainder of Sherman Island was given a levee 12 feet high and 120 feet wide at the base (Thompson and Dutra 1983).

Flood Control

As land reclamation proceeded in the Delta, flood control to protect the vital farms and supporting infrastructure and new towns and cities became a critical concern. In 1880, the State Engineer designed a flood control plan for the Sacramento Valley. This plan included a system of levees and bypasses for transporting floodwaters away from protected areas. In 1917 Congress authorized the Sacramento Flood Control Project, which was completed by the U.S. Army Corps of Engineers in 1960. Storage reservoirs and similar protective measures were constructed on the Sacramento–San Joaquin rivers and major tributaries. These systems, denoted "project levees" to distinguish them from other levees, provide effective flood control for a portion of the Delta.

As a result of the serious flooding problems in 1986, the State Legislature passed the Delta Flood Protection Act of 1988 (SB 34). A portion of the Act provides flood control improvement projects for eight islands (Bethel, Bradford, Holland, Hotchkiss, Jersey, Sherman, Twitchell, and Webb) of the west Delta. These islands were identified as being critical to protecting Delta water quality because they are adjacent to major Delta channels in the area where fresh and salt waters mix. The Act also significantly increased monetary assistance to districts charged with the maintenance of local Delta levees via the Delta Levees Maintenance Subvention Program. In 1991, Senate Bill 1065 went into effect to assure that these flood protection activities result in no net loss of fish or wildlife habitat and to provide $3 million to mitigate past impacts (DWR 1995a).

3.5.2 Documented Cultural Resources in Lower Sherman Island

Despite the long recorded history of Lower Sherman Island and the extensive historic-era activities associated with land reclamation and agriculture in the area, few cultural resources other than significant landscape features have been recorded. A record search conducted by EDAW in March 2006 through the North Central Information Center (NCIC) of the California Historical Resources Information System showed that only the actual levee system encompassing Sherman Island and Lower Sherman Island has been documented as part of a 1997 cultural resources investigation related to a levee improvement project (Orlins 1997). However, a number of shipwrecks or abandoned vessels of unknown age have been noted just to the southeast of the intersection of Mayberry Slough and the Mayberry Cut, and at the southeastern end of Cabin Slough at Kimball Island. Little is presently known of these wrecks and whether they were intentionally abandoned vessels or if they were accidentally grounded or sunk.

In addition to the levee system itself and the remains of the abandoned vessels, verbal communication with Tim Arts (Department of Boating and Waterways) indicates that at least one house in the Cabin Slough area may date to the agricultural era of Lower Sherman Island. However, additional research would be necessary to confirm the general age and potential significance of the building or buildings.

3.6 PUBLIC USE

LSIWA has a long history of public use, particularly hunting and fishing, beginning decades before the area came under the management of the Department in the late 1950s. Hunting and fishing activities remain the focus of most public use today. Other recreation uses include wildlife observation and photography, and powered and non-powered boating. The cabins along the southwest edge of the wildlife area along Cabin Slough support seasonal recreational uses, including by some hunters, as well as longer-term residential use. Regarding non-recreation public uses, LSIWA has been the site of a variety of environmental studies, often in combination of other Delta sites, as part of investigations to support resource management in the Delta. No commercial activities are based in LSIWA, although guided fishing trips may spend time in the area, and a gas pipeline crosses the west side of the area on an easement.

This section will describe current these current recreational and other public uses, and the currently regulations and management policies related to the uses. Because LSIWA is part of a much larger setting of public recreation areas in the west Delta and nearby areas, the section begins with a brief description of recreation in this broader context.

3.6.1 RECREATION

RECREATION IN THE DELTA

The Delta is a major recreational resource for northern California, and recreation is an important economic activity for the communities in and around the Delta. Water-based recreation activities in the Delta include cruising, water-skiing, fishing and hunting from a boat, sailing, and boat camping. The two most popular activities are boating and fishing.

In 1997, the Department of Parks and Recreation (DPR) prepared the Sacramento-San Joaquin Delta Recreation Survey (DPR 1997) for the Delta Protection Commission (DPC) and the Department of Boating and Waterways (DBW). The purpose of the survey was to determine the number of boaters and anglers who use the Delta, the areas where they recreate, the activities in which they participate, among other items. LSIWA is located in the western Delta (Recreation Area Zone D), which the survey found was the most popular area in the Delta for recreational activities of most types (e.g., shore, boat, and tournament fishing; other boating; board sailing or wind surfing; RV camping; tent camping; swimming; biking; walking; hunting on land; wildlife viewing; photography; sightseeing). Although boating was the most popular activity, non-boating recreational activities among people who also participate in boating include, in order of popularity, sightseeing, viewing wildlife, fishing, and board sailing. Among those who participated in fishing, other popular recreational activities include sightseeing, boating, and wildlife viewing. The survey indicated that a large percentage of boaters and anglers in California come to the Delta to recreate, generating considerable expenditures to the local economy.

Boating

Because of its size and geographic position as the outflow of an extensive natural drainage area, the Delta offers a uniquely dependable freshwater recreation opportunity for boaters. Unlike the majority of the state's reservoirs, which are subject to drought and fluctuating water levels, the Delta provides consistency of water levels through dry and wet years with dependability for water-oriented recreation use year after year.

The boating resource provided by the Delta is unique in other ways as well. Recreational watercraft share use of the Sacramento Deep Water Channel and the San Joaquin River with large oceangoing ships, which use those waterways to reach inland ports in Sacramento and Stockton. At the same time, many out-of-the-way sloughs provide quiet, secluded spots for boats to anchor for the day or to stay overnight or for a longer time. Boaters are served by more than 20 large (over 200 berths) marinas in the Delta, most of which are privately owned, and several dozen smaller marinas, also mostly privately owned.

The Sherman Lake Resort adjacent to LSIWA includes a 54 berth marina and boat ramp and sells fuel. Several large marinas are along the south bank of the San Joaquin River within a few miles of LSIWA, including Antioch Marina, Big Break Marina, Lauritzen Yacht Harbor, Lloyd's Holiday Harbor, New Bridge Marina, and San Joaquin Yacht Harbor.

Angling

Angling, both by boat and from land, is another widespread and popular activity in the Delta. Game-fish species include catfish, sturgeon, steelhead, striped bass, largemouth (black) bass, American shad, chinook salmon, crappie, bluegill, and carp. Striped bass is the most popular game species among shore anglers and boat anglers (DPR 1997). The best striped bass fishing in the Delta occurs during the fall and winter when the fish migrate up into the Delta from the ocean and feed heavily in preparation for their spring spawning further upstream.

The Delta is one of the most productive trophy bass fisheries in the nation, and it hosts several world-class bass tournaments every year. The 1997 survey showed that 45% of all State fishing tournaments occurred in the western Delta. The Delta is also well known for its sturgeon and salmon fishing opportunities. Commercial guides and charter boats operate in several areas to take advantage of the diverse angling resource. Bank anglers park along many roadsides in the Delta, where they gain access to the water from the levee banks. Approximately one-third of the fishing recreationists also participate in night fishing (DPR 1997).

Although small boat angling takes place throughout the year, peak months for recreational fishing are April, May, and June, when target species are striped bass, largemouth bass, and catfish. Small charter boats take passengers to fish in Suisun Bay and the Delta, including LSIWA, targeting species such as striped bass and sturgeon. Although party boat passengers fish in the estuary throughout the year, the peak months for fishing are April, May, and June, when striped bass are most abundant.

Hunting

There is a long history of hunting in the Delta in association with privately owned agricultural lands. In addition, 19 private duck hunting clubs are located in the Delta, nearly all in Yolo County in the north Delta. Hunting is also permitted on a few publicly owned properties in the Delta and several publicly owned water-covered areas, such as LSIWA. Hunting from boats is popular at the large flooded islands, which include Big Break and Franks Tract as well as Lower Sherman Island (DPR 1997).

DPR currently operates a duck hunting program during the duck season at Franks Tract State Recreation Area (SRA), elements of which may be applicable to the duck hunting program at LSIWA. The Frank's Tract program runs from mid-October to January. Hunters pay for blind permits, of which there is a quota of 24 due to safe distance limits. The blinds are mostly in the northern central region of Frank's Tract. The blinds are removed at the end of the season. The fee collected goes to the State Parks' general fund and partly goes to abatement costs for boats. Most of the hunters return every year. According to staff at the SRA, the level of monitoring of the duck hunters is not adequate currently due to the small number of DPR staff available for the task. Because there are no launch ramps within the Franks Tract project site, the hunters generally launch from marinas on Bethel Island or elsewhere in the Delta (Galloway, pers. comm., 2004).

Other Recreational Activities

Recreational vehicle (RV) and tent camping is also available at several locations in the Delta, primarily at larger parks, resorts, and marinas. However, facilities at private resorts and marinas are generally available only to tenants and their guests, not the general public. Public camping facilities are relatively few in number. Among the largest is Brannan Island State Recreation Area, about seven miles east of LSIWA, which provides over 120 RV and tent campsites, along with 32 berthing slips for boat campers and a six-lane boat ramp. Closer to LSIWA, in 2004 a new RV camp opened on Sherman Island Road, less than two miles from the entrance to the Sherman Island Public Access Facility. RV and tent camping also occurs at the adjacent Sherman Lake Resort, which provides 20 camping spaces, and at a few minimally improved sites along Sherman Island road used by sailboarders and kite boarders.

The far western side of the Delta, along the Sacramento River, has become renowned throughout the western United States as one of the premier wind sports locations in the country. It has gained this reputation due to the strong and steady summer winds that blow from the San Francisco Bay and are constrained between hills and low mountain ranges on either side of the river. Windsurfers and kite boarders make use of several developed and informal access points in that portion of the Delta. The Rio Vista Windsurfing Association has developed primitive staging and river access points at several locations along Sherman Island Road. The Brannan Island State Recreation Area includes the Windy Cove river access area on the Sacramento River, developed with wind sport enthusiasts' input. In addition to river access, the site includes restrooms, outdoor showers, and covered or shaded picnic sites.

3.6.2 RECREATION AT LOWER SHERMAN ISLAND WILDLIFE AREA

Recreational activities at LSIWA are constrained by the relative inaccessibility, aside from access by boat. Nevertheless, LSIWA receives substantial amounts of recreational use focused primarily on hunting and fishing and, in the County Access Area, wind sports such as boardsailing and kite surfing. Other activities include motorized pleasure boating, non-motorized boating, camping, wildlife observation.

HUNTING

Waterfowl hunting is one of the major uses of LSIWA during the October through January season. The area is open to all and there is no fee to hunt. Waterfowl hunting is the primary form of hunting at LSIWA, but the Fish and Game Code specifies that coots, moorhens, pheasants, doves, and rabbits may also be hunted.

Waterfowl hunting has been an important use of the area for many decades, beginning in the early 1900s, before the lands were in the ownership of the state. As described in Chapter 1, establishment of a public hunting area was a primary purpose of the Department in acquiring the property and local duck hunters were participants in agreements reached with the Department for management of the area in 1958, prior to its establishment as a state wildlife area in 1960.

A hunting group active in LSIWA for many years is the Lower Sherman Island Duck Hunter's Association. The Association was not founded until approximately1990 but some members of the group have many years of experience hunting at LSIWA and in some cases a multi-generational family history of hunting in the area.

This long established use of the area for duck hunting included the construction of duck blinds, which continued until recent years. The Lower Sherman Island Duck Hunter's Association has agreed with the Department to not construct new blinds in LSIWA but is permitted to maintain existing blinds. These are generally wood or metal frame structures onto which cut native vegetation is laid. Hunters also use boat-mounted blinds.

FISHING

Several sources of information for Delta anglers direct them toward Lower Sherman Island as one of the most productive places for both striped bass and black bass fishing in the Delta. These species pursue and trap prey fish such as shad in Sherman Lake, resulting in prime fishing opportunities for bass anglers. Sherman Lake is also listed by some sources as one of the best Delta locations to catch catfish.

Fishing occurs year round at LSIWA. Striped bass fishing is most popular in the fall, winter and spring, coinciding with the fish migration, but resident fish are caught during the summer. The town of Rio Vista, about eight miles up the Sacramento River from LSIWA, holds a well-attended bass festival each year in October of which the highlight is a striped bass fishing derby. Black bass fishing is most popular in the spring and fall, although bass fishing occurs and bass tournaments are held year-round. Summer is the most popular time for anglers to pursue catfish.

The best seasons for sturgeon are generally winter and spring, but these fish are usually caught in the deeper waters of the large rivers and sloughs and in downstream Suisun and San Pablo Bays, rather than in the more shallow Sherman Lake.

As a result of the generally poor access from land, there is relatively little shore angling in the LSIWA, although it is possible at areas around the Sherman Island Public Access Facility. Most of Sherman Lake is not accessible except by boat, and dense aquatic vegetation (dominated by invasive nonnative species) reduces boat access.

The level of angling activity is not known. However, informal observation by Department staff suggest that the level of activity is substantial. Several factors contribute to a potential for a high level of angling activity: good fishing conditions; angler's knowledge and publicizing of the area; easy boat access from both the Sherman Island Public Access Facility and from the Sacramento and San Joaquin Rivers; the presence of boat ramps, marinas, and fishing charters in nearby communities such as Oakley, Antioch, Pittsburg and Rio Vista; and frequent fishing tournament activity in the west Delta.

BOATING

While recreational boaters use the wildlife area, information on activities unrelated to hunting and fishing (i.e., pleasure boating) at Sherman Lake is limited. Hunters and anglers report occasional use by water skiers, jet skiers, and others. The shallowness of the area and the presence of aquatic weeds and shoals reduce use of the area by pleasure boaters. The small marina at Sherman Lake Resort, which provides both berthing and a ramp, may be expected to contribute some boating use, but the generally larger boats moored at that location would more likely use Mayberry Slough and Mayberry Cut along the eastern boundary to LSIWA to reach the San Joaquin River. Some boats may take the shorter route across the upper part of Sherman Lake to reach the Sacramento River.

Berthing and ramps are available on the nearby portions of the San Joaquin River in Pittsburg, Antioch, and Oakley, at both public sites and private marinas. Marinas include Antioch Marina, Big Break Marina, Lauritzen Yacht Harbor, Lloyd's Holiday Harbor, New Bridge Marina, and San Joaquin Yacht Harbor. In addition to ramps at several of these marinas, boaters may use the Antioch Municipal Boat Ramp, directly across the river from LSIWA.

OTHER RECREATION ACTIVITIES

RV and tent camping is permitted at the Sherman Island Public Access Facility, although no formal campsites have been developed. There is space for about 20–30 RVs. No electricity or sewerage hookups are provided. The area was observed to receive substantial use for camping during the summer when sailboarding and kite-surfing conditions were good. These wind-sport enthusiasts may use Sherman Lake, but the great majority launching from the small beach launch sites at Sherman Island Public Assess Facility focus their activity on the Sacramento River and are within LSIWA only when starting and ending their activity on the water.

The only trails on Lower Sherman Island are short trails through riparian scrub at the Sherman Island Public Access Facility used primarily by board sailors to reach the water. Hunters have constructed boardwalks leading from sloughs to blinds constructed at ponds in the interior of the marsh.

Aside from the picnic sites at the Sherman Island Public Access Facility, there are no developed vantage points to view Sherman Lake from within the project site. Views of Sherman Lake are enjoyed from the adjacent Sherman Lake Resort and marina and the levee road leading to the marina.

Boaters using non-powered craft such as kayaks and canoes use Sherman Lake in low numbers. Some of these boaters launch from the Sherman Island Public Access Facility ramp and it is possible for others to cross into LSIWA from access points to the south on the San Joaquin River. However, crossing of the wide and tidally-influenced river would be expected to discourage most non-powered boaters. Sherman Lake within LSIWA is also subject to strong tidal flows, which may also discourage use by paddle-craft.

LSIWA provides opportunities for wildlife observation and photography, both from the Sherman Island Public Access Facility and from the water and old levee areas accessible only by boat. The relative lack of human disturbance at most times has placed the wildlife area on some published lists of good locations in the region to enjoy birding. The river otter may also be observed by visitors interested in wildlife observation or photography.

RESEARCH ACTIVITY

LSIWA has been the site of several CALFED-sponsored and other research projects in recent years, as the scientific community has focused a tremendous amount of interest and effort on learning about the biological conditions and processes in the Delta and has investigated ecological restoration options. Examples of recent study topics include: effects of fire on large areas of the marsh that burned in 2004, tidal marsh sedimentation, and the process of natural marsh restoration in Sherman Lake since the historical breaching of thelevees.

3.6.3 POTENTIAL FOR FUTURE RECREATION DEVELOPMENT

Because most of the LSIWA is not accessible except by boat, the recreational opportunities would only be available to boaters. Extensive recreational development within the LSIWA may also not be compatible with the Department's policies. The existing County-operated launch ramp is accessible from land and presents the best opportunity to accommodate additional recreational activities for recreationists without boats. The current boat ramp facility provides picnic tables under a large shade structure and a small beach is nearby.

The CALFED Bay Delta program has proposed 12 actions that are primarily aimed at improving ecological conditions and modifying the flow and diversion of water in the Delta. Most of these have potential negative impacts to recreation, such as displacement of existing facilities and restrictions on boat travel, as well as potential benefits. Potential benefits would primarily be due to improved water quality, a key recreation issue in the Delta, and habitat restoration that would enhance nature-related pursuits such as non-motorized boating, wildlife viewing, and fishing. Some actions may also provide opportunities for development of new facilities to serve both boaters and land-based recreationists (DPR 1997).

3.6.4 PUBLIC USE REGULATIONS

The Department manages LSIWA under Title 14 of the California Fish and Game Code, Sections 1525-1530 and the California Fish and Game Commission's Hunting and Other Public Uses on State and Federal Lands - California Regulations (the Regulations) (DFG 2005). The Department strives to carry out management responsibilities related to public use in keeping with the agency mission to manage the resources present for the "use and enjoyment by the public." As a state wildlife area, fish and wildlife protection and enhancement are the primary management purposes within LSIWA; recreation and public use within LSIWA are secondary to habitat preservation.

HUNTING REGULATIONS

Current Hunting Regulations

The Regulations provide management direction for lands associated with hunting activities on state and federally-owned lands in California and includes specific management direction for LSIWA. The Regulations include hunting license provisions and requirements; application and fee information; a listing of all hunting areas throughout the state, including wildlife areas; and detailed information regarding areas locations and boundaries, hunting practices and regulations, permit requirements, and firearms and archery equipment regulations in each hunting area.

LSIWA is designated as a “Type C” hunting area by the Regulations. As a Type C hunting area, a permit or pass is not required for most uses. Lower Sherman Island is open to hunting for ducks and geese between the fourth Saturday in October and the last Sunday in January (100 days). The season for canvasback ducks does not start until December 1. Coots and moorhens may also be hunting during a season coinciding with the duck season. Other authorized species that may be hunted during seasons specified in the Regulations include pheasants, doves, and rabbits. However, hunting for these species is minimal at LSIWA due to the small area of suitable upland habitat.

The Regulations prohibit the possession and use of rifles and pistols in LSIWA. Hunting is not permitted in the Lower Sherman Island Public Access Facility leased from the Department by Sacramento County, per the operating agreement with the Department (Appendix C).

Potentially Applicable Hunting Regulations

Regulations vary among areas available to the public for waterfowl hunting in the Delta region (e.g., Liberty Island, Cosumnes River Preserve, Frank’s Tract, Woodward and Modesto Reservoirs, Yolo Bypass Wildlife Area). Some of these regulations could be applied to the LSIWA, and might better support attainment of this LMP’s goals than do current regulations. These potentially applicable regulations are related to:

- **Wildlife Area Type.** The Department’s wildlife areas are classified as Type A, B, or C, and each type has a different set of regulations. As previously described, the LSIWA is currently a Type C wildlife area. If its classification were changed to a Type B wildlife area, numerous regulations would be changed. For example, in Type B wildlife areas, waterfowl hunting is restricted to Saturdays, Sundays, and Wednesdays; and daily entry permits would be required during the waterfowl season.

- **Closed Areas.** At Frank’s Tract and at many of the Department’s wildlife areas, there are areas closed to hunting. The closure of areas has been based on biological resource, public safety, and other considerations.

- **Authorized hunting techniques.** At most hunting areas, there are restrictions on hunting techniques. For example, at Frank’s Tract and at Woodward and Modesto Reservoirs, hunting is authorized only from anchored floating blinds at least 300 yards from other blinds. At the Cosumnes River Preserve, with the exception of special use permits, waterfowl hunting is restricted to boats or floating blinds and hunting may not be conducted from the shore.

- **Design standards for blinds.** Although current regulations at LSIWA include some blind design standards, blinds must satisfy different design standards at other hunting areas. These standards include structural safety criteria, portable toilets, night-time lighting, and posting of a blind number or permit.

- **Blind permits.** Both at Frank’s Tract and at Woodward and Modesto Reservoirs, blind permits are required. These permits are issued annually. At Woodward and Modesto Reservoirs, permits are issued for designated sites through a lottery system. At Frank’s Tract, permits are issued for up to 35 blinds; a lottery would be implemented if over 35 applications were received, but this has not yet occurred. These blind permits require a blind removal deposit to ensure that blinds are removed, and contain a “hold harmless” clause. At Woodward and Modesto Reservoirs, blinds are inspected to ensure that they meet design standards.

- **Special use permits.** At the Cosumnes River Preserve, special use permits have been issued to non-profit organizations for particular hunting events or programs, such as those supporting young or disabled hunters. In this case, the non-profit administers the hunting program and is responsible for the maintenance and removal of blinds and other facilities.

FISHING REGULATIONS

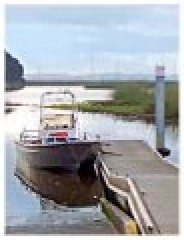
All anglers must display a California Sport Fishing License on their outer clothing while fishing. Resident and non-resident anglers may choose from one-day, two-day, ten-day and annual licenses. Delta anglers must also purchase a Bay Delta Sport Fishing Enhancement Stamp. Anglers fishing under the authority of a one or two-day license are exempt from the Bay Delta Sport Fishing Enhancement Stamp requirement.

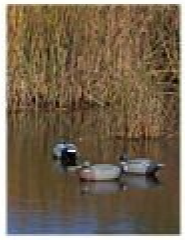
Special season, size limit, and bag limit regulations have been instituted for several species of fish that are commonly caught at LSIWA. These species regulations are summarized in the table below:

Table 3.6-1
Summary of Fishing Regulations at Lower Sherman Island Wildlife Area

Species	Open Season	Size	Bag Limit
Black Bass	All year	12 inches minimum	5 fish daily limit
Striped Bass	All year	18 inches minimum	2 fish daily limit
Sturgeon	All year	46 inched minimum and 72 inches maximum	1 fish daily limit
Trout and Salmon	Jan. 1 through July 15	---	1 hatchery trout or 1 hatchery steelhead; 0 salmon
	July 16 through Dec. 31	---	1 hatchery trout or 1 hatchery steelhead; 2 salmon

4 Management Goals





Final Land Management Plan

4 MANAGEMENT GOALS

The goals presented in this chapter provide broad guidance for long term natural resource and public use management of Lower Sherman Island Wildlife Area (LSIWA). Tasks to implement each goal are also described. It is important to note, however, that implementation of many of the tasks identified in this plan is dependent upon the availability of the necessary staff and an adequate operations and maintenance budget. Thus, additional resources may be required to accomplish the tasks identified in this chapter. Chapter 5 identifies the specific resources required to manage the LSIWA in the future.

The Land Management Plan (LMP) goals and tasks have been evaluated for their potential impacts on the environment in accordance with the provisions of the California Environmental Quality Act (CEQA). An Initial Study, which is included in Appendix B, was prepared in accordance with the State CEQA Guidelines. This Initial Study concluded that the LMP, as proposed, would not have any significant effects on the environment. Accordingly, a proposed Negative Declaration (ND) has been prepared.

The CEQA document analyzes impacts resulting from the programmatic implementation of this LMP. The details of specific projects that may be developed consistently with this LMP are not yet known. Any future projects that may involve environmental effects will need to be evaluated in light of the IS/ND to determine if additional project-specific CEQA analysis is necessary. Permits, consultations and/or approval actions may also be required to approve specific future projects. Examples of potential future permit requirements include the following:

- U.S. Army Corps of Engineers (USACE) - Section 404 of the Clean Water Act (CWA), permit for discharge of fill in waters of the U.S.; Section 10 Rivers and Harbors Act permit for work in navigable waters of the U.S.; approval of modification of USACE levees.

- California Department of Fish and Game – streambed alteration agreement (Section 1602 of Fish and Game Code);

- California Department of Water Resources (State Reclamation Board) – encroachment permit to work on or adjacent to levees and in designated floodways, approval/authorization of new or restored levees;

- California State Lands Commission – consultation/permit regarding possible use of or impacts to submerged lands, including surrounding in-channel islands and lands underlying rivers and streams; and

- Regional Water Quality Control Board - National Pollutant Discharge Elimination System construction stormwater permit (Notice of Intent to proceed under the statewide General Construction Permit), potential discharge permit for wastewater, general order for dewatering, CWA Section 401 certification if a Section 404 permit is required.

Prior to grading or construction in areas that have experienced development or disturbance and could contain hazardous materials, a hazardous materials assessment shall be conducted. Following the results of these surveys, the appropriate agencies or companies shall be consulted to ensure that people and the environment are not exposed to hazardous materials.

4.1 DEFINITION OF MANAGEMENT TERMS

The LMP is intended to be compatible with the Department's standardized format for management plans. The latest version of that format is: *A Guide and Annotated Outline for Writing Land Management Plans*, dated February 2003. Terminology for describing management is part of this standardized format and these terms are defined below and used throughout this plan to describe the current and planned management of the LSIWA.

Element: refers to any biological unit, public use activity, or facility maintenance or management coordination program, as defined below, for which goals have been prepared and presented within this plan.

Biological elements: refer to ecosystems for which specific management goals have been developed within this plan.

Public use element: refers to recreational and other public uses.

Facility maintenance element: refers to the maintenance and administrative program that supports attainment of goals for biological and public use elements.

Scientific research and monitoring element: refers to scientific research and monitoring that supports attainment of goals for biological and public use elements.

Fire management element: refers to the planning and implementation of fire management that supports attainment of the goals for biological and public use elements.

Management coordination element: refers to coordination with management programs that are supportive of and compatible with the activities of other public agencies.

Biological goal: is a statement describing management and its intended long-term results for a biological element.

Public use goal: is a statement describing management and the resulting type and level of public use (which is intended to be compatible with the goals for biological elements).

Facility maintenance goal: is a statement describing management and the resulting type and level of facility maintenance (which is intended to support attainment of the goals for biological and public use elements).

Scientific research and monitoring goal: is a statement describing management of procedures for or types of scientific research and monitoring conducted at LSIWA.

Fire management goal: is a statement describing a desired component of fire management planning or of pre-, during, or post-fire management.

Management coordination goal: is a statement describing the desired type and level of management coordination activities that are required to achieve the biological element goals previously specified within this LMP.

Tasks: are individual projects or work elements that implement the goals and are useful in planning operation and maintenance budgets.

4.2 GOALS AND TASKS FOR ELEMENTS

4.2.1 BIOLOGICAL ELEMENTS

The ecosystems of the LSIWA have been grouped into three biological elements, described in Sections 3.3 and 3.4. They include Riparian and Upland, Emergent Marsh, and Aquatic Ecosystems. (Other types of wetlands are also included in the Marsh Element.) Each of these biological elements has its own set of goals and tasks. These sets of goals and tasks are intended to maintain and enhance upland, riparian, marsh, and aquatic ecosystems to restore natural processes and sustain habitats for native plants and animals, and to provide other desired ecosystem functions.

At LSIWA, there are opportunities for maintaining, enhancing, and restoring riparian, upland, emergent marsh, other wetlands, and aquatic ecosystems, including habitat for special-status and game species. These opportunities include:

- Special-status and game species (including striped bass, largemouth bass, catfish, Delta smelt, longfin smelt, and Chinook salmon) use aquatic habitats in Sherman Lake, and adjacent waters of the Sacramento and San Joaquin rivers;;
- Shorebirds and wading birds use intertidal habitats at LSIWA;
- Special-status plant species (including Mason's lilaeopsis and Suisun Marsh aster) occur in the intertidal zone and adjacent areas of emergent marsh and riparian ecosystems;
- Suisun song sparrow and saltmarsh common yellowthroat occur at LSIWA;
- Numerous other special-status species (including giant garter snake, western pond turtle, California black rail, or salt-marsh harvest mouse) are potentially present at LSIWA;
- Waterfowl use LSIWA, especially in marsh ecosystems;
- The open water surrounding most of LSIWA limits human and pet disturbance, and other stressors of upland, riparian, and marsh systems, and aids management of these stressors.
- Because most of LSIWA is surrounded by open water, prescribed fire may be a feasible management technique.
- Degraded wetland and marsh in the northwestern portion of LSIWA could be enhanced or restored.
- While a constraint on some management actions, dominance of riparian and marsh areas by nonnative species represents opportunities to enhance habitat through their removal.

There are also a number of important constraints on the management of the LSIWA's biological resources. These constraints include:

- Available staff and funding are limited;
- Access is limited — most of LSIWA is accessible only by boat, and most of the interior is not accessible by boat at low tide (due to the high cover of nonnative invasive plants);
- Both authorized and unauthorized uses are causing disturbances;
- The Reclamation Board has an easement for the deposit of dredge spoils on Lower Sherman Island;
- Himalayan blackberry dominates a substantial portion of riparian areas;
- Egeria dominates aquatic vegetation, as does water hyacinth in narrower waterways;
- Water and aquatic organisms (including non-native invasive species) move freely between the wildlife area's aquatic ecosystems and adjacent waters of the Sacramento and San Joaquin rivers; and
- Some management actions could potentially affect flood conveyance, water quality, or Delta hydrodynamics.

The following subsections include goals and tasks for the biological elements. These goals are generally based on Departmental requirements and the site-specific opportunities and constraints. The goals are based on the Fish and Game Code, policies of the Fish and Game Commission, and the goals and objectives of the California Bay-Delta Program's Ecosystem Restoration Program (for which the Department is the lead implementing agency). CESA (Chapter 1.5 of the Fish and Game Code) declares that all state agencies shall seek to conserve threatened and endangered species. In addition, it is the policy of the Commission to protect and preserve all native species experiencing a significant decline which, if not halted, would lead to threatened or endangered designation. Similarly, the goals of the Ecosystem Restoration Program of the California Bay-Delta Program include a range of ecosystem goals, including achieving the recovery of at-risk native species dependent on the Delta, reversing downward population trends of native species that are not listed, and reducing populations of nonnative invasive species.

RIPARIAN AND UPLAND ECOSYSTEM ELEMENT

Riparian and Upland Goal 1: Maintain and enhance habitat for special-status species.

Currently, no special-status wildlife species are known to be using riparian or upland ecosystems at LSIWA, but several special-status animal species could be using riparian or upland ecosystems at LSIWA, and surveys for these species have not been conducted at LSIWA. Similarly, several special-status plants could occur in riparian ecosystems, including Suisun aster (which is known to occur at LSIWA), but comprehensive surveys for these species have not been conducted at LSIWA. Therefore, the results of surveys for these species would determine the need for, and scope of, the other tasks listed below.

Tasks:

1. Conduct surveys for salt-marsh harvest mouse, and other special-status animals and special-status plants that may be present in riparian and upland ecosystems at LSIWA.

2. Manage public use to minimize effects on habitat areas occupied by special-status species.

3. Periodically visit populations of special-status plant species to assess overall habitat integrity and to detect changes in distribution and abundance, and to detect adverse effects of human use, erosion or nonnative species.

4. Develop and implement enhancement strategies that use natural processes to improve habitat for ground-nesting birds and special-status species using riparian and upland ecosystems at the LSIWA.

5. Ensure that all actions undertaken within riparian communities comply with the State and Federal Endangered Species Acts, Section 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations aimed at the protection of special-status species or their habitat.

Riparian and Upland Goal 2: Prevent the introduction and spread of invasive nonnative species.

This goal is based on the need to avoid the potential substantial adverse modifications to riparian ecosystems related to the introduction and spread of invasive species. A goal of the Ecosystem Restoration Program of the California Bay-Delta Program is to prevent the establishment of additional nonnative invasive species. The following tasks represent a strategic approach towards attaining this goal.

Tasks:

1. Monitor hot spots of introduction to enable early detection and rapid eradication of invasive species (e.g., sites along West Sherman Island Road, trails, near cabins, parking areas, etc.)

2. Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed.

3. Clean vehicles and clothing after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders).

4. Coordinate with and support regional control efforts, such as Team Arundo Del Norte and efforts coordinated by the Sacramento County Weed Management Area.

5. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.

6. Apply pesticides in conformance with the Department's Pesticide Use Program, to ensure safe and effective pesticide use that minimizes adverse environmental effects.

Riparian and Upland Goal 3: Control and manage existing infestations of established invasive plant species.

As described previously in Section 3.4, several nonnative, invasive plant species have already caused substantial, adverse changes in the riparian and upland ecosystems of the LSIWA, and have the potential to cause additional alterations. Therefore, controlling the abundance and distribution of these invasive species is an important component of managing ecosystems at LSIWA. The following tasks represent a strategic approach towards attaining this goal.

Tasks:

1. Identify nonnative plant species that have invaded and prioritize management of particular weed species based on their potential impacts to ecosystem functions and human uses (e.g., boat access) and infrastructure, and the feasibility and impacts of control; existing state and federal priorities should be followed where appropriate.

2. Determine appropriate prevention, eradication, and control options for priority weed species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative.

3. Implement appropriate prevention, eradication, and control options for priority weed species.

4. Coordinate with and support regional control efforts, such as Team Arundo Del Norte and efforts coordinated by the Sacramento County Weed Management Area.

5. Periodically evaluate effectiveness of control methods and adjust methods as needed.

6. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS NIS Program.

7. Apply pesticides in conformance with the Department's Pesticide Use Program, to ensure safe and effective pesticide use that minimizes adverse environmental effects.

Riparian and Upland Goal 4: Restore degraded and disturbed riparian and upland areas to conditions that provide desired ecological functions.

This goal is based on the concerns of the Department, the goals and objectives of the California Bay-Delta Program's Ecosystem Restoration Program, and its potential contribution to attainment of this LMP's goal regarding special-status species habitats in riparian and upland areas. The preservation, enhancement and restoration of riparian areas are primary concerns of the Department, as evidenced by the California Riparian Habitat Conservation Program (Chapter 4.1 of the Fish and Game Code). It is also a goal of the Ecosystem Restoration Program to restore large expanses of riparian areas.

Tasks:

1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible riparian and upland restoration projects that would support the goals of this LMP, including review of existing documents and/or conduct of additional assessments (e.g., of physical and biological conditions).

2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.

3. Cooperate with the development and implementation of local and regional restoration plans for upland and riparian ecosystems by the Ecosystem Restoration Program of the California Bay-Delta Program and other programs that are consistent with the goals of this LMP.

MARSH ECOSYSTEM ELEMENT

Marsh Goal 1: Maintain and enhance habitat for special-status species.

Currently, just two special-status animals (Suisun song sparrow and saltmarsh common yellowthroat), but several additional special-status animal species could use marsh or other wetland ecosystems at LSIWA, and surveys for these species have not been conducted at LSIWA. Similarly, several of the special-status plants known from LSIWA may occur in marsh or other wetland ecosystems, but comprehensive surveys for these species have not been conducted at LSIWA, and thus their distribution at LSIWA could be more extensive than documented in CNDDB. Therefore, the results of surveys for these species would determine the need for, and scope of, the other tasks listed below.

Tasks:

1. Conduct surveys for California black rail, western pond turtle, giant garter snake, other special-status animals, and special-status plants that could be present in emergent marsh ecosystems at LSIWA.

2. Manage public use to minimize effects on areas occupied by special-status species.

3. Periodically visit populations of special-status plant species to assess overall habitat integrity and to detect changes in distribution and abundance, and to detect adverse effects of human use, erosion or nonnative species.

4. Develop and implement enhancement strategies that use natural processes (e.g., tidal action) to improve habitat for special-status species using marsh ecosystems at the LSIWA.

5. Ensure that all actions undertaken within marsh ecosystems comply with the State and Federal Endangered Species Acts, Section 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations.

Marsh Goal 2: Maintain and enhance habitat for waterfowl species.

This goal is based on the purpose for which LSIWA was acquired and on the habitats provided by marshes at LSIWA. The LSIWA was acquired to establish a publicly accessible hunting and fishing area (California Fish and Game Commission 1958), and currently provides habitat for waterfowl. Currently, habitat management by hunters, the hunting program, other human uses, fire, and invasive plants all affect waterfowl habitat. With the exception of invasive plants (see Marsh Goal 3), these influences are addressed by the tasks below.

Tasks:

1. Monitor and assess fire and human use effects on habitat for waterfowl.

2. Support the development of Annual Habitat Work Plans by hunters to maintain and enhance habitat for game species.

3. Periodically evaluate the hunting program and regulations and recommend changes as warranted to maintain and enhance marsh habitat for waterfowl.

Marsh Goal 3: Prevent the introduction and spread of invasive nonnative species.

This goal is based on the need to avoid the potential substantial adverse modifications to marsh ecosystems related to the introduction and spread of invasive species. A goal of the Ecosystem Restoration Program of the California Bay-Delta Program is to prevent the establishment of additional nonnative invasive species. The following tasks represent a strategic approach towards attaining this goal.

Tasks:

1. Monitor hot spots of introduction to enable early detection and rapid eradication of new invasive species (e.g., sites along West Sherman Island Road, trails, near parking areas at the Sherman Island Public Access Facility, buildings at Cabin Slough).

2. Develop and implement a plan for the removal of nonnative plant species from recreational home sites leased along Cabin Slough (as required by Section 1526.4 of the Fish and Game Code).

3. Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed.

4. Clean vehicles and clothing after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders).

5. Detect and eradicate small populations of invasive species.

6. Coordinate with and support regional control efforts (e.g., the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife).

7. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS NIS Program.

Marsh Goal 4: Control and manage existing infestations of established invasive plant species.

As described previously in Section 3.4, most marsh and other wetland ecosystems at LSIWA are currently dominated by native species. The primary exception occurs in the northwestern portion of the wildlife area, where invasive perennial pepperweed is abundant in upper elevations of the marsh. Therefore, this goal is focused on controlling the abundance and distribution of these invasive species. The following tasks represent a strategic approach towards attaining this goal.

Tasks:

1. Identify nonnative plant species that have invaded and prioritize management of particular weed species based on potential impacts to ecosystem function, human uses and infrastructure, and feasibility and impacts of control; existing state and federal priorities should be followed where appropriate.

2. Determine appropriate prevention, eradication, and control options for priority weed species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative.

3. Implement appropriate prevention, eradication, and control options for priority weed species.

4. Coordinate with and support regional control efforts (e.g., the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife).

5. Periodically evaluate effectiveness of control methods and adjust methods as needed.

6. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS NIS Program.

Marsh Goal 5: Restore degraded and disturbed areas (e.g., wetlands in northwestern corner of Lower Sherman Island) to conditions that provide desired ecological functions.

This goal is based on the policies of the Fish and Game Commission, and on its contribution to the attainment of other goals of this LMP. Because of the importance of wetlands to a wide variety of fish and wildlife species, it is the policy of the Fish and Game Commission to seek to provide for the protection, preservation, restoration, enhancement, and expansion of wetland habitat in California. The restoration of wetland habitat at LSIWA could contribute to attainment of goals regarding habitat for special-status species and waterfowl.

Tasks:

1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible marsh restoration projects that would support the goals of this LMP, including review of existing documents and/or conduct of additional assessments of physical and biological conditions.

2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.

3. Cooperate with development and implementation of local and regional restoration plans for marsh and other wetland ecosystems by the CALFED Ecosystem Restoration Program and other programs that are consistent with the goals of this LMP.

AQUATIC ECOSYSTEM ELEMENT

Aquatic Goal 1: Maintain and enhance habitat for special-status species.

In addition to Departmental requirements and goals, as indicated in the introduction to biological elements, above, the Department is also guided by the understanding that it is the desire of the State of California to recover salmon and anadromous trout populations to self-sustaining levels. Similarly, the goals of the CALFED Ecosystem Restoration Program include achieving the recovery of at-risk native species dependent on the Delta and reversing downward population trends of native species that are not listed.

Tasks:

1. Monitor use of aquatic ecosystems at LSIWA by special-status aquatic species.

2. Improve habitat for special-status aquatic species using aquatic ecosystems at the LSIWA.

3. Ensure that all actions undertaken at LSI wildlife area comply with the State and Federal Endangered Species Acts, Sections 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations aimed at the protection of special-status species or their habitat.

Aquatic Goal 2: Maintain and enhance habitat for native and nonnative sport fish species.

This goal is primarily based on the purpose for which LSIWA was acquired and on the habitats provided by aquatic ecosystems at LSIWA. The LSIWA was acquired to establish a publicly accessible hunting and fishing area (California Fish and Game Commission 1958), and currently provides habitat for sport fish. This goal is also based on Fish and Game Commission policies and on objectives of the California Bay-Delta Program's Ecosystem Restoration Program. It is the policy of the Commission that the Department shall emphasize programs that ensure, enhance, and prevent loss of sport fishing opportunities. It is also the policy of the Commission that the Department work toward stabilizing and then restoring the declining striped bass fishery of the Sacramento-San Joaquin Delta. The enhancement of fisheries for salmonids and white sturgeon, and the maintenance of fisheries for striped bass and nonnative warmwater fish are objectives of the Ecosystem Restoration Program of the California Bay-Delta Program.

Tasks:

1. Monitor and assess human use, invasive nonnative species, and other effects on habitat for sport fish species.

2. Periodically evaluate angling use and regulations and recommend changes as warranted to maintain and enhance aquatic habitat for sport fish species.

Aquatic Goal 3: Prevent the introduction and spread of invasive nonnative species.

This goal is based on the need to avoid the potential substantial adverse modifications to aquatic ecosystems related to the introduction and spread of invasive species A goal of the Ecosystem Restoration Program of the California Bay-Delta Program is to prevent the establishment of additional nonnative invasive species. The following tasks represent a strategic approach towards attaining this goal.

Tasks:

1. Monitor hot spots of introduction to enable early detection and rapid eradication of invasive species (e.g., the County-operated boat launch).

2. Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed.

3. Clean boats and vehicles after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders).

4. Coordinate with and support regional control efforts, such as the Department of Boating and Waterways (DBW) Aquatic Pest Control Program.

5. Provide education and outreach to support control efforts, and support education and outreach efforts by other programs, such as the USFWS NIS Program.

Aquatic Goal 4: Control and manage existing infestations of established invasive plant species.

As described previously in Section 3.3, several nonnative, invasive species have already caused substantial, adverse changes in aquatic ecosystems of the LSIWA, and have the potential to cause additional alterations. Therefore, controlling the abundance and distribution of these invasive species is an important component of managing ecosystems at LSIWA. The following tasks represent a strategic approach towards attaining this goal.

Tasks:

1. Prioritize management of particular invasive plant species based on potential impacts to ecosystem function, human use and infrastructure, and feasibility and impacts of control; existing state and federal priorities should be followed where appropriate.

2. Determine appropriate prevention, eradication, and control options for high priority invasive plant species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative.

3. Implement appropriate prevention, eradication, and control options for high priority invasive species.

4. Coordinate with and support regional control efforts (e.g., on-going efforts by DBW to control water hyacinth).

5. Periodically evaluate effectiveness of control methods and adjust methods as needed.

6. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS NIS Program.

Aquatic Goal 5: Restore degraded aquatic ecosystems to conditions that provide desired ecological functions.

The restoration of aquatic habitat at LSIWA could contribute to attainment of this LMP's goals regarding habitat for special-status and game species.

Tasks:

1. Cooperate with development and implementation of local and regional restoration plans for aquatic ecosystems by the CALFED Ecosystem Restoration Program and other programs that are consistent with the goals of this LMP.

2. Identify other opportunities to restore aquatic ecosystems at LSIWA.

3. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.

4.2.2 CULTURAL RESOURCES ELEMENT

Archival research has shown that few documented cultural resources are known to exist at LSIWA and the Department is not aware of any significant historical or archeological resources at LSIWA. Furthermore, as much of LSIWA consists of historically and currently submerged lands, relatively few cultural resources are anticipated to remain above water. Under current planning, few ground-disturbing activities are anticipated in the future. Consequently, at LSIWA, there are few opportunities or constraints on the management of cultural resources. Nonetheless, significant prehistoric or historic-era resources may be present, and could potentially be affected by public uses or management actions, particularly by ground-disturbing activities. Potential ground-disturbing activities include levee maintenance by DWR, deposition of dredge materials by the Bureau of Reclamation, and restoration of wetland ecosystems by the Department or other agencies in collaboration with the Department. Section 3.5 contains additional information regarding the cultural resources of LSIWA.

Cultural Resources Goal 1: Catalog and preserve all significant prehistoric, historic-era, or present-day Native American cultural resources that documentary and/or field investigations identify within the LSIWA.

This goal is based on the requirements of CEQA, and on the intent of the Department to provide long-term stewardship of cultural resources at LSIWA.

Tasks:

1. Conduct cultural resource surveys as necessary prior to ground-disturbing activities, and prepare an “inadvertent discovery plan” to be utilized during implementation of any project involving ground-disturbance. The inadvertent discovery plan shall refer to and outline state law regarding the discovery of human remains and include a requirement to consult with a qualified archaeologist in the case of a discovery of cultural resources or human remains during ground-disturbing activities.

2. If cultural resources are found during surveys or excavation, complete and submit resource documentation to the California Historical Resources Information System. If these resources are potentially eligible for listing on the National Register of Historic Places and/or the California Register of Historical Resources, submit evaluations of these resources to the State Historic Preservation Officer and the Office of Historic Preservation.

3. When facility improvements or restoration efforts are proposed that may affect significant cultural resources, consult the CEQA guidelines and/or Section 106 of the National Historic Preservation Act (if federal involvement) for guidance on compliance with regulations.

4. Support efforts to document the history of human activities at the LSIWA.

4.2.3 AUTHORIZED PUBLIC USE ELEMENT

It is the policy of the Fish and Game Commission that lands under its administration are available to the public for wildlife-dependent recreational use whenever such uses will not unduly interfere with the primary purpose for which such lands were acquired. The LSIWA was acquired for the purpose of providing a publicly accessible hunting and fishing area. Because use of LSIWA for hunting is concentrated in emergent marsh and adjacent aquatic areas and is seasonally restricted, several other uses are compatible with hunting at this wildlife area. Compatible, wildlife-dependent uses authorized and ongoing at LSIWA include angling, environmental education, and wildlife observation. Compatible uses that are not wildlife-dependent, but are authorized and ongoing at LSIWA, include boating and wind sports. Gathering of native plant materials for cultural uses also can be compatible and may be on-going. Section 3.6 contains additional information regarding public uses of LSIWA.

At LSIWA, there are several opportunities that support hunting and compatible public uses. These opportunities include:

- The County-operated Sherman Island Public Access Facility provides access to LSIWA for boating and angling;

- Boats can access the wildlife area from both the Sacramento and San Joaquin rivers;

- Conditions for wind sports are excellent;
- Sport fish and waterfowl use the wildlife area; and
- A local hunters group exists at LSIWA (i.e., Lower Sherman Island Duck Hunters Association);

There are also several important constraints on public use of the LSIWA. These constraints include:

- Available staff and funding for operations and maintenance is limited;
- Access to Lower Sherman Island and much of Sherman Lake is limited — most of LSIWA is accessible only by boat, and most of the interior is not accessible by boat at low tide (due to the high cover of nonnative invasive plants);
- Disturbance caused by public uses may affect upland, riparian, marsh, and aquatic ecosystems of LSIWA, in particular on special-status species and their habitat;
- Public uses may affect cultural resources;
- There are potential conflicts between the primary purpose of the wildlife area (i.e., hunting) and other uses (e.g., angling), and potential conflicts among other uses (e.g., between boating and wind sports);
- Use of the wildlife area by members of the local hunters group (i.e., Lower Sherman Island Duck Hunters Association) may conflict with use of the wildlife area by other hunters, and by other users; and
- Public uses may affect the properties leased along Cabin Slough.

Authorized Public Use Goal 1: Support compatible public uses through public outreach, signage, and regulations.

Compatible public uses of the LSIWA are facilitated by informing the public of opportunities for authorized uses at LSIWA and by regulating use of the wildlife area in a manner that supports compatible uses and minimizes conflicts among them.

Tasks:

1. Inform users regarding the wildlife area's boundaries and compatible public uses by providing signage at major access points to the LSIWA and on the Department's web site.
2. Include on outreach materials and the Department's website a contact person's name, phone number, and email at the Department for questions, comments, and suggestions regarding compatible uses of the LSIWA.
3. Periodically conduct reviews of public uses of the LSIWA and evaluate rules, regulations, guidelines and materials to ensure compatibility of public uses.

Authorized Public Use Goal 2: Provide long-term opportunities for hunting and increase opportunities for wildlife-dependent recreation.

This goal is based on the purpose of the Department's acquisition of LSIWA. The LSIWA was acquired to establish a publicly accessible hunting and fishing area (California Fish and Game Commission 1958).

Tasks:

1. Coordinate with non-profit groups (e.g., Lower Sherman Island Duck Hunter's Association and California Waterfowl Association) that promote wildlife-dependent recreational or hunting opportunities that can provide additional support to the Department's management of the LSIWA.

2. Identify potential conflicts with other recreational uses and resolve such conflicts.

3. Inform the public of times and locations where hunting is allowed and of all other restrictions and applicable regulations through outreach, signage, and the Department's website.

4. Monitor or supervise hunting activities as needed.

5. Periodically evaluate the hunting program and regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.

Authorized Public Use Goal 3: Provide long-term opportunities for fishing.

This goal is based on the purpose of the Department's acquisition of LSIWA. The LSIWA was acquired to establish a publicly accessible hunting and fishing area (California Fish and Game Commission 1958).

Tasks:

1. Coordinate with non-profit groups that promote fishing opportunities that can provide additional support to the Department's management of the LSIWA.

2. Identify potential conflicts with other recreational uses and resolve such conflicts.

3. Inform the public of dates and locations where fishing is allowed and of all other restrictions and applicable regulations through outreach, signage, and the Department's website.

4. Monitor or supervise fishing activities as needed.

5. Periodically evaluate the fishing program and regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.

Authorized Public Use Goal 4: Manage water surfaces and use areas to accommodate a variety of different user groups and minimize competition and conflicts among users.

Sherman Lake occupies much of LSIWA and several different user groups use this water surface, including hunters (primarily along the perimeter of Lower Sherman Island), wind sport enthusiasts, anglers, and boaters. The following tasks are intended to reduce conflicts among these user groups.

Tasks:

1. Encourage boater safety through monitoring and enforcement of regulations, including the 5 mph speed limit and proper disposal of wastes.

2. Periodically evaluate management of water surfaces and associated regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.

3. Post signs with boating regulations at major access points.

Authorized Public Use Goal 5: Support use of the LSIWA for environmental education.

This goal is based on policies of the Fish and Game Commission. It is the policy of the Fish and Game Commission that to the maximum extent feasible the Department shall disseminate information to the public regarding conservation, protection, and management of the state's fish and wildlife resources. It is also a policy that the Department shall encourage education programs that increase the public's respect and concern for wild animals, and their knowledge of the interrelationships between wild animals, their environment, and their human neighbors.

Tasks:

1. Provide staff assistance, interpretive materials, and provision of permits for environmental education activities.

2. Encourage all environmental education and natural resource interpretation (informal education) users to incorporate the Department's guidelines for natural resource education messages in their field environmental education activities, curriculums, and interpretive programs, both on and off-site.

Authorized Public Use Goal 6: Evaluate requests by Native Americans for use of the wildlife area for activities such as gathering native plant materials for cultural purposes.

Gathering limited quantities of native plant materials can be compatible with hunting and other wildlife-dependent uses, and the following tasks are intended to ensure that such uses are authorized only when compatible and in a manner that minimizes conflicts with other uses.

Tasks:

1. Work with native peoples requesting access to determine the purpose and need for access and/or collections within the LSIWA based on applicable laws and treaties related to tribal use of state properties.

2. Develop access plans and issue permits for native peoples that are compatible with the goals of the LMP. Any authorization for access would identify species, limits, locations, seasons, and include standard liability clauses.

Authorized Public Use Goal 7: Make the public aware of potential risks in order to encourage safe use of LSIWA.

Though risks are inherent in any physical activity, informing the public of potential risks (e.g., gas lines, underwater obstructions) and reducing access to unsafe areas should increase the safety of users, and that is the intent of the following tasks.

Tasks:

1. Identify areas where warning signs or marker buoys are needed.

2. Subject to funding, install warning signs or marker buoys at identified locations.

4.2.4 UNAUTHORIZED PUBLIC USE ELEMENT

Disposal of waste, construction of unauthorized structures, camping, use of generators and fires, cultivation of marijuana, and other illegal activities have periodically or regularly occurred at Lower Sherman Island. These unauthorized uses damage the wildlife area's ecosystems, affect special-status and game species and their habitats, and interfere with authorized uses. The limited access to Lower Sherman Island limits both the extent and management of unauthorized uses. The limited availability of staff and funding substantially constrains management of unauthorized uses.

Unauthorized Public Use Goal 1: Discourage dumping of trash or waste within the LSIWA.

Dumping of trash has been a problem at LSIWA that adversely affects ecosystems, degrades habitats, and interferes with authorized uses. The following tasks are intended to reduce dumping within LSIWA.

Tasks:

1. Remove existing rubbish and unwanted materials.
2. Establish a regular monitoring and removal program.
3. Ensure that removed materials are taken to an appropriate and approved disposal site.
4. Use signage to discourage dumping (e.g., post signs regulations regarding and penalties for dumping at locations of repeated dumping).

Unauthorized Public Use Goal 2: Prevent unauthorized use of the wildlife area.

Preventing unauthorized uses would prevent the adverse effects caused by those uses, and the following tasks are intended to reduce the frequency and effects of unauthorized uses.

Tasks:

1. Patrol the wildlife area and enforce regulations that prohibit unauthorized uses.
2. Use signage and written notifications to foster cooperation.
3. Issue citations and/or pursue legal action when voluntary cooperation cannot be obtained.
4. Enforce laws and request assistance from the County Sheriff as necessary to enforce laws.
5. Identify locations where illegal uses of state lands are occurring or have occurred.
6. Provide written notification to violators illegally using the LSIWA and establish a process and timeline for the removal of unauthorized buildings, blinds, fencing, docks, landscaping, or other forms of unauthorized appropriation of state property.
7. Seek remediation from unauthorized users for unauthorized appropriation of state property.
8. Restore ecosystems damaged by unauthorized uses as necessary.

4.2.5 FACILITIES ELEMENT

Facilities at LSIWA include the County-operated boat launch (and associated access road, parking and day use areas), levees on Sherman Island, historical levees along Mayberry Cut and Lower Sherman Island, and docks, boardwalks, blinds, abandoned cabins, and leased cabins and associated docks. Some of these facilities support authorized uses or provide other benefits; other facilities (e.g., abandoned buildings and unauthorized structures) support unauthorized uses.

Chapter 2 contains additional information regarding facilities at LSIWA. The County of Sacramento maintains the boat launch and associated facilities at LSIWA, and issues related to their operations and maintenance are addressed under the management coordination element.

At LSIWA, there are opportunities for construction, maintenance, and removal of facilities. These opportunities include:

- Levee maintenance may be performed by Department of Water Resources;
- Collaborative efforts with Department of Boating and Waterways could potentially result in construction of additional facilities;
- A number of unauthorized or abandoned docks, boardwalks, blinds, and other structures exist that require maintenance or removal; and
- Cabin leases contain terms that provide for maintenance and eventual removal of structures.

There are also a number of important constraints on construction, maintenance, and removal of facilities at LSIWA. These constraints include:

- Available staff and funding are limited;
- Access is limited - most of LSIWA is accessible only by boat, and most of the interior is not accessible by boat at low tide (due to the high cover of nonnative invasive plants);
- The Reclamation Board has an easement for the deposit of dredge spoils;
- Construction of facilities could affect conveyance of flood waters;
- Construction, maintenance, and removal of facilities could affect water quality; and
- Construction, maintenance, and removal of facilities could affect ecosystems, including effects on special-status species and their habitats.

Facilities Goal 1: Ensure implementation of all provisions of cabin leases.

The leases for cabins at LSIWA contain provisions including a prohibition on cultivation of nonnative plant species, public access to adjacent navigable waters, Department and county employees having the right to inspect the properties, and the removal of all structures and facilities and returning the area to a natural condition upon termination of the lease.

Tasks:

1. Enforce all provisions of cabin leases including removal of non-native plants, and maintenance and removal of structures.

Facilities Goal 2: Remove remnants of recent human activity (e.g., abandoned structures), provided that such remnants have no historical or management value.

Many remnants of recent human activities adversely affect ecosystems or interfere with public uses of LSIWA; some abandoned structures also support unauthorized uses. Thus, their removal contributes to the attainment of this LMP’s goals regarding biological, cultural, and public use elements.

Tasks:

1. Inventory remains of recent human activity.
2. Assess the value of existing structures as habitat.
3. Identify structures that may have management or historic value.
4. Remove all improvements with no management or historic value.

Facilities Goal 3: Add, improve, and maintain signage that identifies accessible boundaries of the LSIWA, informs the public of laws and regulations applicable to the wildlife area, and provides interpretive and safety information.

Compatible public uses of the LSIWA are facilitated by signage that informs the public of the boundaries, laws and regulations applicable at LSIWA encourages public use, reduces conflicts among uses, increases the safety of users, and discourages unauthorized uses.

Tasks:

1. Install a kiosk or bulletin board with wildlife area maps and Title 14 regulations, interpretive material, and safety information.
2. Start monitoring and maintenance schedule for all signage.
3. Inventory existing boundary signage, and install new signs where necessary.

Facilities Goal 4: Effectively manage existing structures for resource protection, safety, and prevention of unauthorized uses.

Management of structures for resource protection, safety, and prevention of unauthorized uses would contribute to the attainment of goals for biological and public use elements.

Tasks:

1. Regularly monitor the condition and use of existing structures.
2. Take actions as needed to keep desired structures in good repair.

4.2.6 ADMINISTRATION ELEMENT

Administration of the LSIWA includes maintaining and providing records of management actions, expenditures, allocation of staff time, Annual Habitat Work Plans, and leases.

Administration Goal 1: Maintain current data on the management and resources of the reserve.

Current data on the management and resources of the LSIWA would support attainment of goals for biological, cultural, public use, and facility elements.

Tasks:

1. Regularly update GIS data sources as information becomes available.

2. Maintain accurate financial records regarding expenditures, staff, maintenance, and other administrative duties.

3. Administer renewal, modification, and termination of cabin leases as necessary.

4. Coordinate with hunters to develop Annual Habitat Work Plans.

5. Document facilities needs in Department maintenance and capital outlay database.

6. Conduct annual monitoring and reporting of the wildlife area (e.g., condition of signs, structures, etc.)

4.2.6 FIRE MANAGEMENT ELEMENT

Although most of LSIWA is either submerged (i.e., Sherman Lake) or an island covered primarily by marsh, wildfires regularly occur in drier areas at LSIWA, primarily in the fall. These fires are typically ignited by users and they alter upland, riparian, marsh ecosystems; affect facilities and habitat; and at Cabin Slough endanger human safety. The fires may result in both adverse and beneficial effects on the attainment of this LMP's goals. For example, as described in Section 3.4, fires have increased the diversity of marsh vegetation, and may contribute to attainment of the goals for the marsh element. Similarly, fire may improve waterfowl habitat and increase access and visibility for hunters, and through these effects support public use goals. Conversely, fires also may damage facilities, and thus interfere with attainment of goals for public use and facilities.

At LSIWA, there are opportunities for managing fires at LSIWA that result from the wildlife area's setting and the distribution of structures within the LSIWA. Open water along most boundaries limits the locations where fire could spread from the LSIWA to adjacent lands. Other than blinds, structures are restricted to a relatively small portion of the wildlife area: along Cabin Slough or at the County-operated boat launch. Consequently, a wider range of fire management activities may be feasible.

There are also a number of constraints on fire management at LSIWA. These constraints include:

- Available staff and funding are limited;

- Access is limited—most of LSIWA is accessible only by boat, and most of the interior is not accessible by boat at low tide (due to the high cover of nonnative invasive plants); and

- Fire management could cause adverse effects on air quality, special-status and game species habitats (e.g., loss of larger trees, spread of invasive species), public safety, facilities, and public use.

Fire Management Goal 1: Develop and implement wildfire plan for LSIWA.

In 1994, the California State Board of Forestry and the California Fish and Game Commission adopted a "*Joint policy on pre, during, and post-fire activities and wildlife habitat prefire*". This joint policy describes multiple measures that both the Department of Forestry and Fire Protection (CDF) and the Department of Fish and Game should undertake to protect lives and property with consideration of natural resources. These measures would be implemented before, during and after fires.

The development and implementation of a wildfire plan for the LSIWA is complicated by the insular nature of most of the wildlife area. CDF does not have the necessary boats and equipment to fight fires on Lower Sherman Island. Furthermore, during recent fires in the vicinity of Lower Sherman Island, CDF has not taken incident command, but rather has allowed the fires to burn. Consequently, developing and implementing a wildfire plan for Lower Sherman Island may require annexation into, or the establishment of aid agreements with, local fire districts that are willing to assume incident command and/or have necessary equipment. These local fire districts include the Delta Fire Protection District (in Sacramento County) and Contra Costa Consolidated (in Contra Costa County).

Tasks:

1. Meet at least annually with representatives of the California Department of Forestry and Fire Protection, and local fire districts (i.e., Delta Fire Protection District, Contra Costa Consolidated), to discuss fire-related issues relevant to LSIWA, including vegetation management, recent fires on the LSIWA, current contact information and procedures.

2. Coordinate with the California Department of Forestry and Fire Prevention, and local fire districts, to develop a wildland fire response plan for LSIWA. This plan would give protection of life and property the highest priority when responding to a fire, but would give careful consideration to effects on the natural resources of the LSIWA. This plan should identify fire suppression tactics that could have long-term effects on ecosystems (e.g., use of retardant), and avoid or modify those tactics whenever feasible, in order to avoid or minimize long-term effects on the ecosystems of LSIWA. The plan should also identify critical areas where emergency revegetation or mechanical or structural measures may be necessary to prevent excessive erosion or flooding post-fire.

3. Design and implement vegetation management activities in fire breaks at Cabin Slough and the Sherman Island Public Access Facility as necessary.

4. Review cabin leases to determine consistency with fire management tasks, and revise as necessary.

5. Train a DFG biologist to serve the role of Resource Specialist or Agency Representative through the Incident Command System (ICS).

6. As part of Incident Command System (ICS), make available a local plant, wildlife, and fisheries specialist from the Department's staff to provide advice during fires that threaten wildlife habitat at LSIWA.

7. Following fire or fire suppression, implement emergency revegetation, mechanical, and structural measures within those previously defined critical areas that were affected.

4.2.7 SCIENTIFIC RESEARCH AND MONITORING ELEMENT

Scientific research and monitoring contributes to sound management of upland, riparian, marsh, and aquatic ecosystems both in and beyond the wildlife area. Currently, fish populations, weather, and water quality are monitored at or near LSIWA, and the Department is preparing a field-verified vegetation map of LSIWA. However, basic inventory data are lacking for LSIWA. For example, plant and animal species lists based on field surveys do not exist for LSIWA. There also is no on-going monitoring of invasive plant populations, special-status plant populations or their habitats, or any monitoring that could be used to evaluate the effects of public use on ecosystems at LSIWA. Thus, additional research and monitoring could benefit management and attainment of goals for biological elements.

At LSIWA, there are opportunities for scientific research and monitoring. These opportunities include:

- Upland, riparian, marsh and aquatic ecosystems are protected at the wildlife area;

- The wildlife area is accessible by boat from the County-operated boat launch, and from the Sacramento and San Joaquin rivers;

- Existing background information has been compiled by this and other reports; and
- Aquatic ecosystems are being monitored at and near LSIWA.

There are also a number of important constraints on scientific research and monitoring of the LSIWA. These constraints include:

- Available staff and funding are limited;
- Access is limited - most of LSIWA is accessible only by boat, and most of the interior is not accessible by boat at low tide (due to the high cover of nonnative invasive plants);
- The public uses much of the wildlife area;
- Damage and theft of research equipment may occur;
- The Reclamation Board has an easement for deposition of dredge materials;
- Aquatic plants (water hyacinth and egeria) are controlled by Department of Boating and Waterways; and
- Uncontrolled fires occasionally occur.

Scientific Research and Monitoring Goal 1: Support appropriate scientific research and encourage or conduct research that contributes to management goals of the LSIWA.

This goal is based on the need for data from monitoring and scientific research in order to attain many of this plan's goals, and on the policies of the Fish and Game Commission. It is the policy of the Fish and Game Commission that research shall be performed to provide scientific and management data necessary to promote the protection, propagation, conservation, management, or administration of fish and wildlife resources, and whenever possible and advantageous, the services of the University of California or other academic or research institutions, or federal, state, or local agencies shall be used.

Tasks:

1. Review and evaluate proposed research projects utilizing the following criteria.
   A. Potential for research results to improve management of the LSIWA or other wildlife areas;
   B. Potential conflicts between the research and compatible public uses;
   C. Potential conflicts between the research and any biological goals stated in this plan;
   D. Potential contribution of the research to science and society; and
   E. Potential for the research to interfere with or preclude certain types of future research at the LSIWA.

2. Provide letters or permits to researchers specifying dates and times of authorized access, and information on regulations and area restrictions.

3. Require that researchers provide copies of data and/or published papers, and contact researchers to ensure this requirement is fulfilled.

4. Encourage long-term studies of bank erosion, water quality, special-status species populations, and other topics that could potentially inform management of the wildlife area.

5. Conduct high priority surveys, including surveys for salt-marsh harvest mouse, Suisun song sparrow, and California black rail.

4.2.8 MANAGEMENT REVIEW AND COORDINATION ELEMENT

Attainment of the goals of this LMP depends on the implementation of supporting regulations and management practices. Attainment of the goals also can be supported by coordination of management efforts with tenants, neighbors, local agencies, and other state agencies.

An important step towards attainment of the goals of this LMP is to review current regulations and management practices for consistency with and support of the goals; based on this review, if necessary, regulations and management practices could be revised to better support attainment of the goals of this LMP. The information synthesized in the LMP, and the management framework of the LMP goals, provide an opportunity for such a review and revision of regulations and management practices to better support the Department's management goals. The primary constraint on performing this review and changing regulations or management practices is the availability of funding and staff.

The activities of tenants, neighbors, and a number of state and local agencies influence ecosystems at LSIWA. These activities may occur at the wildlife area or elsewhere in the Delta, and are conducted for a wide range of purposes. The entities planning and conducting these activities may not be aware of related activities, effects at LSIWA or of the Department's management goals for LSIWA. Therefore, management coordination could reduce the adverse consequences of these actions and increase the beneficial effects resulting from the actions of these other entities.

At LSIWA, there are opportunities for management coordination. These opportunities include:

- Sacramento-Yolo Mosquito and Vector Control District conducts mosquito abatement;
- Sacramento County Sheriff's Department and the U.S. Coast Guard enforce laws;
- Sacramento County Health Department enforces laws;
- State Water Resources Control Board enforces;
- Sacramento County Parks manages the Sherman Island Public Access Facility;
- Delta Protection Commission and Department of Boating and Waterways are conducting Delta-wide recreational planning;
- California Department of Food and Agriculture is conducting regional invasive plant control efforts;
- Fire management planning by California Department of Forestry and Fire Protection and local fire protection districts (i.e., Delta Fire Protection District, Contra Costa Consolidated) plan fire management;
- Activities of CALFED programs, particularly the Ecosystem Restoration Program, fund activities; and
- Local governments and state agencies conduct regional land use and water supply planning.

There are also major constraints on management coordination of the LSIWA. The most substantial constraint is the lack of staff and funding to perform this coordination. Coordination also requires that other agencies are willing to participate in management coordination and have the staff and funding available to do so.

Management Review and Coordination Goal 1: Ensure regulations and management practices at LSIWA support attainment of LMP goals.

This goal is based on the purpose of this LMP, which includes guiding management of habitats, species, and programs described in the LMP to achieve the Department's mission to protect and enhance wildlife values, and serving as a guide for appropriate public uses of the LSIWA.

Task:

1. Review, and as necessary revise, regulations and management practices at the LSIWA to be consistent with and to support attainment of the goals of this LMP.

Management Review and Coordination Goal 2: Coordinate with federal, state and local agencies regarding plans and projects that may affect habitats at LSIWA

It is the policy of the Fish and Game Commission that to provide maximum protection of fish and wildlife and their habitat, the Department shall review and comment on proposed water development projects or other projects affecting aquatic habitat, and to recommend and seek the adoption of proposals necessary or appropriate for the protection and enhancement of fish and wildlife and their habitat.

Tasks:

1. Review, coordinate, and provide comments and recommendations on federal, state, local government plans, special plans, and proposed projects as appropriate for the purpose of determining the consistency of such plans with the goals of the Department's management plans.

2. Collaborate with the Department of Boating and Waterways (DBW) regarding nonnative invasive plants at the LSIWA and Delta recreational planning.

3. Collaborate with the Delta Protection Commission regarding Delta recreational planning.

4. Coordinate with the Sacramento County Health Department and the State Water Resources Control Board to ensure cabins continue to comply with septic system and water quality regulations;

5. Coordinate with the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife.

6. Collaborate with or submit proposals for CALFED-funded projects that could contribute both to the attainment of this LMP's goals and to attainment of CALFED goals, objectives, targets, and milestones.

7. Support the implementation of research, monitoring, and restoration actions compatible with the goals of this LMP by CALFED implementing agencies.

Management Review and Coordination Goal 3: Coordinate with other law enforcement agencies.

The jurisdictions of several law enforcement organizations overlap at LSIWA, and thus coordination among them should lead to more effective law enforcement; this should also support attainment of this LMP's goals for public use elements.

Tasks:

1. Meet regularly with law enforcement staff from County Sheriff Departments and other agencies as appropriate to coordinate law enforcement activities and explore options for cooperative programs.

2. Pursue joint funding requests with other law enforcement entities to address law enforcement concerns

Management Review and Coordination Goal 4: Coordinate with local public service agencies including the Sacramento-Yolo Mosquito and Vector Control District.

The Fish and Game Code contains a section (1507) regarding the control of mosquito production of managed wetlands in the Department's wildlife areas. While the marshes at LSIWA are not managed wetlands, the Department is still concerned with the control of mosquito production in these wetlands, and the manner of mosquito control and some measures identified in Section 1507 are applicable to the unmanaged wetlands at LSIWA. As described in Section 1507, mosquito production should be controlled in a manner that:

- Maintains or enhances the waterfowl and other wildlife values;

- Minimizes financial costs to the Department and to Sacramento-Yolo Mosquito and Vector Control District;

- Reduces the need for chemical treatment or other non-ecological mosquito control; and

- Increases coordination and communication between the Department and the Sacramento-Yolo Mosquito and Vector Control District, and the State Department of Health Services.

Tasks:

1. In consultation with the Sacramento-Yolo Mosquito and Vector Control District, develop and implement a mosquito control plan that applies best management practices and any other necessary management practices.

2. Communicate regularly with local mosquito and vector control agencies, and coordinate reasonable mosquito and vector control activities consistent with the mosquito control plan and the goals of this LMP.

Management Review and Coordination Goal 5: Maintain relationships with neighbors and tenants to address management issues.

Activities of neighbors, Sacramento County at the County-operated boat launch, and tenants at Cabin Slough all affect ecosystems and public uses at LSIWA, and thus maintaining relationships with neighbors and tenants can contribute to attainment of most goals of this LMP.

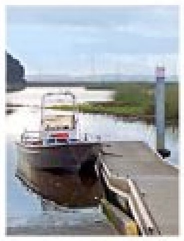
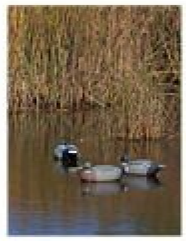
Tasks:

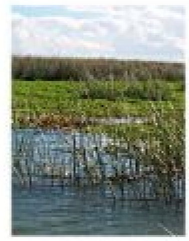
1. Meet or correspond with adjacent landowners and tenants as needed to maintain communication about the management needs of the LSIWA, access needs of adjacent landowners, and convey useful information regarding activities.

2. Collaborate with Sacramento County Parks regarding management of the Sherman Island Public Access Facility and maintenance of the riprap along West Sherman Island Road, and provision of additional facilities, electricity, and potable water at Sherman Island Public Access Facility.

3. Collaborate with the Department of Water Resources regarding management of the Donlon Island area, and regarding its possible inclusion in the LSIWA.

5 OPERATIONS AND MAINTENANCE


FINAL LAND MANAGEMENT PLAN

5 OPERATIONS AND MAINTENANCE

The purpose of this chapter is to describe the staffing and other resources required to perform the operations and maintenance associated with this LMP. The implementation of this LMP will require additional staffing and resources to perform the tasks that described in Chapter 4. The LSIWA is not currently assigned specific staff time or budget. This LMP proposes to manage of the ecosystems of the LSIWA at a level that is more intense than the past. This will require a commitment of additional budgetary resources if the goals of this plan are to be achieved.

In addition to financial resources, this LMP will require management focus to keep it current and revised as necessary. The resources and uses of the wildlife area and of the surrounding Delta will change, as will the policies and programs guiding resource management. Also, adaptive management of the LSIWA and advancement of scientific knowledge will result in new techniques and opportunities for more effective management of the wildlife area. Procedures to help keep this LMP current and relevant are included in Chapter 6.

5.1 OPERATIONS AND MAINTENANCE TASKS TO IMPLEMENT PLAN

Table 5-1, at the end of this chapter, summarizes goals and tasks identified in Chapter 4 “Management Goals” and the labor required to implement them.

5.2 EXISTING STAFF AND ADDITIONAL PERSONNEL NEEDS

Currently, there are no Department staff specifically budgeted to the LSIWA. Other existing staff positions, however, have been providing minimal management services to the LSIWA. In addition, existing positions (not specifically budgeted to the LSIWA) provide some related planning and coordination activities within the Delta region. These include participation in CALFED Program activities, DPC recreation planning, and other planning and coordination activities related to the Delta. These activities require a portion of the time of several positions on an occasional basis.

To appropriately support the LSIWA and to perform the tasks identified in this LMP, a combination of additional site management, maintenance, and warden staffing is required. A position assigned specifically to the LSIWA is needed to implement the LMP with additional support provided by other permanent Department staff augmented by seasonal labor. (Although seasonal employee tasks are not itemized, it is anticipated that an additional personnel year of seasonal employee time [i.e., Scientific Aids, Seasonal Aids] will be needed in order to implement this plan.) Among each category of staff described below, Table 5-1 distributes the hours necessary to implement each task of the LMP (described in Chapter 4).

SITE MANAGEMENT– WILDLIFE HABITAT SUPERVISOR I POSITION

Increased day to day field operations will require 1 personnel year (PY) of a Wildlife Habitat Supervisor I position to be assigned specifically to the LSIWA. This individual will act as the Area Manager for the LSIWA, performing administration (including enforcement of provisions of cabin leases), and planning and coordination of management, as well as the basic communication, monitoring, and support functions that are required for operation and maintenance of the wildlife area. The individual will also assist and direct regular DFG staff, seasonal labor, and volunteers performing maintenance and other tasks required to implement this LMP.

SITE MANAGEMENT AND MONITORING – WILDLIFE BIOLOGIST

For many tasks, particularly those involving biological elements, the specialized skills of biologists are required. These tasks include monitoring, development of specific habitat enhancement and invasive species control measures, management review and coordination, and compliance with state and federal environmental regulations. A wildlife biologist position will not be assigned specifically to the LSIWA; rather, Department biologists will perform necessary tasks on an as-needed basis, and the cost of this labor will be budgeted as an operations and maintenance expense for the LSIWA. Implementation of the LMP will require Wildlife Biologists to provide approximately 300 hours per year of support under the guidance of the Area Manager (Table 5-1).

MAINTENANCE – TRACTOR OPERATOR / LABORER POSITION

Under the direction of the Area Manager, Tractor Operator/Laborers will be required to maintain and operate machinery (including boats), and perform maintenance tasks related to signing, access, removal of trash and abandoned structures, and control of invasive, nonnative species and other habitat improvement projects. These individuals may also provide other similar support related to operation and maintenance of the wildlife area.

Many of these tasks would be seasonal or on an intermittent basis. Consequently, no Tractor Operator/Laborer positions would be assigned to the LSIWA; rather, Tractor Operator/Laborers assigned to other wildlife areas would perform these tasks at Lower Sherman Island on an as-needed basis, and the cost of this labor will be budgeted as an operations and maintenance expense. Implementation of the LMP will require Tractor Operator/Laborers to provide approximately 500 hours per year of support under the guidance of the Area Manager.

LAW ENFORCEMENT – FISH AND GAME WARDEN

To protect fish and wildlife resources and ecosystems, patrol of the LSIWA by a Fish and Game Warden will be required. The individual will provide a frequent presence to deal with fish and game violations and enforce other wildlife area regulations including those related to authorized and unauthorized uses.

Fish and Game wardens are not assigned to a single wildlife area; they patrol multiple wildlife areas as part of their responsibilities, and the cost of these patrols is budgeted as an operations and maintenance expense for wildlife areas. Based on available funding and support required to implement this LMP, the current level of patrol would be increased as directed by the Area Manager. Implementation of the LMP will require Fish and Game Wardens to perform an estimated 300 hours per year of patrols and supporting activities at the LSIWA (Table 5-1).

ARCHEOLOGIST

For tasks related to cultural resource goals, an archaeologist will need to conduct surveys for and document the presence of cultural resources. Implementation of this LMP will require an Archaeologist to provide up to 40 hours per year of support under the guidance of the Area Manager (Table 5-1).

5.3 CAPITAL EQUIPMENT AND MATERIALS AND SUPPLIES

In addition to proposed staff of the LSIWA and additional labor (as described above), operation and maintenance of the wildlife area requires capital equipment and materials and supplies. These resources are described below.

5.3.1 CAPITAL EQUIPMENT

Initial additional equipment that would be required for implementation of this LMP will include:

- One operations vehicle (1/2 or ¾ ton 4wd pickup),
- One jet boat with trailer for patrol and operations, and
- Office space and equipment (computer, printer, phone, etc.) for the Area Manager.

Occasionally, other capital equipment will be required for a particular task. The use of this equipment will be an operations and maintenance expense.

5.3.2 OPERATIONS AND MAINTENANCE

An operations and maintenance budget will be required to provide materials and supplies (office supplies, fuel, etc.) and additional labor (as previously described) to support management. This budget also will need to include costs of vehicle maintenance, small tools and materials for facilities maintenance (e.g., replacement signs), herbicides for control of invasive species, garbage disposal fees, etc. Costs for materials and supplies can be relatively large for some tasks, such as the removal of abandoned structures or eradication of extensive invasive plant infestations; therefore, these tasks may be budgeted separately as capitol improvement or habitat restoration projects, and not included in the general materials and supplies budget for the wildlife area.

5.4 FUNDING SOURCES

Several funding sources are available for capitol improvements, and restoration and enhancement projects within the wildlife area. These funding sources potentially include:

- USFWS Programs (e.g., State Wildlife Grant Program, Federal Aid in Wildlife Restoration Program);
- CBDA Ecosystem Restoration Program (e.g., through the public solicitation process or submittal of an unsolicited proposal for consideration as a directed action);
- Central Valley Project, Wildlife Habitat Augmentation Plan;
- California Wildlife Conservation Board, Habitat Acquisition and Restoration Program;
- State Duck Stamp Program;
- Neotropical Migratory Bird Conservation Act Grants Program;
- Funding from Riparian Joint Venture;
- Ducks Unlimited, Wetland Restoration Program;
- Department of Fish and Game programs (e.g., Comprehensive Wetlands Program);
- Department of Fish and Game Minor/Major Capital Outlay proposals;
- Programs authorized under future bond acts;
- DWR grants available for mitigation of water projects and levee maintenance activities;
- U.S. Environmental Protection Agency grant programs;
- National Oceanic and Atmospheric Administration grant programs (e.g., San Francisco Bay Habitat Restoration Program); and
- National Fish and Wildlife Foundation grant programs (e.g., Bring Back the Natives [BBN], Five Star Restoration Challenge Grants).

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Biological Elements - Riparian and Upland Ecosystems							
Goal 1: Maintain and enhance habitat for special-status species	**Task 1.1**. Conduct surveys for salt-marsh harvest mouse, and other special-status animals and special-status plants that may be present in riparian and upland ecosystems at LSIWA.	-	80	-	-	-	A
	Task 1.2. Manage public use to minimize effects on habitat areas occupied by special-status species.	50	-	-	200	-	A
	Task 1.3. Periodically visit populations of special-status plant species to assess overall habitat integrity and to detect changes in distribution and abundance, and to detect adverse effects of human use, erosion or nonnative species.	-	10	-	-	-	P
	Task 1.4. Develop and implement enhancement strategies that use natural processes to improve habitat for ground-nesting birds and special-status species using riparian and upland ecosystems at the LSIWA.	40	20	-	-	-	P
	Task 1.5. Ensure that all actions undertaken within riparian communities comply with the State and Federal Endangered Species Acts, Section 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations aimed at the protection of special-status species or their habitat.	25	-	-	-	-	P
Goal 2: Prevent the introduction and spread of invasive nonnative species.	**Task 2.1**. Monitor hot spots of introduction to enable early detection and rapid eradication of invasive species (e.g., sites along West Sherman Island Road, trails, near cabins, parking areas, etc.)	-	40	-	-	-	A
	Task 2.2. Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed.	10	10	-	-	-	P
	Task 2.3. Clean vehicles and clothing after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders).	I	I	I	I	I	A
	Task 2.4. Coordinate with and support regional control efforts, such as Team Arundo Del Norte and efforts coordinated by the Sacramento County Weed Management Area.	20	-	-	-	-	A

Table 5-1 Summary of Staffing Required to Implement the Land Management Plan							
Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
	Task 2.5. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.	20	-	-	-	-	A
	Task 2.6. Apply pesticides in conformance with the Department's Pesticide Use Program, to ensure safe and effective pesticide use that minimizes adverse environmental effects.	20	-	-	-	-	A
Goal 3: Control and manage existing infestations of established invasive plant species.	**Task 3.1**. Identify nonnative plant species that have invaded and prioritize management of particular weed species based on their potential impacts to ecosystem functions and human uses (e.g., boat access) and infrastructure, and the feasibility and impacts of control; existing state and federal priorities should be followed where appropriate.	25	15	-	-	-	P
	Task 3.2. Determine appropriate prevention, eradication, and control options for priority weed species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative.	25	15	-	-	-	P
	Task 3.3. Implement appropriate prevention, eradication, and control options for priority weed species.	40	-	80	-	-	A
	Task 3.4. Coordinate with and support regional control efforts, such as Team Arundo Del Norte and efforts coordinated by the Sacramento County Weed Management Area.	I	-	-	-	-	A
	Task 3.5. Periodically evaluate effectiveness of control methods and adjust methods as needed.	I	I	-	-	-	P
	Task 3.6. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.	I	-	-	-	-	A
	Task 3.7. Apply pesticides in conformance with the Department's Pesticide Use Program, to ensure safe and effective pesticide use that minimizes adverse environmental effects.	I	-	-	-	-	A

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Goal 4: Restore degraded and disturbed riparian and upland areas to conditions that provide desired ecological functions.	**Task 4.1**. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible riparian and upland restoration projects that would support the goals of this LMP, including review of existing documents and/or conduct of additional assessments (e.g., of physical and biological conditions).	40	-	-	-	-	P
	Task 4.2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.	160	-	-	-	-	P
	Task 4.3. Cooperate with the development and implementation of local and regional restoration plans for upland and riparian ecosystems by the Ecosystem Restoration Program of the California Bay-Delta Program and other programs that are consistent with the goals of this LMP.	40	-	-	-	-	A
Biological Elements – Marsh Ecosystems							
Marsh Goal 1: Maintain and enhance habitat for special-status species.	**Task 1.1.** Conduct surveys for California black rail, western pond turtle, giant garter snake, other special-status animals, and special-status plants that could be present in emergent marsh ecosystems at LSIWA.	-	I	-	-	-	A
	Task 1.2. Manage public use to minimize effects on areas occupied by special-status species.	I	-	-	I	-	A
	Task 1.3. Periodically visit populations of special-status plant species to assess overall habitat integrity and to detect changes in distribution and abundance, and to detect adverse effects of human use, erosion or nonnative species.	-	I	-	-	-	P
	Task 1.4. Develop and implement enhancement strategies that use natural processes (e.g., tidal action) to improve habitat for special-status species using marsh ecosystems at the LSIWA.	I	I	-	-	-	P
	Task 1.5. Ensure that all actions undertaken within marsh ecosystems comply with the State and Federal Endangered Species Acts, Section 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations.	I	-	-	-	-	A

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Marsh Goal 2: Maintain and enhance habitat for waterfowl species.	**Task 2.1**. Monitor and assess fire and human use effects on habitat for waterfowl.	20	15	-	-	-	P
	Task 2.2. Support the development of Annual Habitat Work Plans by hunters to maintain and enhance habitat for game species.	40	-	-	-	-	A
	Task 2.3. Periodically evaluate the hunting program and regulations and recommend changes as warranted to maintain and enhance marsh habitats for waterfowl.	20	-	-	-	-	P
Marsh Goal 3: Prevent the introduction and spread of invasive nonnative species.	**Task 3.1.** Monitor hot spots of introduction to enable early detection and rapid eradication of new invasive species (e.g., sites along West Sherman Island Road, trails, near parking areas at the Sherman Island Public Access Facility, buildings at Cabin Slough).	-	I	-	-	-	A
	Task 3.2. Develop and implement a plan for the removal of nonnative plant species from recreational home sites leased along Cabin Slough (as required by Section 1526.4 of the Fish and Game Code).	40	20	40	-	-	P
	Task 3.3. Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed.	I	I	-	-	-	P
	Task 3.4. Clean vehicles and clothing after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders).	I	I	I	I	I	A
	Task 3.5. Detect and eradicate small populations of invasives.	I	I	I	-	-	A
	Task 3.6. Coordinate with and support regional control efforts (e.g., the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife).	20	-	-	-	-	A
	Task 3.7. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.	I	-	-	-	-	A

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Marsh Goal 4: Control and manage existing infestations of established invasive plant species.	**Task 4.1.** Identify nonnative plant species that have invaded and prioritize management of particular weed species based on potential impacts to ecosystem function, human uses and infrastructure, and feasibility and impacts of control; existing state and federal priorities should be followed where appropriate.	I	I	-	-	-	A
	Task 4.2. Determine appropriate prevention, eradication, and control options for priority weed species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative.	I	I	-	-	-	P
	Task 4.3. Implement appropriate prevention, eradication, and control options for priority weed species.	-	-	I	-	-	A
	Task 4.4. Coordinate with and support regional control efforts (e.g., the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife).	I	-	-	-	-	A
	Task 4.5. Periodically evaluate effectiveness of control methods and adjust methods as needed.	I	I	-	-	-	P
	Task 4.6. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.	I	-	-	-	-	A
Marsh Goal 5: Restore degraded and disturbed areas (e.g., wetlands in northwestern corner of Lower Sherman Island) to conditions that provide desired ecological functions.	**Task 5.1.** Evaluate opportunities, constraints, and potential restoration benefits to identify feasible marsh restoration projects that would support the goals of this LMP, including review of existing documents and/or conduct of additional assessments of physical and biological conditions.	I	-	-	-	-	P
	Task 5.2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.	I	-	-	-	-	P

Table 5-1 Summary of Staffing Required to Implement the Land Management Plan							
Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
	Task 5.3. Cooperate with development and implementation of local and regional restoration plans for marsh and other wetland ecosystems by the CALFED Ecosystem Restoration Program and other programs that are consistent with the goals of this LMP.	I	-	-	-	-	P
Biological Elements - Aquatic Ecosystems							
Goal 1: Maintain and enhance habitat for special-status species.	**Task 1.1.** Monitor use of aquatic ecosystems at LSIWA by special-status aquatic species.	-	I	-	-	-	A
	Task 1.2. Improve habitat for special-status aquatic species using aquatic ecosystems at the LSIWA.	10	10	20	-	-	P
	Task 1.3. Ensure that all actions undertaken at LSI wildlife area comply with the State and Federal Endangered Species Acts, Sections 401 and 404 of the Clean Water Act, Section 1602 of Fish and Game Code, and other applicable regulations aimed at the protection of special-status species or their habitat.	I	-	-	-	-	A
Goal 2: Maintain and enhance habitat for native and nonnative sport fish species.	**Task 2.1.** Monitor and assess human use, invasive nonnative species, and other effects on habitat for sport fish species.	-	I	-	-	-	A
	Task 2.2. Periodically evaluate angling use and regulations and recommend changes as warranted to maintain and enhance aquatic habitat for sport fish species.	10	-	-	-	-	P
Goal 3: Prevent the introduction and spread of invasive nonnative species.	**Task 3.1.** Monitor hot spots of introduction to enable early detection and rapid eradication of invasive species (e.g., the County-operated boat launch).	-	I	-	-	-	A
	Task 3.2. Periodically evaluate effectiveness of monitoring and control methods and adjust methods as needed.	I	I	-	-	-	P
	Task 3.3. Clean boats and vehicles after leaving infested areas and before entering uninfested areas (i.e., inspect and remove visible plant materials and mud, spray/rinse boat, vehicle, equipment, and waders).	I	I	I	I	I	A
	Task 3.4. Coordinate with and support regional control efforts, such as the Department of Boating and Waterways (DBW) Aquatic Pest Control Program.	I	-	-	-	-	A

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2] WHS	BIO	TOL	FGW	ARCH	Frequency[3]
	Task 3.5. Provide education and outreach to support control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.	I	-	-	-	-	A
Goal 4: Control and manage existing infestations of established invasive plant species.	**Task 4.1.** Prioritize management of particular invasive plant species based on potential impacts to ecosystem function, human use and infrastructure, and feasibility and impacts of control; existing state and federal priorities should be followed where appropriate.	I	I	-	-	-	P
	Task 4.2. Determine appropriate prevention, eradication, and control options for high priority invasive plant species; in making this determination, consider guidance available from the Department's Pesticide Use Program and from other organizations, such as the USFWS NIS Program and The Nature Conservancy's Invasive Species Initiative.	I	I	-	-	-	P
	Task 4.3. Implement appropriate prevention, eradication, and control options for high priority invasive species.	-	-	I	-	-	P
	Task 4.4. Coordinate with and support regional control efforts (e.g., on-going efforts by the DBW to control water hyacinth).	I	-	-	-	-	A
	Task 4.5. Periodically evaluate effectiveness of control methods and adjust methods as needed.	I	I	-	-	-	P
	Task 4.6. Provide education and outreach regarding control efforts, and support education and outreach efforts by other programs, such as the USFWS Non-native Invasive Species (NIS) Program.	I	-	-	-	-	A
Goal 5: Restore degraded aquatic ecosystems to conditions that provide desired ecological functions.	**Task 5.1.** Cooperate with development and implementation of local and regional restoration plans for aquatic ecosystems by the CALFED Ecosystem Restoration Program and other programs that are consistent with the goals of this LMP.	I	-	-	-	-	P
	Task 5.2. Identify other opportunities to restore aquatic ecosystems at LSIWA.	I	-	-	-	-	P
	Task 5.3. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.	I	-	-	-	-	P

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Cultural Resources Element							
Cultural Resources Goal 1: Catalog and preserve all significant prehistoric, historic-era, or present-day Native American cultural resources that documentary and/or field investigations identify within the LSIWA.	**Task 1.1.** Conduct cultural resource surveys as necessary prior to ground-disturbing activities, and prepare an “inadvertent discovery plan” to be utilized during implementation of any project involving ground-disturbance. The inadvertent discovery plan shall refer to and outline state law regarding the discovery of human remains and include a requirement to consult with a qualified archaeologist in the case of a discovery of cultural resources or human remains during ground-disturbing activities.	5	-	-	-	20	P
	Task 1.2. If cultural resources are found during surveys or excavation, complete and submit resource documentation to the California Historical Resources Information System. If these resources are potentially eligible for listing on the National Register of Historic Places and/or the California Register of Historical Resources, submit evaluations of these resources to the State Historic Preservation Officer and the Office of Historic Preservation.	5	-	-	-	20	P
	Task 1.3. When facility improvements or restoration efforts are proposed that may affect significant cultural resources, consult the CEQA guidelines and/or Section 106 of the National Historic Preservation Act (if federal involvement) for guidance on compliance with regulations.	10	-	-	-	-	P
	Task 1.4. Support efforts to document the history of human activities at the LSIWA.	I	-	-	-	-	P
Authorized Public Use Element							
Goal 1: Support compatible public uses through public outreach, signage, and regulations.	**Task 1.1.** Inform users regarding the wildlife area’s boundaries and compatible public uses by providing signage at major access points to the LSIWA and on the Department’s web site.	15	-	30	-	-	A
	Task 1.2. Include a contact person’s name, phone number and email at the Department for questions, comments, and suggestions regarding compatible uses of the LSIWA.	I	-	-	-	-	A
	Task 1.3. Periodically conduct reviews of public uses of the LSIWA and evaluate rules, regulations, guidelines and materials to ensure compatibility of public uses.	20	-	-	-	-	P

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Goal 2: Provide long-term opportunities for hunting and increase opportunities for wildlife-dependent recreation.	**Task 2.1.** Coordinate with non-profit groups (e.g., Lower Sherman Island Duck Hunter's Association and California Waterfowl Association) that promote wildlife-dependent recreational or hunting opportunities that can provide additional support to the Department's management of the LSIWA.	30	-	-	-	-	A
	Task 2.2. Identify potential conflicts with other recreational uses and resolve such conflicts.	20	-	-	-	-	A
	Task 2.3. Inform the public of times and locations where hunting is allowed and of all other restrictions and applicable regulations through outreach, signage, and the Department's website.	I	-	-	-	-	A
	Task 2.4. Monitor or supervise hunting activities as needed.	-	-	30	30	-	A
	Task 2.5. Periodically evaluate the hunting program and regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.	I	-	-	-	-	P
Goal 3: Provide long-term opportunities for fishing.	**Task 3.1.** Coordinate with non-profit groups that promote fishing opportunities that can provide additional support to the Department's management of the LSIWA.	I	-	-	-	-	P
	Task 3.2. Identify potential conflicts with other recreational uses and resolve such conflicts.	I	-	-	-	-	A
	Task 3.3. Inform the public of dates and locations where fishing is allowed and of all other restrictions and applicable regulations through outreach, signage, and the Department's website.	I	-	-	-	-	A
	Task 3.4. Monitor or supervise fishing activities as needed.	-	-	I	I	-	A
	Task 3.5. Periodically evaluate the fishing program and regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.	I	-	-	-	-	P

Table 5-1 Summary of Staffing Required to Implement the Land Management Plan							
Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Goal 4: Manage water surfaces and use areas to accommodate a variety of different user groups and minimize competition and conflicts among users.	**Task 4.1.** Encourage boater safety through monitoring and enforcement of regulations, including the 5 mph speed limit and proper disposal of wastes.	-	-	-	I	-	A
	Task 4.2. Periodically evaluate management of water surfaces and associated regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.	I	-	-	-	-	P
	Task 4.3. Post signs with boating regulations at major access points.	-	-	I	-	-	A
Goal 5: Support use of the LSIWA for environmental education.	**Task 5.1.** Provide staff assistance, interpretive materials, and provision of permits for environmental education activities.	30	-	-	-	-	A
	Task 5.2. Encourage all environmental education and natural resource interpretation (informal education) users to incorporate the Department's guidelines for natural resource education messages in their field environmental education activities, curriculums, and interpretive programs, both on and off-site.	I	-	-	-	-	A
Goal 6: Evaluate requests by Native Americans for use of the wildlife area for activities such as gathering native plant materials for cultural purposes.	**Task 6.1.** Work with native peoples requesting access to determine the purpose and need for access and/or collections within the LSIWA based on applicable laws and treaties related to tribal use of state properties.	8	-	-	-	-	P
	Task 6.2. Develop access plans and issue permits for native peoples that are compatible with the goals of the LMP. Any authorization for access would identify species, limits, locations, seasons, and include standard liability clauses.	8	-	-	-	-	P
Goal 7: Make the public aware of potential risks in order to encourage safe use of LSIWA.	**Task 7.1.** Identify areas where warning signs or marker buoys are needed.	5	-	-	-	-	P

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
	Task 7.2. Subject to funding, install warning signs or marker buoys at identified locations.	I	-	I	-	-	P
Unauthorized Public Use Element							
Goal 1: Discourage dumping of trash or waste within the LSIWA.	**Task 1.1.** Remove existing rubbish and unwanted materials.	30	-	80	-	-	A
	Task 1.2. Establish a regular monitoring and removal program.	20	-	10	-	-	P
	Task 1.3. Ensure that removed materials are taken to an appropriate and approved disposal site.	I	-	I	-	-	A
	Task 1.4. Use signage to discourage dumping (e.g., post signs regulations regarding and penalties for dumping at locations of repeated dumping).	-	-	8	-	-	A
Goal 2: Prevent unauthorized use of the wildlife area.	**Task 2.1.** Patrol the wildlife area and enforce regulations that prohibit unauthorized uses.	-	-	-	I	-	A
	Task 2.2. Use signage and written notifications to foster cooperation.	I	-	-	-	-	A
	Task 2.3. Issue citations and/or pursue legal action when voluntary cooperation cannot be obtained.	-	-	-	I	-	A
	Task 2.4. Enforce laws and request assistance from the County Sheriff as necessary to enforce laws.	-	-	-	I	-	A
	Task 2.5. Identify locations where illegal uses of state lands are occurring or have occurred.	20	-	-	-	-	A
	Task 2.6. Provide written notification to violators illegally using the LSIWA and establish a process and timeline for the removal of unauthorized buildings, blinds, fencing, docks, landscaping, or other forms of unauthorized appropriation of state property.	40	-	-	-	-	P
	Task 2.7. Seek remediation from unauthorized users for unauthorized appropriation of state property.	30	-	-	-	-	P
	Task 2.8. Restore ecosystems damaged by unauthorized uses as necessary.	I	-	-	-	-	P

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Facilities Element							
Goal 1: Ensure implementation of all provisions of cabin leases.	**Task 1.1.** Enforce all provisions of cabin leases including removal of non-native plants, and maintenance and removal of structures.	200	-	-	50	-	A
Goal 2: Remove remnants of recent human activity (e.g., abandoned structures), provided that such remnants have no historical or management value.	**Task 2.1.** Inventory remains of recent human activity.	10	-	10	-	-	P
	Task 2.2. Assess the value of existing structures as habitat.	4	10	-	-	-	P
	Task 2.3. Identify structures that may have management or historic value.	4	-	-	-	-	P
	Task 2.4. Remove all improvements with no management or historic value.	-	-	20	-	-	P
Goal 3: Add, improve, and maintain signage that identifies accessible boundaries of the LSIWA, informs the public of laws and regulations applicable to the wildlife area, and provides interpretive and safety information.	**Task 3.1.** Install a Kiosk or bulletin board with wildlife area maps and Title 14 regulations, interpretive material, and safety information.	8	-	32	-	-	P
	Task 3.2. Start monitoring and maintenance schedule for all signage.	-	-	I	-	-	P
	Task 3.3. Inventory existing boundary signage, and install new signs where necessary.	-	-	8	-	-	P
Goal 4: Effectively manage existing structures for resource protection, safety, and prevention of unauthorized uses.	**Task 4.1.** Regularly monitor the condition and use of existing structures.	10	-	-	-	-	P
	Task 4.2. Take actions as needed to keep desired structures in good repair.	10	-	16	-	-	P

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Administration Element							
Goal 1: Maintain current data on the management and resources of the reserve.	**Task 1.1.** Regularly update GIS data sources as information becomes available.	8	20	-	-	-	A
	Task 1.2. Maintain accurate financial records regarding expenditures, staff, maintenance, and other administrative duties.	70	-	-	-	-	A
	Task 1.3. Administer renewal, modification, enforcement, and termination of cabin leases as necessary.	40	-	-	-	-	A
	Task 1.4. Work with hunters to develop Annual Habitat Work Plans.	I	-	-	-	-	A
	Task 1.5. Document facilities needs in Department maintenance and capital outlay database.	10	-	-	-	-	A
	Task 1.6. Conduct annual monitoring and reporting of the wildlife area (e.g., condition of signs, structures, etc.)	I	-	I	-	-	A
Fire Management Element							
Goal 1: Develop and implement wildfire plan for LSIWA.	**Task 1.1.** Meet at least annually with representatives of the California Department of Forestry and Fire Protection, and local fire districts, to discuss fire-related issues relevant to LSIWA, including vegetation management, recent fires on the LSIWA, current contact information and procedures.	20	-	-	-	-	A
	Task 1.2. Coordinate with the California Department of Forestry and Fire Prevention, and local fire districts, to develop a wildland fire response plan for LSIWA.	I	-	-	-	-	P
	Task 1.3. Design and implement vegetation management activities in fire breaks at Cabin Slough and the Sherman Island Public Access Facility as necessary	20	-	30	-	-	P
	Task 1.4. Review cabin leases to determine consistency with fire management tasks, and revise as necessary.	I	-	-	-	-	P
	Task 1.5. Train a DFG biologist to serve the role of Resource Specialist or Agency Representative through the Incident Command System (ICS).	10	10	-	-	-	P

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
	Task 1.6. As part of Incident Command System (ICS), make available a local plant, wildlife and fisheries specialist from the Department's staff to provide advice during fires that threaten wildlife habitat at LSIWA.	I	I	-	-	-	P
	Task 1.7. Following fire or fire suppression, implement emergency revegetation, mechanical, and structural measures within those previously defined critical areas that were affected.	20	8	40	-	-	P
Scientific Research and Monitoring Element							
Goal 1: Support appropriate scientific research and encourage or conduct research that contributes to management goals of the LSIWA.	**Task 1.1.** Review and evaluate proposed research projects utilizing the following criteria. A. Potential for research results to improve management of the LSIWA or other wildlife areas; B. Potential conflicts between the research and compatible public uses; C. Potential conflicts between the research and any biological goals stated in this plan; D. Potential contribution of the research to science and society; and E. Potential for the research to interfere with or preclude certain types of future research at the LSIWA.	20	-	-	-	-	P
	Task 1.2. Provide letters or permits to researchers specifying dates and times of authorized access, and information on regulations and area restrictions.	I	-	-	-	-	P
	Task 1.3. Require that researchers provide copies of data and/or published papers, and contact researchers to ensure this requirement is fulfilled.	I	-	-	-	-	P
	Task 1.4. Encourage long-term studies of bank erosion, water quality, special-status species populations, and other topics that could potentially inform management of the wildlife area.	I	-	-	-	-	P
	Task 1.5. Conduct high priority surveys, including surveys for salt-marsh harvest mouse, Suisun song sparrow, and California black rail.	I	-	-	-	-	P

Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

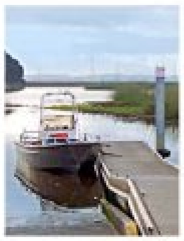
Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Management Review and Coordination Element							
Goal 1: Ensure regulations and management practices at LSIWA support attainment of LMP goals.	**Task 1.1.** Review, and as necessary revise, regulations and management practices at the LSIWA to be consistent with and to support attainment of the goals of this LMP.	40	20	-	20	4	P
Goal 2: Coordinate with federal, state and local agencies regarding plans and projects that may affect habitats at LSIWA	**Task 2.1.** Review, coordinate, and provide comments and recommendations on federal, state, local government plans, special plans, and proposed projects as appropriate for the purpose of determining the consistency of such plans with the goals of the Department's management plans.	30	-	-	-	-	P
	Task 2.2. Collaborate with the Department of Boating and Waterways (DBW) regarding nonnative invasive plants at the LSIWA and Delta recreational planning.	I	-	-	-	-	P
	Task 2.3. Collaborate with the Delta Protection Commission regarding Delta recreational planning.	I	-	-	-	-	P
	Task 2.4. Coordinate with the Sacramento County Health Department and the State Water Resources Control Board to ensure cabins continue to comply with septic system and water quality regulations	I	-	-	-	-	P
	Task 2.5. Coordinate with the California Department of Food and Agriculture's program to survey, control, and monitor purple loosestrife.	I	-	-	-	-	P
	Task 2.6. Collaborate with or submit proposals for CALFED-funded projects that could contribute both to the attainment of this LMP's goals and to attainment of CALFED goals, objectives, targets, and milestones.	I	-	-	-	-	P
	Task 2.7. Support the implementation of research, monitoring, and restoration actions compatible with the goals of this LMP by CALFED implementing agencies.	I	-	-	-	-	P

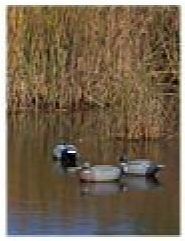
Table 5-1
Summary of Staffing Required to Implement the Land Management Plan

Goals	Tasks	Annual Staff Hours[1, 2]					Frequency[3]
		WHS	BIO	TOL	FGW	ARCH	
Goal 3: Coordinate with other law enforcement agencies.	**Task 3.1.** Meet regularly with law enforcement staff from County Sheriff Departments and other agencies as appropriate to coordinate law enforcement activities and explore options for cooperative programs.	-	-	-	I	-	A
	Task 3.2. Pursue joint funding requests with other law enforcement entities to address law enforcement concerns	-	-	-	I	-	P
Goal 4: Coordinate with local public service agencies including the Sacramento-Yolo Mosquito and Vector Control District.	**Task 4.1.** In consultation with the Sacramento-Yolo Mosquito and Vector Control District, develop and implement a mosquito control plan that applies best management practices and any other necessary management practices.	10	-	10	-	-	A
	Task 4.2. Communicate regularly with local mosquito and vector control agencies, and coordinate reasonable mosquito and vector control activities consistent with the mosquito control plan and the goals of this LMP.	I	-	-	-	-	A
Goal 5: Maintain relationships with neighbors and tenants to address management issues.	**Task 5.1.** Meet or correspond with adjacent landowners and tenants as needed to maintain communication about the management needs of the LSIWA, access needs of adjacent landowners, and convey useful information regarding activities.	30	-	-	-	-	A
	Task 5.2. Collaborate with Sacramento County Parks regarding management of the Sherman Island Public Access Facility and maintenance of the riprap along West Sherman Island Road, and provision of additional facilities, electricity, and potable water at Sherman Island Public Access Facility.	I	-	-	-	-	A
	Task 5.3. Collaborate with the Department of Water Resources regarding management of the Donlon Island area, and regarding its possible inclusion in the LSIWA.	I	-	-	-	-	P
	TOTALS	1545	293	472	300	44	

Notes:
[1] – BIO = Wildlife Biologist - Responsible for plant/wildlife surveys and similar tasks requiring technical knowledge of plant and wildlife biology, survey methods and ability to identify plants and wildlife in the field; TOL = Tractor Operator Laborer - responsible for operation and maintenance of equipment, weed control, facilities maintenance, etc.; FGW = Fish and Game Warden – responsible for law enforcement; WHS = Wildlife Habitat Supervisor - responsible for overall site management and administration, planning of wildlife habitat management activities, and management coordination; ARCH = Archaeologist
[2] – I = Hours have been included in those for another closely related task.
[3] – A = Annually, P = periodically

6 Future Revisions to this Plan





Final Land Management Plan

6 FUTURE REVISIONS TO THIS PLAN

All planning documents eventually become dated and require revision so they can continue to provide practical direction for operational activities. A common and unfortunate situation is that the revision of planning documents is often neglected because the process for revision is considered too involved and too cumbersome. To address this problem, this section incorporates a hierarchy of revision procedures in which the level of process and required involvement is proportionate to the level of change that is proposed. This LMP reflects the best information available during the planning process, but it is understood that new information will become available over time and there will be the need to make adjustments to keep this LMP current. Such new information may include any of the following:

- Feedback generated by adaptive management of the LSIWA.
- Other scientific research that directs improved techniques of habitat management.
- Documented threats to the habitats and/or fish and wildlife species.
- Management of related facilities in the Sacramento-San Joaquin Delta.
- New legislative or policy direction.

When the new information dictates a change to this LMP, it is important that there is an appropriate process established. Public outreach and public input will be necessary in proportion to the proposed change to the policy established by this LMP. Unless a reasonable and clear revision process exists, this LMP, like plans in many organizations will become outdated and irrelevant.

6.1 MINOR REVISIONS

A process is required to accommodate minor revisions to this plan that may include the addition of new property to the LSIWA or the adoption of limited changes to the goals and tasks that are directed through adaptive management, by other scientific information or by legislative direction. This procedure will be applicable to revisions which meet the following criteria:

- No change is proposed to the overall purposes of this LMP.

- CEQA documentation (if required) is prepared and approved.

- Appropriate consultation within the Department occurs.

- Appropriate consultation with other agencies occurs.

- Adjoining neighbors are consulted regarding the revision, if the revision is related to a specific location or the acquisition of additional area.

The minor revision may be prepared by the staff assigned to LSIWA or with other Department resources and requires approval by the Regional Manager.

6.2 MAJOR REVISIONS

Major revisions or a new LMP could occur if new policy direction requires a procedure comparable to the LMP planning process. The procedure for major revisions will meet the following criteria:

- Substantial revision is proposed to this LMP or the adoption of a complete new plan is proposed.
- Appropriate CEQA documentation is prepared and approved.
- Appropriate consultation within the Department occurs.

- Appropriate coordination and consultation with other agencies occurs.
- A public outreach program is conducted proportionate to the level of the proposed revision.

The major revision or new plan may be prepared utilizing available Department resources. The major revision or new plan requires recommendation by the Regional Manager and approval by the Director of the Department.

If the appropriate procedure for a particular, proposed revision is not apparent, the determination of which of these procedures to use shall be made by the regional manager in consultation with the Department's Lands and Facilities Branch.

6.3 FIVE YEAR PLAN STATUS REPORTS

Periodic evaluation is important to help ensure that the Purposes and Goals of the Plan are being met. Chapter 4 Management Goals contains many specific tasks that include monitoring of the LSIWA and evaluation the adequacy of the management of the area. Cumulatively, these efforts will provide feedback regarding the success of the overall management effort.

Periodic and detailed analysis of this feedback data will, however, be necessary to assess the status of this LMP.

A comprehensive review of the achievement of the goals of the LMP should be prepared every five years following the date of adoption of this LMP. A status report documenting this review should include the following elements:

- Evaluation of the achievement of the purposes and goals of this LMP.

- Evaluation of the completion or annual completion, as appropriate, of each task contained in this LMP.

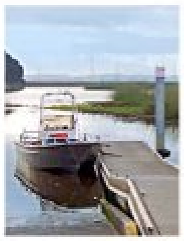
- Evaluation of the effectiveness of the Department's coordination efforts with CALFED, local governments, and other property management and regulatory agencies involved in the Delta.

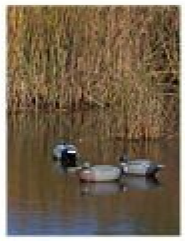
- Notation of important, new scientific information that has bearing on the management of the LSIWA.

- Recommendations for revisions to this LMP to incorporate new information and improve its effectiveness.

The status report should be prepared by the Area Manager. It should be submitted to the Department's Lands and Facilities Branch for review and comment, approved by the Regional Manager and submitted to the Director of the Department. This report should serve as a basis for revision of this LMP and appropriate adjustments to ongoing management practices.

7 Document Preparers





Final Land Management Plan

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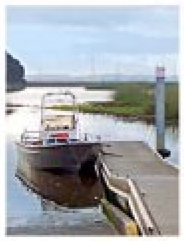
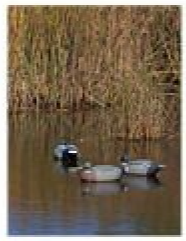
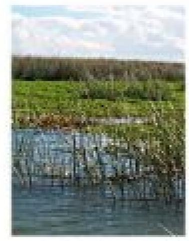
8 LITERATURE CITED







FINAL LAND MANAGEMENT PLAN

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APPENDIX A

Public Outreach Summary

APPENDIX A
PUBLIC OUTREACH SUMMARY

In the course of the production of the Lower Sherman Island Wildlife Area (LSIWA) Land Management Plan (LMP) and accompanying Initial Study/Negative Declaration (IS/ND), several public outreach efforts were conducted. These efforts started with interviews of known or suspected user groups and knowledgeable individuals. A summary follows, including interview questions, persons interviewed, and stakeholder input.

When the Draft version of the LMP and IS/ND was complete, a Notice of Intent (NOI) to adopt a proposed ND was prepared and distributed. The NOI (attached) described the LSIWA LMP and IS/ND, provided the dates of the 30-day public comment period for these documents, outlined where hard copies of the documents were available for public review, provided the website address where electronic copies of the documents were available for public review, and provided information regarding a public meeting being held to collect and address public comments on the LMP and IS/ND. The NOI was posted with Sacramento County and the State Clearinghouse, published in the Sacramento Bee on October 11, 2006 and October 21, 2006, and sent to various agencies and other interested parties. Hard copies of the documents were made available for review at the Department of Fish and Game offices in Stockton and Rancho Cordova, the Yolo Bypass Wildlife Area Headquarters, and the Isleton Neighborhood Library. These posting methods and locations were chosen in an effort to reach the greatest number of interested parties, including other agency personnel.

A public meeting was held in a Caltrans District 10 meeting room in Stockton on the evening of November 1, 2006. This venue and time were also chosen to accommodate the greatest number of interested parties, including other agency personnel throughout the Central Valley. At this meeting, the LMP and IS/ND were summarized, public comments were accepted and addressed verbally, and forms were provided to members of the public to submit additional written comments. A summary of verbal comments received at this meeting and written comments received following this meeting are included below.

After this public meeting was held in Stockton, an additional public meeting was held on December 13, 2006 in Contra Costa County at the request of Sportsmen, Inc. Yacht Club. This supplemental public meeting was held to provide broader public outreach and to collect more public comment from user groups and knowledgeable individuals that access the LSIWA from the south, primarily by boat. Much of the discussion at this meeting echoed the points raised at the meeting held in Stockton. Written comments received during and after this meeting are included below. Public comments were accepted after the end of the official public comment period, which closed on November 9, 2006, to provide sufficient opportunity for these users to comment on the proposed plan and IS/ND.

Following receipt of all public comments, some changes to the LSIWA LMP were made and responses to public comments were prepared. A description of changes and responses follows.

GENERAL RESPONSES

Two topics accounted for the majority of comments received on the *Lower Sherman Island Wildlife Area Land Management Plan Public Draft* (Draft LMP) (EDAW 2006). These topics were: 1) potential adverse effects of the restoration concepts described and assessed in *Restoration Concepts to Enhance Habitat on Lower Sherman Island* (Philip Williams and Associates, Ltd., San Francisco, CA), which was attached to the LMP as Appendix J, and 2) potential effects of the LMP on hunting regulations at the LSIWA. These two areas of concern, and the revisions made to the draft LMP in response to these concerns, are described in the two general responses below.

GENERAL RESPONSE 1–ASSESSMENT OF RESTORATION CONCEPTS

A report entitled *Restoration Concepts to Enhance Habitat on Lower Sherman Island* (PWA 2006) was attached to the Draft LMP as Appendix J. This report summarized an evaluation of a wide range of potential restoration actions that could enhance or restore one or more habitats at the LSIWA. For each restoration concept, the report provided a preliminary assessment of construction feasibility and potential beneficial and adverse effects. These preliminary assessments were conducted to provide information for the development of management goals and tasks related to future restoration.

This report was included with the Draft LMP to provide relevant background information, and was not a description of proposed management. With the exceptions of invasive plant control and enhancing grassland, upper marsh, and riparian habitats, the specific restoration concepts described in this report were not incorporated into the Draft LMP. In part, this was because the report’s preliminary assessment indicated that these restoration actions could potentially cause adverse effects on biological resources, hydrology/water quality, and recreation, which would not be compatible with one or more LMP goals.

However, many commenters thought these restoration actions were being proposed as part of the LMP. Multiple comments stated that these restoration concepts could cause substantial adverse effects on habitats, water quality, and recreational use of the LSIWA.

In response to these comments, and to avoid confusion or implication that the LMP proposes to implement the restoration concepts that were described in Appendix J (but not in the text of the LMP itself), Appendix J has been removed from the final LMP.

GENERAL RESPONSE 2–POTENTIAL CHANGES TO HUNTING PROGRAM AND REGULATIONS

In Chapter 3 of the Draft LMP (Environmental Setting), the current hunting regulations at the LSIWA were described, and potentially applicable hunting regulations from other public waterfowl hunting areas in the Delta region were summarized. Although many site-specific differences exist among hunting areas, these regulations were considered potentially applicable to the LSIWA, because they are being used elsewhere in the region for management of comparable public uses of resources. The summary of these potentially applicable regulations was included in the Draft LMP to provide context for the current regulations described in the LMP, and to indicate the variety of regulations that could be implemented, if necessary, to attain the goals of the LMP.

In general, commenters did not consider the types of potentially applicable regulations described in Chapter 3 to be necessary at the LSIWA. They noted the potential adverse effects that these regulations could have on use of the wildlife area for hunting, and potential adverse effects on habitat. Of particular concern were potential restrictions on hunting times or locations (e.g., closed areas) and future coordination between the Department and local hunting organizations. Several commenters also pointed out the involvement of hunters in enhancing, creating, and maintaining habitat at the wildlife area, and the contributions that hunters make to management of the wildlife area.

In the LMP, the Department does not propose to implement specific changes to hunting regulations at the LSIWA. It does, however, include a task for the Department to periodically evaluate the hunting program and regulations to identify changes that are warranted to maintain consistency with the goals of this LMP (Authorized Pubic Use Goal 2, Task 5). The hunting program and regulations strongly affect attainment of the LMP's goal to provide long-term opportunities for hunting and increase opportunities for wildlife-dependent recreation (Authorized Public Use Goal 2), which is based on the Department's purpose in acquiring the LSIWA—to establish a publicly accessible hunting and fishing area. The hunting program and regulations also can affect the attainment of a number of other LMP goals related to biological and public use elements. Therefore, the periodic review of the hunting program and regulations is an important aspect of managing the LSIWA.

Coordination of the management of the LSIWA with non-profit groups that promote wildlife-dependent recreation is included in the LMP. The Department has coordinated its management of the LSIWA with non-profit groups that promote wildlife-dependent recreation (including the Lower Sherman Island Duck Hunter's Association), and has included a task to continue that coordination (Authorized Public Use Goal 2, Task 1).

In response to these comments, two changes have been made to hunting-related text of the Draft LMP. In the section Potentially Applicable Hunting Regulations (Page 3.6-6 of the Draft LMP), the second sentence has been revised to clarify that the potentially applicable regulations described in this section may or may not support attainment of the LMP's goals. The sentence now reads:

Some of these regulations could be applied to the LSIWA, and might better support attainment of this LMP's goals than do current regulations.

Also, two tasks for Unauthorized Use Goal 2 (*Prevent unauthorized use of the wildlife area*) have been revised to clarify that the tasks refer only to unauthorized blinds, docks, etc. and not to authorized structures. The tasks now read:

6. Provide written notification to violators illegally using the LSIWA and establish a process and timeline for removal of unauthorized buildings, blinds, fencing, docks, landscaping, or other forms of unauthorized appropriation of state property.

7. Seek remediation from unauthorized users for unauthorized appropriation of state property.

SPECIFIC RESPONSES

A number of comments on the public draft of the LMP were received in addition to comments on the two topics previously addressed in general responses. These comments are addressed individually in this section.

STATE OF CALIFORNIA
Governor's Office of Planning and Research
State Clearinghouse and Planning Unit

Arnold Schwarzenegger
Governor

Letter A

Sean Walsh
Director

November 13, 2006

Sara Holm
Department of Fish and Game, Region 2
1701 Nimbus Road
Rancho Cordova, CA 95670

Subject: Lower Sherman Island Land Management Plan
SCH#: 2006102054

Dear Sara Holm:

The State Clearinghouse submitted the above named Negative Declaration to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on November 9, 2006, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Terry Roberts

Terry Roberts
Director, State Clearinghouse

Enclosures
cc: Resources Agency

Document Details Report
State Clearinghouse Data Base

SCH# **2006102054**
Project Title Lower Sherman Island Land Management Plan
Lead Agency Fish & Game #2

Type **Neg** Negative Declaration

Description The Land Management Plan (LMP) will guide the Department's management, planning, and operations of the LSIWA. The LSIWA is an extensive tract consisting of natural vegetation and open water that provides diverse and valuable wildlife habitats and related recreational opportunities. LSIWA is an important part of Sacramento-San Joaquin River Delta due to its natural functions and values as well as the opportunities it provides for human use.

Lead Agency Contact

Name Sara Holm
Agency Department of Fish and Game, Region 2
Phone (530) 745-0486 ***Fax***
email
Address 1701 Nimbus Road
City Rancho Cordova ***State*** CA ***Zip*** 95670

Project Location

County Sacramento
City Antioch
Region
Cross Streets W. Sherman Island Road and River Road (Hwy. 160)
Parcel No.
Township 2N, 3N ***Range*** 1E, 2E ***Section*** ***Base***

Proximity to:

Highways Hwy. 4 and 160
Airports
Railways AT, SP, SF RR
Waterways Sacramento River, San Joaquin River
Schools Several Antioch schools
Land Use Agricultural (AG-80)

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Biological Resources; Cumulative Effects; Flood Plain/Flooding; Forest Land/Fire Hazard; Geologic/Seismic; Growth Inducing; Landuse; Minerals; Noise; Public Services; Recreation/Parks; Septic System; Sewer Capacity; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian

---

Reviewing Agencies Resources Agency; Department of Parks and Recreation; Native American Heritage Commission; Regional Water Quality Control Board, Region 3; Department of Water Resources

---

Date Received 10/11/2006 ***Start of Review*** 10/11/2006 ***End of Review*** 11/09/2006

Note: Blanks in data fields result from insufficient information provided by lead agency.

STATE OF CALIFORNIA -- THE RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 942360001
(916) 653-5791

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RECEIVED
OCT 26 2006
STATE CLEARING HOUSE

October 23, 2006

Sara Holm
California Department of Fish and Game
1701 Nimbus Road
Rancho Cordova, California 95670

Lower Sherman Island Land Management Plan
State Clearinghouse (SCH) Number: 2006102054

The project corresponding to the subject SCH identification number has come to our attention. The limited project description suggests your project may be an encroachment on the State Adopted Plan of Flood Control. You may refer to the California Code of Regulations, Title 23 and Designated Floodway maps at http://recbd.ca.gov/. Please be advised that your county office also has copies of the Board's designated floodways for your review. If indeed your project encroaches on an adopted food control plan, you will need to obtain an encroachment permit from the Reclamation Board prior to initiating any activities. The attached Fact Sheet explains the permitting process. Please note that the permitting process may take as much as 45 to 60 days to process. Also note that a condition of the permit requires the securing all of the appropriate additional permits before initiating work. This information is provided so that you may plan accordingly.

If after careful evaluation, it is your assessment that your project is not within the authority of the Reclamation Board, you may disregard this notice. For further information, please contact Sam Brandon of my staff at (916) 574-0651.

Sincerely,

Mike Mirmazaheri, Chief
Floodway Protection Section

cc: Governor's Office of Planning and Research
State Clearinghouse
1400 Tenth Street, Room 121
Sacramento, CA 95814

COMMENT LETTER A

Comment A-1: The project involves the adoption of a management plan that, of itself, would cause no encroachment on an adopted flood control plan. The implementation of management actions described in the LMP would be conducted in conformance with regulatory requirements, including the requirement for an encroachment permit for any activities that encroach on an adopted flood control plan. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on *CEQA Guidelines* Sections 15162–15164.

CALIFORNIA
OUTDOOR
HERITAGE
ALLIANCE

"...promoting conservation and protecting our hunting and shooting heritage."

1600 Sacramento Inn Way · Suite 232 · S
916.643.4607 phone · 916.643.4682 fax · ww

Letter B

November 9, 2006

Ms. Sara Holm
California Department of Fish and Game
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670

RE: Sherman Island Wildlife Area Land Management Plan

Dear Ms. Holm:

On behalf of the California Waterfowl Association (CWA), the California Outdoor Heritage Alliance would like to take this opportunity to provide the following comments on the Department's Sherman Island Wildlife Area (SIWA) Land Management Plan. Our comments focus primarily on the potential impacts to waterfowl hunting

First, it should be noted that the SIWA is unique in terms of its history, habitat and degree of public access; thus, hunting regulations that are currently applied to Department's other wildlife areas are not necessarily appropriate for this area. Unlike other wildlife areas, the SIWA is primarily a navigable waterway, and is thus Constitutionally burdened with public trust obligations that permit hunting and other boat-related recreation. The area was also originally acquired by the Department specifically as a public shooting area for waterfowl and other game birds. Waterfowl hunting is furthermore a historical use which well precedes acquisition of the area by the Department.

Since the SIWA is only accessible by boat and densely vegetated in most areas, public access is very limited. Conflict between waterfowl hunters and other users is furthermore rare because hunting season is limited to the fall and winter months when most other types of recreational uses are minimal. Habitat restoration opportunities are similarly restricted because most of the area is subject to tidal flow, making habitat management more difficult and expensive than other wildlife areas. However, it should be noted that hunters have traditionally provided important management assistance to the area by creating loafing areas for waterfowl and certain public access improvements. CWA therefore believes that the Department should continue to rely on the assistance of waterfowl hunters in order to keep management costs to a minimum.

CWA also believes that the Department's current working agreement with the Lower Sherman Island Duck Hunters Association is functioning well, and has helped address problems such as delinquent blinds and hunters monopolizing certain areas.

Recognizing these factors, CWA believes that additional hunting restrictions are fully unnecessary at this time, including many of those proposed in the Management Plan's

"Potentially Applicable Hunting Regulations" section on page 3.6-6. Specifically, we submit the following:

1. Wildlife Area Type – SIWA should remain a Type C area. It is one of very few quality waterfowl hunting areas in the Central Valley that is open 7 days per week, which is important for many hunters who cannot hunt weekends for work or family reasons. Hunting success is also dependent largely on weather, which requires the flexibility of being able to access the area throughout the week.
2. Closed Areas – Recognizing the significant amount of sanctuary area on both public and private wetlands throughout the Central Valley, CWA believes that additional closed zones on SIWA are not necessary from a biological perspective. Because access is limited to boats only and hunting takes place during the fall and winter months, closed zones are also not necessary for public safety purposes.
3. Authorized Hunting Techniques – No additional restrictions on hunting techniques are necessary at this time. CWA believes the working agreement between the Department and the lower Sherman Island Duck Hunters Association is functioning well and should continue to be honored by the Department.
4. Design Standards for Blinds – CWA recognizes the need for design standards for blinds to ensure an adequate level of public safety. However, we believe the details need to be worked out cooperatively between the Department and the hunters who maintain the blinds.
5. Blind Permits/Lottery – Because crowding is not a significant problem, a lottery should not be implemented to determine who can hunt the SIWA. A lottery may also wrongly exclude some hunters who have created and annually maintained the blinds on the area. However, the Department may want to consider requiring a general hunting pass for the SIWA and charging a small fee to support habitat improvements on the area (similar to the pass/fee that is required for hunting Type B areas but without any hunt day restrictions).
6. Special Use Permits – Any special use permits should be coordinated through the Lower Sherman Island Duck Hunters Association.

Thank you for the opportunity to provide input. Should you have any questions or need further clarification regarding CWA's comments, please feel free to contact me at 916-643-4607.

Sincerely,

Mark Hennelly

Mark Hennelly, Vice President
California Outdoor Heritage Alliance

COMMENT LETTER B

Comment B1: Comment noted.

Comment B2: Please see General Response 2.

Comment B3: Comment noted.

Comment B4: Please see General Response 2.

Comment B5: Please see General Response 2.

Comment B6: Please see General Response 2.

Comment B7: Comment noted.

Letter C

Lower Sherman Island Duck Hunters Association

c/o 4720 Oak Forest Avenue
Oakley, CA 94561

November 6, 2006

Department of Fish & Game
Sacramento Valley-Central Sierra Region
Attn: Sara Holm
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670

Re: Lower Sherman Island Wildlife Management Plan

Dear Ms. Holm:

The Lower Sherman Island Duck Hunters Association submit the following comments to Land Management Plan and IS/ND.

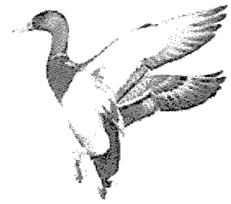
Restoration of the LSIWA in accordance with CALFED projects is objectionable. Placing barriers around the lake would restrict public access, eliminate tidal flows and destroy an important tidal nursery for Delta Smelt, Chinook Salmon and Striped Bass. Recent studies have shown wetland restoration projects such as this to be a major cause of methyl mercury which is harmful to the environment, the aquatic food chain, animals and humans. Such an undertaking should require a comprehensive Environmental Impact Report.

Our Association looks forward to working cooperatively with DFG to provide long-term opportunities for hunting as well as fishing. We are opposed to any regulation changes which would restrict hunting to Saturday, Sunday and Wednesday. DFG obtained LSIWA specifically to be a "public shooting ground". Restricting shooting days would eliminate the opportunity to hunt for individuals who do not have weekends or Wednesdays off or are financially unable to join a private duck hunting club. Arbitrarily restricting hunting opportunities could reduce hunting license sales which help support DFG operations.

We are concerned about Unauthorized Public Use Element, Goal 2, Tasks 2.6 & 2.7. Many blinds and structures related to hunting have been in use and maintained for decades. DFG and our Association have worked cooperatively under the Annual Habitat Work Plan and Interim Rules. What criteria will be used to identify violators, timeline for removal of blinds, docks, etc.? Through sweat equity our members have created hunting opportunities and understand that the remaining blinds are open to the public on a first come basis. Our work keeps areas open for fish, wildlife and waterfowl that would otherwise be overgrown with Blackberry, Water Hyacinth, Pennywort, Egeria and Milfoil.

Lower Sherman Island Duck Hunters Association

c/o 4720 Oak Forest Avenue
Oakley, CA 94561



The September/October 1972 issue of Outdoor California published by DFG stated, "The Department of Fish and Game believes the best management of Lower Sherman Island is to keep it in an undeveloped condition." Our Association believes this to be true today. Access to LSIWA is by boat only, restricting accessibility and constraining recreational use. Large expenditure of funds for personnel and equipment outlined in the LMP appear questionable at best. The Mission Statement of our Association, which appears to the largest user group of LSIWA is as follows:

Dedicated to conserving Lower Sherman Island's waterfowl, wetlands and hunting heritage. Through stewardship of the wetlands, ensure areas remain open for waterfowl and other wildlife. Retain Lower Sherman Island in its present undeveloped state as a wildlife area for public hunting and fishing.

We look forward to working with DFG to create hunting and fishing opportunities at the LSIWA.

Lower Sherman Island Wildlife Area Land Management Plan

Draft Land Management Plan and Initial Study/Proposed Negative Declaration PUBLIC COMMENTS

(*please hand in or mail back by November 9, 2006*)

Name: ROGER S. MAMMON

Organization (if any): LOWER SHERMAN ISLAND DUCK HUNTERS ASSOC.

Address (optional): 4720 OAK FOREST AVENUE

City, State, Zip: OAKLEY, CA 94561

The California Department of Fish and Game (DFG) is preparing a Land Management Plan and an Initial Study/Negative Declaration (IS/ND) for the Lower Sherman Island Wildlife Area. DFG invites you to provide specific comments on the Land Management Plan Goals and Tasks, and the environmental impact analysis provided in the IS/ND.

If there is information which you believe should be incorporated into the Land Management Plan, or if you have any comments on the analysis described in the IS/ND, please provide your specific comments below. Thank you!

Comments PLEASE SEE THE ATTACHED LETTER FOR COMMENTS ON THE DRAFT MANAGEMENT PLAN & INITIAL STUDY / PROPOSED NEGATIVE DECLARATION. THE COMMENTS ARE BEING SUBMITTED BY THE BOARD OF THE L.S.I.D.H.A. AND ITS 104 MEMBERS.

Roger S. Mammon
President

COMMENT LETTER C

Comment C1: Please see General Response 1.

Comment C2: Please see General Response 2.

Comment C3: Please see General Response 2.

Comment C4: Please see General Response 1.

Comment C5: The labor and equipment needs provided in the LMP (i.e., Table 5-1) are the Department’s best estimates of the labor and equipment that would be required to perform all of the tasks in the LMP associated with its goals. It is unclear if the comment is referring to the accuracy of these estimates (i.e., that they are substantial overestimates) or to the number of tasks included in the LMP and thus in the personnel and equipment estimates. Therefore, further, more specific response to the comment can not be made.

Comment C6: Comment noted.

Letter D

January 10, 2007
Antioch,CA

Sara Holm,

The members of Sportsmen, Inc. Yacht Club want to thank you for attending and participating in our meeting to discuss and receive public comment on the Lower Sherman Island Land Management Plan.

A geographic/political oddity caused by Lower Sherman Island being in Sacramento county, but primarily used by Contra Costa residents, boaters, fishermen and hunters created the 'oversight' of not publicly notifying the actual users of Lower Sherman of the public hearing to develop a land management plan. The closest public access to a copy of the plan was over 21 miles away across a toll bridge and along a very dangerous levee road with NO access by public transportation.

This meeting was attended by 113 stake holders, the Oakley Chamber of Commerce President and Senator Torlakson's office. Stake holders included cabin holders, duck hunters, fisherman and boaters. These folks represented many organizations and attended on very short notice on a workday night and with no public notice. The 'around-the-room' introductions showed the varied interests and affiliations of the stakeholders.

John Hunter's description of the project was very informative, and represented the document's contents honestly. Mr. Hunter's interaction with the group showed concern and understanding. The elimination of suffix J removed many of the groups' opposition to the plan and a general consensus was 'leave it alone, it's working the way it is. If it ain't broke, don't fix it'.

It has been over 3 decades since the plan has been updated and this should be used as an opportunity to make a real guideline for the future. In a state that will approve a 4 ½ Billion dollar levee improvement bond with almost no controls on it's use, it isn't unrealistic to think there may be money available in the future for maintenance and improvement of a great natural resource.

There are some non-truths in the document that should be corrected.

1. There is <u>NO</u> deep channel through the lake. There are deep pockets at the west-most entrance from the Sacramento river, at the entrance to Mayberry slough, Mayberry cut, and the Broad slough entrance on the west side of the island at the 'Run Way', not Cabin slough. The only 'channel' through the lake is one created by boats using a single pathway through the lake enabled by a privately maintained marker listed on the chart. The marker was lost this winter and is now only visible at low tide (2006-2007).
2. Striped bass do not hide in the weeds waiting for small fish to swim by -- they cruise the outside of the weed beds looking for small fish leaving the protection of the weed bed. Black bass (largemouth bass) hide in the weeds as described.

3. Hydrilla is not a recent introduction into the lake. As a child in the fifties I gathered Hydrilla for my guppy tank, as I couldn't afford to buy it at the aquarium store. The water condition has caused the growth of Hydrilla due to lack of flow for flushing and high nutrient content caused by agricultural run-off. This might not be able to be proved scientifically, but is the TRUTH.
4. There are no opportunities for overnight boating. There are many overnight safe anchorages in the lake and slough area. These are totally unimproved, and many can be reached at ~~night~~ Low tide only. Many overnight rendezvous take place in the 'back sloughs' of Sherman lake. The following are suggestion for inclusion the Final draft of the Land Use Report.

- Originally, Lower Sherman lake was turned over to the Dept. Of Fish and Game to create a hunting opportunity, and no private duck clubs were to be formed and a fee for hunting permit was to be charged. This is not represented in the new document. No permits are being issued and the public comments include one by a game warden to indicate he felt threatened when in Sherman lake.
- Weed beds are becoming a major problem accessing areas of the lake. Possible Fish and Game could work with Boating and Waterways to control this problem. Limited dredging would be a method of maintaining main channels through the lake.
- A full-time 'truly dedicated' Fish and Game employee could organize projects and find funding cooperating with stake holders to maintain and improve the area. This person should be 'based' at your facility at the Antioch Fishing Pier, not in Stockton. We don't need a game warden or a biologist, but a coordinator who could direct enforcement activities.
- Since Cal-Fed wants to take away our water, possibly they could fund major improvement to the lake. The Delta channel islands along the east end of the lake have all but disappeared due to wind and wave action. These could be restored, protecting Sherman island proper, re-creating Mayberry slough along the east end of the lake and allowing increased fishing and anchorage sites, and also a protected area for water skiing.
- Restoring Delta Channel island along Mayberry Cut and Sherman lake.
- Restoring the Marker buoy in Sherman lake as noted on chart as privately maintained.
- Emphasis of future development of Lower Sherman island should be continued, limited public use and not creation of a preserve, allowing only kayaking and bird watching.
- A history of Lower Sherman island should be developed before the old-timers are all gone. The parallel slough to Cabin slough, locally known as Whorehouse slough was a notorious 'play yard' of the Antioch Area in the more Victorian era at the turn of the century through Prohibition.
- The state-owned Donlon island area should be incorporated in the Lower Sherman island site as both areas share boundaries and are of similar make-up. Kimball island has already been lost to public control, but as a dedicated marsh. This use will enhance Lower Sherman island.
- Fresh water flows to and through the Sacramento river should be guaranteed to maintain the brackish nature of Lower Sherman island, which is a major fish nursery and is vital to the continuation of the recreational fishing resource. As more and more water is siphoned from the river system for export to Southern Calif. water brokers, this natural resource will become a saltwater marsh

Thank you again for extending the public comment period, and know that the Lower Sherman island stakeholders want to be partners with the Dept. Of Fish and Game in maintaining the Lower Sherman island area as a recreation area with multiple uses. We might not be 'tree huggers', but we do want to maintain and continue this valuable resource.

Please find attached Public Comment sheets received at the Dec.13 meeting at Sportsmen Yacht Club.

Sincerely

Charles W. Worrell

Charles W.(Bill) Worrell
Member Sportsmen Inc. Yacht Club
California Striped Bass Association
Driftwood Yacht Club

Letter D-A

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

PLAN: DIKE SHERMAN LAKE (AKA LOWER SHERMAN ISL.)
PROBLEMS 1). THIS IS WETLAND DESTRUCTION NOT "RESTORATION
OF HISTORICAL WETLAND HABITAT
2). NO CLEAR DEMONSTRATION OF FEASABILITY
OF CREATING STRUCTURALLY SOUND LEVES/DIKE
SYSTEM AS PROPOSED.
3). NEW DIKE/LEVEE CONSTRUCTION HAS
OBVIOUS ENVIRONMENTAL IMPACT ON LARGE
AREAS OF CRITICAL RIVER/ESTUARY AREAS. THIS
ENVIRONMENTAL IMPACT IS NOT ADEQUATELY ADDRESSED

Name Dan LIVEY, MD
Address PO BOX 3272
ANTIOCH CA.
Phone # (925) 634-1552
Organization SPORTSMEN YACHT CLUB, ANTIOCH CA.

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Audway Gonzalez

Letter D-B

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

John

(1) Statement made about man Power Being used currently at Sherman Lake site what man power is currently being used & why? what man Power would be needed to impliment & manage this program

Name

Address

Phone #

Organization

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-C

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Sherman Lake is very important for the tidal action and the flushing of the river. If you close off Sherman Lake it will cause more salt water intrusion into the Delta.

Name John & Carol Hunter
Address 1832 Ohlone HTS
Clayton, CA 94517
Phone # 925 672-7074
Organization Sportsmen Yacht Club

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-D

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Sarah Holm Fish & Game rep.
Land mgmt. plans re Sherman Isle.
Wild life mgmt. to operate property
mgmt. plans / development (EFG)
signage, cleanups etc, Environmental
licensing (traffic / site / boundaries –
(DFG) Equatic eco system, marsh public use
Mgmt. Goals – (repairing – Fire) Disclosure
ch. 4 & 5 – Agreement of Title transfer to D.F.G.
Calfed report – (surveys) =

Name Lavernne Thompson

Address 374 Shadow Creek Way
Rio Vista, CA. 94571

Phone # 707-374-3613

Organization SLYC/NCPCA/SPYC

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670

CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-E

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Sherman Island was acquired by the Dept of Fish & Game to be used as a hunting and fishing area. Leave it in its natural state! DO NOT DEVELOPE IT It currently serves its purpose.

Don't send more water to Southern California and waste this area

Name KEN FOWLER

Address 2804 G ST
ANTIOCH, CA 94509

Phone # 925-757-6331

Organization LOWER SHERMAN ISLAND DUCK HUNTERS ASSN.

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670

CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-F

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

LEAVE SHERMAN ISLAND ALONE. IF IT'S NOT BROKE, DON'T FIX IT.

Name JOE FRAY

Address 4681 PINOT CT.
OAKLEY, CA.

Phone # 925-625-5929

Organization LOWER SHERMAN ISLAND HUNTERS ASS, SPORTSMAN Y. C.

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670

CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-G

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Sherman Island is best left alone
and let nature take its' course
Don't Dam Sherman Lake

Name Alan Alcorn

Address 5 Wilbur Ave
Antioch Ca.

Phone # (925) 754-2511

Organization Sportsman Yacht Club

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-H

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

YOUR SPENDING MONEY TO RESEARCH & DEVELOPE NEW LEVEE AREAS - why NOT STOP USE THIS MONEY TO REPAIR CURRANT LEVEES.
If These AREA'S ARE FOR PUBLIC USE - HOW CAN YOU SEGREGATE different CLASSES OF People BY RESTRICTING MOTOR BOATS / wheel chairs / CANOE'S ect.
This SOUND AS ~~too~~ if ITS THE CANAL & WATER TO LA All over AGAIN "PERIFREAL CANAL"

SNEAKEY WAY TO DO IT.

Name: PAUL G. SCANNELL

Address: 2901 CARMONA WY
AnTioch CA 94509

Phone #: 925-777-9948

Organization: BLUE GAVEL / Shreiners / SPORTSMAN Y.C.

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-I

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Keep water Clean

Name Bert Schneider

Address 2814 Harris Dr.
Antioch 94509

Phone # 757 3086

Organization Sportsmen

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670

CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-J

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Why would you consider damming off Sherman ~~and~~ and to comment it would improve fish & other wide life? Hunting, fishing & Boating will be damaged. It will have an economic impact of the local communities, Antioch, Brentwood & Oakly.
So if the damming is not going to be done Why was it put in the plan?

Name Carline Moore

Address 4633 Menona Ct

Antioch, CA 94531

Phone # 925-583-2302

Organization Diablo Yacht Club

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-K

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

If it ain't broke don't fix it

Name Bill Bates

Address 1725 Elm Road
Concord Ca 94519

Phone # (925) 689-4428

Organization Tracy Wildlife

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter
D-L

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

(1) Restore Marker in Sherman Lake

(2) Repair Channel Islands around Mayberry Slough and Mayberry Cut

(3) Do Not Dam Sherman Lake and Mayberry Slough

(4) Release enough water to maintain habitat

Name Kelley Manning

Address 725 Fulton Shipyard Road
Antioch Ca 94509

Phone # (925) 254-2886

Organization Driftwood Yacht Club

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-M

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Restore Delta Channel Islands in Mayberry Slough and Mayberry Cut. This would improve water flow and re-establish habitant for fish + wildlife and also improve boating, providing safe anchorages and calm water. Cal-Fed's program to restore 50 miles of Delta Sloughs could be used to fund such a project

Name Bill Worrell

Address 1200 August Way
Antioch, Ca 94509

Phone # 757-5525

Organization Sportsman Inc Yacht Club, California Striped Bass Association

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-N

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LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Why should my Recreational area be limited to sopply water to Southern California to fill pools?
If this area is required to allow kyackers as the only users, there is no money generated from property taxes or gastaxes.. that are provided by motor boat owners.
Please allow enough water to allow the eco System of the delta to Recover from past mistakes

Name Bob Art

Address 620 Kinglet St
Suisun City, Calif 94585

Phone # 707 422 7172

Organization Sportsmen Yacht Club

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-O

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

I beleve the best thing To do is Nothing. If you have no money why have a Land plan.
Sherman Island is made up of Small Islands and Channels good for duck hunting and fishing in small boats. I have been fishing in Sherman waters for more Than 50 years. I would not like To see it Chang. Hope you Can See are pionts

Name Joseph Horn

Address 3115 Elizabeth Ln.
Antioch, Ca. 12-14-06

Phone # 925-757-0797

Organization CSBA - NRA - Cities for save Drinking water

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

Letter D-P

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Restore marker in Sherman Lake, marked on N.O.A.A. Chart # 18661 as obstruction marker and on early charts as private maintained marker. This has been destroyed this winter and is now only visable at low tide. This marker has been used by boaters for decades to safely cross Sherman lake. ~~It~~ marks a row of telephone poles left from before the island flooded. These poles have all rotted of at the water line but are still upright under water

Name Bill Worrell

Address 1200 August Way
Antioch Ca. 94509

Phone # 757-5525

Organization Sportsmen Inc Yacht Club

Letter D-Q

LOWER SHERMAN ISLAND WILDLIFE AREA
LAND MANAGEMENT PLAN

Special Public Comment Meeting
Sportsmen, Inc. Yacht Club
6 p.m. Wednesday December 13th 2006

After hearing an explanation of the land management plan, I believe the following has not been addressed, and needs to be included in the final draft. I am a stakeholder in Sherman Island Lake.

Sherman Lake Land Managment Plan - continuing to Big Break
Franks Track - slows DFG - CAL Fed ARE progressing
Back towards movent of our Water South - Ie Perferal Canal.
At Least with Perfferal Canal we got to Vote on it.
Plan needs to be realistic but goals - so if $ become Available
you can act quickly - Need
We want you DFG to Represent us the users.

Thank you for giving us this opportunity.

Name BARBARA Chapman

Address 717 Anderson Way
Rio Vista, CA. 94571

Phone # 707-374-3439

Organization Sportsmen YC - Northern California Power Cruiser Association (NCPCA) 250 40 Yacht Clubs
San Leandro Yacht Club

374

90

CALIFORNIA DEPARTMENT OF FISH AND GAME
SACRAMENTO VALLEY CENTRAL SIERRA REGION
1701 NIMBUS ROAD, SUITE A
RANCHO CORDOVA, CA 95670
CONTACT: SARA HOLM
AREA MANAGER
916/358-2881

COMMENT LETTER D

Comment D-1: Comment noted.

Comment D-2: As described above, a Notice of Intent (NOI) was distributed that outlined where hard copies of the documents were available for public review, and provided the website address where electronic copies of the documents were available for public review. The NOI was posted with Sacramento County and the State Clearinghouse, was published in the Sacramento Bee on October 11, 2006 and October 21, 2006, and was sent to various agencies and other interested parties. Hard copies of the documents were posted at the Department of Fish and Game offices in Stockton and Rancho Cordova, the Yolo Bypass Wildlife Area Headquarters, and the Isleton Neighborhood Library. These posting methods and locations were chosen in an effort to reach the greatest number of interested parties, including other agency personnel.

Comment D-3: Introductory; no response is necessary. Please note that the meeting was organized by the Sportsmen, Inc. Yacht Club.

Comment D-4: Comment noted.

Comment D-5: Comment noted. (This comment refers to a revision of the Draft LMP that is described in General Response 1.)

Comment D-6: The Department agrees that the LMP should provide guidance for future management, and this is part of the purpose of the LMP (as described in *Purpose of Land ManAgement Plan* on page 1-3).

Comment D-7: The comment that there is not a deep channel through Sherman Lake is correct. The LMP describes Sherman Lake as being deeper at the eastern end than in the eastern portion of the Lake (based on available bathymetry). In several places (such as in 3.1.3 *Topography*, page 3.1-7) the LMP refers to channels into the marsh or connecting the lake to the San Joaquin River, but these descriptions do not mean that there is a deep channel in the lake maintained for the passage of boats.

Comment D-8: In response to this comment, the text on page 3.3-7, third full paragraph, last sentence has been changed to read:

> Egeria has also been documented to diminish habitat quality for native species by displacing native flora and providing habitat for nonnative predator fish species including largemouth (black) bass, which feed on delta smelt and juvenile Chinook salmon (Grimaldo et al. 2004; Brown 2003).

Comment D-9: Although the comment addresses "Hydrilla", this was considered to refer to the egeria in Sherman Lake. The LMP does not state when egeria arrived at Sherman Lake. The statement about the amount of egeria present in 2000 was not meant to imply that egeria was a recent arrival. Therefore, in response to this comment, the following sentence was added to the LMP as the first sentence of the third full paragraph on page 3.3-7:

> Egeria likely established at the LSIWA many years ago, but the date has not been documented.

Comment D-10: The comment accurately describes the condition of overnight ancorages at the LSIWA. Although the Draft LMP briefly described the use of overnight anchorages in the delta, it did not describe overnight anchorages at the wildlife area. Therefore, in response to this comment, in Chapter 3 *Environmental Setting,* the first paragraph under Boating (on page 3.6-4) has been revised to read as follows:

> While recreational boaters use the wildlife area, information on activities unrelated to hunting and fishing ~~(i.e.~~, such as pleasure boating~~)~~ at Sherman Lake, ~~water ski~~ The shallowness of the area and the presence of aquatic weeds and shoals reduce use of the area by pleasure boaters. Also, although there are locations where boats could anchor overnight, many of these locations are inaccessible during low tides and none have developed facilities. Hunters and anglers report occasional use by water skiers, jet skiers, and others. The small marina at Sherman Lake Resort, which provides both berthing and a ramp, may be expected to contribute some boating use, but the generally larger boats moored at that location would more likely use Mayberry Slough and Mayberry Cut along the eastern boundary ~~to~~ of the LSIWA to reach the San Joaquin River. A privately maintained buoy marker indicated an underwater obstruction adjacent to this route until it was damaged in 2006. Some

boats may take the shorter route across the upper part of Sherman Lake to reach the Sacramento River.

Comment D-11: This information is presented in the Draft LMP. In *1.4 Acquisition History* (pages 1-2 and 1-3), the Draft LMP states that the control of the property was transferred to the California Fish and Game Commission for the purpose of establishing and maintaining a public shooting ground. This section of the LMP also summarizes the management recommendations from the initial management plan proposed in 1957; these recommendations included a permit system for public hunting, encouragement of fishing, provision of a boat ramp, and the establishment of regulations to ensure that the area is not used as a private duck club by any individual or group, among other recommendations. The purpose of the wildlife area's acquisition by the Department is also referred to in Chapter 4 Management Goals (for example, see Authorized Public Use Goal 2 on page 4-12).

Comment D-12: The Department agrees that weed beds reduce access in the wildlife area and that coordination with the Department of Boating and Waterways could help reduce this problem. For this reason, the LMP includes the following task for Management Review and Coordination Goal 2:

> 2. Collaborate with the Department of Boating and Waterways (DBW) regarding nonnative invasive plants at <u>the</u> LSIWA~~,~~ and Delta recreational planning.

Comment D-13: Comment noted.

Comment D-14: The Department agrees that restoration of habitat at the wildlife area would support the attainment of a number of the targets of the CALFED program, and thus it could be appropriate for CALFED to fund restoration actions at the wildlife area. For this reason, the LMP includes a task to collaborate with or submit proposals for CALFED-funded projects that could contribute both to the attainment of this LMP's goals and to attainment of CALFED goals, objectives, targets, and milestones (Task 6 for Management Review and Coordination Goal 2, page 4-22). The specific suggestion regarding the restoration of islands along the east end of Sherman Lake has been noted.

Comment D-15: Comment noted.

Comment D-16: The repair of the marker buoy would be consistent with Authorized Use Goal 7 (*Make the public aware of potential risks in order to encourage safe use of LSIWA*). Therefore, in response to this comment, the text under Authorized Use Goal 7 has been revised as follows.

> Though risks are inherent in any physical activity, informing the public of potential risks <u>(e.g., gas lines, underwater obstructions)</u> and reducing access to unsafe areas should increase the safety of users, and that is the intent of the following tasks:
>
> **Tasks:**
>
> 1. Identify areas where warning signs or marker buoys are needed.
> 2. Subject to funding, install warning signs or marker buoys at identified locations.

Comment D-17: The conversion of the wildlife area to a preserve is not a goal of the LMP. It is the policy of the Fish and Game Commission that lands under its administration, including the LSIWA, are available to the public for wildlife-dependent recreational use whenever such uses will not unduly interfere with the primary purpose for which such lands were acquired. The LSIWA was acquired for the purpose of providing a publicly accessible hunting and fishing area. Therefore, the continued provision of opportunities for hunting and other wildlife-dependent recreation at the wildlife area is a goal of the LMP (i.e., Authorized Use Goal 2, page 4-12).

Comment D-18: A history of the wildlife area would contribute to the cataloging and preservation of significant prehistoric, historic-era, or present-day Native American resources in the wildlife area, which is a goal of the LMP (Cultural Resources Goal 1). Therefore, in response to this comment, a fourth task has been added under Cultural Resources Goal 1 (on page 4-11) that reads as follows:

> <u>4. Support efforts to document the history of human activities at the LSIWA.</u>

Comment D-19: Incorporation of the state-owned Donlon Island area could contribute to attainment of the goals of the LMP. Therefore, in response to this comment, a third task has been added to Management Review and Coordination Goal 5 (on page 4-23) that reads as follows:

Task 3. Collaborate with the Department of Water Resources regarding management of the Donlon Island area, and regarding its possible inclusion in the LSIWA.

Comment D-20: Please see General Response 1.

ATTACHMENTS TO COMMENT LETTER D

Comment D-A-1: Please see General Response 1.

Comment D-A-2: Please see General Response 1.

Comment D-A-3: Please see General Response 1.

Comment D-B-1: No staff persons are currently assigned to the LSIWA because of budgetary constraints. However, wardens patrol the wildlife area, and some, limited labor is provided by other Department staff on an as needed basis.

Comment D-B-2: Table 5-1 of the LMP provides an estimate of the hours by position that would be required to implement each task in the LMP.

Comment D-C-1: Please see General Response 1.

Comment D-D-1: It is unclear what portions of the LMP the comment is referring to.

Comment D-E-1: Please see General Responses 1 and 2.

Comment D-E-2: Please see General Response 1.

Comment D-F-1: Please see General Response 1.

Comment D-G-1: Please see General Response 1.

Comment D-H-1: Please see General Response 1.

Comment D-H-2: The LMP does not contain goals to restrict access to motor boats, wheel chairs, canoes, etc.; in contrast, the LMP contains goals to support public access and use, including to provide long-term opportunities for fishing (Authorized Public Use Goal 3) and to manage water surfaces and use areas to accommodate a variety of different user groups and minimize competition and conflicts among users (Authorized Public Use Goal 4). Large portions of the LSIWA, however, are largely inaccessible via most modes of transportation, and the LMP does not contain specific tasks that would substantially change this attribute of the wildlife area.

Comment D-H-3: Please see General Response 1.

Comment D-I-1: It is unclear what portions of the LMP the comment is referring to, but it has been interpreted to be referring to the assessment of restoration actions, and so please see General Response 1.

Comment D-J-1: Please see General Response 1.

Comment D-K-1: Please see General Response 1.

Comment D-L-1: Please see response to Comment D-16.

Comment D-L-2: Please see responses to comments D-14 and D-15.

Comment D-L-3: Please see General Response 1.

Comment D-L-4: Please see General Response 1.

Comment D-M-1: Please see responses to comments D-14 and D-15.

Comment D-N-1: Please see General Response 1.

Comment D-N-2: Please see response to Comment D-17.

Comment D-N-3: Please see General Response 1.

Comment D-O-1: Comment noted.

Comment D-O-2: Please see General Responses 1 and 2.

Comment D-P-1: Please see response to Comment D-16.

Comment D-Q-1: Please see General Response 1.

Comment D-Q-2: The Department agrees that the goals and tasks in the plan need to be realistic and flexible (to accommodate different levels of funding).

Comment D-Q-3: Comment noted.

Comment D-Q-4: Comment noted.

SUMMARY OF ORAL COMMENTS AND RESPONSES

The following summary is a compilation of the public comments received during the Department of Fish and Game (Department) Lower Sherman Island Wildlife Area (LSIWA) Land Management Plan (LMP) public meeting held on November 1, 2006 in Stockton, CA.

Speakers included:

Mark Hennelly, CA Waterfowl Assn.
Gary Adams, CA Striped Bass Assn.
Steve Abfalter, Lower Sherman Island Duck Hunters Assn.
John H. Banks, CA Striped Bass Assn.
Ken Fowler, Lower Sherman Island Duck Hunters Assn.
Anthony Macaluso

1. HUNTING RESTRICTIONS:

(a) We don't want new hunting restrictions. LSI has a different history and function than other wildlife areas so it should be less restrictive than other wildlife areas. The existing agreement between DFG and the Lower Sherman Island Duck Hunters Association (LSIDHA) is sufficient. We don't want the wildlife area changed from a Class C to a Class B wildlife area; this would cause too much hunting congestion by limiting the hunting period. The LSIWA has always been first come, first served and has worked well. Closed areas are not necessary; the lake functions as a reserve because it is too windy for hunting. The man-made ponds provide good habitat for birds, and they're only hunted three months out of the year.

Response: Please see General Response 2.

(b) Regarding Goal 2, Task 2.6 on page 5-14, will the blinds being maintained by the LSIDHA be targeted for removal?

Response: Please see General Response 2.

(c) Since 1925 hunters have been building habitat and recreation facilities (e.g. ponds, blinds, ditches, walkways) for free. Without this, the LSIWA would be a barren wasteland. The LMP proposes to spend tax money to do the same things that the hunters have been doing for free.

Response: Please see General Response 2.

2. APPENDIX J, RESTORATION CONCEPTS:

(a) We don't want the levee (#2) depicted in Appendix J built or proposed. Anglers access Sherman Lake via the Sacramento River, and Sherman Lake provides a lot of water mixing between Sacramento and San Joaquin Rivers. Adding this levee would ruin fish nurseries in Sherman Lake, would change the salinity, would increase the growth of invasive aquatic plants, and would turn the lake into a stagnant pond. This seems like it would be a significant impact. This is just a ploy to get more water down south.

Response: Please see General Response 1.

(b) The area depicted as #4 is called "the tundra". Nothing grows there and nothing will, except pickleweed. At night there are lots of fur bearers in this area.

Response: Comment noted.

(c) I can't figure out what the plans are for the areas depicted as #1 and #3, and they would be a waste of tax money anyway.

Response: Please see General Response 1.

(d) The area depicted as #5 would be a better place to spend restoration money.

Response: Comment noted.

3. DEPARTMENT PRESENCE AND NEEDS AT THE LSIWA:

(a) The LSIWA has been neglected from a land management perspective. We would like to see more DFG staff presence and Coast Guard helicopter presence to improve safety and rescue operations. The LSIWA needs more DFG patrolling but doesn't need a full-time staff person.

Response: The Department agrees that more Department staff presence would be beneficial, as is reflected in Section 5.2 *Existing Staff and Additional Personnel Needs*. Specific comment regarding a full-time staff person is noted.

(b) A jet boat wouldn't work for DFG because there is too much egeria; DFG should purchase an air boat. An air boat wouldn't work for DFG because it would be swamped with waves in the lake.

Response: Comments noted.

4. ACCESS TO THE LSIWA:

(a) Getting across Franks Tract is not possible because of egeria growth. We don't want Sherman Lake to be the same way.

Response: The Department agrees that the growth of egeria within the the LSIWA is problematic. Please see response D-12.

(b) We want boat access to the LSIWA to remain. If the LMP is implemented, would access remain all around the lake?

Response: The LMP does not propose changes to boat access around the lake. The LMP does include Tasks to manage public use to minimize effects on areas occupied by special-status species (e.g. Marsh Goal 1, Task 2). However, most of these habitat areas have limited boat access because of shallow depths and dense aquatic plant growth.

5. SIGNAGE:

(a) What kind of signs would be posted?

Response: Most signs at the LSIWA would mark the wildlife area's boundaries, list its regulations, or both. To make this clearer, Task 1 of Authorized Public Use Goal 1 has been revised to read:

> 1. Inform users regarding <u>the wildlife area's boundaries and</u> compatible public uses by providing signage at major access points to the LSIWA and on the Department's website.

(b) Proposed signs should be metal signs so the beavers don't eat them. Proposed signs should explain the health risks of eating toxic fish from the area because the water is so polluted.

Response: Comments noted.

6. OTHER:

(a) The Department of Water Resources (DWR) is compromising DFG goals and trying to get more water to the Contra Costa intakes.

Response: The context of this comment was in reference to Appendix J potential restoration actions involving rebuilding a levee on the north side of the lake. Please see General Response 1.

(b) The LSIWA should be in the DFG Bay Delta region.

Response: A reorganization of Department regional boundaries is currently underway, which will put oversight of the LSIWA within the Bay Delta Region.

(c) Who determines what “restoration to a natural state” would be like?

Response: Restoration to a natural state is not a goal of the LMP. Rather, LMP goals focus on maintaining and enhancing habitat for wildlife (e.g. Marsh Goal 1 and Marsh Goal 2). Thus, approaches to enhancement would be based on the ecological requirements of wildlife species at LSIWA.

(d) We don’t want LMP goals to restrict the use of the LSIWA to particular user groups.

Response: The Department agrees that use of the LSIWA should not be restricted to particular user groups. Section 4.2.3 of the LMP includes goals and tasks to accommodate a number of different types of user groups.

(e) If the LMP is anticipated to be approved in December, why bother getting public comment?

Response: As described above, public comment was solicited to ensure that all view points and information are incorporated in the LMP, as appropriate. The final version of the LMP was anticipated to be approved in December, following incorporation of public comments as appropriate.

(f) The best management for the LSIWA is to leave it in its natural state.

Response: The Department agrees that maintaining the LSIWA in a natural state is an appropriate goal, while also accommodating appropriate recreational uses. For this reason, the LMP includes Biological Goals (Section 4.2.1) and Authorized Public Use Goals (Section 4.2.3).

State of California – The Resources Agency ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF FISH AND GAME

http://www.dfg.ca.gov

Sacramento Valley Central Sierra Region
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670

DATE: October 11, 2006

TO: Responsible Agencies, Interested Parties, and Organizations

SUBJECT: Notice of Availability and Intent to Adopt an Initial Study/Negative Declaration (IS/ND) for the Lower Sherman Island Wildlife Area Land Management Plan (LMP) in Sacramento County, California

Project Location: The Lower Sherman Island Wildlife Area (LSIWA) occupies roughly 3,100 acres at the confluence of the Sacramento and San Joaquin rivers, in the southernmost portion of Sacramento County. LSIWA is accessed by West Sherman Island Road, approximately 2 miles North of Highway 4 and approximately 2 miles west of Highway 160.

Description of the Proposed Project: The California Department of Fish and Game (Department), as Lead Agency, has directed the preparation of and intends to adopt an IS/ND for the proposed project in compliance with the California Environmental Quality Act (CEQA) and State CEQA Guidelines. The project being proposed is the adoption and implementation of the LMP.

The LMP will guide the Department's management, planning, and operations of the LSIWA. The LSIWA is an extensive tract consisting of natural vegetation and open water that provides diverse and valuable wildlife habitats and related recreational opportunities. LSIWA is an important part of Sacramento-San Joaquin River Delta due to its natural functions and values as well as the opportunities it provides for human use.

The purpose of the LMP is to:

1. guide management of habitats, species, and programs described in the LMP to achieve the Department's mission to protect and enhance wildlife values;

2. serve as a guide for appropriate public uses of the LSIWA;

3. serve as a descriptive inventory of fish, wildlife, and native plant habitats that occur on or use the LSIWA;

4. provide an overview of the property's operation and maintenance and of the personnel requirements associated with implementing management goals (this LMP also serves as a budget planning aid for annual regional budget preparation); and

5. present the environmental documentation necessary for compliance with state and federal statutes and regulations, provide a description of potential and actual environmental impacts that may occur during plan management, and identify mitigation measures to avoid or lessen these impacts.

The IS/ND describes the project and its potential impacts on the environment, and concludes that the proposed project would not have any significant effects on the environment.

Public Review Period: The LMP and IS/ND is being circulated for public review and comment for a period of 30 days beginning on October 11, 2006. Your views and comments on the LMP and how the project may affect the environment are welcomed. Written comments must be postmarked no later than November 9, 2006, and should be submitted to the following address:

Sara Holm, Wildlife Biologist
Department of Fish and Game
Sacramento Valley-Central Sierra Region
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670

Copies of the LMP and the incorporated IS/ND may be reviewed on the Department's website http://www.dfg.ca.gov/html/pubnotice.html, at the above address, and at the following locations during normal business hours:

Department of Fish and Game
Central Valley Bay-Delta Branch
4001 North Wilson Way
Stockton, CA 95206

Yolo Bypass Wildlife Area Headquarters
45211 County Road 32B
Davis, CA 95816

Isleton Neighborhood Library
Isleton Elementary School
412 Union Street
Isleton, CA 95641

Comments may also be provided on the LMP or the IS/ND at a public hearing scheduled at 5:30 PM on November 1, 2006, to be held at the following location:

Caltrans District 10 Office
1976 East Charter Way
Stockton, CA

Form A

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 # ____________

RECEIVED
OCT 11 2006
~~STATE CLEARINGHOUSE~~

Project Title: Lower Sherman Island Land Management Plan

Lead Agency: California Department of Fish and Game   Contact Person: Sara Holm
Mailing Address: 1701 Nimbus Road   Phone: 530-745-0486
City: Rancho Cordova   Zip: 95670   County: Sacramento

Project Location:
County: Sacramento   City/Nearest Community: Antioch   Total Acres: 3,100
Cross Streets: W. Sherman Island Road and River Road (Hwy 160)   Zip Code: 94571
Assessor's Parcel No. ____________   Section: ____________   Twp. 2N, 3N   Range: 1E, 2E   Base: ____________
Within 2 Miles: State Hwy #: Hwy 4 & 160   Waterways: Sacramento River, San Joaquin River
Airports: None   Railways: AT, SP, SF Railroad   Schools: Several Antioch Schools

Document Type:

CEQA: ☐ NOP ☐ Early Cons ☒ Neg Dec ☐ Mit Neg Dec ☐ Draft EIR ☐ Supplement to EIR (Note prior SCH # below) ☐ Subsequent EIR (Note prior SCH # below) ☐ Other ____________

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI

Other: ☐ Joint Document ☐ Final Document ☒ Other Land Management Plan

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 ____________

Development Type:

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

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:

Agricultural (AG-80)

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

See attached.

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.

September 2005

Reviewing Agencies Checklist

continued

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".

- X Air Resources Board
- X Boating & Waterways, Department of
- ___ California Highway Patrol
- ___ Caltrans District # ___
- ___ Caltrans Division of Aeronautics
- ___ Caltrans Planning
- ___ Coachella Valley Mountains Conservancy
- ___ Coastal Commission
- ___ Colorado River Board Commission
- X Conservation, Department of
- ___ Corrections, Department of
- X Delta Protection Commission
- ___ Education, Department of
- ___ Office of Public School Construction
- ___ Energy Commission
- X Fish & Game Region # 3
- ___ Food & Agriculture, Department of
- ___ Forestry & Fire Protection
- ___ General Services, Department of
- ___ Health Services, Department of
- ___ Housing & Community Development
- ___ Integrated Waste Management Board
- ___ Native American Heritage Commission
- ___ Office of Emergency Services
- ___ Office of Historic Preservation
- X Parks & Recreation
- ___ Pesticide Regulation, Department of
- ___ Public Utilities Commission
- X Reclamation Board
- X Regional WQCB # 5
- X Resources Agency
- ___ S.F. Bay Conservation & Development Commission
- ___ San Gabriel & Lower Los Angeles Rivers & Mountains Conservancy
- ___ San Joaquin River Conservancy
- ___ Santa Monica Mountains Conservancy
- X State Lands Commission
- ___ SWRCB: Clean Water Grants
- X SWRCB: Water Quality
- ___ SWRCB: Water Rights
- ___ Tahoe Regional Planning Agency
- ___ Toxic Substances Control, Department of
- X Water Resources, Department of
- X Other Sacramento County Board of Supervisors
- X Other Solano County Board of Supervisors

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

Starting Date October 11, 2006 Ending Date November 9, 2006

Lead Agency (Complete if applicable):

Consulting Firm: EDAW, Inc
Address: 2022 J Street
City/State/Zip: Sacramento, CA 95814
Contact: John Hunter
Phone: (916) 414-5800

Applicant: California Department of Fish and Game
Address: 1701 Nimbus Road, Suite A
City/State/Zip: Rancho Cordova, CA 95670
Phone: (916) 358-2881

Signature of Lead Agency Representative: Banky E Curtis for SONKE MASTRUP, DEPUTY DIRECTOR Date 10/6/06

Authority cited: Section 21083 and 21087, Public Resources Code. Reference: Section 21161, Public Resources Code.

LOWER SHERMAN ISLAND INTERVIEW NOTES

DEPARTMENT OF FISH AND GAME PERSONNEL

Brad Burkholder, Environmental Scientist
Department of Fish and Game
Central Valley Bay-Delta Branch
January 30, 2006

Dan Lehman, Lieutenant
Department of Fish and Game
February 2, 2006

Carolyn Doody, Ground Warden
Department of Fish and Game
February 3, 2006

1 GENERAL ENVIRONMENTAL ISSUES AND EFFECTS OF HUMAN USES

A) What important environmental problems are occurring at LSI? These resource issues are offered for your thinking.

- water quality – salinity
- other water quality
- nutrient (carbon) consumption
- fish habitat and fish use
- recreation (e.g., boating, sail or kite sports, fishing, hunting)
- wetland habitat
- invasive exotic species
- flooding
- levee and bank erosion
- unauthorized structures

B) How are human uses affecting these problems?

C) How might management of the LSI WMA address these environmental problems or reduce their magnitude at LSI?

D) What constraints limit the ability of management actions to address these issues?

E) Please summarize helpful environmental information regarding these issues that you know is available. Also, what key data gaps need to be filled?

F) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted regarding these issues at LSI?

- Unregulated uses are the main causes of environmental problems at LSI. Unregulated and regulated recreation (e.g. overnight camping, authorized and unauthorized cabins and blinds, hunters) is manipulating the habitat.

- Invasive plants are thriving, and recreationists may be exacerbating this; for example, weekenders and cabin tenants clear and mow vegetation, and plant non-native ornamental plants.
- Trash is a problem. Some cabin residents don't properly dispose of their trash (such as bottle, cans, and oil), although they are supposed to attend to their trash per their lease. In addition, picnickers, hunters, and over-nighters leave trash. It would not be practical to have DFG provide and maintain trash bins for public use.
- Water quality issues arise with the tenants. Some cabin tenants have illegal septic systems that discharge untreated waste directly into the sloughs. In addition, herbicides and fertilizers likely run off into the sloughs. Possible solutions include building code inspections, requiring proper waste disposal in tenant's leases, and pressure from an outside agency such as County Health.
- The main constraint for addressing these problems is a lack of staff and money to provide oversight.
- Data gaps for management of the wildlife area include a lack of natural resource information and a lack of baseline user information.
- There doesn't appear to be too much erosion occurring at LSI. However, hunters sometimes dig out "fingers" in the vegetation so that they can pump water from these "fingers" into their man-made ponds.

2 RESTORATION ISSUES

A) What restoration opportunities or needs exist at LSI?

B) What goals would you have for restoration actions at LSI; that is, stated differently:

- what do you believe restoration actions should accomplish?
- what would be your desired outcome or desired end condition?

C) Do any of these goals stand out as higher priority?

D) What ideas have you already considered for restoration actions that would address these goals?

E) What major constraints exist on the implementation of your ideas for restoration actions?

F) Please summarize helpful environmental information or documents that you know are available to address your ideas. Also, what key data gaps need to be filled?

G) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted during the planning process for restoration actions at LSI?

- There are three areas in particular that could use restoration:
  - One, the upland area on the northwest side of the island, possibly formed by old dredge spoils. This area now has a lot of pepperweed and saltgrass, and small amounts of pickleweed and alkali heather. There may be sandy soils which could be suitable for dune habitat restoration.
  - Two, the wetland areas, dominated by cattails and tulles. Additional tidal action may provide enhanced habitat. There may be an opportunity to increase the amount of

transition zone between the cattails and tulles and the upland, e.g. more pickleweed habitat.

- Three, possibly the edge habitat along the remnant levees, e.g. increase the riparian scrub.

- The removal of the nonnative and invasive plants, especially along the western tip (an access point for day users, primarily duck hunters), would be helpful.
- Eucalyptus, Oleander, Pampas grass have established or have been planted.
- Restoration goals should be to improve habitat for wildlife (e.g. fish habitat, bird habitat). Aesthetics should not be a driving factor for restoration activities.
- The area that needs restoration the most is the cabin slough area.
- Short term restoration activities should include eradication of nonnatives on the western and southern perimeters.

3 HUMAN USE ISSUES

A) What is your user group's general perspective of the existing situation at LSI?

B) At LSI, what important problems are occurring with human uses? These uses are offered for your thinking.

- hunting
- fishing
- recreational boating
- windsurfing or other sail or kite sports
- wildlife viewing
- use of existing cabins and associated docks
- unauthorized uses or structures

C) What conflicts exist between different uses?

D) How might management of the LSI WMA resolve these use issues or reduce their magnitude at LSI? And, what actions addressing these issues do you consider a high priority?

E) What goals would you have for management of human uses at LSI? (In other words, regarding use of LSI, what would be your desired outcome or future condition?) And, which of these objectives do you consider a high priority?

F) What are the major constraints on management that affect the attainment of these goals?

G) Please summarize helpful information or documents that you know are available and that address these issue. Also, what key data gaps need to be filled?

H) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted during the planning process for future management of the LSI WMA?

- These questions were answered from the Manager's perspective of human use issues at LSI.
- There is a small group of users (hunters) with control over the interior of the island and they exclude other user groups, mostly during hunting season. The "resident" hunters also prevent

other hunters from hunting at LSI. The hunters don't seem to have conflicts with the wind sport enthusiasts because they seem to be pretty contained to the area of the County park.

- Possible solutions could include an educational program- post signs at landing points and in marinas with regulations, post signs delineating wildlife area boundaries, post signs precluding the use/building of unauthorized structures, print articles in local papers with regulations. A revamp of the regulations may be needed.
- The cabins pose a conflict with the public because there is a perception that the cabin tenants receive special treatment. It is perceived that it is unfair for the DFG to allow people to have private cabins in a public wildlife area.
- The highest objectives of the LMP should involve the removal of the structures (cabins, blinds, etc.) and to better regulate the users through educational programs and other means. When leases expire, blinds and cabins deteriorate and should be removed. The removal of these structures would be visible evidence of enforcement of the regulations. The main constraints to enacting these solutions are a lack of staff and money, and pressures of local politics.

4 FIRE MANAGEMENT

A) What problems have fires at LSI caused for human uses or public safety?

B) How could management of the LSI WMA address these problems in the future?

C) How have fires affected natural resources at LSI?

D) What goals for fire management would you have for the LSI WMA?

E) What are the major constraints on fire management at LSI that would affect the attainment of these goals?

F) Please summarize helpful information or documents that you know are available and that address fire management issues at LSI. Also, what key data gaps need to be filled?

G) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted during the planning process for fire management at the LSI WMA?

- There are no procedures for fire control that DFG knows of.
- The wildlife management division is in charge of fire control.
- DFG has been contacted by the air quality control board regarding smoke from fires in the wildlife area, and DFG has been fined for air quality violations for smoke.
- There is no fire response plan for LSI. If a fire occurs, DFG calls the Coast Guard and they have a small fire boat that will respond.
- Because the area is surrounded by water, fire doesn't pose a large threat and a response to fire is not required very often.
- Competitive or territorial hunters have burned other hunters' blinds six or seven times, and these fires have spread to the surrounding habitat. Some hunters view this as habitat enhancement.

- Three or four times tenant’s cabins have burned and the fire has spread to the surrounding habitat. The Air Resources Control Board has levied fines to the DFG for these types of accidental fires.
- DFG does not conduct controlled burns.
- DFG asked for help from CDF while they burned old structures to dispose of them, but CDF wouldn’t assist without a release of liability from DFG. DFG attorneys wouldn’t supply a release of liability, so no structures have been intentionally burned.

5 MANAGEMENT COORDINATION (THESE QUESTIONS ARE FOR DFG STAFF ONLY)

A) What interactions (formal or informal) do you currently have (if any) with local governments, federal agencies, and other state agencies? The following list is offered for your thinking.

- Sacramento-Yolo Mosquito and Vector Control District
- Sacramento County, Department of Regional Parks, Recreation and Open Space
- Sacramento County Sheriff’s Department
- Solano County
- Contra Costa County
- California Bay Delta Authority
- California Department of Boating and Waterways
- California Department of Forestry and Fire Protection
- Delta Protection Commission
- Department of Water Resources
- Regional Water Quality Control Board
- State Lands Commission
- The Reclamation Board
- U.S. Fish & Wildlife Service
- U.S. Army Corps of Engineers

B) Have there been approaches to management coordination that have been successful? Why or why not?

C) What constraints or barriers keep you agency from working more collaboratively with other agencies?

- Vector Control visits LSI but DFG has no knowledge of their activities or knowledge of their actions/results.
- DFG has only dealt with Sacramento County in regard the boat launch.
- DFG has only dealt with the sheriff’s department when they call the sheriff to deal with illegal activities at LSI (e.g. tenants/visitors growing marijuana plants, creating methamphetamines).
- DFG doesn’t interact with Solano County or Contra Costa County.
- DFG interacts with the Bay Delta Authority with the Ecosystem Restoration Program (ERP) a little. DFG recommends considering the goals/actions presented in the ERP Plan because it has newer information than DFG.
- Rec. Board, DWR, State Lands, RWQCB, and USACE: these agencies are often involved in large scale projects in the Delta which could affect DFG properties like LSI, and DFG is rarely, if ever, included in these discussions. Likewise, DFG could plan activities that would be in conflict with their plans, but because they aren’t involved in the discussions of these

large projects, nobody would be aware. If these entities are managing their properties without knowledge of each others' plans, there could be a train wreck. For example, if DFG plans restoration projects at LSI, and DWR plans major water projects like Flooded Islands that could significantly alter the water conditions, DFG's restoration project could be derailed. Management coordination with these entities should be included in the LMP goals/tasks to try to improve this coordination.

- Conceptual discussions have occurred between DFG and Boating and Waterways for possible joint projects (e.g. a boat trail, docks). Their Egeria and Hyacinth control program would be applicable to LSI, although DFG is not currently aware of what the program entails.
- Informal discussions occurred with Dept of Forestry and Fire regarding the possibility of conducting small controlled burns of debris on the island.
- DFG is not aware of any defined procedures in case of fire.
- Some interactions occur with the Coast Guard. DFG notifies the Coast Guard if they will be conducting activities at LSI.
- Some information sharing has occurred with the Delta Protection Commission.

6 LAW ENFORCEMENT

A) Please describe the scope of your law enforcement duties related to Lower Sherman Island.

B) Are these activities in response to people who are there for recreation or for other types of activity?

C) Please describe the current law enforcement needs of your jurisdiction as it relates to LSI.

D) Based on your experience, can you describe trends in illegal activity at LSI and in adjacent areas?

E) Do you feel that your law enforcement agency has proper access to the LSI WA?

F) Please describe the scope and schedule of your patrols at LSI.

- Patrol visits to LSI depend on the availability of a boat, and the area is difficult to access even with a boat.
- DFG visits LSI a minimum number of once per year, although no visits occurred in 2005. Usually six or seven visits occur per year.
- Visits to other wildlife areas average several times per week.
- DFG flies over the LSI once per year to look for man-made ponds.
- Flying over the area twice per year would be helpful.
- When felonies have occurred, DFG has asked for help from the Sacramento County Sheriff's Department, but they have responded that LSI is not in their County.
- Although the whole wildlife area is in Sacramento County, DFG has called Contra Costa County and Solano County to help with felony violations.

Cabin tenants

- Typically DFG enforcement duties would involve enforcing hunting, fishing, and environmental regulations, by patrolling for these activities. However, at LSI the cabins have led the wildlife area managers to take on property management duties.
- Since 1992 the tenants have held a lifetime lease on their cabins and property that reverts to DFG upon their death
- Sometimes tenants die and DFG doesn't know, so their cabins become vacant, or their heirs sublease the property illegally.
- Enforcement conflicts at LSI have included illegal methamphetamine labs, marijuana plantations operated by the tenants, and the recovery of body parts.
- Conflicts that affect environmental resources in particular include trash problems at the cabin sites, including hazardous trash, native vegetation removal by the tenants, and water quality problems with illegal wastewater disposal.
- Sacramento County code required the tenants to designate their camps as "wet" or "dry" camps. Some tenants came into compliance, but most "dry camps" discharge waste water directly to the delta, and illegally take up water from the delta.
- DFG used to turn violators over to the Health Department but they haven't been doing that lately.
- Tenants were illegally pile driving and expanding their cabins in violation of their lease and DFG 1600 code. Most of them tore down these illegal expansions one or two years ago.
- Tenants have been bringing in nonnative plants, but many of them have since been removed. Planting these ornamentals (and removing them) causes disturbance to the native vegetation that was previously found in these areas.
- Tenants have also been mowing the vegetation around their cabins to increase their useable lot sizes. In one case, the mowed area was three or four acres in size.
- Tenants have been planting invasive species such as eucalyptus and pampas grass.
- Pot growing has been a problem, and drug manufacturing (crystal meth) at LSI has been increasing.
- There have been problems with squatters at cabins with expired leases, and problems with tenants having illegal propane tanks on their decks.
- DFG would like to remove old structures with a barge, but it is too expensive. Although not ideal, another method contemplated to dissuade illegal use of these structures is to flatten them and leave them in place.

Hunters

- Visits to LSI are primarily used to respond to complaints about hunters.
- The structures pose the biggest problem because they provide for territorial behavior.
- Refereeing territorial disputes uses time that would otherwise be used to enforce environmental regulation issues.
- One of the warden's duties at LSI is to enforce hunting regulations and wildlife area regulations in a boat. Examples include checking for licenses, bag limits, pond baiting, shot composition, species taken, time limits, methods of take, and proper equipment use.

- Hunting is not patrolled outside of the hunting season.
- LSI is a Type C wildlife area, which means that hunting is free, no permit is needed, and there if no check station. The lack of these oversight mechanisms makes regulating proper use more difficult.
- Because the wildlife area is only accessible by boat, it is difficult to patrol.
- There is a contingent of hunters from about 60-70 family groups that are territorial of LSI
- LSI is the only wildlife area that allows permanent blinds to be constructed, LSI is the only wildlife area that allows the use of decoys all season or all year, and LSI is the only wildlife area with its own duck hunters association. These blinds and placed decoys serve to "claim" a hunting spot for these territorial hunters. The hunter claiming ownership of a hunting spot will threaten "visiting" hunters to get them to leave the hunting spot that they have claimed as their own.
- Undercover DFG officers conducted an undercover operation posing as visiting hunters to identify aggressive and territorial "resident" hunters.
- These territorial hunters also have built ponds on the high ground to expand their hunting grounds. In one case a hunter had a blind with a TV, bar, shooting station, generator, a pump to fill the pond, and a big garbage pit.
- These ponds alter the fish habitat and probably impound fish.
- All of the hunters also cause trash problems.
- Environmental impacts from the hunters tend to be more from habitat disturbance rather than by over-hunting.
- The County Sheriff doesn't go out to LSI. The Coast Guard sometimes goes out there for safety.
- The Delta Bass Unit may patrol the area too.
- DWR only has funding for anadromous fish
- Jet skiers and wind surfers also sometimes compete with the hunters and anglers.
- There are no regulations that preclude other uses during the hunting season.

Fishing

- LSI fishing includes striper, sturgeon, black bass (usually catch and release).
- The primary conflict that occurs with anglers involves verbal confrontations between anglers and hunters who don't want them there during hunting season.
- Conflicts between anglers and hunters have been trending upwards.
- Bass fishing tournaments have been giving bigger purses, which has increased bass fishing in the LSI area.
- When the anglers enter the LSI area they risk getting shot by hunters.
- Wardens patrol for fishing licenses, bag limits, fishing methods, species taken, and especially size limits.
- Over-fishing seems to occur mostly with sturgeon.
- The take of non-game species is not usually a problem.

- Because fishing boats that can get into the LSI area are typically only about 12-30 feet, there doesn't seem to be a problem with them causing bank erosion.

Campers

- They are not supposed to have fires, but they do.
- They leave trash.
- They cause water quality problems because there are no public facilities for camping.

Solutions

- LSI needs more "warden time" because the location is so difficult to patrol, and there are so many more added duties because of the cabins and blinds.
- Enforcement problem trends tend to cycle. The hunting territorialism gets better and worse, and the situation with the cabins get better for a while and then interest drops off.
- LSI needs a permanent assigned warden.
- The wildlife management division should be taking care of cabins, not the enforcement division.
- 15 to 20 years ago a DFG employee named Bailey was working on LSI exclusively and he made good progress. He was in the wildlife management division. He was even able to do land and resource management such as planting native vegetation, rather than just working on enforcement of hunting and cabin regulations.
- LSI needs more staff time, more money, and especially a boat.

Constraints

- Right now the warden must reserve a boat to get out to LSI, and must have a DFG partner join them from Benicia or Folsom (the Elk Grove post is currently closed). Therefore, all patrol trips must be planned in advance.
- In an emergency the warden could probably jump onto a Coast Guard boat, but otherwise there isn't really a capacity for an emergency response
- Other wildlife areas are light years ahead of LSI because they are staffed by wildlife management department staff, they are accessible by car, and they have wardens assigned to them.

OTHER AGENCY PERSONNEL

John Fritz, Water Management
Sacramento/Yolo Mosquito & Vector Control District
March 16, 2006

Scott Bahrenfuss, Captain
Rio Vista Fire District
March 22, 2006

Tim Arts, Field Supervisor
Department of Boating and Waterways, Aquatic Weed Program
March 22, 2006

Dave Lydick, Park Ranger Manager
Sacrament County Parks Department
March 23, 2006

Todd Raymond
Sacramento County Sheriff's Department
Mr. Raymond was contacted on several occasions between March 21, 2006 and April 13, 2006 with no response.

1 GENERAL ENVIRONMENTAL ISSUES AND EFFECTS OF HUMAN USES

A) What important environmental problems are occurring at LSI? These resource issues are offered for your thinking.

- water quality – salinity
- other water quality
- nutrient (carbon) consumption
- fish habitat and fish use
- recreation (e.g., boating, sail or kite sports, fishing, hunting)
- wetland habitat
- invasive exotic species
- flooding
- levee and bank erosion
- unauthorized structures

B) How are human uses affecting these problems?

C) How might management of the LSI WMA address these environmental problems or reduce their magnitude at LSI?

D) What constraints limit the ability of management actions to address these issues?

E) Please summarize helpful environmental information regarding these issues that you know is available. Also, what key data gaps need to be filled?

F) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted regarding these issues at LSI?

- The Sacramento/Yolo Mosquito & Vector Control District does not have any record of performing any inspections at Lower Sherman Island. Therefore, they do not have any information to provide on the area.
- The primary constraint for The Sacramento/Yolo Mosquito & Vector Control District to inspect the area is that it is only accessible by boat; this prohibits any type of regular surveillance.
- The Sacramento/Yolo Mosquito & Vector Control District is going to make arrangements to take a boat to the property to evaluate the site this year. After this visit they would be happy to coordinate with DFG regarding the results of their inspection.
- Aquatic plants are making the lake areas shallower.
- The DPW is only treating hyacinth; egeria is not being treated. There is also some primrose and some pennywart. DPW does not know if there are native primrose or just exotic primrose.

- Human uses are probably not affecting aquatic weeds at LSI. Boat traffic may be exacerbating the spread of egeria.
- DPW will be purchasing a new boat which will be more effective at treating aquatic weeds in areas like LSI.
- The Antioch boat launch area can have chop 3, 4, or 5 feet high and the air boat that the DPW uses can only withstand chop about 1 to 2 feet high.
- Aggressive control of aquatic weeds at LSI is needed, but DPW is not really the agency who is responsible for addressing this need. DFG is the agency with the authority to treat the aquatic weeds.
- There is a big need for on-going treatment to clear up the invasive plants and DFG should lead this task.
- DPW could probably help treat the invasive aquatic weeds if an agreement were in place with DFG.
- DPW estimates that they have the hyacinth in the LSI area approximately 70-80% controlled.
- Because the area is tidal, the equipment needs (e.g. a suitable boat) are a constraint.
- Data gaps include a lack of knowledge of what the extent of the invasive aquatic weed problem is at LSI.
- Some good aerials would be helpful to establish baseline conditions.
- Research is needed to determine if the aquatic plant species are all exotic or if there are native species.
- Dr. Lars Anderson would be a helpful resource.
- DFG needs to pay more attention to the wildlife area.
- Jet skiers are harmful to the environment because they ski through the sloughs like a slalom course at 40 mph and scare the birds.

2 RESTORATION ISSUES

A) What restoration opportunities or needs exist at LSI?

B) What goals would you have for restoration actions at LSI; that is, stated differently:

- what do you believe restoration actions should accomplish?
- what would be your desired outcome or desired end condition?

C) Do any of these goals stand out as higher priority?

D) What ideas have you already considered for restoration actions that would address these goals?

E) What major constraints exist on the implementation of your ideas for restoration actions?

F) Please summarize helpful environmental information or documents that you know are available to address your ideas. Also, what key data gaps need to be filled?

G) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted during the planning process for restoration actions at LSI?

- Constraints to performing restoration activities include difficult access, money to remove invasive plants, the possible need for an NPDES permit and a Biological Opinion for potential ESA impacts. The LSI area is the mixing zone for the delta smelt.
- DPW could perform aquatic weed removal for Hyacinth and egeria without further environmental reviews. Other species are not covered under their agreements.
- Aquatic weeds are smothering native plants.
- DFG needs to remove invasive aquatic plants to clear the waterways and prevent siltation.
- The parks department has planted some elderberry and some native oaks in the "Sherman Island Fishing Access" area (the boat launch).
- There is some erosion occurring on the entry road adjacent to the entry station which the parks department has rip-rapped with rock.
- This erosion is exacerbated because the windsurfers clear a path through the rip rap for easy access to the water. The parks department replaces the rip rap as needed.
- Hyacinth grows in the boat launch area. DPW treats this area and the parks department will physically remove it with a rake
- Himalayan blackberry grows in the boat launch parking lot area and along the entry road. The parks department hand prunes the blackberry outside of the nesting season.
- The entry road and the parking lot flood occasionally but they are designed to.

3 HUMAN USE ISSUES

A) What is your user group's general perspective of the existing situation at LSI?

B) At LSI, what important problems are occurring with human uses? These uses are offered for your thinking.

- hunting
- fishing
- recreational boating
- windsurfing or other sail or kite sports
- wildlife viewing
- use of existing cabins and associated docks
- unauthorized uses or structures

B) What conflicts exist between different uses?

C) How might management of the LSI WMA resolve these use issues or reduce their magnitude at LSI? And, what actions addressing these issues do you consider a high priority?

D) What goals would you have for management of human uses at LSI? (In other words, regarding use of LSI, what would be your desired outcome or future condition?) And, which of these objectives do you consider a high priority?

E) What are the major constraints on management that affect the attainment of these goals?

F) Please summarize helpful information or documents that you know are available and that address these issue. Also, what key data gaps need to be filled?

G) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted during the planning process for future management of the LSI WMA?

- The primary purpose of the parks departments MOU with the Wildlife Conservation Board (DFG) is to provide hunting and fishing access.
- Now the parks department has an agreement with DFG that allows self-contained overnight camping, used primarily by the windsurfers and some anglers.
- No overnight parking is allowed in the boat launch parking area.
- 20-30 years ago there was more hunting and fishing but the trend has been that these uses have been diminishing.
- This may be because there are less people doing this type of recreation in general and it may be because there are reduced birds and fish.
- Windsurfing has been an increasing use. The area is the 2nd or 3rd best windsurfing area in the U.S. and the 2nd best in the west behind the Columbia River Gorge. The parks department sells annual passes to people from AZ, HI, and NV
- Jet skiing has been increasing in the area too.
- The windsurfing and jet skiing are compatible uses because the windsurfers use the area when it is windy and the jet skiers use the area when it is calm.
- These two uses are also compatible with hunting and fishing because their seasons don't overlap. The period of time that the area is used by the windsurfers and jet skiers is approximately May 15 to September 15.
- Electricity and potable water at the boat launch area would improve the camping conditions.
- Potable water at the area would also allow a fish cleaning station.
- The primary constraints to making these improvements are money and parks department staff time needed for planning.

4 FIRE MANAGEMENT

A) What problems have fires at LSI caused for human uses or public safety?

B) How could management of the LSI WMA address these problems in the future?

C) How have fires affected natural resources at LSI?

D) What goals for fire management would you have for the LSI WMA?

E) What are the major constraints on fire management at LSI that would affect the attainment of these goals?

F) Please summarize helpful information or documents that you know are available and that address fire management issues at LSI. Also, what key data gaps need to be filled?

G) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted during the planning process for fire management at the LSI WMA?

- In the past 18 years or so the Rio Vista Fire Department has only been involved in a couple of fire incidents at Lower Sherman Island Wildlife Area.

- One fire incident burned several acres on Upper Sherman Island.
- If the wildlife area is a State Recreation Area then it would fall under the jurisdiction of CDF.
- CDF has been notified in the past where there area island fires, but they just let the fires burn.
- The Rio Vista Fire Department can only get to areas accessible by road.
- The major constraint for fire management at LSI is access to the area.
- Island fires are not a big public safety problem.
- Fires may be an improvement for natural resources at LSI when they clear out overgrowth.
- The Brannon State Recreation Area may have a fire management plan that could be helpful to review.
- The Delta Fire Protection District Board of Directors (3 individuals) and the Contra Costa Consolidated Fire District may be helpful to contact.
- Last year there was a barge fire out in the island area that nobody wanted to take responsibility for. A fire boat from Vallejo addressed the fire. The Coast Guard may have taken incident command.
- The Coast Guard may take incident command in cases like this, but the resources (e.g. fire boat, manpower) are provided by somebody else.
- Somebody needs to accept oversight of the area.
- Upper Sherman Island is within the Delta Fire Protection District boundaries, which also includes Twitchel Island.
- Lower Sherman Island could potentially be annexed into the Delta Fire Protection District, but incident command of fires in the wildlife area would be tough because the District is small.
- Contra Costa County might have a fire boat.
- If the Delta Fire Protection District annexed the wildlife area they would probably need to have the Contra Costa Consolidated Fire District perform most of the fire response.
- The Delta Fire Protection District has Alarm systems (response procedures) which include mutual aid agreements and automatic aid agreements with outside agencies. Therefore, mechanisms are already in place for similar joint responses.
- Maybe the Contra Costa Consolidated Fire District could annex the wildlife area.

5 LAW ENFORCEMENT

A) Please describe the scope of your law enforcement duties related to Lower Sherman Island.

B) Are these activities in response to people who are there for recreation or for other types of activity?

C) Please describe the current law enforcement needs of your jurisdiction as it relates to LSI.

D) Based on your experience, can you describe trends in illegal activity at LSI and in adjacent areas?

E) Do you feel that your law enforcement agency has proper access to the LSI WA?

F) Please describe the scope and schedule of your patrols at LSI.

- The Rio Vista Fire Department is not involved with law enforcement at LSI.
- If medical needs arise at LSI, the Coast Guard or the Sheriffs Department would pick up the patient and bring them to the boat launch. Then the Fire Department would take over care.
- The parks department has a ranger for the delta region which includes 4 parks. This ranger patrols the LSI boat launch area.
- This ranger visits the 4 parks Thursday through Sunday from April through September. From October through March a ranger visits the area when the caretaker calls with a problem.
- The parks ranger enforces entry fee payments, boat speed laws with jet skiers, fire management for ring fires and fireworks, and some DFG regulations (e.g. visible fishing license).
- Sometimes visitors act like trouble-makers, but these incidents have declined since the parks department got a permanent camp host.
- There is an on-site manager of the boat launch area who assists in minor law enforcement needs (e.g. illegal campfires, shooting, vandalism, driving off-road, drinking parties).
- The current enforcement at the boat launch area is adequate.
- The parks department had adequate access to the land areas under their jurisdiction.

USER GROUPS

Roger Mammon
Lower Sherman Island Duck Hunters
March 28, 2006

Mark Hennelly
California Waterfowl Association
March 31, 2006

Gary Adams
California Striped Bass Association
March 31, 2006

1 GENERAL ENVIRONMENTAL ISSUES AND EFFECTS OF HUMAN USES

A) What important environmental problems are occurring at LSI? These resource issues are offered for your thinking.

- water quality – salinity
- other water quality
- nutrient (carbon) consumption
- fish habitat and fish use
- wetland habitat
- invasive exotic species
- flooding
- levee and bank erosion

- Water quality – Salinity is more of a problem than other factors, due to too much water being taken from the system (LSI is an important staging area for pre-spawners for certain game fish, a passage way for salmon, and an important nursery for young-of-year fish). Temperatures as high as 80 degrees F occur in west Sherman Lake where little flow or flushing occurs, which is bad for fish.
- Filtering out of silt by aquatic plants is making water much more clear; however, wind stirs up silt, so lake gets murky more quickly.
- Invasive species – Flow issue worsens invasive species (lake of adequate flow from upstream). Exotic plant growth has reduced flow and flushing, particularly in the summer time.
- Invasive species are an issue and need to be controlled. DFG hasn't devoted a lot of resources to do this. Have gotten help from duck hunters, particularly in management of ponds. There wouldn't be half the use of the area by waterfowl without this pond management.
- Invasive aquatic plants are starting to fill in the area. Many areas in LSI are a lot shallower than they had been in the past; sloughs are getting choked up by periwinkle where flows are low, and are getting inaccessible to boaters and waterfowl.
- Pennywort and periwinkle are native, but are becoming a nuisance due to reduced flow. These plants are also warming the water and I suspect additional negative effects on other native aquatic species, such as copepods and salmon smolts. [Note: Periwinkle is identified in plant guide sources as an exotic native to Europe]
- Levee and bank erosion - Levee and bank erosion is not much of a problem
- Levee and bank erosion is not really an issue. I don't believe walking on levees is a cause of any problems. Any problems are due to wave action and rodents.
- Haven't seen erosion. Increased tule growth has protected levee and banks.
- Carbon – Egeria accumulates on the bottom when it dies back, which should have an effect on carbon accumulation.
- General comments on effects of human uses — There are some issues, like hunters leaving decoys, and some trash from all users.

  Tampering with the area to add public access could lead to abuses by opening up area to other uses, such as wind surfing.

  Duck hunters are part of the solution. Need to encourage DFG and duck hunters to work together. Without duck hunters' efforts, tules would take over. DFG doesn't have the resources to do the work needed.

B) How are human uses affecting these problems?

- recreation (e.g., boating, sail or kite sports, fishing, hunting)
- unauthorized structures
- cabins and associated uses
- other uses or behaviors
- Cabins and associated uses – Cabins are probably inappropriate in the wildlife area, and are unique to LSI. Probably need a statutory change to get rid of them.

I have not been involved in any cabin or related issues. My understanding is that removal is required at end of lifetime lease.
Transients may use cabins and cause sanitation problems.

- Unauthorized structures – I don't know of any [interviewee later acknowledged that DFG considers some blinds as such]. Building of blinds and walkways has been going on since the 1920s. DFG has been removing some. The Duck Hunter Association was founded due to DFG running roughshod over duck hunters. No new blinds are being built and I don't believe there are any issues with existing blinds. Some are floating blinds, and so have no impact on land.
- Natural area should not be disturbed to promote additional recreation. Those that do use area are very good stewards.
- Only duck hunters help with management of the area – other recreationists don't contribute.
- Enforcement presence is low – there is a lack of wardens to control activities out there.
- Don't see any negative issues. Boats may actually open up sloughs. Tule reduction was actually applauded (by DFG?).

C) How might management of the LSI WMA address these environmental problems or reduce their magnitude at LSI?

- Water quality is more of a Delta-wide issue. Suggestion: possibly open another channel off of the Sacramento River to increase flushing. This would improve habitat.
- The biggest thing is management of water being exported; tidal flows are interrupted.
- DFG needs to maintain agreement with duck hunters.
- It is a money issue; need more funding for ACTIVE management; wetlands require active management.
- Control of aquatic vegetation is a primary concern. DFG should use mechanical removal more. I don't like it but spraying is a necessity.
- Recreation uses are not a threat to the ecology.

D) What constraints limit the ability of management actions to address these issues?

- Very limited enforcement. DFG is harnessed by legislature, with too many responsibilities that should be handled by others (example given was DFG checking water quality, which interviewee believed should be a Health Department task).
- DFG should not be hand-in-hand with DWR, whose job is to export water.
- The Legislature cuts back DFG funding continuously.
- DFG is laughing stock in other states – they have the highest fees in the nation.
- Other properties receive more funding, and so attract a lot more birds.
- DBW says they think they can do a better job with aquatic plant control if they could start earlier in season (interviewee recognized issue with potential fish effects if control started earlier). Environmental groups are suing to stop spraying of invasives.

E) Please summarize helpful environmental information regarding these issues that you know is available. Also, what key data gaps need to be filled?

- A number of studies have been done in the Delta and in LS. Studies are rejected by DWR when they don't like the results.
- Other organizations have very good information.
- There is a lot of data out there on the benefits of fire and herbicides on habitat management.
- Friends of the River have done studies.
- There is a need for specific data for LSI – it is a unique area, with tidal action, hard to control environmental factors (unlike many other areas where have dry season and good access to do more active physical manipulation and management).
- Use duck hunters as a source – they have more long-term knowledge of conditions and changes out there.

F) Who are key experts, knowledgeable individuals, or stakeholders that should be consulted regarding these issues at LSI?

- Delta-Keepers: Bill Jennings, now with CSPA and "Allied Fishing Groups", driving force in water quality issues (deltakeep@aol.com, (209) 464-5067)
- Marinas – Chris Lauritzen of Lauritzen Yacht Harbor, in Oakley (near Antioch Bridge); his family has fished the area for generations.
- Roger Mammon, LSI Duck Hunter's Association [interviewer mentioned that Roger Mammon had already been interviewed.]
- Warden, Regional Manager (she is new) [interviewer mentioned that others are interviewing DFG staff for this plan.]
- Tina Swanson, Bay Institute [Dr. Tina Swanson, Senior Scientist]

2 RESTORATION ISSUES

A) What restoration opportunities or needs exist at LSI?

- Open up new channel to Sacramento River (see response to 1 C).
- There is very little that can be done without more water and better temperatures.
- I am concerned about plan to fill in Sherman Lake. The problem is really upstream (inadequate flow).
- Need to manage the area to encourage waterfowl-friendly plants and native vegetation; duck hunters are helping to keep the area from being overgrown.
- Disk seasonally-flooded areas, use herbicide to control certain species. If these actions are not done, will get solid tules and cattails; the food value is low, these plants will choke out ponds, and no areas will be left for waterfowl to rest and breed.

B) What goals would you have for restoration actions at LSI; that is, stated differently:

- what do you believe restoration actions should accomplish?
- what would be your desired outcome or desired end condition?
- Better flows and flushing; do not fill it in.

- Desired outcome is more habitat for fishing and game birds and other birds
- A goal should be control of arundo [Giant reed]using herbicide and fire.
- Have folks expert in waterfowl habitat management to manage the area
- Need new design. I recognize the challenges, physically, of management at LSI.

C) Do any of these goals stand out as higher priority?

- No responses.

D) What ideas have you already considered for restoration actions that would address these goals?

- See above responses (2A and 2B). The restoration actions I mentioned have been tried other places; I haven't looked at LSI specifically.

E) What major constraints exist on the implementation of your ideas for restoration actions?

- Money; DWR has the money, but has long-term plans to fill in the area, which is very much opposed by fishermen.
- Funding and environmental factors.

3 HUMAN USE ISSUES

A) What is your user group's general perspective of the existing situation at LSI?

- LSI is a good place to get away that the general public doesn't really know about, full of cuts and sloughs that provide excellent habitat; leave it alone.
- Duck hunters want to be part of solution and part of management of the area; give them the right tools.
- DFG tried to crack down on duck hunters – ridiculous to do this before have more funding to do proper management.
- Island itself should be left alone, preserve it in current natural state.

B) At LSI, what important problems are occurring with human uses? These uses are offered for your thinking.

- hunting
- fishing
- recreational boating
- windsurfing or other sail or kite sports
- use of existing cabins and associated docks
- unauthorized uses or structures
- wildlife viewing
- There aren't really any problems – just have a few irresponsible people, like in any group.
- Have heard of problems with cabins. The cabins area is so accessible from the south side, that it is hard to control these uses.

C) What conflicts exist between different uses?

- None that I am aware of at this time.
- Bird watchers need to understand that other users pay the bills through license and stamp fees.
- Conflicts with hunters are occasional – time of year and hours of day that hunters are there isn't when most anglers are there.
- Sometimes are conflicts with fishermen in duck hunting season; limited to late fall and winter hunting season, is only occasional
- Some recreational boating use – jet skiing, water skiing, sail sports — occurs in Sherman Lake, which has potential for conflicts.
- No real conflicts. Some bass fishermen don't respect hunters – they are out there making money – but problems are usually minor.
- DFG says blinds have to be used in a first come-first use basis. We sometimes come upon unknown hunters in our blind, but generally we ask people in the blind to share or we go elsewhere.
- A goal of the Duck Hunter organization has been to reduce conflicts among duck hunters themselves.

D) How might management of the LSI WMA resolve these use issues or reduce their magnitude at LSI? And, what actions addressing these issues do you consider a high priority?

- Need to get more enforcement, particularly during the hunting season, which would help minimize conflicts.

E) What goals would you have for management of human uses at LSI? (In other words, regarding use of LSI, what would be your desired outcome or future condition?) And, which of these objectives do you consider a high priority?

- Protection of traditional uses – hunting and fishing. New uses should respect these existing uses. Existing uses deserve protection, and new uses should not be ones that are in conflict with these.

F) What are the major constraints on management that affect the attainment of these goals?

- Funding.

4 FIRE MANAGEMENT

A) What problems have fires at LSI caused for human uses or public safety?

- Fires are not really a problem for human use or public safety.
- Sherman Island burns only occasionally; I have only seen it burn twice in 20 years. I don't know how the fires start.
- There are no problems or issues with fire. It burns when no one is out there. Blinds are not at risk because they are generally built of a metal framework to support vegetation which is replaced each season.

- Boats only land on beaches on Sacramento River, so they can easily escape area if a fire starts.

B) How could management of the LSI WMA address these problems in the future?

- No responses (no perception of problems).

C) How have fires affected natural resources at LSI?

- None that I am aware of – on a historic level, fire would destroy invasive species.
- Not sure if fires have beneficial or adverse impact. DFG should always consider this tool for management.
- Duck hunters view fire positively; it helps clear choked areas.
- My perception is that there is a fire or two every year or two.
- I don't know of any effects; fires probably do more good than harm, gets rid of older underbrush.

D) What goals for fire management would you have for the LSI WMA?

- Putting in new access, or areas where people would build bonfires, would cause problems.
- Fire is a natural part of the system; Indians burned the area.
- Fire issue is used to limit access by those that have used the area for generations.
- Would have a goal of controlling noxious weeds and improving wildlife habitat. Fire is a good tool if properly managed.

E) What are the major constraints on fire management at LSI that would affect the attainment of these goals?

- Winds – too windy much of the time to burn.
- Want to burn when recreation use is low.
- Is there anything we haven't covered in this conversation that you would like to add?
- Biggest issue is General Plan of DWR (not made public) which has a large influence on DFG budget.
- Main goal is to protect duck hunting and to be sure duck hunters are part of the solution.

APPENDIX B

Environmental Review

NEGATIVE DECLARATION

Pursuant to Sections 15070 and 15071 of the California Environmental Quality Act (CEQA) guidelines, the California Department of Fish and Game proposed to adopt this Negative Declaration.

1. **Title and Short Description of Project:** Lower Sherman Island Wildlife Area Land Management Plan.

   The California Department of Fish and Game (Department) is proposing to adopt a land management plan for the Lower Sherman Island Wildlife Area to help guide its planning and operations.

   The Lower Sherman Island Wildlife Area (LSIWA) is an extensive tract of natural vegetation and Delta waters that provides diverse and valuable wildlife habitats and related recreational opportunities and is integral to the functioning and human use of the Delta.

   The Department, as part of the Resources Agency of the State of California, has the following mission to guide its planning and operations: "The mission of the Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public."

   The purpose of this land management plan (LMP) is to:

   1. guide management of habitats, species, and programs described in the LMP to achieve the Department's mission to protect and enhance wildlife values;
   2. serve as a guide for appropriate public uses of the LSIWA;
   3. serve as descriptive inventory of fish, wildlife, and native plant habitats that occur on or use the LSIWA;
   4. provide an overview of the property's operation and maintenance and of the personnel requirements associated with implementing management goals (this LMP also serves as a budget planning aid for annual regional budget preparation); and
   5. present the environmental documentation necessary for compliance with state and federal statutes and regulations, provide a description of potential and actual environmental impacts that may occur during plan management, and identify mitigation measures to avoid or lessen these impacts.

2. **Location of Project:** The proposed project is located at the LSIWA, which occupies roughly 3,100 acres, primarily marsh and open water, at the confluence of the Sacramento and San Joaquin Rivers in the western Sacramento–San Joaquin River Delta (Delta).

3. **Project Proponent:** California Department of Fish and Game

4. **Said project will not have a significant effect on the environment for the following reasons:**

   The proposed project involves the adoption of a management plan, which of itself would cause no environmental impacts. Implementation of the management plan may include actions that would physically alter the environment. Possible actions that may result from the adoption and implementation of the management plan were anticipated and analyzed at a programmatic level.

   Although implementation of some elements of the plan (e.g., restoration or enhancement activities, the removal of abandoned structures or of other remnants of human activities) would have the potential for environmental impacts, these impacts would not be substantial because of their small scale, because the LMP includes tasks that would require the avoidance of significant construction effects, and because many of these projects would enhance rather than degrade environmental resources. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. Therefore, less-than-significant environmental impacts would be anticipated as a result of the adoption and implementation of this LMP.

5. As a result thereof, the preparation of an Environmental Impact Report pursuant to CEQA (Division 13 of the Public Resources Code of the State of California) is not required.

In accordance with Section 21082.1 of the California Environmental Quality Act, California Department of Fish and Game (DFG) has independently reviewed and analyzed the Initial Study and Negative Declaration for the proposed project and finds that the Initial Study and Negative Declaration reflect the independent judgment of the DFG.

I hereby approve this project:

Notice of Determination

Form C

To:

☒ Office of Planning and Research

For U.S. Mail: P.O. Box 3044, Sacramento, CA 95812-3044

Street Address: 1400 Tenth St., Sacramento, CA 95814

☐ County Clerk
County of: ____________________
Address: ____________________

From:

Public Agency: Department of Fish and Game
Address: Sacramento Valley Central Sierra Region
1701 Nimbus Road, Suite A Rancho Cordova, CA 95670
Contact: Ms. Sara Holm
Phone: 530-745-0486

Lead Agency (if different from above): ____________________
Address: ____________________
Contact: ____________________
Phone: ____________________

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if submitted to State Clearinghouse): # 2006 102 054

Project Title: Department of Fish and Game Lower Sherman Island Wildlife Area Land Management Plan

Project Location (include county): Lower Sherman Island, Sacramento County

Project Description:

The project is the adoption and implementation of the Lower Sherman Island Wildlife Area (LSIWA) Land Management Plan (LMP). The LSIWA is an extensive tract consisting of natural vegetation and open water that provides diverse and valuable wildlife habitats and related recreational opportunities. The LMP will guide the Department's management, planning, and operations of the LSIWA.

This is to advise that the Department of Fish and Game (☒ Lead Agency or ☐ Responsible Agency) has approved the above described project on ____________ (Date) and has made the following determinations regarding the above described project:.

1. The project [☐ will ☒ will not] have a significant effect on the environment.
2. ☐ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☒ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☐ were ☒ were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [☐ was ☒ was not] adopted for this project.
4. A statement of Overriding Considerations [☐ was ☒ was not] adopted for this project.
5. Findings [☐ were ☒ were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval, or the negative Declaration, is available to the General Public at: DFG Sacramento Valley Central Sierra Region 1701 Nimbus Road, Suite A Rancho Cordova, CA 95670

Signature (Public Agency) ____________________ Title Acting Dep. Director

Date 6/5/07 Date Received for filing at OPR ____________________

RECEIVED
JUN 8 2007
STATE CLEARING HOUSE

Authority cited: Sections 21083, Public Resources Code.
Reference Section 21000-21174, Public Resources Code.

Revised 2005

APPENDIX B ENVIRONMENTAL REVIEW

PROJECT INFORMATION		
1.	Project Title:	Lower Sherman Island Wildlife Area Land Management Plan
2.	Lead Agency Name and Address:	Department of Fish and Game Sacramento Valley Central Sierra Region 1701 Nimbus Road, Suite A Rancho Cordova, CA 95670
3.	Contact Person and Phone Number:	Sara Holm (916) 358-2881
4.	Project Location:	Sacramento County, California
5.	Project Sponsor's Name and Address:	Same as above
6.	General Plan Designation:	Natural Preserve
7.	Zoning:	AG-80 (Agricultural, 80-acre parcels)
8.	Description of Project: (Describe the whole action involved, including, but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.) See Chapter 2 – Project Description	
9.	Surrounding Land Uses and Setting: (Briefly describe the project's surroundings)	See Chapter 2 – Project Description
10:	Other public agencies whose approval is required: (e.g., permits, financing approval, or participation agreement)	None

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	☒	None

DETERMINATION (To be completed by the Lead Agency)

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]	
Signature	Date
Sandra Morey	Regional Manager
Printed Name	Title
California Department of Fish and Game	
Agency	

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 “Earlier Analyses,” as described in (5) below, 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:
   the significance criteria or threshold, if any, used to evaluate each question; and
   the mitigation measure identified, if any, to reduce the impact to less than significance.

The goals, tasks, activities, and resulting actions described in the Lower Sherman Island Wildlife Area Land Management Plan (LMP) were evaluated for their potential effects on the environment in accordance with the provisions of the California Environmental Quality Act (CEQA) and the State CEQA Guidelines. Chapters 2 and 3 of the LMP describe the setting and baseline conditions used for this CEQA analysis. This Initial Study was prepared in accordance with the State CEQA Guidelines to evaluate these impacts, and concludes that the proposed LMP would not have any significant effects on the environment. Accordingly, a proposed Negative Declaration has been prepared.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
I.	**AESTHETICS** -- 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 that would adversely affect day or nighttime views in the area?	☐	☐	☐	☒
II.	**AGRICULTURE RESOURCES:** 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?	☐	☐	☐	☒
III.	**AIR QUALITY** -- 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?	☐	☐	☒	☐

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
c)	Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in 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?	☐	☐	☒	☐
IV.	**BIOLOGICAL RESOURCES** -- 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 US 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?	☐	☐	☐	☒

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
V.	**CULTURAL RESOURCES** -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 resource 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?	☐	☐	☒	☐
VI.	**GEOLOGY AND SOILS** -- 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?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
VII. HAZARDS AND HAZARDOUS MATERIALS -- 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?	☐	☐	☒	☐
VIII. HYDROLOGY AND WATER QUALITY -- 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)?	☐	☐	☐	☒

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
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)	Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒
IX.	**LAND USE AND PLANNING** - 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?	☐	☐	☐	☒

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
X.	**MINERAL RESOURCES** -- 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?	☐	☐	☐	☒
XI.	**NOISE** -- 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?	☐	☐	☐	☒
XII.	**POPULATION AND HOUSING** -- 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?	☐	☐	☐	☒

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
XIII.	**PUBLIC SERVICES**				
a)	Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
	Fire protection?	☐	☐	☒	☐
	Police protection?	☐	☐	☒	☐
	Schools?	☐	☐	☐	☒
	Parks?	☐	☐	☐	☒
	Other public facilities?	☐	☐	☐	☒
XIV.	**RECREATION --**				
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?	☐	☐	☒	☐
XV.	**TRANSPORTATION/TRAFFIC** -- 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?	☐	☐	☐	☒

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
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)?	☐	☐	☐	☒
XVI.	**UTILITIES AND SERVICE SYSTEMS** 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 serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
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?	☐	☐	☐	☒

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less Than Significant Impact	No Impact
XVII.	**MANDATORY FINDINGS OF SIGNIFICANCE**				
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?	☐	☐	☒	☐

EXPLANATION FOR ANSWERS GIVEN

AESTHETICS

a) b), d) No impact. Adoption and implementation of the proposed LMP would preserve existing native vegetation and natural visual resources, and would not involve the construction of any new buildings or outdoor lighting. Facility improvements that could result from the implementation of the LMP would be very small in scale, such as signage, and would not affect vistas or scenic resources. Therefore, adoption of the LMP would not adversely affect scenic vistas, views, visual character, or scenic resources, nor would it create light or glare effects.

c) Less-than-significant impact. Implementation of some of the management tasks described in the proposed LMP would involve modifications to the existing visual environment (e.g., restoration or enhancement activities, the removal of abandoned structures, the removal of other remnants of human activities, placement of signage). It is anticipated that projects that would be implemented as a result of adoption of the proposed LMP would improve aesthetic conditions in the plan area. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

AGRICULTURAL RESOURCES

a), b), c) No impact. Although property in the wildlife area may have been used for agricultural production from the mid-1800s to the 1920s prior to levee failures, there are no current farming or ranching operations on the property and the area is not under a Williamson Act contract. The proposed LMP would conserve existing land resources and would not result in the building of any new structures. The project area does not contain prime or unique farmland, or farmland of statewide importance. No impact to agricultural resources would occur.

AIR QUALITY

a), d) No impact. Adoption of the proposed LMP would not require the construction of new structures, generate significant automobile or boat trips, or involve the use or disturbance of any malodorous substances. Therefore, adoption of the LMP would not generate air emissions from new construction or operations, nor would it create any objectionable odors.

b), c), e) Less-than-significant impact. Although implementation of some of the management tasks described in the proposed LMP could involve the use of construction equipment (e.g., restoration or enhancement activities, the removal of abandoned structures or other remnants of human activities), thus temporarily increasing equipment emissions, these would be short-term impacts and would not cause a considerable cumulative increase of air pollutants. Potential restoration projects could include the excavation of wetlands, which could temporarily release objectionable odors, but it is not anticipated that these types of odors would be released in large quantities or for long durations. Also, because the wildlife area is isolated (including an absence of nearby residences), these odors would not reach a substantial number of people. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

BIOLOGICAL RESOURCES

e), f) No impact. The LMP includes protection and enhancement as primary goals for both wildlife and their habitat. It also ensures that all actions comply with state and federal Endangered Species Acts and other applicable regulations aimed at the protection of special-status species and wildlife. This ecosystems approach would preserve or enhance endangered species and their habitats. Therefore, adoption of the proposed LMP would not result in adverse impacts to any wildlife, habitat, or wildlife movement, nor would it conflict with any policies, ordinances, or plans protecting biological resources.

a), b), c), d) Less-than-significant impact. Although implementation of some of the management tasks described in the proposed LMP would have the potential for temporary construction impacts to wildlife and sensitive habitats such as wetlands (e.g., restoration or enhancement activities, the removal of abandoned structures or of other remnants of human activities), these impacts would not be substantial because of their small scale, because the LMP includes tasks that would require avoiding significant construction effects, and because these projects would have a net benefit to wildlife and habitat. Any of these types of projects would be implemented in conformance with regulatory requirements such as DFG regulations, USFWS regulations, State Water Quality Control Board regulations, Section 404 of the Clean Water Act, and any applicable plans or ordinances protecting biological resources. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

CULTURAL RESOURCES

a), b), c), d) Less-than-significant impact. Adoption of the proposed LMP would not require any construction or excavation; therefore, adoption of the proposed LMP would not adversely affect archaeological or paleontological resources, or disturb any human remains. Although implementation of some of the management tasks described in the proposed LMP would involve disturbance of land for habitat restoration and demolition of structures (e.g., restoration or enhancement activities, the removal of abandoned structures or of other remnants of human activities), the LMP includes requirements for cultural resource surveys prior to ground disturbance, consultation with a qualified archaeologist in the case of an inadvertent discovery, submittal of resource documentation to the California Historical Resources Information System and the National Register of Historic Places, and submittal of evaluations of these resources to the State Historic Preservation Officer and the Office of Historic Preservation, as appropriate.. These measures would identify and protect any historic resources prior to their demolition. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

GEOLOGY AND SOILS

a), c), d), e) No impact. No construction is proposed as part of the LMP nor would any be required as a result of the implementation of any of the LMP goals or tasks; therefore, the proposed project would not change the current exposure of people to geologic hazards or expansive soils. LMP goals include tasks to improve existing septic systems, and no new septic systems would be installed as a result of adoption of the proposed LMP.

b) Less-than-significant impact. Implementation of some of the management tasks described in the proposed LMP would involve ground disturbance (e.g., restoration or enhancement activities, the removal of abandoned structures or of other remnants of human activities), but these projects would be implemented with a goal of a net decrease in soil erosion or topsoil loss, and would be conducted in conformance with regulatory requirements regarding soil erosion. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

HAZARDS AND HAZARDOUS MATERIALS

g), h) No impact. No construction, excavation, or demolition is proposed as part of the LMP; therefore, adoption of the LMP would not introduce or intensify any hazardous risks to the public or the environment. The wildlife area is not adjacent to an urbanized area and it is surrounded by water. The few residences in the wildlife area are intermixed with wildlands; however, adoption and implementation of the fire management goal and accompanying tasks would decrease potential risks of loss, injury or death involving wildland fires.

a), b), c), d), e), f) Less-than-significant impact. Implementation of some of the management tasks described in the proposed LMP would involve a potential for exposing people or the environment to hazardous materials (e.g., ground disturbance during restoration or enhancement activities, especially in previously developed areas or in areas of dredge spoils; the demolition and transportation of abandoned structures; the removal of other remnants of human activities). However, prior to ground disturbance in areas that have experienced development or disturbance and could contain hazardous materials, a hazardous materials assessment would be conducted. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

HYDROLOGY AND WATER QUALITY

b), e), g), h), i), j) No impact. Adoption of the proposed LMP would not utilize surface or groundwater resources, construct new buildings or impervious surfaces, or alter existing risks of tsunami.

a), c), d), f) Less-than-significant impact. Implementation of some of the management tasks described in the proposed LMP (e.g. restoration or enhancement activities, the removal of abandoned structures, the removal of other remnants of human activities) would involve a potential for the discharge of sediments or pollutants and alteration of drainage patterns. However, these projects would be conducted in conformance with regulatory requirements regarding erosion and sediment control, flooding, and water quality protection, and would be implemented with a goal of a net improvement in water quality.

In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

LAND USE AND PLANNING

a), b), c) No impact. The proposed LMP would not require any physical changes to an established community, nor would any project implemented following adoption of the LMP physically divide an established community. The wildlife area is managed in conformance with State Lands Commission requirements, and the LMP has been developed in conformance with management plans for adjacent areas. The goals of the LMP provide for natural resource protection and preservation and require that any projects implemented following adoption of the proposed LMP conform with any habitat conservation plans and natural community conservation plans that may be applicable at that time.

MINERAL RESOURCES

a), b) No impact. No construction is proposed, and no resource extraction would occur. No mineral resources of value are located within the wildlife area. Therefore, the proposed project would not conflict with mineral resource protection plans or result in the loss of a known mineral resource.

NOISE

c), e), f) No impact. No building construction or substantial change in operations is proposed; therefore, the project would not generate any building construction-related or operational noise impacts. No permanent operational changes would occur that would increase ambient noise levels.

a), b), d) Less-than-significant impact. Although implementation of some of the management tasks described in the proposed LMP could involve the use of construction equipment (e.g., restoration or enhancement activities, the removal of abandoned structures or of other remnants of human activities), thus temporarily increasing ambient noise, these activities would be short-term and would not result in a substantial increase in ambient noise levels. Furthermore, because the wildlife area is isolated, these types of short term noise impacts would not be anticipated to reach a substantial number of people.

Because the LMP requires that all actions comply with state and federal Endangered Species Acts and other applicable regulations aimed at the protection of special-status species and wildlife communities, construction-related projects would not occur during times of the year, such as breeding seasons, when noise impacts could adversely affect wildlife. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

POPULATION AND HOUSING

a), b), c). No impact. The proposed LMP does not involve any change in housing nor would it induce growth by the provision of new infrastructure or by the removal of any barriers to growth. It is anticipated that as tenant's leases expire, the resident population at the wildlife area will decrease. Implementation of some of the management goals and tasks may require additional staff hours, but this would not be anticipated to induce a population growth that would require additional housing.

PUBLIC SERVICES

a) Less-than-significant impact. Adoption of the proposed LMP would not require substantial changes to existing levels of public services. Implementation of public use, facilities, and fire management goals could require a minimal increase in staff hours per year by the local fire departments if one of them annexes the wildlife area, the County Sheriff's department, and DFG staff, but these potential minimal increases would not be anticipated to create the need for new or altered facilities. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

RECREATION

a), b) Less-than-significant Impact. Several management goals in the LMP would support the continued use of the wildlife area for public recreation, and Authorized Public Use Goal 2 aims to increase opportunities for wildlife-dependent recreation. Management Review and Coordination Goal 5 Task 2 involves collaborating with Sacramento County Parks regarding the provision of additional facilities, electricity, and potable water at Sherman Island Public Access Facility, which could increase the level of use at this facility. However, adoption and implementation of the proposed LMP would not increase existing levels of mostly wildlife-dependent recreational use of the wildlife area in a manner or to an extent that deterioration of existing facilities would occur. The small number of recreational users would not exceed the carrying capacity of the natural resources or degrade existing natural features or recreational facilities. The possible provision of additional features at the Public Access Facility would not cause an adverse physical effect on the environment because they would be installed in compliance with this LMP, which includes measures to prevent such adverse effects. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

TRANSPORTATION/TRAFFIC

a), b), c), d), e), f), g) No Impact. Levels of use at the wildlife area are anticipated to remain the same following adoption of the LMP. Therefore, no changes are anticipated to automobile, boat, or air traffic levels. The only road that accesses the wildlife area is West Sherman Island Road, which ends at the boat ramp. No design changes are proposed for this road, nor are any changes anticipated with boat traffic patterns; therefore, no traffic hazards are anticipated. Because no changes to current traffic levels or patterns are anticipated, no changes to emergency access or parking are anticipated and adoption of the LMP would not interfere with alternative transportation plans.

UTILITIES AND SERVICE SYSTEMS

a), b) Less-than-significant impact. Adoption of the proposed LMP is anticipated to improve existing conditions in regard to wastewater treatment. Adoption and implementation of Management Coordination Goal 1, Task 4, would require that existing substandard systems be maintained, removed, or replaced to meet current legal standards. Because these systems would be improved in conformance with appropriate regulatory requirements, it is not anticipated that any required construction or expansion of existing facilities would cause significant environmental effects. In addition, prior to implementation of any projects that are consistent with the LMP, the Department would subject them to CEQA review in light of the information in this document. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164.

c), d), e), f), g). No Impact. The LMP does not include a proposal for additional storm drain facilities, additional water supplies, additional wastewater treatment, or additional solid waste disposal. All existing residences that have water treatment facilities use septic systems. Adoption of the proposed LMP and implementation of the goals and tasks contained therein would not require the construction of new residences or facilities; therefore, adoption of the proposed LMP would generate no new demand for no changes to storm drain facilities, additional water supplies, additional wastewater treatment, or additional solid waste disposal.

MANDATORY FINDINGS OF SIGNIFICANCE

a). Less-than-significant impact. Adoption of the proposed LMP and implementation of the goals and tasks contained therein would help protect and enhance natural resources. Some projects that could be implemented as a result of adoption of the proposed LMP would have a potential for impacts to biological and cultural resources (e.g., restoration or enhancement activities, the removal of abandoned structures or of other remnants of human activities), as described in Sections IV and V above. However, because projects would be conducted following all applicable regulatory requirements, because many of the goals and tasks are designed to have a net benefit to these resources, and because no large-scale projects are anticipated that could threaten species populations or plant communities, adoption of the proposed LMP would not cause a significant impact to these biological or cultural resources.

b) Less-than-significant impact. Adoption of the proposed LMP and implementation of the goals and tasks contained therein would not require any substantial infrastructure improvements or new construction, and any projects implemented would be conducted following all applicable regulatory requirements. In addition, most of the proposed goals and tasks are proposed to encourage a net benefit to environmental conditions. Therefore, although there is a potential for some temporary and less than significant impacts to the environment as described above, none of these impacts would be cumulatively considerable.

c) Less-than-significant impact. The proposed project is a land management plan that generally continues the existing uses of the wildlife area with improvements in operation and protection and enhancement of the environment. Implementation of the LMP would comply with all applicable laws and regulations. As a result, adoption of the proposed LMP and implementation of the goals and tasks contained therein would not have any direct or indirect environmental effects which would cause substantial adverse effects on human beings.

APPENDIX C

Legal Description of Property and Operating Agreement for Lower Sherman Island Public Access Facility

AGREEMENT FOR THE TRANSFER OF CONTROL AND POSSESSION OF STATE OWNED LANDS

14301

THIS AGREEMENT, made and entered into this 20th day of April, 1960, by and between the Department of Finance, hereinafter called "Finance", the Sacramento and San Joaquin Drainage District, acting by and through the Reclamation Board, hereinafter called District, and the Department of Fish and Game, hereinafter called "Fish and Game";

W I T N E S S E T H:

WHEREAS, Finance has control and possession of the hereinafter described lands, together with the improvements thereon; and

WHEREAS, Fish and Game desires to acquire said lands, together with the improvements contained thereon, on the terms and conditions herein contained;

NOW, THEREFORE, it is hereby mutually agreed by the parties hereto as follows:

1. Pursuant to the provisions of Section 13110 of the Government Code of the State of California, Finance hereby transfers unto Fish and Game, and Fish and Game accepts the control and possession of the land, together with all improvements contained thereon, situated in the County of Sacramento, State of California, described as follows:

> All that certain parcel or tract of real property, situate, lying and being portions of Township 2 North Range 1 East; Township 2 North Range 2 East; Township 3 North Range 1 East and Township 3 North Range 2 East; said parcel being all of Sherman Island lying West of Mayberry Slough; said tract being also Subdivisions "A", "B", "C", "D", "E", "F" and "G", as said subdivisions are shown on the official map entitled "Map Showing Subdivisions of the lands of Dos Rios Reclamation Company, Sherman Island, Sacramento County, California", filed in the office of the County Recorder of Sacramento County; in Book 8 of Maps; said parcel containing 3,250 acres more or less, being known also as

14301 FEB 11 1963

INDEXED

Reclamation District Number 50, lying at the confluence of Sacramento and San Joaquin River in the County of Sacramento, State of California.

Excepting and reserving unto Finance, and the District and their successors, assigns, contractors and agents, a right of way and easement at such time or times as they may desire to deposit or waste earth or other material upon the above-described real property in connection with any flood control, reclamation or navigation project and also at such time or times as they may desire to excavate and remove earth or other material therefrom in connection with said purposes; provided, however, that Finance or the District, their successors or assigns, shall consult with Fish and Game prior to each exercise of the above rights in order to attempt to minimize any damage to or interference with the activities or facilities of Fish and Game upon the said real property; and provided further, that if Fish and Game first secures the advance approval of Finance and the District for the location and construction of any buildings it may desire to locate upon the said real property then the above rights shall not be exercised in a manner which will damage or interfere with the use of these buildings.

14301

2. It is agreed that in the event the property herein transferred is ever sold, the proceeds of such sale shall be deposited in the general fund in the State Treasury.

3. It is further agreed that Fish and Game shall consult with and obtain the approval of the District for any use to which Fish and Game wishes to put this property or any improvement to be made thereon in order to minimize any damage to or interference with any flood control activity or any Federal, State, or local flood control work or works located in the vicinity of the property herein transferred.

IN WITNESS WHEREOF, the parties hereto have executed this agreement the date first above written.

DEPARTMENT OF FISH & GAME

By ______________________
Administrative Officer

DEPARTMENT OF FINANCE

By ______________________
A. W. Collins
Assistant Director

SACRAMENTO AND SAN JOAQUIN DRAINAGE DISTRICT
acting by ~~and through~~ the Reclamation Board

____
General Manager and Chief Counsel

OFFICIAL RECORDS
SACRAMENTO COUNTY CALIF.
RECORDED AT REQUEST OF
STATE OF CALIFORNIA
1963 FEB 11 AM 11 04

Leonard J. Hooper
COUNTY RECORDER

14201

STATE OF CALIFORNIA }
COUNTY OF SACRAMENTO } ss.

On this fifteenth day of December A.D. 19 61, before me,

- - - - Mary K. Hicks - - - -, a Notary Public in and for the said county and State,

duly commissioned and qualified, personally appeared Robert W. James - -

~~and~~ ______________________, known to me to be the General Manager and Chief Counsel ~~[illegible]~~ ~~respectively~~, of The Reclamation Board of the State of California, and acknowledged to me that ~~they~~ executed the foregoing instrument for and on behalf of The Reclamation Board of the State of California.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal, the day and year in this certificate first above written.

SEAL

Mary K. Hicks
Notary Public in and for the County of Sacramento, State of California
My commission expires July 22, 1964

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BOOK 4606 PAGE 286

STATE OF CALIFORNIA)
) ss
COUNTY OF SACRAMENTO)

On this 1st day of February, 1963 before me, NANCY A LACEY, a Notary Public in and for said County and State, personally appeared A. W. Collins, known to me to be the Assistant Director of Finance (General Services) of the Department of Finance, who signed the within instrument on behalf of the Department of Finance.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal at my office in the said County and State aforesaid, the day and year in this certificate first above written.

SEAL

Nancy A. Lacey

NANCY A. LACEY
Notary Public in and for the County of Sacramento, State of California.
My Commission expires November 12, 1965

ACKNOWLEDGMENT
DEPARTMENT OF FISH AND GAME

STATE OF CALIFORNIA)
COUNTY OF SACRAMENTO) SS.

ON THIS 1st DAY OF February, IN THE YEAR ONE THOUSAND NINE HUNDRED AND Sixty-three BEFORE ME, ALICE M. GARIBALDI, A NOTARY PUBLIC IN AND FOR SAID COUNTY AND STATE, RESIDING THEREIN, DULY COMMISSIONED AND SWORN, PERSONALLY APPEARED James A. Leiby, KNOWN TO ME TO BE THE Administrative Officer ~~DIRECTOR~~ OF THE DEPARTMENT OF FISH AND GAME OF THE STATE OF CALIFORNIA THAT EXECUTED THE WITHIN INSTRUMENT, AND ALSO KNOWN TO ME TO BE THE PERSON WHO EXECUTED THE WITHIN INSTRUMENT ON BEHALF OF THE STATE OF CALIFORNIA THEREIN NAMED AND ACKNOWLEDGED TO ME THAT THE STATE OF CALIFORNIA EXECUTED THE SAME.

IN WITNESS WHEREOF, I HAVE HEREUNTO SET MY HAND AND AFFIXED MY OFFICIAL SEAL THE DAY AND YEAR IN THIS CERTIFICATE FIRST ABOVE WRITTEN.

14301

SEAL

Alice M. Garibaldi

ALICE M. GARIBALDI, NOTARY PUBLIC IN AND FOR THE COUNTY OF SACRAMENTO
STATE OF CALIFORNIA

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for file

TRANSFER OF CONTROL AND POSSESSION OF LAND ON DOS RIOS ISLAND (SHERMAN ISLAND) FROM DEPARTMENT OF FINANCE TO FISH AND GAME COMMISSION FOR ESTABLISHING PUBLIC SHOOTING GROUNDS

THIS INDENTURE, made and entered into this 10th day of October, 1944, by and between the DEPARTMENT OF FINANCE, hereinafter called "Finance" and the FISH AND GAME COMMISSION, hereinafter called "Commission",

W I T N E S S E T H:

WHEREAS, Finance has control and possession of certain hereinafter described real property owned by the State of California and located on Dos Rios Island (Sherman Island) in the County of Sacramento, State of California; and

WHEREAS, Commission has requested Finance to transfer to Commission the control and possession of the above referred to real property for the purpose of establishing a public shooting ground thereon, and it is agreeable to Finance that such request be granted upon the terms and conditions hereinafter set forth;

NOW, THEREFORE, in consideration of the premises and pursuant to authority contained in Section 675.2, Political Code of the State of California, Finance does hereby transfer to Commission, subject to the reservations and conditions hereinafter set forth, for the purposes of establishing and maintaining a public shooting ground under the provisions of the Fish and Game Code of the State of California, and for no other purpose or purposes the control and possession of the following described real property owned by the State of California and situate in the County of Sacramento, State of California:

All that certain parcel or tract of real property situate, lying and being portions of Township 2 North Range 1 East; Township 2 North Range 2 East; Township 3 North Range 1 East and Township 3 North Range 2 East; said parcel being all of Sherman Island lying West of Mayberry Slough; said tract being also Subdivisions, "A", "B", "C", "D", "E", "F", and "G", as said subdivisions are shown on the official map entitled, "Map Showing Subdivisions of the lands of Dos Rios Reclamation Company Sherman Island, Sacramento County, California", filed in the office of the County Recorder of Sacramento County; in Book 8 of Maps; said parcel containing 3,100 acres more or less, being known also as Reclamation District number 50, lying at the confluence of Sacramento and San Joaquin River in the County of Sacramento, State of California.

This transfer of control and possession of the aforesaid real property is made subject to the following conditions and reservations:

1. That such transfer may be terminated at any time by Finance upon giving ninety days' written notice to Commission. In the event of such termination, Commission agrees to execute and deliver such instruments as may be necessary to effect the retransfer to Finance of the control and possession of said real property.

2. That there is hereby expressly reserved to Finance the continuous right of ingress to and egress from any portion or portions of the real property included in the above described real property.

3. That the real property herein described shall be subject at all times to full and complete use for flood control and reclamation purposes, and that authorized representatives and contractors of the Federal Government and of the Reclamation Board of the State of California shall have the continuous right of ingress to and egress from any portion or portions of said real property for such purposes.

4. That Commission shall not construct any improvements upon the real property herein mentioned without first securing written approval of Finance.

5. In the event of the termination of this agreement Commission shall thereupon at its own expense and risk when requested to do so by Finance, remove all materials and any other

property a... equipment placed by or for Commission upon said real property and restore said premises as nearly as possible to the same state and condition they were in at the effective date of this agreement, but if Commission should fail so to do within ninety days after such termination and request, Finance may so do at the risk of Commission and all costs and expense of said removal and restoration of said premises as aforesaid shall be paid by Commission upon demand.

Notwithstanding anything contained herein to the contrary, this agreement may be terminated or the provisions of this agreement may be changed, altered or amended by mutual consent of the parties hereto.

IN WITNESS WHEREOF the parties have hereunto set their hands the day and year aforesaid.

DEPARTMENT OF FINANCE
JAMES S. DEAN, Director of Finance

By K. M. Dorton
Deputy

FISH AND GAME COMMISSION

By L. F. Chappell
Executive Officer

APPROVED
DEPARTMENT OF NATURAL RESOURCES
Warren T. Hannum
DIRECTOR

DEPARTMENT OF FINANCE
APPROVED
OCT 10 1944

RECEIVED
OCT 11 1944
Department of Natural Resources
ACCOUNTING OFFICE

No fee 606

62-00157

RECORDED WITH
STATE BOARD OF CONTROL

THE 3rd DAY OF

June 1920

PROPERTY AGENT

BY L. E. C.

Filed in the office of the
SECRETARY OF STATE
the Third day of
June A.D. 1920
By Frank C. Jordan
By Frank H. Berry

SACRAMENTO AND SAN JOAQUIN DRAINAGE
DISTRICT

to

STATE OF CALIFORNIA.

D E E D

DATED: April 24, 1920.

RECORDED AT REQUEST OF
State Board of Control
JUN 1 1920 9
15 A 531
Sacramento
C. H. Root
J. G. Berger

reed 5/1/20

THIS INDENTURE, made and entered into this 24th day of April, 1920, by and between SACRAMENTO AND SAN JOAQUIN DRAINAGE DISTRICT, a corporation (created by that certain act of the Legislature of the State of California, approved May 26, 1913, being Chapter 170 of the Statutes passed at the regular session of said Legislature in the year 1913), acting by and through the Reclamation Board of California, herein designated as the party of the first part, and STATE OF CALIFORNIA, herein designated as the party of the second part;

W I T N E S S E T H:

The party of the first part herein, for and in consideration of the sum of One Dollar ($1.00) to it in hand paid, the receipt whereof is hereby acknowledged, has, subject to the conditions hereinafter set out, granted, bargained, transferred, sold and conveyed, and does, subject to the conditions hereinafter set out, hereby grant, bargain, transfer, sell and convey, to the party of the second part herein, all of that certain piece or parcel of land, situate, lying and being in the County of Sacramento, State of California, being a portion of Dos Rios Island and described as follows:-

A piece or parcel of land situate, lying and being in the County of Sacramento, State of California, and being all of those certain lots known, designated and described as lots Numbers One (1), Two, (2), Three (3), Four (4), Five (5), Six (6), and a portion of lot nine (9) of Subdivision "A" of the Dos Rios Reclamation Company, as the same are shown and delineated on that certain map or plat, entitled "Map of Subdivision "A" of the Dos Rios Reclamation Company, Sherman Island, Sacramento County, California", which said map or plat was filed for record in the office of the County Recorder, County of Sacramento, on December 27, 1910, in Book 11 of Maps, Map No. 30. The portion of lot Nine (9), being all of said lot Nine (9), excepting that portion containing 23.19 acres, a little more or less, which was conveyed by D. W. Carmichael and Myrtie R. Carmichael, his wife, to the State of California, by that certain deed dated October 19, 1917, and recorded November 13, 1917, in Book 478 of Deeds, at page 18, Records of Sacramento County, California.

Also all of Subdivisions "B", "C", "D", "E" and "F", and a portion of Subdivision "G", as said Subdivisions are shown and delineated on that certain map or plat entitled "Map Showing Subdivisions of the lands of Dos Rios Reclamation Company, Sherman Island, Sacramento County, California, Containing 3401.76 Acres", which said map or plat was filed for record in the office of County Recorder of the County of Sacramento, on July 18, 1907, in Book No. 8 of Maps, Map No. 36. The portion of Subdivision "G" included in this indenture being more particularly described as follows, to-wit:

Beginning at the most s .therly corner of Subdivision "G", and running thence North 0° 24' West, 2724.4 feet; thence West 2780.7 feet; thence South 43° 21' East 316.8 feet; thence South 39° 16' East 2925 feet; thence South 64° 29' East 439.3 feet; thence South 84° 01' East 385.0 feet to the point of beginning.

The above described tracts containing 2633.51 Acres, a little more or less, as shown upon blue print attached hereto, and made a part hereof.

TOGETHER WITH, all the tenements and hereditaments thereunto belonging or in anywise appertaining.

TO HAVE AND TO HOLD, subject to the conditions herein named, said land to the said party of the second part herein forever.

The said land herein described is a portion of Dos Rios Island located upon the left bank of the Sacramento River immediately above its juncture with the San Joaquin River, and is conveyed upon the express condition that the same is to be used for the deposit of waste, or spoil bank material excavated from the Sacramento River for the purpose of channel enlargement, in accordance with the plan of flood control heretofore adopted by the State of California; providing, however, that any of said land may be used by the said party of the second part for any lawful purpose not inconsistent with, or which will not interfere with, the use of said land for the deposit of said waste material excavated, or to be excavated from the channel of the Sacramento River.

The party of the second part herein, by the acceptance of this indenture, agrees to hold said land subject to such condition.

IN WITNESS WHEREOF, the party of the first part herein, has by resolution, authorized its officers to execute and place its official seal upon this indenture the day and year first hereinabove written.

SACRAMENTO AND SAN JOAQUIN DRAINAGE DISTRICT

By A C Fletcher
President of the Reclamation Board

By Thos. Mayhew
Secretary of the Reclamation Board

M R Ellott
APR 27 1929
O C Leavey

Approved as to legal form:

Frank Freeman
Attorney for the Reclamation Board

U. S. WEBB, Attorney General,
By R. T. McKisick, Deputy.

OPERATING AGREEMENT
FOR
LOWER SHERMAN ISLAND PUBLIC ACCESS,
Sacramento County

This Operating Agreement is made and entered into this 19th day of August, 1999, between the County of Sacramento, hereinafter called "Operator" and the STATE OF CALIFORNIA, acting through the Department of Fish and Game, hereinafter called "State". Operator and State hereby agree as follows:

I. RECITALS

(a) State has under its control those certain lands described in Exhibit C hereof which Operator and State desire to use for public access and wildlife habitat purposes.

(b) The development, use, operation and maintenance of said lands on a cooperative basis between Operator and State is herein referred to as the "Project".

(c) The parties hereto have heretofore entered into a Cooperative Agreement for the Project, dated June 8, 1966, as amended on April 17, 1979 and August 4, 1981, to provide for the Operation and Maintenance of Lower Sherman Island Angling Access, also known as Lower Sherman Island Public Access.

(d) The parties hereto desire to upgrade the existing public access improvements and construct additional public access improvements on the Project for public recreational purposes and include all the public access improvements into a new cooperative agreement for the operation and maintenance thereof.

(e) Operator has additionally entered into a separate agreement with the California Department of Boating and Waterways, DBW Contract # 97-204-286, dated March 24, 1998, to construct public access improvements within the Project area and said improvements shall be included as Project improvements for the purposes of this agreement.

(f) The development, use, operation and maintenance of the Project on a cooperative basis is in accordance with the authorization of State's Wildlife Conservation Board on August 19, 1999, and Operator's Resolution No 99-1023.

(g) Signature of this document on behalf of the State hereby certifies that all conditions for exemption set forth in State Administrative Manual (SAM) Section 1215 have been complied with, and that this document is exempt from review by the State Department of Finance (SAM Section 1219).

II. GENERAL TERMS AND CONDITIONS

(h) Effective with the date of this cooperative agreement, that certain cooperative agreement dated June 8, 1966, as amended on April 17, 1979, and August 4, 1981, is terminated.

(i) PROJECT NAME: The name of this Project is Lower Sherman Island Public Access. This name shall be used in all documents, signs, publications, brochures, general literature or news releases, and Operator shall not rename the Project without the approval of State.

(j) EXHIBITS: This agreement incorporates by reference Exhibit A (Standard Terms and Conditions), Exhibit B (Plans or Project Description) and Exhibit C (Project Area Legal Description).

(k) PROJECT DEVELOPMENT: Any development or improvement of facilities on said area, as described in Exhibit B hereof, will be carried out by separate agreement. Within ninety (90) days of completion of construction of any development or improvement of facilities, Operator shall submit a copy of "as-built" plans of such development or improvement to State.

(l) TERM: The Term of this agreement is twenty five (25) years commencing with the date hereof. This agreement may be extended or amended by mutual agreement of the parties hereto, or terminated as hereinafter provided.

(m) NOTICES: Notices required between the Operator and State will be deemed to have been given when mailed to the respective addresses below, first-class postage fully prepaid thereon:

To Operator: County of Sacramento
Department of Regional Parks, Recreation and Open Space
3711 Branch Center Road
Sacramento, California 95827

To State: State of California
Department of Fish and Game
Wildlife Conservation Board
801 K Street, Suite 806
Sacramento, CA 95814

COUNTY OF SACRAMENTO
Department of Regional Parks,
Recreation and Open Space

BY Ronald D. Suter
Ronald D. Suter
Director

Date Signed: 10·13·99

Attest: Laura Lenz-Lyons

STATE OF CALIFORNIA
Department of Fish and Game
Wildlife Conservation Board

BY W. John Schmidt
W. John Schmidt
Executive Director

Date Signed: 10/25/99

APPROVED
NOV - 9 1999
DEPT OF GENERAL SERVICES

Teresa L Baron Irwin

EXHIBIT A

STANDARD TERMS AND CONDITIONS TO OPERATING AGREEMENT

I. SCOPE AND PURPOSE

1. SCOPE: This Agreement pertains to the facilities and improvements as described in Exhibit B hereof and to the area as described in Exhibit C hereof. The development, use, operation and maintenance of such facilities on the described area is called the Project.

2 PURPOSE AND USE: The Project premises and every part thereof shall be used only for sport fishing or other wildlife-related or appropriate recreational activities. Subject to Paragraph 6 hereof, Operator may use the premises for temporary or special purposes through agreement with others. The premises and Project facilities shall, unless otherwise specifically provided herein, be available without charge, and there shall be no restrictions to public ingress or egress at any time except when it is necessary to close the area for maintenance, repair, public safety, security or for protection of the structure or facilities. Operator shall notify State within 48 hours of making such closures.

II. MAINTENANCE AND OPERATION

3. MAINTENANCE: Operator shall provide all normal Project maintenance and operation of the area and improvements thereon for and in accordance with the purposes expressed and, except for occurrences beyond the control of the Operator, or "Acts of God", shall make all reasonable and necessary repairs, replace broken, damaged or worn structural components or fixtures so as to keep the structures and facilities in a safe usable condition, and perform housekeeping operations as required so as to keep the premises and improvements clean, attractive, and free of accumulations of litter, garbage, or debris. Equipment and materials not needed for routine maintenance operations shall not be stored or stockpiled on the premises.

4. PROJECT SIGNS: A Project sign and direction signs, if required, will be provided and installed at project cost, and maintained by Operator. The Project sign shall show the name of the Project, the Operator and State agency or agencies involved. The location and makeup of the Project sign or directional signs, including dimensions, materials and lettering, shall be as mutually agreed upon by Operator and State. Direction signs shall be installed and maintained by Operator as required on or off the site to direct the public

to the Project or Project facilities, or for safe and appropriate public use of the area and Project facilities.

5. ADDITIONAL IMPROVEMENTS: Except as provided by separate agreement as herein above described, State shall not be obligated to make or cause to be made any further developments, or to make improvements or repairs to any structures or facilities within the Project area. However, Operator may at its own cost place or construct on the premises any structures, alterations or improvements in addition to those set forth and described herein as the Project, provided that they:
   (a) are in accord with the purposes herein set forth;
   (b) are constructed, maintained and operated for the use, enjoyment, service and protection of the public;
   (c) do not directly or indirectly reduce, restrict or interfere with the primary purposes of the Project; and
   (d) have the prior written approval of the State.

   Any improvements made and installed on the premises at Operator's cost shall be and remain the property of Operator during the term hereof, but in the event this agreement is terminated, State may require Operator to remove said improvements, or have them removed and charge Operator for the cost thereof.

6. CONCESSIONS: Operator may enter into agreements with others to provide services, conveniences or facilities to complement the Project improvements provided that:
   (a) the purpose of any such agreement is consistent with the purposes and uses described herein;
   (b) any revenues received by Operator from such concession agreements are deposited in a special account identified with the Project and are used solely for operation and maintenance of Project;
   (c) Operator maintains adequate records of revenues and expenditures relating to any such concession agreements and makes them available for audit when requested by State; and
   (d) such agreements, including the percentages of revenue to be distributed to Concessionaire and Operator, are approved by State prior to award.

7. No charges or fees shall be imposed or collected by the County or any concessionaire for the privilege of ingress to or egress from the Public Access for launching of boats, or for the privilege of fishing the waters of the Public Access area, provided, however, that the County may charge a vehicular entrance fee for parking or use of the County-provided facilities. All charges, fees, and collections for parking concessions, special services, or accommodations established by the County shall be subject to prior written approval from the State, and such charges, fees, collections, and profits derived by the County therefrom or otherwise under this agreement shall be used by the County solely in the furtherance of the purposes herein set forth.

III. GENERAL PROVISIONS

8. ASSIGNMENT: Operator shall not assign this agreement in whole or in part, nor delegate any of its rights, duties or interests unless otherwise specifically provided for in the agreement.

9. LIABILITY: Operator hereby waives all claims and recourse against State including the right to contributions for any loss or damage arising from, growing out of, or in any way connected with or incident to this agreement or the Project except claims arising from the concurrent or sole negligence of State, its officers, agents and employees. Further, Operator shall indemnify, hold harmless, and defend State, its officers, agents and employees against any and all claims, demands, damages, costs, expenses or liability arising out of the design, construction, operation, maintenance, existence or failure of the Project. If State is named as co-defendant pursuant to Government Code Sections 895 et seq., Operator shall notify State and represent it, unless State elects to represent itself, in which case State shall bear its own litigation costs, expenses and attorney's fees.

10. INDEPENDENT CONTRACTOR: Operator and any of its officers, agents and employees shall, in the performance of this agreement, act in an independent capacity and not as officers, agents or employees of State.

11. NONDISCRIMINATION: Operator hereby certifies that in the performance of its responsibilities and duties under this agreement and any assignment thereof, and in the administration of any concession agreement for services or accommodations, it will comply

with all State and Federal nondiscrimination laws, and the area will be open and accessible for the use and enjoyment of the general public on equal and reasonable terms.

12. BREACH: In the event Operator fails to comply with any of the terms and conditions of this agreement, State may, after written notice to Operator to remedy the breach and a period of ninety (90) days, correct any deficiency or cause of breach and charge Operator all costs in connection therewith, including administrative costs.

13. TERMINATION: This agreement shall be for the term commencing with the date hereof and ending twenty-five (25) years thereafter. The Operator hereby agrees that the State may terminate this agreement at any time during the term hereof by giving notice to the Operator at least ninety (90) days prior to the date when such termination shall become effective. The Operator may terminate this agreement only with the consent of the State, and if the State so consents, such termination shall be effective on such date as the parties may agree.

14. WAIVER OF RIGHTS: It is the intention of the parties to this agreement that from time to time either party may waive certain of its rights under the agreement. Any such waiver by the parties hereto of their rights with respect to default or any other matter arising in connection with this agreement shall not be deemed to be a waiver with respect to any other default or matter.

15. REMEDIES NOT EXCLUSIVE: The use by either State or Operator of any remedy specified in the agreement for the enforcement of the agreement is not exclusive and shall not deprive the party using such remedy, or limit the application of any other remedy provided by law.

16. SUCCESSORS AND ASSIGNS: This agreement and all its provisions shall apply to and bind the successors and assigns of the parties hereto.

17. OPINIONS AND DETERMINATIONS: Where the terms of the agreement provide for action to be based upon the opinion, judgement, approval, review, or determination of either State or Operator, such terms are not intended to be and shall never be construed as permitting such opinion, judgement, approval, review or determination to be arbitrary, capricious or unreasonable.

EXHIBIT B

SITE AND PROJECT DESCRIPTION

Lower Sherman Island Public Access facility consists of a two-lane boat ramp, boarding float, parking area, access road, trails, post and cable fences, signs and portable comfort stations. The improvements to the facility will include renovation of the existing parking area and entrance road, a new boarding float, restrooms, lighting, entrance gate, shade ramadas, a second gravel parking area, and other amenities.

PROJECT AREA LEGAL DESCRIPTION

All that certain parcel or tract of real property, situate , lying and being portions of Township 2 North, Range 1 East; Township 2 North, Range 2 East; Township 3 North, Range 1 East; and Township 3 North, Range 2 East; said parcel being all of Sherman Island lying West of Mayberry Slough; said tract being also Subdivisions "A", "B", "C", "D", "E", "F" and "G", as said subdivisions are shown on the official map entitled "Map Showing Subdivisions of the lands of Dos Rios Reclamation Company, Sherman Island, Sacramento County, California", filed in the office of the County Recorder of Sacramento County; in Book 8 of Maps; said parcel containing 3,250 acres more or less, being known also as Reclamation District Number 50, lying at the confluence of Sacramento and San Joaquin River in the County of Sacramento, State of California.

That certain agreement made and entered into the 8th day of June, 1966, as amended the 17th day of April, 1979, by and between the State of California, acting by and through its Department of Fish and Game, hereinafter called the State, and the County of Sacramento, a political subdivision of the State of California, hereinafter called the County for the operation and maintenance of the Lower Sherman Island Angling Access, Sacramento County, is hereby further amended as follows:

1. Paragraph 3 is amended to read as follows:

"3. It is understood that said angling access area, and every part thereof, shall, at all times during the term hereof, be available to the public for access to fishing, and the public shall have unrestricted ingress and egress, except as hereinafter provided and at such times as the maintenance and upkeep operations of the County do not permit it. County may charge for vehicular access, provided that such vehicular access fee does not exceed those charged by the State Park System for similar facilities, and provided, further, that monies collected shall be used only for direct costs of operation and maintenance of said area."

2. Paragraph 5 is amended to read as follows:

"5. This agreement shall be for the term commencing with the date hereof and ending March 31, 2006. The County hereby agrees that the State may terminate this agreement at any time during the term hereof by giving notice to the County at least ninety days next prior to the date when such termination shall become effective."

3. Paragraphs 11, 12 and 13 are added as follows:

"11. State hereby permits County, to the exclusion of all other persons, firms or corporations, to operate or permit others to operate, such concessions as may enhance and benefit public fishing to the end that greater use and enjoyment of said area for public fishing may be pro-

– such concessions

public shall thereupon become subject to and to such rules and regulations as may be promulgated by County relative thereto. All such concessions shall be administered in accordance with health and sanitation standards prescribed by State laws.

"12. Subject to Paragraph 11, the County may establish, charge and collect such charges or fees relative to any such concessions, special services or accommodations provided for the public by the County in such amount as County may from time to time deem fit and proper. All fees and charges to the public for services and accommodations provided for herein shall be agreed upon in writing between the parties hereto, and proposed increases in rates for services and accommodations shall be subject to prior approval of the State. All charges, fees, collections and profits derived by the County shall be used only for the operation and maintenance of said area. ✓

"13. County shall keep and maintain accurate records and accounts of revenues received and of expenditures made for operation and maintenance in accordance with Paragraphs 3 and 12, and shall reserve in the State the right to audit said records and accounts."

Except as herein modified, all other terms and conditions of said agreement are to remain in full force and effect.

IN WITNESS WHEREOF, this amendment to agreement has been executed by the parties hereto this 4th day of August, 1981.

BOARD OF SUPERVISORS
COUNTY OF SACRAMENTO

ATTEST:

By

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME

By

Executive Officer
Wildlife Conservation Board

RESOLUTION NO. 81-902

BE IT RESOLVED AND ORDERED that the Chairperson of the Board of Supervisors be and she is hereby authorized and directed to execute Amendment No. 2 to that certain Cooperative Agreement dated June 8, 1966 as amended April 17, 1979, between the State of California, Department of Fish and Game, and the County of Sacramento for the operation and maintenance of the Lower Sherman Island Angling Access which shall amend paragraphs 3 and 5 and add paragraphs 11, 12, and 13 to said agreement.

On a motion by Supervisor Smoley, seconded by Supervisor Sheedy, the foregoing Resolution was passed and adopted by the Board of Supervisors of the County of Sacramento, State of California, this 4th day of August, 1981, by the following vote, to wit:

AYES: Supervisors, Bryan, Johnson, Sheedy, Smoley, Collin

NOES: Supervisors, None

ABSENT: Supervisors, None

Ilona Collin

Chairperson of the Board of Supervisors of Sacramento County, California

(SEAL)

ATTEST: Betty D. Parker
Clerk of the Board of Supervisors

In accordance with Section 25103 of the Government Code of the State of California, a copy of this document has been delivered to the Chairman of the Board of Supervisors, County of Sacramento, on

AUG 4 1981

By [signature]
Deputy Clerk, Board of Supervisors

FILED

1981

BOARD OF SUPERVISORS

Betty D. Parker

CLERK OF THE BOARD

COOPERATIVE AGREEMENT
THE STAT JF CALIFORNIA, DEPARTMENT OF FIS.. AND GAME
and
THE COUNTY OF SACRAMENTO
FOR OPERATION AND MAINTENANCE OF LOWER SHERMAN ISLAND ANGLING ACCESS

THIS AMENDMENT TO AGREEMENT made and entered into this 17th day of April, 1979, by and between the State of California, acting by and through its duly appointed, qualified and acting Director of the Department of Fish and Game, hereinafter called the State, and the County of Sacramento, a political subdivision of the State of California, hereinafter called the County.

W I T N E S S E T H:

WHEREAS, the parties hereto entered into a Cooperative Agreement dated June 8, 1966, wherein the State agreed to develop the Lower Sherman Island Angling Access and the County agreed to operate and maintain the area; and

WHEREAS, the State has allocated funds for area erosion controls at a meeting on February 7, 1979.

NOW THEREFORE, it is mutually agreed by and between the parties hereto that paragraph 1 of the said Cooperative Agreement is hereby amended as follows:

"1. The State will, at its sole cost and expense, develop said angling access area substantially in accordance with plans approved by the Wildlife Conservation Board on April 15, 1966, and February 7, 1979."

Except as herein modified, all other terms and conditions of said agreement shall remain unchanged and in full force and effect.

IN WITNESS WHEREOF, this agreement has been executed by and on behalf of the parties hereto the day and year first above written.

COUNTY OF SACRAMENTO

By Sandra R. Smoley

ATTEST:

By Betty D Parker

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME
WILDLIFE CONSERVATION BOARD

By Chester M. Hart
Executive Officer

I hereby certify that all conditions for exemption set forth in State Administrative Manual Section 1209 have been complied with and this document is exempt from review by the Department of Finance.

By Chester M. Hart

RESOLUTION NO. 79-435

BE IT RESOLVED AND ORDERED that the Chairperson of the Board of Supervisors be and she is hereby authorized and directed to execute an Amendment to an Agreement, in the form hereto attached, on behalf of the COUNTY OF SACRAMENTO, a political subdivision of the STATE OF CALIFORNIA, with the STATE OF CALIFORNIA, acting by and through its Director of Fish and Game, relating to the operation and maintenance of Lower Sherman Island Fishing Access, and to do and perform everything necessary to carry out the purpose of this resolution.

On a motion by Supervisor Johnson, seconded by Supervisor Collin, the foregoing Resolution was passed and adopted by the Board of Supervisors of the County of Sacramento, State of California, this 17th day of April, 1979, by the following vote, to wit:

AYES:	Supervisors	Collin, Johnson, Sheedy
NOES:	Supervisors	None
ABSENT:	Supervisors	Wade, Smoley

In accordance with Section 25103 of the Government Code of the State of California a copy of this document has been delivered to the Chairman of the Board of Supervisors, County of Sacramento, on

APR 17 1979

By Dorrien Moyer
Deputy Clerk, Board of Supervisors

FILED

APR 17 1979

BOARD OF SUPERVISORS

By Betty L Parker
CLERK OF THE BOARD

Sandra R. Smoley
Chairperson of the Board of Supervisors of Sacramento County, California

(SEAL)

ATTEST: Betty L Parker
Clerk of the Board of Supervisors

The foregoing is a correct copy of a resolution adopted by the Board of Supervisors, Sacramento County, California on APR 17 1979

Dated APR 17 1979

Clerk of said Board of Supervisors

By Dorrien Moyer
Deputy

WCB COPY

COOPERATIVE AGREEMENT
Between
THE STATE OF CALIFORNIA, DEPARTMENT OF FISH AND GAME
and
COUNTY OF SACRAMENTO
FOR OPERATION AND MAINTENANCE OF LOWER SHERMAN ISLAND ANGLING ACCESS

THIS AGREEMENT, made and entered into this 8th day of June 1966, by and between the State of California, acting by and through its duly appointed, qualified, and acting Director of the Department of Fish and Game, hereinafter called the State, and the County of Sacramento, a political subdivision of the State of California, hereinafter called the County;

W I T N E S S E T H:

WHEREAS, the State has under its control, those certain premises known as Lower Sherman Island; and

WHEREAS, the County desires to cooperate with the State in the operation and maintenance of said area as an angling access area; and

WHEREAS, the State desires to cooperate with the County in the operation and maintenance of said area;

NOW THEREFORE, the parties hereto, for and in consideration of the covenants, agreements, and stipulations hereinafter expressed, do hereby mutually agree as follows:

1. The State will, at its sole cost and expense, develop said angling access area substantially in accordance with plans approved by the Wildlife Conservation Board on April 15, 1966.

2. The County will, upon completion of said development by the State, provide all necessary maintenance and upkeep of the said angling access area for the term hereof. Such maintenance shall include, but not be limited to, keeping launching ramp, floats, access road, parking area, sanitary facilities, and other improvements developed by the State in good repair and free from unsightly conditions and debris accumulations.

3. It is understood that said angling access area, and every part thereof, shall at all times during the term hereof, be available to the public without charge for access to fishing, and the public shall have free

Term expires 9-30-86

and unrestricted ingress and egress, except at such times as the maintenance and upkeep operations of the County do not permit it.

4. County may, at its sole expense, construct and maintain on the demised premises such other improvements for general recreation as it may desire, subject to approval by State, so long as such development and/or structures do not interfere with the major purpose of creating access to public fishing.

5. This agreement shall be for the term commencing with the date hereof and ending ~~September 30, 1986~~ March 31, 2006. The County hereby agrees that the State may terminate this agreement at any time during the term hereof by giving notice to the County at least ninety days next prior to the date when such termination shall become effective.

6. All notices which may be given by either party to the other shall be deemed to have been fully given when made in writing and deposited in the United States Mail, certified and postage prepaid, and addressed to the County as follows: Board of Supervisors, County of Sacramento, Sacramento, California; and to the State as follows: Department of Fish and Game, 1416 Ninth Street, Sacramento, California. The address to which the notices shall or may be mailed as aforesaid may be changed by written notice by such party to the other as hereinbefore provided, but nothing contained herein shall preclude the giving of any such notice by personal service.

7. This agreement is not assignable by the County in whole or in part without written consent of the State first had and obtained.

8. That the parties hereto agree that the County and any of its agents and employees, in the performance of this agreement, shall act in an independent capacity and not as officers or employees or agents of the State.

9. That the County agrees to indemnify and save harmless the State, its officers, agents, and employees from any and all claims and losses to any person, firm, or corporation, arising out of the exercise by the County of its rights and obligations under this agreement.

10. The attached sheet entitled "Fair Employment Practices" is made a part of this agreement.

IN WITNESS WHEREOF, this agreement has been executed by and on behalf of the parties hereto, the day and year first above written.

BOARD OF SUPERVISORS
COUNTY OF SACRAMENTO

ATTEST:
Betty L George

By Eugene T. Gualco
CHAIRMAN, SACRAMENTO COUNTY
BOARD OF SUPERVISORS

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME

By
Administrative Officer

RESOLUTION NO. ________

BE IT RESOLVED AND ORDERED that the Chairman of the Board of Supervisors be and he is hereby authorized and directed to execute an Agreement, in the form hereto attached, on behalf of the COUNTY OF SACRAMENTO, a political subdivision of the State of California, with the STATE OF CALIFORNIA, acting by and through its Director of Fish and Game, relating to the operation and maintenance of Lower Sherman Island Angling Access,

and to do and perform everything necessary to carry out the purpose of this Resolution.

PASSED AND ADOPTED by the Board of Supervisors of the County of Sacramento, State of California, this 1st day of June, 1966, by the following vote, to wit:

AYES: Supervisors,

NOES: Supervisors,

ABSENT: Supervisors,

Eugene T. Gualco

Chairman of the Board of Supervisors of Sacramento County, California

(SEAL)

ATTEST: Betty L. George

Clerk of the Board of Supervisors

The foregoing is a correct copy of a resolution adopted by the Board of Supervisors, Sacramento County, California on JUN 1 1966

Dated JUL 6 1966

Clerk of said Board of Supervisors

By Irene Medes

Deputy

COUNTY OF SACRAMENTO

Department of Regional Parks, Recreation and Open Space

RONALD D. SUTER
Director

DEPUTY DIRECTORS
Jill Ritzman, Leisure Services & Regional Parks
Gary Kukkola, Rangers & American River Parkway
Thom Oliver, Golf & Contract Maintenance

May 6, 2003

Sherman Island Camping Proposal

Currently the Sherman Island Access is operated as a day use only area. The access is posted that the gate is closed at night. The park caretaker does try to lock the gate on certain nights and times of the year to cut down on late night parties and vandalism but at the same time not restrict access by fishermen. During the summer season there is a large number of sailboarders that come from throughout California and Nevada as well as other states and countries that use Sherman Island for sail boarding. Many of these users come in self-contained vans and motor homes and have traditionally stayed overnight either on the levee road outside the park or in the park illegally. With our staffing limitations the Ranger unit has been able to send two Rangers to Sherman Island on late night shifts 2 or 3 times per summer season to enforce the after hours use. Even this token enforcement effort takes away from the maintenance and operations duties that the assigned Ranger is responsible for. The few times that the overnight campers get cited seems to not be a deterrent to illegally staying overnight.

What Sacramento County Parks is proposing for Sherman Island is;

- Self contained overnight camping to be accommodated in the existing front and middle parking lots.
- Camping to be limited to a maximum of 14 consecutive days with a minimum break of 30 days in between.
- Currently the County Parks fee ordinance calls a camping fee of $10 per night.
- Being in the park for fishing (even night fishing) does not constitute overnight camping and will only be subject to the day use fee (same as current policy).
- Camping use will not impact the fishing access or the boat launch parking area. We anticipate that with a $10 camping fee there will be less overnight camping then there is currently.
- Charging for the existing overnight camping will bring in approximately $5,000/year of additional revenue that will be used to help maintain the Sherman Island Access.

We strongly feel that by legalizing the self contained camping at Sherman Island and charging for it we will have a more controlled access with fewer campers than currently are using the facility. There will be no negative impact on the primary use of this facility, which is fishing and hunting access. The approval of Fish & Game to allow this use per the operating agreement is very important to the County Parks Department.

Sincerely,
Dave Lydick
Chief Ranger

State of California - The Resources Agency GRAY DAVIS, *Governor*

DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
Sacramento Valley-Central Sierra Region
1701 Nimbus Road, Suite A
Rancho Cordova, CA 95670
(916) 358-2900

May 30, 2003

Mr. Dave Lydick, Chief Ranger
County of Sacramento
Department of Regional Parks
4040 Bradshaw Road
Sacramento, CA 95827

Dear Mr. Lydick:

You have been in contact with my staff regarding a proposal to allow charging a fee for self contained overnight camping at the Sherman Island access site. After reviewing your proposal, (attached) I concur with your request.

If you have questions, please contact Mr. Armand Gonzales at (916) 358-2876.

Sincerely,

Banky E. Curtis

Banky E. Curtis
Regional Manager

cc: Ms. Georgia Lipphardt
Wildlife Conservation Board
Sacramento, CA 95814

Mr. Armand Gonzales
Mr. Mike Grima
Ms. Patricia Perkins
Sacramento Valley-Central Sierra Region
Rancho Cordova, CA 95670

APPENDIX D

Lower Sherman Island Wildlife Area–Related Conservation Measures, Targets, and Programmatic Actions from the CALFED Ecosystem Restoration Program Plan and Multi-Species Conservation Strategy

APPENDIX D LOWER SHERMAN ISLAND WILDLIFE AREA–RELATED CONSERVATION MEASURES, TARGETS, AND PROGRAMMATIC ACTIONS FROM THE CALFED ECOSYSTEM RESTORATION PROGRAM PLAN AND MULTI-SPECIES CONSERVATION STRATEGY

CALFED has established numerous targets, actions, and conservation measures for resource management in the Delta. To identify EDAW staff reviewed the Ecosystem Restoration Program Plan (2000a, e) and the Multi-Species Conservation Strategy (2000f) and identified targets, actions, and measures related to management tasks of this LMP. Identified targets, actions, and measures have been summarized in Tables D-1, D-2, and D-3 for the riparian and upland, marsh, and aquatic ecosystem biological elements, respectively. Some objectives from the Ecosystem Restoration Program Plan that provided relevant guidance also have been included in these tables.

Table D-1
CALFED Targets, Actions, and Conservation Measures Related to Management of Riparian and Upland Element at LSIWA.

Title	Text	Source
California black rail MSCS Conservation Measure 11	To the extent practicable, control non-native predator populations in occupied habitat areas and salt marshes enhanced and restored under the ERP.	Ecosystem Restoration Program Plan, Volume I, page 277
California black rail MSCS Conservation Measure 3	Restore wetland and perennial grassland habitats adjacent to occupied nesting habitats to create a buffer of natural habitat to protect nesting pairs from potential adverse affects that could be associated with future changes in land use on nearby lands and to provide suitable foraging habitat and nesting habitat area suitable for the natural expansion of populations.	Ecosystem Restoration Program Plan, Volume I, page 276
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 11	11. To the extent practicable, control non-native predator populations in occupied habitat and saltmarshes and freshwater marshes enhanced and restored under the ERP.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 3	3. Restore wetland and perennial grassland habitats adjacent to occupied nesting habitats to create a buffer of natural habitat. This buffer would protect nesting pairs from adverse effects that could be associated with future changes in land use on nearby lands and provide suitable foraging habitat and nesting habitat suitable for the natural expansion of populations.	Multi-Species Conservation Strategy, Table E-2
California Black Rail Programmatic Action 10	Restore, protect, and improve emergent wetlands, tidal sloughs, and adjacent uplands.	Ecosystem Restoration Program Plan, Volume I, page 276
California Black Rail Programmatic Action 3	Enhance and restore connectivity between tidal sloughs and adjacent upland refugial habitats.	Ecosystem Restoration Program Plan, Volume I, page 276
California Black Rail Programmatic Action 4	Improve the connection between wetland and upland habitat areas to reduce predation.	Ecosystem Restoration Program Plan, Volume I, page 276
California Black Rail Programmatic Action 9	Develop and implement alternatives to land management practices on public lands that continue to degrade the quality or inhibit the recovery of black rail habitats.	Ecosystem Restoration Program Plan, Volume I, page 276
Central Valley Stream Temperatures Action 1A	Improve riparian woodland habitats along migrating channels and sloughs of the Delta.	Ecosystem Restoration Program Plan, Volume II, page 101
Disturbance MSCS Conservation Measure	Manage enhanced and restored habitat areas to avoid or minimize potential impacts associated with recreational uses on lands acquired or managed under conservation easements on the saltmarsh common yellowthroat.	Ecosystem Restoration Program Plan, Volume I, page 531
Double-crested cormorant (rookery) MSCS Species Specific Conservation Measure 2	2. Avoid or minimize disturbances to nesting colonies that could be associated with implementing CALFED actions within 0.25 mile of active nesting colonies during the nesting period (February–August).	Multi-Species Conservation Strategy, Table E-3

Table D-1
CALFED Targets, Actions, and Conservation Measures Related to Management of Riparian and Upland Element at LSIWA.

Title	Text	Source
Double-crested cormorant (rookery) MSCS Species Specific Conservation Measure 3	3. Avoid or minimize CALFED actions that could result in the degradation or loss of traditional nesting habitat.	Multi-Species Conservation Strategy, Table E-3
Double-crested cormorant (rookery) MSCS Species Specific Conservation Measure 4	4. To the extent consistent with CALFED objectives, manage existing reservoirs that support breeding populations, and design and manage new storage reservoirs to provide suitable nesting and foraging habitat conditions.	Multi-Species Conservation Strategy, Table E-3
Giant Garter Snake Species Target	Protect the existing population and habitat within the Delta Region, and restore, enhance, and manage suitable habitat areas adjacent to known populations to encourage the natural expansion of the species.	Ecosystem Restoration Program Plan, Volume I, page 300
Harvest of Fish and Wildlife Action 1A	Provide additional funding to the DFG for additional enforcement.	Ecosystem Restoration Program Plan, Volume II, page 118
Harvest of Fish and Wildlife Target 1	Reduce illegal harvest of anadromous fish and wildlife in the Delta by increasing enforcement effort.	Ecosystem Restoration Program Plan, Volume II, page 118
Invasive Riparian and Marsh Plants MSCS Conservation Measure 3	Identify and implement feasible methods for controlling invasive non-native marsh plants.	Ecosystem Restoration Program Plan, Volume I, page 485
Invasive Riparian And Salt Marsh Plants Restoration Action 3	Develop and implement management plans based on the assessment of weeds and sites to achieve specific targets for each weed and site.	Ecosystem Restoration Program Plan, Volume I, page 485
Invasive Riparian And Salt Marsh Plants Restoration Action 4	Wherever necessary and appropriate, implement habitat restoration simultaneous with or following control measures.	Ecosystem Restoration Program Plan, Volume I, page 485
Invasive Riparian and Salt Marsh Plants Action 1A	Control non-native riparian plants.	Ecosystem Restoration Program Plan, Volume II, page 116
Invasive Riparian and Salt Marsh Plants Target 2	Reduce the aerial extent of invasive non-native woody species, such as Giant Reed (i.e., arundo or false bamboo) and eucalyptus, that compete with native riparian vegetation by reducing the area of non-natives by 50% throughout the Delta and eradicating invasive woody plants from restoration areas.	Ecosystem Restoration Program Plan, Volume II, page 117

Table D-1
CALFED Targets, Actions, and Conservation Measures Related to Management of Riparian and Upland Element at LSIWA.

Title	Text	Source
Non-Native Wildlife Action 2	Reduce Norway rat populations in and adjacent to suitable habitat areas for California clapper rail, California black rail, and salt marsh harvest mouse to reduce predation on eggs, juveniles, and adults and assist in the recovery of these species. A combination of activities would be required to prevent the rats from establishing in important habitat areas (i.e., remove garbage and rubbish; ensure proper construction of residences and food storage structures; break down stubble in field crops, such as corn, to expose the rodents to predation during winter) and reduce populations in important habitat areas where rats are already established (e.g., use biological controls, practice the environmental controls listed above, and use rodentacides).	Ecosystem Restoration Program Plan, Volume I, page 493
Non-Native Wildlife Action 3	Reduce feral cat populations in and adjacent to suitable habitat for California clapper rail, California black rail and salt marsh harvest mouse, San Joaquin pocket mouse, kangaroo rat, and blunt-nosed leopard lizard habitats to reduce predation on eggs, juveniles, and adults and assist in the recovery of these species.	Ecosystem Restoration Program Plan, Volume I, page 493
Perennial Grassland Action 3	Implementing an intensive management program to control non-native vegetation and enhance native grasses and other plant species.	Ecosystem Restoration Program Plan, Volume I, page 174
Perennial Grassland MSCS Conservation Measure 2	Restore wetland and perennial grassland habitats adjacent to nesting habitats occupied by Suisun song sparrow to create a buffer of natural habitat to protect nesting pairs from potential adverse affects that could be associated with future changes in land use on nearby lands and to provide habitat suitable for the natural expansion of populations.	Ecosystem Restoration Program Plan, Volume I, page 175
Perennial Grassland MSCS Conservation Measure 3	Restore wetland and perennial grassland habitats adjacent to habitats occupied by salt marsh harvest mouse to create a buffer of natural habitat to protect populations from potential adverse affects that could be associated with future changes in land use on nearby lands and to provide habitat suitable for the natural expansion of populations.	Ecosystem Restoration Program Plan, Volume I, page 175
Perennial Grassland MSCS Conservation Measure 5	Restore wetland and perennial grassland habitats adjacent to habitats occupied by saltmarsh common yellowthroat to create a buffer of natural habitat to protect populations from potential adverse affects that could be associated with future changes in land use on nearby lands and to provide habitat suitable for the natural expansion of populations.	Ecosystem Restoration Program Plan, Volume I, page 175
Perennial Grassland Target 1	Restore 4,000 to 6,000 acres of perennial grasses in the North, East, South, and Central and West Delta Ecological Management Units associated with existing or proposed wetlands and floodplain habitats.	Ecosystem Restoration Program Plan, Volume II, page 111

Table D-1
CALFED Targets, Actions, and Conservation Measures Related to Management of Riparian and Upland Element at LSIWA.

Title	Text	Source
Riparian and Riverine Aquatic Habitat Target 6	Restore or plant riparian and riverine aquatic habitats in association with actions to recreate slough habitat and set back levees.	Ecosystem Restoration Program Plan, Volume II, page 109
Riparian and Riverine Aquatic Habitats MSCS Conservation Measure 6	Coordinate protection and restoration of riparian habitat areas with other federal and state programs (e.g., the Riparian Habitat Joint Venture, the SB 1086 program, and the Corps' Sacramento and San Joaquin Basin Comprehensive Study) that could affect management of occupied and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.	Ecosystem Restoration Program Plan, Volume I, page 157
Riparian and Riverine Aquatic Habitats MSCS Conservation Measure 8	Within the current range of valley elderberry longhorn beetle, design ERP riparian habitat enhancements and restorations to include suitable riparian edge habitat, including elderberry savanna.	Ecosystem Restoration Program Plan, Volume I, page 158
Riparian and Riverine Aquatic Habitats Prescription for NCCP Community Goal	Restore approximately 1,200 acres of riparian habitat in the Delta Region, 200–300 acres in the Bay Region, 3,650 acres in the Sacramento River Region, and 5,450–5,950 acres in the San Joaquin River Region; protect and enhance 500 acres of existing riparian habitat in the Delta Region; and enhance and restore riparian habitat associated with restoration of 18,000–26,000 acres of stream channel meander corridors in the Sacramento and San Joaquin River Regions. Avoid, minimize, and compensate for all CALFED impacts on valley/foothill riparian habitat.	Multi-Species Conservation Strategy, Table 3-2
Seasonal Wetlands MSCS Conservation Measure 1	To the extent practicable, design restored seasonal wetlands in habitat areas occupied by Swainson's hawk to provide overwinter refuge for rodents to provide source prey populations during spring and summer.	Ecosystem Restoration Program Plan, Volume I, page 150
Swainson's hawk MSCS Conservation Measure that adds detail to CALFED Actions 5	5. To the extent practicable, manage restored or enhanced habitats under the ERP to maintain desirable rodent populations and minimize impacts associated with rodent control.	Multi-Species Conservation Strategy, Table E-2
Swainson's hawk MSCS Species Prescription	Protect, enhance, and increase Swainson's hawk habitat sufficiently to support a viable breeding population. The interim prescription is to increase the current estimate of breeding pairs in the Central Valley from 1,000 to 2,000. This prescription will be modified based on the results of a population viability analysis being conducted by DFG.	Multi-Species Conservation Strategy, Table 3-1
Valley Elderberry Longhorn Beetle Action 1	Protect and restore wetland, riparian, and grassland habitat.	Ecosystem Restoration Program Plan, Volume I, page 257
Valley Elderberry Longhorn Beetle Action 2	Implement control measures to eradicate invasive plant species.	Ecosystem Restoration Program Plan, Volume I, page 257

Table D-1
CALFED Targets, Actions, and Conservation Measures Related to Management of Riparian and Upland Element at LSIWA.

Title	Text	Source
Valley Elderberry Longhorn Beetle Action 3	Reduce land and water management practices that degrade habitats used by these species.	Ecosystem Restoration Program Plan, Volume I, page 257
Wading Birds Action 5	Limit disturbance to nesting, roosting, and foraging habitats.	Ecosystem Restoration Program Plan, Volume I, page 372
Waterfowl Action 1	Implementing management strategies to protect important existing habitat areas.	Ecosystem Restoration Program Plan, Volume I, page 368
Waterfowl Action 4	Restoring and improving wetlands in conjunction with adjacent herbaceous uplands to improve breeding habitat.	Ecosystem Restoration Program Plan, Volume I, page 388
Western burrowing owl MSCS Species Specific Conservation Measure 1	1. Restore or enhance 1–2 acres of suitable nesting habitat for each acre of occupied nesting habitat that is converted to unsuitable nesting habitat as a result of CALFED actions.	Multi-Species Conservation Strategy, Table E-3
Western burrowing owl MSCS Species Specific Conservation Measure 2	2. To the extent consistent with ERP objectives, design and manage grassland and agricultural land habitat restorations and enhancements to provide suitable foraging habitat conditions.	Multi-Species Conservation Strategy, Table E-3
Western burrowing owl MSCS Species Specific Conservation Measure 3	3. To the extent consistent with ERP objectives, restore perennial grassland adjacent to occupied nesting habitats to provide foraging and nesting habitat suitable for the natural expansion of populations.	Multi-Species Conservation Strategy, Table E-3
Western burrowing owl MSCS Species Specific Conservation Measure 4	4. Avoid or minimize disturbances that could be associated with implementing CALFED actions near active nest sites during the nesting period (March–August).	Multi-Species Conservation Strategy, Table E-3
Western burrowing owl MSCS Species Specific Conservation Measure 5	5. To the extent consistent with ERP objectives, manage restored or enhanced habitats to maintain desirable rodent populations and minimize impacts associated with rodent control.	Multi-Species Conservation Strategy, Table E-3
Western Pond Turtle Action 3	Restore suitable adjacent upland habitat or modify land use practices to render existing uplands as suitable habitat and reestablish connectivity between wetland and upland habitat areas, provide nest and hibernation sites, and provide refuge habitat during floods.	Ecosystem Restoration Program Plan, Volume I, page 341
Western Pond Turtle Action 4	Create buffer zones where none currently exist to improve habitat value.	Ecosystem Restoration Program Plan, Volume I, page 341
Western Pond Turtle Action 4	Create buffer zones where none currently exist to improve habitat value.	Ecosystem Restoration Program Plan, Volume I, page 341

Table D-1
CALFED Targets, Actions, and Conservation Measures Related to Management of Riparian and Upland Element at LSIWA.

Title	Text	Source
Western pond turtle MSCS Conservation Measure	To the extent practicable, capture individuals from habitat areas that would be affected by CALFED actions and relocate them to nearby suitable existing, restored, or enhanced habitat areas.	Ecosystem Restoration Program Plan, Volume I, page 342
Western Pond Turtle Short-Term Objective	Determine the status and habitat requirements of pond turtles throughout the region and develop a conservation strategy in concert with habitat protection measures.	Ecosystem Restoration Program Plan, Volume I, page 341
White-tailed kite MSCS Species Specific Conservation Measure 1	1. Before implementing CALFED actions that could result in the loss or degradation of occupied nesting habitat or disturbance to nesting pairs, conduct surveys in suitable nesting habitat within the breeding range of the white-tailed kite to locate active nest sites.	Multi-Species Conservation Strategy, Table E-3
White-tailed kite MSCS Species Specific Conservation Measure 2	2. Avoid or minimize disturbances to nesting pairs that could be associated with implementing CALFED actions within 0.25 mile of active nest sites during the nesting period (February–September).	Multi-Species Conservation Strategy, Table E-3
White-tailed kite MSCS Species Specific Conservation Measure 3	3. Avoid or minimize CALFED actions that could result in the loss of traditional nesting trees.	Multi-Species Conservation Strategy, Table E-3
White-tailed kite MSCS Species Specific Conservation Measure 4	4. Restore or enhance 2–5 acres of suitable nesting habitat near affected areas for each acre of occupied nesting habitat that is converted to unsuitable nesting habitat as a result of CALFED actions. Restored or enhanced compensation habitat should be located in areas that support nesting pairs near valley oak woodlands.	Multi-Species Conservation Strategy, Table E-3
White-tailed kite MSCS Species Specific Conservation Measure 5	5. To the extent consistent with ERP objectives, enhance and restore natural habitats and agricultural habitats adjacent to occupied nesting habitats to create a buffer zone of natural habitat. This buffer zone would protect nesting pairs from adverse effects that could be associated with future changes in land use on nearby lands and provide foraging and nesting habitat suitable for the natural expansion of populations.	Multi-Species Conservation Strategy, Table E-3
White-tailed kite MSCS Species Specific Conservation Measure 6	6. To the extent consistent with ERP objectives, manage restored or enhanced habitats under the ERP to maintain desirable rodent populations and minimize impacts associated with rodent control.	Multi-Species Conservation Strategy, Table E-3

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
California black rail MSCS Conservation Measure 10	Direct some habitat enhancements and restorations towards increasing habitat connectivity among existing and restored tidal marshes.	Ecosystem Restoration Program Plan, Volume I, page 277
California black rail MSCS Conservation Measure 11	To the extent practicable, control non-native predator populations in occupied habitat areas and salt marshes enhanced and restored under the ERP.	Ecosystem Restoration Program Plan, Volume I, page 277
California black rail MSCS Conservation Measure 12	Identify and implement feasible methods for controlling invasive non-native marsh plants.	Ecosystem Restoration Program Plan, Volume I, page 277
California black rail MSCS Conservation Measure 13	Monitor to determine use of restored salt marsh habitat by California clapper rails and the rate at which restored habitats are colonized.	Ecosystem Restoration Program Plan, Volume I, page 277
California black rail MSCS Conservation Measure 2	Coordinate protection, enhancement, and restoration of saltmarsh and associated habitats with other federal, state, and regional programs (e.g., the San Francisco Bay Area Wetlands Ecosystem Goals Project, and USFWS species recovery plans) that could affect management of current and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.	Ecosystem Restoration Program Plan, Volume I, page 276
California black rail MSCS Conservation Measure 3	Restore wetland and perennial grassland habitats adjacent to occupied nesting habitats to create a buffer of natural habitat to protect nesting pairs from potential adverse affects that could be associated with future changes in land use on nearby lands and to provide suitable foraging habitat and nesting habitat area suitable for the natural expansion of populations.	Ecosystem Restoration Program Plan, Volume I, page 276
California black rail MSCS Conservation Measure 4	Initial species recovery efforts should be directed to locations where there are immediate opportunities for protection, enhancement, or restoration of suitable habitat.	Ecosystem Restoration Program Plan, Volume I, page 276
California black rail MSCS Conservation Measure 5	To the extent practicable, design dikes constructed in enhanced and restored saline emergent wetlands to provide optimal wetland to upland transition habitat.	Ecosystem Restoration Program Plan, Volume I, page 276
California black rail MSCS Conservation Measure 6	Direct ERP salt marsh enhancement efforts towards existing degraded marshes that are of sufficient size and configuration to develop fourth order tidal channels (marshes would likely need to be at least 1,000 acres in size).	Ecosystem Restoration Program Plan, Volume I, page 276

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
California black rail MSCS Conservation Measure 7	To the extent practicable, design salt marsh enhancements and restorations to provide low-angle upland slopes at the upper edge of marshes to provide for the establishment of suitable and sufficient wetland to upland transition habitat. Transition habitat zones should be at least 0.25 mile in width.	Ecosystem Restoration Program Plan, Volume I, page 277
California black rail MSCS Conservation Measure 8	Manage enhanced and restored habitat areas to avoid or minimize impacts on the California black rail associated with recreational uses on lands acquired or managed under conservation easements	Ecosystem Restoration Program Plan, Volume I, page 277
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 11	11. To the extent practicable, control non-native predator populations in occupied habitat and saltmarshes and freshwater marshes enhanced and restored under the ERP.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 12	12. Identify and implement feasible methods for controlling invasive non-native marsh plants.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 13	13. Monitor to determine use of restored saltmarsh and freshwater marsh habitats by California black rails and the rate at which restored habitats are colonized.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 2	2. Coordinate protection, enhancement, and restoration of saltmarsh, freshwater marsh, and associated habitats with other federal, State, and regional programs (e.g., the San Francisco Bay Ecosystem Goals Project and USFWS species recovery plans) that could affect management of current and historical habitat use areas. Coordination would avoid conflicts among management objectives and identify opportunities for achieving multiple management objectives.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 3	3. Restore wetland and perennial grassland habitats adjacent to occupied nesting habitats to create a buffer of natural habitat. This buffer would protect nesting pairs from adverse effects that could be associated with future changes in land use on nearby lands and provide suitable foraging habitat and nesting habitat suitable for the natural expansion of populations.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 6	6. Direct ERP saltmarsh and freshwater marsh enhancement efforts toward existing degraded marshes that are of sufficient size and configuration to develop fourth-order tidal channels (marshes would most likely need to be at least 1,000 acres).	Multi-Species Conservation Strategy, Table E-2

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 7	7. To the extent practicable, design saltmarsh and freshwater marsh enhancements and restorations that provide low-angle upland slopes at the upper edge of marshes to provide suitable and sufficient wetland-to-upland transition habitat. Transition habitat zones should be at least 0.25 mile wide.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Conservation Measure that adds detail to CALFED Actions 8	8. Manage enhanced and restored habitat to avoid or minimize impacts on the California black rail that could be associated with recreational uses on lands acquired or managed under conservation easements.	Multi-Species Conservation Strategy, Table E-2
California black rail MSCS Species Prescription	Maintain the current distribution and existing populations of the California black rail; reestablish and maintain viable populations of the species throughout its historical range in the Delta Region and the portion of the Bay Region within the ERP Focus Area.	Multi-Species Conservation Strategy, Table 3-1
California Black Rail Programmatic Action 10	Restore, protect, and improve emergent wetlands, tidal sloughs, and adjacent uplands.	Ecosystem Restoration Program Plan, Volume I, page 276
California Black Rail Programmatic Action 3	Enhance and restore connectivity between tidal sloughs and adjacent upland refugial habitats.	Ecosystem Restoration Program Plan, Volume I, page 276
California Black Rail Programmatic Action 4	Improve the connection between wetland and upland habitat areas to reduce predation.	Ecosystem Restoration Program Plan, Volume I, page 276
California Black Rail Programmatic Action 9	Develop and implement alternatives to land management practices on public lands that continue to degrade the quality or inhibit the recovery of black rail habitats.	Ecosystem Restoration Program Plan, Volume I, page 276
California Black Rail Species Target	Maintain the current distribution and existing populations of the California black rail, and reestablish and maintain viable species' populations throughout its historic range in the portion of the Bay Region within the ERP focus area.	Ecosystem Restoration Program Plan, Volume I, page 275
Delta Mudwort (Tidal Brackish And Freshwater Marsh Special-Status Plant Species) Species Target	Protect at least 90% of occupied habitat, including 90% of high quality habitat, throughout the range of the species to protect geographic diversity, and expand suitable habitat by 100 linear miles.	Ecosystem Restoration Program Plan, Volume I, page 248
Delta mudwort and Delta tule pea MSCS Conservation Measure that adds detail to CALFED Actions 1	1. Maintain processes that support the dynamic habitat of Delta mudwort and Delta tule pea throughout the species' range and associated with existing source populations.	Multi-Species Conservation Strategy, Table E-2

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Delta mudwort and Delta tule pea MSCS Conservation Measure that adds detail to CALFED Actions 2	2. To the extent consistent with CALFED objectives, create unvegetated, exposed substrate at tidal margins of restored and created tidal fresh emergent wetland and riparian habitat.	Multi-Species Conservation Strategy, Table E-2
Delta mudwort and Delta tule pea MSCS Conservation Measure that adds detail to CALFED Actions 3	3. To the extent consistent with CALFED objectives, incorporate suitable habitat for these species into levee designs.	Multi-Species Conservation Strategy, Table E-2
Delta mudwort and Delta tule pea MSCS Conservation Measure that adds detail to CALFED Actions 4	4. Incorporate sufficient edge habitat to support the species in levee set back and channel island habitat restoration designs.	Multi-Species Conservation Strategy, Table E-2
Delta mudwort and Delta tule pea MSCS Conservation Measure that adds detail to CALFED Actions 5	5. Maximize sinuosity of restored and created slough channels to increase water-land edge habitat.	Multi-Species Conservation Strategy, Table E-2
Delta mudwort and Delta tule pea MSCS Conservation Measure that adds detail to CALFED Actions 6	6. Maintain and restore habitat and populations throughout the species geographic ranges, and expand the species ranges to the historical and ecological ranges based on hydrological, salinity, and other habitat attributes.	Multi-Species Conservation Strategy, Table E-2
Delta mudwort and Delta tule pea MSCS Conservation Measure that adds detail to CALFED Actions 7	7. Monitor existing populations and their habitat at 5-year intervals.	Multi-Species Conservation Strategy, Table E-2
Delta mudwort MSCS Species Prescription	Protect at least 90% of occupied habitat, including 90% of high-quality habitat, throughout the species range to protect geographic diversity; expand suitable habitat by 100 linear miles.	Multi-Species Conservation Strategy, Table 3-1
Delta Sloughs Action 1A	To replace lost slough habitat and provide high-quality habitat areas for fish and associated wildlife, the short-term solution for the Central and West Delta Ecological Unit is to restore 20 miles of slough habitat. The long-term solution is to restore 50 miles of slough habitat (121–303 acres). In each the North Delta and East Delta Ecological Units, the short-term solution is to restore 10 miles of slough habitat. The long-term solution is to restore 30 miles of slough habitat 961–82 acres). In the South Delta Ecological Unit, the short-term solution is to restore 25 miles of slough habitat and the long-term solution is to restore 50 miles of slough habitat (152–303 acres).	Ecosystem Restoration Program Plan, Volume II, page 105

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Delta Sloughs General Target	The general target for restoration of Delta sloughs is to restore 160 miles in the Sacramento-San Joaquin Delta Ecological Management Zone. The restoration of Delta sloughs will, in many instances, be closely linked to the restoration of tidal perennial habitat, and fresh and saline emergent marshes. In developing the approach to habitat restoration, a mosaic of habitats is very desirable, including provisions for increasing the overall linear mileage of Delta sloughs.	Ecosystem Restoration Program Plan, Volume I, page 127
Delta Sloughs Target 1	Restore ecological structure and functions of the Delta waterways network by increasing the land-water interface ratio a minimum of 50 to 75% compared to 1906 conditions and by restoring 65 to 165 miles of small distributary sloughs (less than 50 to75 feet wide) hydrologically connected to larger existing Delta channels. (Note: This target is in addition to the Delta slough target presented in the target section for Delta Channel Hydraulics.)	Ecosystem Restoration Program Plan, Volume II, page 105
Delta Tule Pea (Tidal Brackish And Freshwater Marsh Special-Status Plant Species) Species Target	Protect at least 90% of occupied habitat, including 90% of high quality habitat, throughout the range of the species to protect geographic diversity, and expand suitable habitat by 100 linear miles.	Ecosystem Restoration Program Plan, Volume I, page 248
MSCS Conservation Measure 2	To the extent consistent with CALFED objectives, create unvegetated, exposed substrate at tidal margins of restored and created tidal fresh emergent wetland and riparian habitat.	Ecosystem Restoration Program Plan, Volume I, page 250
MSCS Conservation Measure 3	Maximize sinuosity of restored and created slough channels to increase water-land edge habitat.	Ecosystem Restoration Program Plan, Volume I, page 250
MSCS Conservation Measure 4	Monitor existing populations and their habitat at five year intervals.	Ecosystem Restoration Program Plan, Volume I, page 250
Delta tule pea MSCS Species Prescription	Protect at least 90% of occupied habitat, including 90% of high-quality habitat, throughout the species range to protect geographic diversity; expand suitable habitat by 100 linear miles.	Multi-Species Conservation Strategy, Table 3-1
Disturbance MSCS Conservation Measure	Manage enhanced and restored habitat areas to avoid or minimize potential impacts associated with recreational uses on lands acquired or managed under conservation easements on the saltmarsh common yellowthroat.	Ecosystem Restoration Program Plan, Volume I, page 531
Fresh Emergent Wetland Habitat (Tidal) Target 1	Increase existing tidal emergent wetland habitat in the Delta by restoring 30,000 to 45,000 acres of lands designated for floodplain restoration.	Ecosystem Restoration Program Plan, Volume II, page 106

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Fresh Emergent Wetland MSCS Conservation Measure 12	Consistent with CALFED objectives, create unvegetated, exposed substrate at tidal margins of restored and created tidal fresh emergent wetland and riparian habitat to benefit delta mudwort.	Ecosystem Restoration Program Plan, Volume I, page 145
Fresh Emergent Wetland MSCS Conservation Measure 13	To the extent consistent with ERP objectives, design and manage wetland habitat restorations and enhancements to provide suitable nesting and foraging habitat conditions for dependent species.	Ecosystem Restoration Program Plan, Volume I, page 145
Fresh Emergent Wetland MSCS Conservation Measure 3	Coordinate protection, enhancement, and restoration of fresh emergent wetland habitats with other federal, state, and regional programs (e.g., USFWS recovery plans) that could affect management of current and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.	Ecosystem Restoration Program Plan, Volume I, page
Fresh Emergent Wetland MSCS Conservation Measure 4	To the extent practicable, design restoration of tidal habitat to create unvegetated, exposed substrate habitat for Mason's lilaeopsis at tidal margins of tidal fresh emergent wetland and riparian habitats.	Ecosystem Restoration Program Plan, Volume I, page 144
Fresh Emergent Wetland MSCS Conservation Measure 5	Direct ERP salt and freshwater marsh enhancement efforts towards existing degraded marshes that are of sufficient size and configuration that are large enough to develop fourth order tidal channels (marshes would likely need to be at least 1,000 acres in size).	Ecosystem Restoration Program Plan, Volume I, page 144
Fresh Emergent Wetland MSCS Conservation Measure 6	To the extent practicable, design salt and freshwater marsh enhancements and restorations to provide low-angle upland slopes at the upper edge of marshes to provide for the establishment of suitable and sufficient wetland to upland transition habitat. To the extent feasible, transition habitat zones should be at least 0.25 mile in width.	Ecosystem Restoration Program Plan, Volume I, page 145
Fresh Emergent Wetland MSCS Conservation Measure 7	To the extent practicable, control non-native predator populations in occupied habitat areas and salt and freshwater marshes enhanced and restored under the ERP.	Ecosystem Restoration Program Plan, Volume I, page 145
Fresh Emergent Wetland MSCS Conservation Measure 8	Identify and implement feasible methods for controlling invasive non-native marsh plants.	Ecosystem Restoration Program Plan, Volume I, page 145
Fresh Emergent Wetland MSCS Conservation Measure 9	Monitor to determine use of restored salt and freshwater marsh habitats by California black rails and the rate at which restored habitats are colonized.	Ecosystem Restoration Program Plan, Volume I, page 145

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Giant garter snake MSCS Conservation Measure that adds detail to CALFED Actions 10	10. Monitor suitable wetlands restored in the Delta Region adjacent to or near occupied habitats to assess if and when (relative to habitat maturity) giant garter snakes occupy restored habitat or to identify reasons they are not using restored and apparently suitable habitat.	Multi-Species Conservation Strategy, Table E-2
Giant garter snake MSCS Species Prescription	Protect the existing population and habitat within the Delta Region; restore, enhance, and manage suitable habitat areas adjacent to known populations to encourage the species to expand naturally.	Multi-Species Conservation Strategy, Table 3-1
Giant Garter Snake Species Target	Protect the existing population and habitat within the Delta Region, and restore, enhance, and manage suitable habitat areas adjacent to known populations to encourage the natural expansion of the species.	Ecosystem Restoration Program Plan, Volume I, page 300
Harvest of Fish and Wildlife Action 1A	Provide additional funding to the DFG for additional enforcement.	Ecosystem Restoration Program Plan, Volume II, page 118
Harvest of Fish and Wildlife Target 1	Reduce illegal harvest of anadromous fish and wildlife in the Delta by increasing enforcement effort.	Ecosystem Restoration Program Plan, Volume II, page 118
Invasive Riparian and Marsh Plants MSCS Conservation Measure 3	Identify and implement feasible methods for controlling invasive non-native marsh plants.	Ecosystem Restoration Program Plan, Volume I, page 485
Invasive Riparian And Salt Marsh Plants Restoration Action 3	Develop and implement management plans based on the assessment of weeds and sites to achieve specific targets for each weed and site.	Ecosystem Restoration Program Plan, Volume I, page 485
Invasive Riparian And Salt Marsh Plants Restoration Action 4	Wherever necessary and appropriate, implement habitat restoration simultaneous with or following control measures.	Ecosystem Restoration Program Plan, Volume I, page 485
Mason’s Lilaeopsis (Tidal Brackish And Freshwater Marsh Special-Status Plant Species) Species Target	Expand suitable habitat by 100 linear miles and protect at least 90% of the currently occupied habitat including 90% of high quality habitat occurrences in the North, South, and East Delta and Napa River Ecological Management Units.	Ecosystem Restoration Program Plan, Volume I, page 247
Mason's Lilaeopsis and Suisun Marsh Aster MSCS Conservation Measure 1	Maintain processes that support the dynamic habitat distributed throughout the species range and associated with existing source populations (species occurs on eroding margins of levees).	Ecosystem Restoration Program Plan, Volume I, page 249
Mason's Lilaeopsis and Suisun Marsh Aster MSCS Conservation Measure 2	To the extent practicable, design restoration of tidal habitats to create unvegetated, exposed substrate habitat at tidal margins of tidal fresh emergent wetland and riparian habitat.	Ecosystem Restoration Program Plan, Volume I, page 249

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Mason's Lilaeopsis and Suisun Marsh Aster MSCS Conservation Measure 3	To the extent consistent with CALFED objectives, incorporate sufficient edge habitat to support the species in levee set back and channel island habitat restoration designs.	Ecosystem Restoration Program Plan, Volume I, page 249
Mason's Lilaeopsis and Suisun Marsh Aster MSCS Conservation Measure 4	To the extent practicable, maximize sinuosity of restored and created slough channels to increase water-land edge habitat.	Ecosystem Restoration Program Plan, Volume I, page 249
Mason's Lilaeopsis and Suisun Marsh Aster MSCS Conservation Measure 5	To the extent consistent with CALFED objectives, maintain and restore habitat and populations throughout the species' geographic ranges and expand habitat and populations to their historical and ecological ranges based on hydrologic, salinity and other habitat requirements of the species.	Ecosystem Restoration Program Plan, Volume I, page 249
Mason's Lilaeopsis and Suisun Marsh Aster MSCS Conservation Measure 6	Consistent with CALFED objectives, incorporate suitable habitat for these species in band protection designs used in CALFED actions.	Ecosystem Restoration Program Plan, Volume I, page 249
Mason's Lilaeopsis and Suisun Marsh Aster MSCS Conservation Measure 7	Monitor status and distribution of the species at five-year intervals and document expansion of the species into restored habitat for the duration of the Program.	Ecosystem Restoration Program Plan, Volume I, page 249
Mason's lilaeopsis and Suisun Marsh that adds detail to CALFED Actions 3	3. To the extent consistent with CALFED objectives, incorporate sufficient edge habitat to support the species in levee setback and channel island habitat restoration designs.	Multi-Species Conservation Strategy, Table E-1
Mason's lilaeopsis and Suisun Marsh that adds detail to CALFED Actions 4	4. To the extent practicable, maximize sinuosity of restored and created slough channels to increase water-land edge habitat.	Multi-Species Conservation Strategy, Table E-1
Mason's lilaeopsis and Suisun Marsh that adds detail to CALFED Actions 5	5. To the extent consistent with CALFED objectives, maintain and restore habitat and populations throughout the species' geographic ranges and expand habitat and populations to their historical and ecological ranges based on hydrologic, salinity, and other habitat requirement of the species.	Multi-Species Conservation Strategy, Table E-1
Mason's lilaeopsis and Suisun Marsh that adds detail to CALFED Actions 6	6. Consistent with CALFED objectives, incorporate suitable habitat for these species in bank protection designs used in CALFED actions.	Multi-Species Conservation Strategy, Table E-1

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Mason's lilaeopsis and Suisun Marsh that adds detail to CALFED Actions 7	7. Monitor status and distribution of the species at 5-year intervals and document expansion of the species into restored habitat for the duration of the program.	Multi-Species Conservation Strategy, Table E-1
Mason's lilaeopsis MSCS Species Prescription	Expand suitable and occupied habitat for the Mason's lilaeopsis by 100 linear miles; protect at least 90% of the currently occupied habitat, including 90% of high-quality habitat occurrences in the North, South, and East Delta and Napa River Ecological Management Units.	Multi-Species Conservation Strategy, Table 3-1
Non-Native Wildlife Action 2	Reduce Norway rat populations in and adjacent to suitable habitat areas for California clapper rail, California black rail, and salt marsh harvest mouse to reduce predation on eggs, juveniles, and adults and assist in the recovery of these species. A combination of activities would be required to prevent the rats from establishing in important habitat areas (i.e., remove garbage and rubbish; ensure proper construction of residences and food storage structures; break down stubble in field crops, such as corn, to expose the rodents to predation during winter) and reduce populations in important habitat areas where rats are already established (e.g., use biological controls, practice the environmental controls listed above, and use rodentacides).	Ecosystem Restoration Program Plan, Volume I, page 493
Non-Native Wildlife Action 3	Reduce feral cat populations in and adjacent to suitable habitat for California clapper rail, California black rail and salt marsh harvest mouse, San Joaquin pocket mouse, kangaroo rat, and blunt-nosed leopard lizard habitats to reduce predation on eggs, juveniles, and adults and assist in the recovery of these species.	Ecosystem Restoration Program Plan, Volume I, page 493
Suisun Marsh Aster (Tidal Brackish And Freshwater Marsh Special-Status Plant Species) Species Target	Expand suitable habitat by 100 linear miles and protect at least 90% of the currently occupied habitat including 90% of high quality habitat occurrences in the North, South, and East Delta and Napa River Ecological Management Units.	Ecosystem Restoration Program Plan, Volume I, page 247
Suisun Marsh aster MSCS Species Prescription	Expand suitable and occupied habitat for the Suisun Marsh aster by 100 linear miles; protect at least 90% of the currently occupied habitat, including 90% of high-quality habitat occurrences in the North, South, and East Delta and Napa River Ecological Management Units.	Multi-Species Conservation Strategy, Table 3-1

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Tidal Brackish And Freshwater Marsh Special-Status Plant Species (Delta Mudwort, Delta Tule Pea, Bristly Sedge, Point Reyes Birds-Beak, And Delta Coyote Thistle) Action 4	Manage protected areas occupied by the species to promote conditions favorable for the establishment, growth, and vigor of the species. Include management techniques such as exotic weed control and hydrologic regulation.	Ecosystem Restoration Program Plan, Volume I, page 248
Tidal Brackish And Freshwater Marsh Special-Status Plant Species (Delta Mudwort, Delta Tule Pea, Bristly Sedge, Point Reyes Birds-Beak, And Delta Coyote Thistle) Action 5	Restore moderate or low quality sites to low elevation intertidal habitats and promote establishment of species in this guild. During the restoration of habitat, promote ecological functions such as sediment deposition and erosion to balance the formation and loss of intertidal habitats.	Ecosystem Restoration Program Plan, Volume I, page 248
Tidal Brackish Marsh Habitat Plant Community Group Action 4	Restore a more natural elevation gradient in wetlands to allow a greater diversity of native saline plant species, including special-status plant species that are adapted to different elevations and provide a broader range of habitats for wildlife.	Ecosystem Restoration Program Plan, Volume I, page 388
Tidal Fresh Emergent Wetland Prescription for NCCP Community Goal	Increase the extent of tidal freshwater emergent habitat by 30,200–45,800 acres in the Delta Region through restoration, restore habitat along 115-260 miles (700-1,275 acres) of restored tidal sloughs, and enhance habitat by controlling non-native plants. Avoid, minimize, and compensate for all CALFED impacts on tidal freshwater emergent habitat.	Multi-Species Conservation Strategy, Table 3-2
Tidal Freshwater Marsh Habitat Plant Community Group Action 5	Reintroduce native plants into suitable sites.	Ecosystem Restoration Program Plan, Volume I, page 388
Tricolored blackbird MSCS Species Specific Conservation Measure 1	1. Before implementing CALFED actions that could result in the loss or degradation of traditional nesting habitat or disturbance to nesting colonies, conduct surveys in suitable nesting habitat within portions of the species' breeding range that could be affected by CALFED actions to locate nesting colonies.	Multi-Species Conservation Strategy, Table E-3
Tricolored blackbird MSCS Species Specific Conservation Measure 2	2. Avoid or minimize disturbances to nesting colonies that could be associated with implementing CALFED actions within 0.25 mile of active nesting colonies during the nesting period (mid-April–July).	Multi-Species Conservation Strategy, Table E-3

Table D-2
CALFED Targets, Actions, and Conservation Measures Related to Management of Marsh Element at LSIWA.

Title	Text	Source
Tricolored blackbird MSCS Species Specific Conservation Measure 3	3. To the extent consistent with ERP objectives, design and manage wetland and agricultural habitat restorations and enhancements to provide suitable nesting and foraging habitat conditions.	Multi-Species Conservation Strategy, Table E-3
Tricolored blackbird MSCS Species Specific Conservation Measure 4	4. To the extent consistent with ERP objectives, enhance and restore natural and agricultural habitats adjacent to known nesting colonies to create buffer zone of natural habitat. This buffer zone would protect colonies from adverse effects that could be associated with future changes in land use on nearby lands and provide foraging and nesting habitat suitable for the natural expansion of populations.	Multi-Species Conservation Strategy, Table E-3
Wading Birds Action 5	Limit disturbance to nesting, roosting, and foraging habitats.	Ecosystem Restoration Program Plan, Volume I, page 372
Waterfowl Action 1	Implementing management strategies to protect important existing habitat areas.	Ecosystem Restoration Program Plan, Volume I, page 368
Waterfowl Action 4	Restoring and improving wetlands in conjunction with adjacent herbaceous uplands to improve breeding habitat.	Ecosystem Restoration Program Plan, Volume I, page 388
Western Pond Turtle Action 1	Implement a preservation plan to protect these areas from adverse effects associated with human encroachment and recreation.	Ecosystem Restoration Program Plan, Volume I, page 341
Western Pond Turtle Action 3	Restore suitable adjacent upland habitat or modify land use practices to render existing uplands as suitable habitat and reestablish connectivity between wetland and upland habitat areas, provide nest and hibernation sites, and provide refuge habitat during floods.	Ecosystem Restoration Program Plan, Volume I, page 341
Western Pond Turtle Action 4	Create buffer zones where none currently exist to improve habitat value.	Ecosystem Restoration Program Plan, Volume I, page 341
Western Pond Turtle Long-Term Objective	Restore self-sustaining populations of western pond turtles to habitats throughout the Bay-Delta watershed including the Delta.	Ecosystem Restoration Program Plan, Volume I, page 341

Table D-3
CALFED Targets, Actions, and Conservation Measures Related to Management of Aquatic Element at LSIWA

Title	Text	Source
Bay-Delta Aquatic Foodweb Action 5	Increasing the amount and diversity of organic matter input from the Bay-Delta	Ecosystem Restoration Program Plan, Volume I, page 105
Delta Sloughs Action 1A	To replace lost slough habitat and provide high-quality habitat areas for fish and associated wildlife, the short-term solution for the Central and West Delta Ecological Unit is to restore 20 miles of slough habitat. The long-term solution is to restore 50 miles of slough habitat (121–303 acres). In each the North Delta and East Delta Ecological Units, the short-term solution is to restore 10 miles of slough habitat. The long-term solution is to restore 30 miles of slough habitat 961–182 acres). In the solution is to restore 25 miles of slough habitat and the long-term solution is to restore 50 miles of slough habitat (152–303 acres).	Ecosystem Restoration Program Plan, Volume II, page 105
Delta Sloughs Action 2	Restore hydrologic conditions necessary for establishing Delta sloughs by constructing setback levees, removing dikes, constricting slough openings, and managing flows through Delta channels.	Ecosystem Restoration Program Plan, Volume I, page 127
Delta Smelt Action 5	Increase the amount of shallow-water habitat in areas critical to spawning and rearing.	Ecosystem Restoration Program Plan, Volume I, page 198
Delta smelt MSCS Conservation Measure 1	Coordinate protection, enhancement, and restoration of occupied delta smelt habitats with other federal, state, and regional programs (e.g., the San Francisco Bay Area Wetlands Ecosystem Goals Project, the Anadromous Fish Restoration Program, and the U.S. Fish and Wildlife Service recovery plans) that could affect management of current and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.	Ecosystem Restoration Program Plan, Volume I, page 198
Delta smelt MSCS Conservation Measure 3	Restore and enhance delta smelt habitat to provide suitable water quality (i.e., low concentrations of pollutants) and substrates for egg attachment (submerged tree roots, branches, rock, and emergent vegetation) to important spawning areas.	Ecosystem Restoration Program Plan, Volume I, page 199
Delta smelt MSCS Conservation Measure 8	Allow delta smelt unrestricted access to suitable spawning habitat and protect these areas from physical disturbance (e.g., heavy equipment operation) and flow disruption in the period from December to July by maintaining adequate flow and suitable water quality to attract migrating adults in the Sacramento and San Joaquin River channels and their tributaries, including Cache and Montezuma Sloughs and their tributaries.	Ecosystem Restoration Program Plan, Volume I, page 199

Table D-3
CALFED Targets, Actions, and Conservation Measures Related to Management of Aquatic Element at LSIWA

Title	Text	Source
Delta smelt MSCS Conservation Measure 9	All in-channel modification projects implemented under CALFED should use best management practices to minimize mobilization of sediments that might contain toxins, localize sediment movement, and reduce turbidity.	Ecosystem Restoration Program Plan, Volume I, page 199
Delta smelt MSCS Conservation Measure that adds detail to CALFED Actions 3	3. Restore and enhance delta smelt habitat to provide suitable water quality (i.e., low concentrations of pollutants) and substrates for egg attachment (submerged tree roots, branches, rock, and emergent vegetation) to important spawning areas.	Multi-Species Conservation Strategy, Table E-1
Delta smelt MSCS Conservation Measure that adds detail to CALFED Actions 8	8. Allow delta smelt unrestricted access to suitable spawning habitat and protect these areas from physical disturbance (e.g., heavy equipment operation) and flow disruption from December to July. Maintaining adequate flow and suitable water quality would attract migrating adults in the Sacramento and San Joaquin River channels and their tributaries, including Cache and Montezuma Sloughs and their tributaries.	Multi-Species Conservation Strategy, Table E-1
Disturbance Action 2A	Establish and enforce no motorized boating zones within 50 yards of important California black rail nesting areas in the Delta from March to June.	Ecosystem Restoration Program Plan, Volume II, page 119
Disturbance Action 2B	Establish and enforce no wake zones in 5 to 25 miles of existing dead-end channels in the Delta from March to June.	Ecosystem Restoration Program Plan, Volume II, page 119
Disturbance Action 2C	Establish and enforce no motorized boating zones in the small tidal channels created in restored tidal fresh emergent wetlands and Delta floodplains of levee setbacks.	Ecosystem Restoration Program Plan, Volume II, page 119
Disturbance Action 3A	Identify important shallow water spawning areas and establish and enforce no wake zones within 50 yards of these important Delta habitats from March to June.	Ecosystem Restoration Program Plan, Volume II, page 119
Disturbance Target 1	Reduce boat traffic and boat speeds in areas where levees or channel islands and their associated shallow-water and riparian habitat may be damaged by wakes. This will protect important Delta habitats such as berm islands from erosion caused by boat wake.	Ecosystem Restoration Program Plan, Volume II, page 119
Disturbance Target 2	Reduce boat wakes near designated important California black rail nesting areas in the Delta from March to June to levels necessary to prevent destruction of nests. This will assist in recovery of this listed species.	Ecosystem Restoration Program Plan, Volume II, page 119
Disturbance Target 3	Reduce boat wakes near important shallow water spawning areas in the Delta from March to June to levels necessary to protect successful spawning behavior and success. This will help in recovery of listed species.	Ecosystem Restoration Program Plan, Volume II, page 119

Table D-3
CALFED Targets, Actions, and Conservation Measures Related to Management of Aquatic Element at LSIWA

Title	Text	Source
Eel-Grass Pondweed MSCS Conservation Measure	Conduct surveys in suitable habitat areas that could be affected by CALFED actions to determine whether species are present before implementing actions that could result in loss or degradation of occupied habitat.	Ecosystem Restoration Program Plan, Volume I, page 348
Freshwater Fish Habitats MSCS Conservation Measure 19	Coordinate protection and restoration of freshwater fish habitats with other federal and state programs (e.g., U.S. Fish and Wildlife Service recovery plans, the SB 1086 program, and the Corps' Sacramento and San Joaquin Basin Comprehensive Study) that could affect management of occupied and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.	Ecosystem Restoration Program Plan, Volume I, page 163
Harvest of Fish and Wildlife Action 1A	Provide additional funding to the DFG for additional enforcement.	Ecosystem Restoration Program Plan, Volume II, page 118
Harvest of Fish and Wildlife Target 1	Reduce illegal harvest of anadromous fish and wildlife in the Delta by increasing enforcement effort.	Ecosystem Restoration Program Plan, Volume II, page 118
Invasive Aquatic Plants Action 1A	Conduct large-scale, annual weed eradication programs throughout existing and restored dead-end and open-ended sloughs and channels within each of the Delta's ecological units. The goal is that less than 1% of the surface area of these sloughs and channels is covered by invasive non-native aquatic plants within 10 years.	Ecosystem Restoration Program Plan, Volume II, page 116
Invasive Aquatic Plants Restoration Action 3	Develop and implement management plans to achieve specific targets for each weed and site.	Ecosystem Restoration Program Plan, Volume I, page 467
Invasive Aquatic Plants Restoration Action 4	Implement habitat restoration (e.g., planting native pondweeds and other desirable aquatic and emergent wetland plants) concurrent with or following implementation of control measures, where appropriate.	Ecosystem Restoration Program Plan, Volume I, page 467
Invasive Aquatic Plants Restoration Action 5	Eradicate water hyacinth from major tributaries and marinas, locks, important wetland areas, and wildlife refuges in the Sacramento-San Joaquin Delta Ecological Zone.	Ecosystem Restoration Program Plan, Volume I, page 467
Invasive Aquatic Plants Restoration Action 6	Elsewhere, reduce the biomass of infested acreage to a lower maintenance level than of the present summer cover. This goal would be approached beginning in the tributaries entering the Delta, and aiming for total eradication there; then water hyacinth will be contained at maintenance levels in upstream locations.	Ecosystem Restoration Program Plan, Volume I, page 467

Table D-3
CALFED Targets, Actions, and Conservation Measures Related to Management of Aquatic Element at LSIWA

Title	Text	Source
Invasive Aquatic Plants Target 1	Manage existing and restored dead-end and open-ended sloughs and channels within the Sacramento-San Joaquin Delta Ecological Management Zone so that the total surface area of these sloughs and channels covered by invasive non-native aquatic plants is reduced.	Ecosystem Restoration Program Plan, Volume II, page 116
Invasive Riparian and Salt Marsh Plants Target 1	Reduce surface area covered by non-native plants to less than 1%.	Ecosystem Restoration Program Plan, Volume II, page 116
Longfin Smelt Action 2	Increase the amount of shallow water spawning habitat in the Delta.	Ecosystem Restoration Program Plan, Volume I, page 205
Longfin smelt MSCS Conservation Measure 4	Provide suitable water quality and substrates for egg attachment (submerged tree roots, branches, rock, and emergent vegetation) to important spawning areas in the Delta and tributaries of northern Suisun Bay.	Ecosystem Restoration Program Plan, Volume I, page 205
Longfin smelt MSCS Conservation Measure that adds detail to CALFED Actions 1	1. Coordinate protection, enhancement, and restoration of occupied longfin smelt habitat with other federal, State, and regional programs (e.g., the San Francisco Bay Ecosystem Goals Project, the Anadromous Fish Restoration Program, and USFWS recover plans	Multi-Species Conservation Strategy, Table E-1
Longfin smelt MSCS Conservation Measure that adds detail to CALFED Actions 4	4. Provide suitable water quality and substrates for egg attachment (submerged tree roots, branches, rock, and emergent vegetation) to spawning areas in the Delta and tributaries of northern Suisun Bay.	Multi-Species Conservation Strategy, Table E-1
Longfin smelt MSCS Conservation Measure that adds detail to CALFED Actions 5	5. Provide unrestricted access to suitable spawning habitat and protect these areas from physical disturbance (e.g., heavy equipment operation) and flow disruption from December to July. Maintaining adequate flow and suitable water quality would attract migrating adults in the Sacramento and San Joaquin River channels and their tributaries, including Cache and Montezuma Sloughs and their tributaries.	Multi-Species Conservation Strategy, Table E-1
Non-Native Warmwater Gamefish Action 1	Acquire and enhance aquatic habitat	Ecosystem Restoration Program Plan, Volume I, page 417
Non-Native Warmwater Gamefish Action 4	Eliminate water hyacinth and other noxious aquatic plants from the Delta	Ecosystem Restoration Program Plan, Volume I, page 417

Table D-3
CALFED Targets, Actions, and Conservation Measures Related to Management of Aquatic Element at LSIWA

Title	Text	Source
Nontidal Perennial Aquatic Habitat Target 1	Develop 500 acres of deep open-water areas (more than 4 to 6 feet deep) within restored fresh emergent wetland habitats in the Delta to provide resting habitat for water birds, foraging habitat for diving ducks and other water birds and semi-aquatic mammals that feed in deep water, and habitat for associated resident pond fish species.	Ecosystem Restoration Program Plan, Volume II, page 104
Nontidal Perennial Aquatic Habitat Prescription for NCCP Community Goal	Restore 1,600 acres of lacustrine habitat adjacent to existing and restored wetlands in the Bay Region. Avoid, minimize, and compensate for loss of lacustrine habitat where evaluated species are affected by CALFED actions.	Multi-Species Conservation Strategy, Table 3-2
Riparian and Riverine Aquatic Habitats MSCS Conservation Measure 1	Provide suitable water quality (i.e., low concentration of pollutants) and substrates for delta smelt, longfin smelt, and splittail egg attachment (submerged tree roots, branches, rock, and emergent vegetation) to important spawning areas.	Ecosystem Restoration Program Plan, Volume I, page 157
Striped Bass Action 1	Protect and restore shallow water, tidal slough, and wetlands habitats.	Ecosystem Restoration Program Plan, Volume I, page 410
Striped Bass Action 7	Provide greater enforcement to reduce illegal harvest.	Ecosystem Restoration Program Plan, Volume I, page 410
Tidal Perennial Aquatic Habitat Target 1	Restore 1,500 acres of shallow-water habitat in the North Delta Ecological Management Unit; 1,000 acres of shallow-water habitat in the East Delta Ecological Management Unit; 2,000 acres of shallow-water habitat in the South Delta Ecological Management Unit; and 2,500 acres of shallow-water habitat in the Central and West Delta Ecological Management Unit.	Ecosystem Restoration Program Plan, Volume II, page 104

APPENDIX E

Synthesis of Available Fisheries Data

APPENDIX E SYNTHESIS OF FISHERIES DATA

This appendix provides a summary of information available on the fish populations inhabiting the western Delta adjacent to the Lower Sherman Island Wildlife Area (LSIWA).

SPECIES COMPOSITION AND DISTRIBUTION

The fishery survey programs designed and implemented by the Department (Baxter et al. 1999) are long-term studies that began in 1980 and continue; data is collected monthly using multiple gear types to sample juvenile and adult fish and macroinvertebrates, in addition to sampling for fish eggs and larvae. The fishery data has been analyzed based on the density of each species collected, using various sampling methods. The density of a species collected using the otter trawl, which samples on and near the bottom (benthic and epibenthic zone), is reported as the number of individuals per hectare. The density of ichthyoplankton collected in the plankton net is reported as the number of individuals per 10,000 cubic meters of water sampled. The density of a species collected using the midwater trawl, which samples in the water column (pelagic zone), is reported as the number of individuals per 10,000 cubic meters of water sampled. Information on the calculation of densities for each the Department's sampling methods is presented by Baxter et al. (1999). The Delta smelt 20 millimeter (mm) surveys, conducted throughout spring in the Delta since the early 1990s provide additional information on the seasonal and geographic distribution of Delta smelt larvae in various regions of the Delta.

The following sections summarize and analyze information from Department surveys to characterize:

- Species composition in Suisun Bay and the western Delta in the vicinity of Sherman Lake;
- Differences in species composition by location/habitat;
- Occurrence of threatened and endangered species; and
- Interannual variation in species abundance and distribution.

The information generated through these analyses has been documented in the following sections.

DEPARTMENT FISHERY SURVEYS

The Department sampled approximately monthly using midwater trawls and otter trawls, from 35 stations from the South Bay upstream into the Sacramento River, to Sherman Island and the San Joaquin River at Antioch (Baxter et al. 1999). An additional 17 sampling stations were added between 1988 and 1994. Fishery sampling data from Stations 535, 736, 758, and 837 were selected to represent the fish community in Suisun Bay and the western Delta near Sherman Lake. Information on the fishery community in Suisun Bay and the Delta is also available from the Department's real-time monitoring program. Data on the seasonal densities and geographic distribution of larval Delta smelt were from the 20 mm Delta smelt surveys at Station 703 in Lower Sherman Lake. Fishery data are also available from the Department's summer townet and fall midwater trawl surveys. Many of these fishery survey programs target specific species during limited times of the year (20 mm Delta smelt survey, summer townet survey, fall midwater trawl survey, etc.). The Bay–Delta fishery survey program, however, has sampled year round over an extended period represents a variety of hydrological and environmental conditions in the Delta. Hence the survey provides important information on the seasonal distribution of the fishery community and is the primary source of data used to characterize the Delta fishery community in the following section.

The Department's Bay–Delta open water stations that began operating in 1980 sample monthly using otter trawls and midwater trawls. The otter trawl is towed on the bottom against the current for 5 minutes and then retrieved. The midwater trawl is towed with the current for 12 minutes and retrieved obliquely. The plankton net (505-µm mesh) mounted on a steel sled is towed on the bottom for 5 minutes and retrieved obliquely. Inshore fishery sampling has been conducted using a beach seine. This DFG fishery survey program has sampled in the Suisun

Bay and Delta channels, but not specifically within Sherman Lake, however, results of these extensive fishery surveys in the area are expected to be representative of the fishery community inhabiting the flooded islands.

The variation in sampling methods expectedly yields different results. The otter trawl samples more effectively from the near substrate area (epibenthic), the midwater trawl samples more effectively in the open-water column, and the plankton net samples the smaller components of the aquatic community. The beach seine samples the inshore fishery community inhabiting shallow water areas immediately adjacent to the shoreline. It is necessary to review the results of all four methods to gain an understanding of the overall aquatic community inhabiting Suisun Bay and the Delta in the vicinity of Sherman Lake. Because many of the fish inhabiting the area, particularly as adults, are not effectively sampled by these conventional survey methods additional information from limited electrofishing surveys and reports from recreational anglers fishing in the flooded islands and surrounding waters has also been used.

The Department's survey data has been used to determine species composition in the aquatic community as the total numbers of a species collected at each survey station or for each group of surveyed stations. Species composition is therefore a measure of the number of individuals of each species caught, not a measure of the biomass represented by the species.

Results of the Department's fishery survey program provide valuable insight into the species composition, geographic distribution, and seasonal periods of occurrence for various fish species inhabiting the confluence of the Sacramento and San Joaquin Rivers near Sherman Lake. Results of the surveys should, however, be interpreted with caution. Fishery sampling using plankton nets, otter trawls, beach seines, and midwater trawls, primarily collect the early life stages of fish species. Larger sub-adult and adult fish are able to avoid capture by these sampling methods and therefore are either absent or may be underrepresented as members of fish community. For example, juvenile steelhead emigrating through the Delta effectively avoid capture and therefore, although present in the Delta during their migration period, may not be detected using these conventional fishery sampling techniques. A number of fish species that inhabit areas associated with pilings and docks or other structures such as largemouth bass may also be underrepresented in the sampling effort. Species that inhabit shallow water areas or intertidal habitat are also underrepresented in results of the Department's open water fishery surveys conducted in deeper subtidal habitats. Larger individuals, such as adult striped bass and sturgeon, although present within Suisun Bay and the Delta, are not represented in collections using these sampling techniques. Analysis and interpretation of the Department's fishery data, although a useful and powerful source of information available to describe the fish and macroinvertebrate community, needs to be interpreted in combination with information from other surveys, and general information on habitat conditions within an area of estuary, when establishing a foundation for characterizing fish and macroinvertebrate communities within the flooded islands and other regions of the estuary.

LOWER SAN JOAQUIN RIVER AND SUISUN BAY NEAR SHERMAN LAKE

Sampling in the lower Sacramento and San Joaquin Rivers near Sherman Lake using otter trawls and midwater trawls at Stations 535, 736, and 837 show that the most abundant fish species inhabiting the area include striped bass, longfin smelt, American shad, yellowfin goby, threadfin shad, white catfish, Delta smelt, and Chinook salmon (Table E-1). In total, 46 fish species have been collected from these sampling stations using the otter trawl and midwater trawl. Delta smelt were the seventh most abundant fish species collected.

Data on the occurrence and abundance of crab and shrimp were summarized from the Department's otter trawl surveys. As would be expected, the crab community inhabiting Suisun Bay and the western Delta near Sherman Lake is dominated by the recently introduced Chinese mitten crab. Bay shrimp were the most common shrimp species in Suisun Bay and the western Delta in the general vicinity of Lower Sherman Lake.

Results of inshore beach seine surveys in Suisun Bay and the western Delta (Stations 758 and 837) showed that inland silversides dominate the near-shore fishery community (Table E-2). Other fish species included striped bass, threadfin shad, Chinook salmon, splittail, Sacramento pikeminnow, American shad, tule perch, Delta smelt, and 17 other species.

Striped bass, longfin smelt, unidentified smelt, Pacific herring, prickly sculpin, threadfin shad, and northern anchovy eggs and larvae were the most common ichthyoplankton collected in the Suisun Bay and western Delta(Stations 535, 736, and 837; Table E-3). In total 36 taxa of fish and larvae were collected in Suisun Bay and western Delta plankton sampling near Sherman Lake.

Results of DFG 20 mm Delta smelt surveys at Station 703, located in Sherman Lake, between 1995 and 2002 showed that the larval Delta smelt densities were highly variable. The proportion of the larval Delta smelt collected in Sherman Lake varied from less than 1 % (1995) to 22% (2000). Approximately 15% of the larval Delta smelt collected in 1997 were from Lower Sherman Lake, with approximately 5% of the larval Delta smelt collected in 1999 and 2002 were from Sherman Lake. Larval Delta smelt densities were typically greatest in Sherman Lake in June.

In addition, results of discussions with recreational anglers indicate that adult striped bass, white catfish, and sturgeon support recreational fisheries in the main river channels surrounding Sherman Lake. Habitat in Sherman Lake supports active recreational fisheries for largemouth bass, striped bass, and catfish.

Table E-1
Species Composition and Relative Abundance of Fish Collected from Suisun Bay and the Western Delta near Sherman Lake by Otter Trawl and Midwater Trawl

Fish Species	Number Collected
Striped Bass	10,161
Longfin Smelt	3,429
American Shad	2,997
Yellowfin Goby	1,725
Threadfin Shad	1,277
White Catfish	748
Delta Smelt	630
Chinook Salmon	455
Channel Catfish	443
Northern Anchovy	357
White Sturgeon	203
Starry Flounder	195
Pacific Staghorn Sculpin	149
Splittail	141
Tule Perch	128
Bigscale Logperch	92
Pacific Herring	81
Bearded Goby	72
Chameleon Goby	58
River Lamprey	35
Shimofuri Goby	29
Pacific Lamprey	27
Threespine Stickleback	16
Prickly Sculpin	15

Table E-1
Species Composition and Relative Abundance of Fish Collected from Suisun Bay and the Western Delta near Sherman Lake by Otter Trawl and Midwater Trawl

Common Carp	12
Plainfin Midshipman	11
Bay Goby	8
Green Sturgeon	5
White Croaker	5
Brown Bullhead	4
Sacramento Pikeminnow	4
Steelhead Trout	4
English Sole	3
Inland Silverside	3
Redear Sunfish	3
Bluegill	2
California Halibut	2
Goldfish	2
Speckled Sanddab	2
Wakasagi	2
Black Bullhead	1
Black Crappie	1
Largemouth Bass	1
Pacific Tomcod	1
Shiner Perch	1
Western Mosquitofish	1

Stations 535, 736, and 837
Source: DFG unpublished data

Table E-2
Species Composition and Relative Abundance of Fish Collected from the Suisun Bay and the Western Delta near Sherman Lake by Beach Seine

Fish Species	Number Collected
Inland Silverside	4,451
Striped Bass	1,244
Threadfin Shad	560
Chinook Salmon	78
Splittail	64
Sacramento Pikeminnow	56
American Shad	52
Tule Perch	47
Delta Smelt	32
Threespine Stickleback	17
Yellowfin Goby	16
Pacific Staghorn Sculpin	5
Western Mosquitofish	4
Longfin Smelt	2
Northern Anchovy	2
Steelhead Trout	2
Surf Smelt	2
White Catfish	2
Bigscale Logperch	1
Channel Catfish	1
Common Carp	1
Golden Shiner	1
Jacksmelt	1
Largemouth Bass	1
Prickly Sculpin	1
White Crappie	1

Stations 758 and 837
Source: DFG unpublished data

Table E-3
Species Composition and Relative Abundance of Fish Eggs and Larvae (ichthyoplankton) Collected in Suisun Bay and the Western Delta near Sherman Lake

Fish Species	Number Collected
Striped Bass	14,417
Longfin Smelt	12,063
Unidentified Smelt	6,855
Pacific Herring	2,469
Prickly Sculpin	2,087
Threadfin Shad	1,334
Northern Anchovy	1,216
Chameleon Goby	942
Yellowfin Goby	714
Delta Smelt	333
Arrow/cheekspot Goby	179
Common Carp	133
Unidentified Minnow	119
Unidentified Sunfish	76
Bigscale Logperch	33
American Shad	19
Inland Silverside	7
Splittail	6
Threespine Stickleback	6
Bay Goby	4
Bluegill	4
Goby Type II	4
Sacramento Sucker	3
White Sturgeon	3
Arrow Goby	2
Cheekspot Goby	2
Jacksmelt	2
Starry Flounder	2
Unidentified Goby	2
Bay Pipefish	1
Chinook Salmon	1
Longjaw Mudsucker	1
Pacific Staghorn Sculpin	1
Unidentified Fish	1
Western Mosquitofish	1
White Croaker	1

Stations 535, 736, and 837
Source: DFG unpublished data

APPENDIX F

Vascular Plant Species Observed or Likely to be Present at LSIWA

APPENDIX F VASCULAR PLANTS OBSERVED OR LIKELY PRESENT AT LOWER SHERMAN ISLAND WILDLIFE AREA

The list below was compiled from three sources: unpublished observations made by Mike Vasey (San Francisco State University) in the northwestern portion of Lower Sherman Island, on multiple dates during 2004 (source code: "V"); unpublished observations made by John Hunter (EDAW) on July 15, 2000 and November 4, 2005 (source code "H"); and data collected by England and Naley (1989) on multiple dates at Donlon Island (source code "E&N"). Because of the proximity of Donlon Island to the Lower Sherman Island Wildlife Area (LSIWA) and the similarity of habitats at Donlon Island and the wildlife area, species observed at Donlon Island were considered likely to be present at the LSIWA as well. The scientific names of native plants are in bold. Nomenclature follows Hickman 1993.

AIZOACEAE
Sesuvium verrucosum – Upper marsh in transition to upland [Source: V, H]

ANACARDIACEAE
Schinus molle – Riparian, one tree growing at boat launch [Source: H]

APIACEAE
Apium graveolens – Marsh [Source: V]
Foeniculum vulgare – Upland, riparian [Source: V, H]
Hydrocotyle ranunculoides – Marsh, forming floating fringe at lower elevations [Source: H]
Hydrocotyle umbellata – Marsh, particularly eroding banks [Source: V, H, E&N]
Lilaeopsis masonii – Marsh (banks and open areas) [Source: H, CNDDB]
Oenanthe sarmentosa – Marsh [Source: V, H]

APOCYNACEAE
Nerium oleander – Upland, planted along Cabin Slough [Source: H]

ASCLEPIADACEAE
Asclepias fascicularis – Upland [Source: V]

ASTERACEAE
Ambrosia artemisiifolia – Upland [Source: H]
Anthemis cotula – Upland [Source: V, E&N]
Artemisia douglasiana – Riparian [Source: V, H]
Aster lentus – Marsh, [Source: V, H, CNDDB]
Baccharis pilularis – Riparian [Source: H]
Bidens frondosa – Marsh, riparian [Source: E&N]
Bidens laevis – Marsh [Source: V, H]
Carduus pycnocephalus – Upland [Source: H]
Conyza canadensis – Upland [Source: E&N]
Cotula coronopifolia – Marsh [Source: V, E&N]
Euthamia occidentalis – Riparian, marsh [Source: V, H]
ASTERACEAE *(Continued)*
Gnaphalium luteo-album – Upland [Source: E&N]
Grindelia stricta var. ***angustifolia*** – Marsh [Source: V, H]
Heterotheca grandiflora – Upland [Source: V, E&N]
Lactuca serriola – Upland [Source: H]
Pluchea odorata – Marsh, riparian [Source: V, H]

Sonchus oleraceus – Upland, riparian [Source: V, E&N]
Taraxicum officinale – Riparian, upland [Source: E&N]
Xanthium strumarium – Upland, riparian [Source: V, H, E&N]

BETULACEAE
Alnus rhombifolia – Riparian [Source: E&N]

BRASSICACEAE
Lepidium latifolium – Upland, marsh, riparian [Source: V, H, E&N]
Raphanus sativus – Upland [Source: V]
Rorripa sinuata – Marsh, riparian [Source: V]

CACTACEAE
Opuntia ficus-indica – Upland, planted along Cabin Slough [Source: H]

CARYOPHYLLACEAE
Stellaria media – Upland [Source: E&N]

CHENOPODIACEAE
Atriplex triangularis – Marsh [Source: V, H]
Chenopodium album – Upland [Source: E&N]
Chenopodium ambrosioides – Marsh, riparian, upland [Source: E&N]
Salicornia virginica – Marsh, abundant in patches of upper marsh in the northwestern portion of Lower Sherman Island [Source: V,H]

CONVOLVULACEAE
Calystegia sepium – Marsh, riparian [Source: V, H]
Cressa truxillensis – [Source: V]

CYPERACEAE
Carex species – Marsh [Source: V, H]
Carex species (dense pubescent inflorescence) – Marsh [Source: V]
Cyperus eragrostis – Marsh [Source: V, H, E&N]
Cyperus erythrorhizos – Marsh, riparian [Source: E&N]
Scirpus acutus var. ***occidentalis*** – Marsh, the predominant tule of the marshes at the wildlife area [Source: V, H]
Scirpus americanus – Marsh, locally abundant [Source: V, H]
Scirpus californicus – Marsh, most abundant in the lower intertidal zone [Source: H, E&N]
Scirpus maritimus – Marsh, uncommon [Source: V]

EQUISETACEAE
Equisetum hymale ssp. ***affine*** – Riparian [Source: E&N]

FABACEAE
Acacia species – Upland, planted along Cabin Slough [Source: H]
Lathyrus jepsonii ssp ***jepsonii*** – Riparian, marsh [Source: V]
Lotus purshianus – Upland [Source: V]
Lotus scoparius – Upland [Source: V]
Medicago orbicularus – Upland [Source: E&N]
Melilotus albus – Upland [Source: E&N]
Melilotus indicus – Upland [Source: E&N]
Trifolium hybridum – Upland, riparian [Source: E&N]
Trifolium species – Upland (could be a native or nonnative species) [Source: E&N]

FRANKENIACEAE
Frankenia salina – Upland, marsh [Source: E&N]

HYDROCHARITACEAE
Egeria densa – Aquatic [Source: H]

IRIDACEAE
Iris pseudacorus – Marsh [Source: H]

JUNCACEAE
Juncus acutus ssp. ***leopoldii*** – Riparian [Source: E&N]
Juncus balticus – Marsh, riparian [Source: V, H]
Juncus bufonius – Upland, marsh, riparian [Source: H, E&N]
Juncus effusus – Marsh, riparian [Source: H, E&N]
Juncus xiphioides – Marsh [Source: V]

LAMIACEAE
Lycopus americanus – Marsh, riparian [Source: V, H, E&N]
Lycopus asper – Marsh [Source: V]
Mentha arvensis – Marsh [Source: H]

LILIACEAE
Asparagus officinalis ssp. *officinalis* – Marsh [Source: V, H]

LYTHRACEAE
Lythrum californicum – Marsh [Source: V, E&N]

MALVACEAE
Malva neglecta – Upland [Source: V]

MYRTACEAE
Eucalyptus globulus – Upland [Source: H]

ONAGRACEAE
Epilobium ciliatum – Marsh, riparian, upland [Source: V, H]
Ludwigia peploides – Marsh, riparian, there is also a nonnative subspecies that may be present at the wildlife area [Source: H, E&N]
Oenothera elata ssp***.*** ***hookeri*** – Upland [Source: V, E&N]

PINACEAE
Pinus species – Planted along Cabin Slough [Source: H]

PLANTAGINACEAE
Plantago subnuda – Marsh [Source: V, E&N]

POACEAE
Agrostis viridis – Upland, marsh [Source: E&N]
Arundo donax – Marsh, riparian [Source: E&N]
Avena species – Upland [Source: H]
Bromus diandrus – Upland [Source: V, E&N]
Bromus hordeaceus – Upland [Source: V, H]
Cortaderia selloana – Upland [Source: V, H]

Cynodon dactylon – Upland, riparian [Source: V, E&N]
Deschampsia Caespitosa ssp. ***holciformis*** – Upland [Source: H]
Distichlis spicata – Upper marsh [Source: V, H]
Lolium multiflorum – Upland [Source: V, H, E&N]
Paspalum dilatatum – Marsh, upland [Source: H, E&N]
Paspalum distichum – Marsh [Source: V]
Phragmites australis – Marsh, locally abundant [Source: V, H]
Polypogon monspeliensis – Upland [Source: V, H, E&N]
Pucinella species – Upland (could be a native or nonnative species) [Source: E&N]
Taeniatherum caput-medusae – Upland [Source: V]

POLYGONACEAE
Polygonum argyrocoleon – Upland [Source: E&N]
Polygonum hydropiperoides – Marsh [Source: H]
Polygonum persicaria – Marsh [Source: V, E&N]
Polygonum punctatum – Marsh [Source: V]
Rumex crispus – Upland [Source: V, H]
Rumex salicifolius var ***denticulatus*** – Marsh, upland, riparian [Source: V, H]

PONTEDERIACEAE
Eichhornia crassipes – Aquatic, lower fringe of marshes [Source: H]

POTAMOGETONACEAE
Potamogeton pectinatus – Aquatic [Source: H]

PRIMULACEAE
Samolus parviflorus – Marsh, riparian, predominantly along banks and exposed sediment in the intertidal zone [Source: V]

PUNICACEAE
Punica granatum – Upland, planted along Cabin Slough [Source: H]

ROSACEAE
Rosa californica – Riparian [Source: V, H]

Rubus discolor – Riparian, the most abundant species in the riparian zone, forms dense thickets along the levee remnants [Source: V, H]

RUBIACEAE
Galium triflorum – Marsh [Source: V, H]

SALICACEAE
Populus alba – Planted along cabin slough [Source: H]
Populus fremontii ssp ***fremontii*** – Riparian [Source: V, H, E&N]
Salix goodingii – Riparian [Source: H, E&N]
Salix hindsii – Riparian [Source: H, E&N]
Salix lasiolepis – Riparian, the most abundant willow along the levee remnants [Source: V, H]

SCROPHULARIACEAE
Bellardia trixago – [Source: V]
Mimulus guttatus – Marsh [Source: V, H]
Mimulus moschatus – Marsh [Source: E&N]

Veronica anagallis-aquatica – Marsh, riparian [Source: E&N]

SOLANACEAE
Solanum americanum – Upland, marsh, riparian [Source: V, H, E&N]

TYPHACEAE
Sparganium eurycarpum ssp. ***eurycarpum*** – Marsh [Source: V, H]
Typha angustifolia – Marsh [Source: V, E&N]
Typha domingensis – Marsh [Source: V, H]
Typha latifolia – Marsh [Source: V, H, E&N]

VERBENACEAE
Verbena bonariensis – Riparian, [Source: E&N]
Verbena litoralis – Riparian [Source: V]

APPENDIX G

Bird Species Observed or Likely to be Present at LSIWA

APPENDIX G POTENTIAL BIRD SPECIES THAT COULD OCCUR AT LOWER SHERMAN ISLAND WILDLIFE AREA

Common Name	*Scientific Name*
American white pelican	*Pelecanus erythrorhynchos*
Greater White-fronted Goose	*Anser albifrons*
Snow Goose	*Chen caerulescens*
Ross's Goose	*Chen rossii*
Canada Goose	*Branta canadensis*
Brant	*Branta bernicla*
Tundra Swan	*Cygnus columbianus*
Wood Duck	*Aix sponsa*
Gadwall	*Anas strepera*
Eurasian Wigeon	*Anas penelope*
American Wigeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Blue-winged Teal	*Anas discors*
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Northern Pintail	*Anas acuta*
Green-winged Teal	*Anas crecca*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Surf Scoter	*Melanitta perspicillata*
Bufflehead	*Bucephala albeola*
Common Goldeneye	*Bucephala clangula*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Ring-necked Pheasant	*Phasianus colchicus**
California Quail	*Callipepla californica*
Red-throated Loon	*Gavia stellata*
Pacific Loon	*Gavia pacifica*
Common Loon	*Gavia immer*
Pied-billed Grebe	*Podilymbus podiceps*
Eared Grebe	*Podiceps nigricollis*
Western Grebe	*Aechmophorus occidentalis*
Clark's Grebe	*Aechmophorus clarkii*

Common Name	*Scientific Name*
Brown Pelican	*Pelecanus occidentalis*
Double-crested Cormorant	*Phalacrocorax auritus*
American Bittern	*Botaurus lentiginosus*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Green Heron	*Butorides virescens*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Turkey Vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
White-tailed Kite	*Elanus leucurus*
Northern Harrier	*Circus cyaneus*
Cooper’s Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Sharp-shinned hawk	*Accipiter striatus*
Swainson’s Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
Rough-legged Hawk	*Buteo lagopus*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
American peregrine falcon	*Falco peregrinus anatum*
California black rail	*Laterallus jamaicensis coturniculus*
California clapper rail	*Rallus longirostris*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Common Moorhen	*Gallinula chloropus*
American Coot	*Fulica americana*
Black-bellied Plover	*Pluvialis squatarola*
Mountain plover	*Charadrius montanus*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Solitary Sandpiper	*Tringa solitaria*
Willet	*Catoptrophorus semipalmatus*
Spotted Sandpiper	*Actitis macularia*
Whimbrel	*Numenius phaeopus*
Greater sandhill crane	*Grus canadensis*

Common Name	*Scientific Name*
Long-billed Curlew	*Numenius americanus*
Marbled Godwit	*Limosa fedoa*
Ruddy Turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Semipalmated Sandpiper	*Calidris pusilla*
Western Sandpiper	*Calidris mauri*
Least Sandpiper	*Calidris minutilla*
Baird’s Sandpiper	*Calidris bairdii*
Pectoral Sandpiper	*Calidris melanotos*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Wilson’s Snipe	*Gallinago delicata*
Wilson’s Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Bonaparte’s Gull	*Larus philadelphia*
Mew Gull	*Larus canus*
Ring-billed Gull	*Larus delawarensis*
California Gull	*Larus californicus*
Herring Gull	*Larus argentatus*
Thayer’s Gull	*Larus thayeri*
Glaucous-winged Gull	*Larus glaucescens*
California least tern	*Sterna antillarum browni*
Caspian Tern	*Sterna caspia*
Elegant Tern	*Sterna elegans*
Forster’s Tern	*Sterna forsteri*
Least Tern	*Sterna antillarum*
Black Tern	*Chlidonias niger*
Rock Pigeon	*Columba livia**
Mourning Dove	*Zenaida macroura*
Barn Owl	*Tyto alba*
Western Burrowing owl	*Athene cunicularia*
Great Horned Owl	*Bubo virginianus*
Long-eared Owl	*Asio otus*
Short-eared Owl	*Asio flammeus*
Black-chinned Hummingbird	*Archilochus alexandri*
Anna’s Hummingbird	*Calypte anna*
Allen’s Hummingbird	*Selasphorus sasin*
Belted Kingfisher	*Ceryle alcyon*
Downy Woodpecker	*Picoides pubescens*
Northern Flicker	*Colaptes auratus*
Western Wood-Pewee	*Contopus sordidulus*

Common Name	*Scientific Name*
Willow Flycatcher	*Empidonax traillii*
Pacific-slope Flycatcher	*Empidonax difficilis*
Black Phoebe	*Sayornis nigricans*
Say's Phoebe	*Sayornis saya*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Western Kingbird	*Tyrannus verticalis*
Loggerhead Shrike	*Lanius ludovicianus*
Cassin's Vireo	*Vireo cassinii*
Warbling Vireo	*Vireo gilvus*
Western Scrub-Jay	*Aphelocoma californica*
Yellow-billed Magpie	*Pica nuttalli*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
California horned lark	*Eremophila alpestris actia*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Oak Titmouse	*Baeolophus inornatus*
Bushtit	*Psaltriparus minimus*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Marsh Wren	*Cistothorus palustris*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Western Bluebird	*Sialia mexicana*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Northern Mockingbird	*Mimus polyglottos*
European Starling	*Sturnus vulgaris**
American Pipit	*Anthus rubescens*
Cedar Waxwing	*Bombycilla cedrorum*
California yellow warbler	*Dendroica petechia brewsteri*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*

Common Name	*Scientific Name*
Hermit Warbler	*Dendroica occidentalis*
Common Yellowthroat	*Geothlypis trichas*
Saltmarsh common yellowthroat	*Geothlypis trichas sinus*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-breasted Chat	*Icteria virens*
Western Tanager	*Piranga ludoviciana*
Spotted Towhee	*Pipilo maculatus*
California Towhee	*Pipilo crissalis*
Chipping Sparrow	*Spizella passerina*
Lark Sparrow	*Chondestes grammacus*
Savannah Sparrow	*Passerculus sandwichensis*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Suisun Song Sparrow	*Melospiza melodia maxillaris*
Lincoln's Sparrow	*Melospiza lincolnii*
White-throated Sparrow	*Zonotrichia albicollis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Dark-eyed Junco	*Junco hyemalis*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Blue Grosbeak	*Passerina caerulea*
Lazuli Bunting	*Passerina amoena*
Red-winged Blackbird	*Agelaius phoeniceus*
Tricolored Blackbird	*Agelaius tricolor*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Brown-headed Cowbird	*Molothrus ater*
Bullock's Oriole	*Icterus bullockii*
House Finch	*Carpodacus mexicanus*
Lesser Goldfinch	*Carduelis psaltria*
American Goldfinch	*Carduelis tristis*

* = introduced

Source: This list was compiled by EDAW biologists from personal knowledge of the species and the project area, from review of the Audubon Christmas Bird Count 2005/2006 Pittsburg Marsh area survey, and from review of bird survey results at Donlon Island (England, A. and Naley, M. 1989).

APPENDIX H

Amphibian, Reptile, and Mammal Species Likely to be Present at LSIWA

APPENDIX H AMPHIBIAN, REPTILE, AND MAMMAL SPECIES LIKELY TO BE PRESENT AT LSIWA.

The following lists are of amphibian, reptile, and mammal species that are likely to be present at the LSIWA. This list was developed from a review by an EDAW wildlife biologist of the species lists generated by the California Wildlife Habitat Relationships system (CDFG 2002), habitat conditions at the LSIWA, and the distribution of species in the vicinity of the LSIWA. (No surveys for amphibians, reptiles, or mammals are known to have been conducted at LSIWA..)

AMPHIBIANS AND REPTILES

Western toad (*Bufo boreas*)
Bullfrog (*Rana catesbiana*)
Western pond turtle (*Actinemys marmorata marmorata*)
Western fence lizard (*Sceloporus occidentalis*)
Alligator lizard (*Elgaria coerulea*)
Gopher snake (*Pituophis melanoleucus*)
Common garter snake (*Thamnophis sirtalis*)
Western aquatic garter snake (*Thamnophis couchii*)

MAMMALS

Virginia opossum (*Dedelphis virginiana*)
Ornate shrew (*Sorex ornatus*)
Desert cottontail (*Sylvilagus audubonii*)
Black-tailed jackrabbit (*Lepus californicus*)
California ground squirrel (*Spermophilus beecheyi*)
Botta’s pocket gopher (*Thomomys bottae*)
American beaver (*Castor canadensis*)
Western harvest mouse (*Reithrodontomys megalotis*)
Deer mouse (*Peromyscus maniculatus*)
California vole (*Microtus californicus*)
Muskrat (*Ondatra zibethicus*)
Black rat (*Rattus rattus*)
Norway rat (*Rattus norvegicus*)
House mouse (*Mus musculus*)
Coyote (*Canis lantrans*)
Red fox (*Vulpes vulpes*)
Raccoon (*Procyon lotor*)
American mink (*Mustela vision*)
Striped skunk (*Mephitis mephitis*)
Northern river otter (*Lutra canadensis*)
Domestic cat (*Felis domesticus*)

APPENDIX I

Studies Conducted at or in the Vicinity of the Lower Sherman Island Wildlife Area

APPENDIX I STUDIES CONDUCTED AT OR IN THE VICINITY OF THE LOWER SHERMAN ISLAND WILDLIFE AREA

Studies with Data from the Vicinity of the Lower Sherman Island Wildlife Area

Study	Authors	Year	Full Reference
Literature			
Sherman Island agricultural diversion evaluation.	Nobriga, M. and Z. Matica.	2000	Nobriga, M. and Z. Matica. 2000. Sherman Island agricultural diversion evaluation. Interagency Ecological Studies Program for the Sacramento-San Joaquin Estuary Newsletter 13:55-56.
The effects of wetland restoration on the production and bioaccumulation of methylmercury in the Sacramento-San Joaquin Delta, California. *In*: "An assessment of ecological and human health impacts of mercury in the Bay-Delta watershed."	Slotton, D.G., S. M. Ayers, T. H. Suchanek, R. D. Weyand, A. M. Liston, C. Asher, D. C. Nelson, and B. Johnson.	2002	Slotton, D.G., S. M. Ayers, T. H. Suchanek, R. D. Weyand, A. M. Liston, C. Asher, D. C. Nelson, and B. Johnson. 2002. The effects of wetland restoration on the production and bioaccumulation of methylmercury in the Sacramento-San Joaquin Delta, California. In: "An assessment of ecological and human health impacts of mercury in the Bay-Delta watershed." final report submitted to the CALFED Bay-Delta Program.
Report on the 1980-1995 fish, shrimp, and crab sampling in the San Francisco Estuary, California. The Interagency Ecological Program for the Sacramento-San Joaquin Estuary.	Baxter, R, K. Hieb, S. DeLeon, K. Fleming, and J. Orsi.	1999	Baxter, R, K. Hieb, S. DeLeon, K. Fleming, and J. Orsi. 1999. Report on the 1980-1995 fish, shrimp, and crab sampling in the San Francisco Estuary, California. The Interagency Ecological Program for the Sacramento-San Joaquin Estuary. Technical Report 63.
Spatial-temporal Distribution and Habitat Associations of Age-0 Splittail in the Lower San Francisco Estuary Watershed.	Feyrer, F., Sommer, T., and R. Baxter	2005	Feyrer, F., Sommer, T., and R. Baxter. 2005. Spatial-temporal Distribution and Habitat Associations of Age-0 Splittail in the Lower San Francisco Estuary Watershed. Copeia, 2005, No. 1.
Fish Community Ecology in an Altered River Delta: Spatial Patterns in Species Composition, Life History Strategies, and Biomass.	Nobriga, M., Feyrer, F., Baxter, R., and M. Chotkowski	2005	Nobriga, M., Feyrer, F., Baxter, R., and M. Chotkowski. 2005. Fish Community Ecology in an Altered River Delta: Spatial Patterns in Species Composition, Life History Strategies, and Biomass. Estauries, Vol. 28, No. 5, p. 776-778.
Bioavailability of organic matter in a highly disturbed estuary: The role of detrital and algal resources.	Sobczak, W., Cloern, J., Jassby, A., and A. Muller-Solger	2002	Sobczak, W., Cloern, J., Jassby, A., and A. Muller-Solger. 2002. Bioavailability of organic matter in a highly disturbed estuary: The role of detrital and algal resources. Procedings on the National Academy of Sciences, Vol. 99, No. 12.
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Integrated Regional Wetland Monitoring Pilot Project (includes vegetation mapping, bird and fish sampling, and sediment monitoring)	Siegel, S, et al.	NA	Description of Integrated Regional Wetland Monitoring Pilot Project is available at: http://www.swampthing.org/
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