

FINAL

TUBBS ISLAND RESTORATION PLAN
and
ENVIRONMENTAL ASSESSMENT

Prepared by

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Table of Contents

- I. TUBBS ISLAND RESTORATION AND MAINTENANCE PLAN.....1
 - A. Project Purpose and Location1
 - B. Background1
 - C. Goals and Objectives.....3
 - 1. Tubbs Island Marsh Restoration Project Goals and Objectives3
 - a. Goal.3
 - b. Objectives.3
 - 2. Lower Tubbs Island Levee Maintenance Project Goals and Objectives4
 - a. Goal.4
 - b. Objectives.4
 - D. Description of the Projects.....4
 - 1. Tubbs Island Marsh Restoration Project Design.4
 - a. New Levee Construction.....7
 - b. Existing Dike Modification.8
 - c. Circulation Improvements.....9
 - 2. Lower Tubbs Island Levee Maintenance Project.9
 - E. Habitat Types and Associated Wildlife.....10
 - 1. Agricultural Fields.10
 - 2. Salt Marsh.11
 - 3. Seasonal Wetland.....11
 - 4. Muted Tidal Marsh.11
 - 5. Levees.12
 - F. Monitoring12
 - 1. Endangered and Sensitive Species.....12
 - 2. Birds.....13
 - 3. Fish.....13
 - 4. Vegetation and Project Development.13
 - G. Permits and Regulatory Requirements.....13
 - H. Implementation Schedule.....13
 - I. Summary.....14

I. TUBBS ISLAND RESTORATION AND MAINTENANCE PLAN

A. Project Purpose and Location

The Tubbs Island Restoration and Maintenance plan consists of two parts. Marsh restoration will occur on Tubbs Island and levee maintenance will occur on Lower Tubbs Island. The purpose of the Tubbs Island Marsh Restoration Project is to restore 72 acres of tidal marsh habitat for the benefit of endangered and threatened species and for a variety of waterbirds, fish, and other estuarine organisms. The purpose of the maintenance project is to repair and maintain a two-mile levee enclosing a 248-acre muted tidal marsh. The adjacent projects are located approximately 3 miles south of the Highway 37/121 intersection within the San Pablo Bay National Wildlife Refuge (Refuge) in Sonoma County, California (Figure 1).

B. Background

The San Francisco Bay estuary is the largest estuary on the West Coast of North America. Before the arrival of Europeans in the mid-1800s, San Francisco Bay was surrounded by approximately 860 square miles of marshes and hundreds of square miles of mudflats that provided excellent habitat for waterfowl, shorebirds, and many other species of wildlife. Since then, more than 90% of these wetlands have been significantly altered or no longer exist due to hydraulic mining, farming, urbanization, waste disposal, salt production, and transportation systems (ABAG 1991). Over the years, these activities have caused extensive losses of wildlife habitat, degradation of water quality, reduction of natural flushing, and accelerated sedimentation in the Bay.

Human activities have greatly affected San Pablo Bay including the project area. Historically, Tubbs Island was part of a series of marsh islands surrounded by tidal sloughs. Around the early 1900s, levees were constructed along the edges of the sloughs and the islands were dewatered for agricultural use (ABAG 1991). Recognizing the importance of the area to wildlife, the U.S. Fish and Wildlife Service (Service) established the San Pablo Bay National Wildlife Refuge in 1974.

In 1981, the Service acquired 72 acres of diked historic wetlands on Tubbs Island through a 66-year lease with the California State Lands Commission. This site is part of a larger parcel diked in the early 1900s for reclamation and farmed until 1983 when farming ceased. Restoration of the diked site to tidal marsh has been considered since 1976. Due to high costs associated with constructing a new interior flood protection levee for the adjacent landowner, the Refuge was not able to restore the site. In 1997, this project was selected for potential funding from the United Heckathorn Natural Resource Damage Assessment settlement and federal supplemental flood funds were appropriated because of storm damages to the levee. Ducks Unlimited Inc. has also agreed to cosponsor this project.

Lower Tubbs Island, a 248-acre muted tidal marsh site was acquired in 1978 from The Nature Conservancy (TNC). Before TNC's ownership, the land was managed as a private duck club. It is currently managed as a muted tidal marsh that provides alternative sheltered wetlands for a variety of waterbirds including California black rails.

Levee maintenance is required for the continued management of the 248-acre site as a muted tidal marsh. Its levees are subject to severe weathering and tidal forces from San Pablo Bay and require repairs and maintenance every 10 to 15 years. Maintenance is overdue on this levee, but due to a lack of funds has been delayed. Flood funds were appropriated by Congress in FY97 to complete this work. Ducks Unlimited, Inc. has also agreed to cosponsor this project.

These two projects will complement an adjacent wetland restoration project in the lower Tolay Creek watershed scheduled to begin in fall 1998 (USFWS 1997). The muted tidal marsh is between Tolay Creek and the Tubbs Island marsh restoration project. By maintaining the 248-acre muted tidal marsh, an area of an undisturbed established wetland habitat will be available for wildlife while wetland restoration is occurring on adjacent land. It is planned that the site will continue to be managed as muted tidal marsh for another 10 to 15 years, the expected life of the levee before additional maintenance will be required. In the future, when adjacent wetland habitat has been restored, the muted marsh can be converted to a fully tidal marsh.

C. Goals and Objectives

1. Tubbs Island Marsh Restoration Project Goals and Objectives

a. Goal.

To restore and enhance tidal salt marsh habitat on Tubbs Island for the benefit of endangered and threatened species, migratory birds and other estuarine dependent wildlife.

b. Objectives.

- Restore 72 acres of diked historic wetlands
- Create a self-sustaining tidal salt marsh capable of providing wildlife resources adequate protection without artificially increasing the risk of predation
- Maintain floodplain protection for adjacent landowners
- Restore the site in a manner requiring minimal maintenance
- Monitor and evaluate the results of the proposed project for its effects on endangered species and estuarine resources
- Integrate adjacent restoration projects to increase hydrologic circulation and ecological exchange when appropriate

2. Lower Tubbs Island Levee Maintenance Project Goals and Objectives

a. Goal.

Maintain an existing levee necessary for the continued management of a 248-acre muted tidal marsh.

b. Objectives.

- Maintain the integrity of the existing levee to provide muted tidal wetland habitat
- Maintain existing muted tidal wetland habitat available for wildlife while adjacent marsh restoration projects are being established

- Provide safe pedestrian access for the public so they may participate in compatible wildlife-dependent recreation
- Provide safe regulated vehicle access for management activities

D. Description of the Projects

1. Tubbs Island Marsh Restoration Project Design.

An advanced project plan for marsh restoration at San Pablo Bay National Wildlife Refuge was prepared by SVERDRUP & PARCEL and Associates, Inc. (1985). The plan included constructing a new dike to protect the adjacent upland areas from tidal action, breaching the existing outboard dike and placing water control structures to provide improved water circulation to Lower Tubbs Island (Figures 2 and 3).

The site, exclusive of the dikes that border it along the bay, varies in elevation from 0 to -4.5 Mean Sea Level (MSL), generally sloping from north to south. Because the entire south end of Tubbs Island is below high tide level, a system of ditches and several pumping stations on adjacent farmland have been installed to maintain the water table below the land surface. These facilities are used to remove surplus rainfall and any seepage through the dikes. Pumping and farm operations have contributed to several feet of subsidence due to the groundwater removal and soil consolidation. The elevation of Tubbs Island is 3 to 5 feet lower than that of either Lower Tubbs Island or Tolay Creek. The daily tidal range outboard of the site is approximately 6 feet measured from higher high water to lower low water and seldom exceeds eight feet (ACOE 994). San Pablo Bay is extremely shallow next to the site, with over a mile of mudflats at low tide. Surface elevation on the bay side of the existing dike is approximately 0.0 MSL.

Elevations mentioned in the text are referenced to Mean Sea Level as defined by the U.S. Coast and Geologic Survey National Geodetic Vertical Datum (NGVD) of 1929. Tidal elevations that are referenced to Mean Lower Low Water (MLLW), have been adjusted to correspond to NGVD when mentioned in this study. Tidal levels are for a station at the mouth of the Petaluma River, approximately 3 miles from the project site, and are based on the 1960 to 1978 tidal epochs (Table 1).

Soils in the project vicinity consist of sedimentary deposits of silt and clay that extend to a depth of approximately 70 feet. These materials are of Recent Age geologically and are still in an active state of consolidation. Firm to stiff silt and clay underlie the surface deposits (USSCS 1972).

Table 1. Tidal data for the mouth of Sonoma Creek (in feet).

	NGVD	NOAA TIDAL
Extreme High	6.4	8.5
Mean Higher High Water	3.45	5.56
Mean Tide Level	0.77	2.88
Mean Lower Low Water	-2.11	0.00

Table 2. Design tides (in feet) for new Tubbs Island marsh restoration setback levee and Lower Tubbs Island maintenance levee projects.

	NVGD
Extreme High	6.4
Mean Higher High Water	3.5
Mean Tide Level	0.8

The components of the preferred restoration option consist of the following work items:

a. New Levee Construction.

Project construction includes a new 2000-foot levee on the northeast side of a 72-acre fallow agricultural field next to San Pablo Bay. The new dike will run east to west, paralleling the Refuge’s boundary, and connect to existing levees. Dike construction will use native materials excavated from higher areas within the site or from adjacent areas. Material estimates are found in Table 3.

Before excavation, existing grassland vegetation will be removed from the dike and borrow areas. Test holes indicate that the water table is approximately 3 feet below ground. Assuming 6 inches of soil will be removed to clear the existing vegetation, and that two feet of material can be removed for use in the dike without encountering groundwater, approximately 15 acres will need to be excavated to obtain the required fill volume for the new levee. Some processing of the excavated material may be necessary to lower its moisture content and obtain optimum compaction in the dike. The new levee will be constructed with the use of scrapers and dozers. The high moisture content of the soil may require the use of elevating scrapers, although the large area and shallow depth of excavation is ideally suited for a scraper operation.

Dikes will be constructed to assure structural integrity to prevent flooding of neighboring landowners. The bayward side of the dike will be constructed to allow for settlement to a 6:1 slope. A two-foot layer of riprap may be placed within the dike to protect the dike from structural damage if the vegetation and soil are eroded from the face of the dike. The landward side of the dike will be constructed to obtain a slope of 3:1 after settlement. The dike will be seeded with native grass to improve the erosion resistance of the dike. The top of the dike will be wide enough to accommodate vehicle access. It will be surfaced with a 6-inch layer of crushed rock.

Table 3. Estimated materials for new levee construction.

Levee Fill	50,000 cubic yards
Rock riprap	4,000 cubic yards

Filter fabric	5,400 square yards
Rock surfacing	600 cubic yards
Water control structures	2 - 36" structures
Seeding	3 acres

b. Existing Dike Modification.

The existing dike was originally constructed from materials borrowed from the inboard side of the dike. Over the years it has been raised and reinforced as needed, mainly using local materials. The original dike was approximately 15 feet wide on top with side slopes of 3:1. Most of the outboard side of the dike has been armored to stabilize it from tidal erosion. Small remnants of salt marsh vegetation are present in a few locations along the outboard side of the levee. The eastern end of the levee slants inland in a northerly direction and borders about 10 acres of salt marsh on the bay side.

After the new setback levee is built, the existing outboard dike will be breached near the midpoint of the outer levee in an area minimizing impacts to salt marsh. The 150-foot wide breach will be excavated to provide a final bottom elevation that matches the surrounding mudflats, and have side slopes of 10:1. Initially at low tide, this will create 2 to 4 foot water depths in the restored site. Due to the large portion of the site that is at or below the mean lower low water elevation, most of the site will not drain on a regular basis until sedimentation raises the bottom elevation.

The levee breach will provide full daily tidal exchange to the site. The existing dike will provide the new levee a large degree of protection from wave action. Part of the dike on each side of the breach may be stabilized with riprap or other suitable material to reduce erosion. A non-woven filter fabric would be placed underneath the riprap to prevent the silt and sand in the dike from being washed out.

Sedimentation within the project site will occur over time. As the site elevation increases, the deposition rate slows since the ground surface is inundated for a shorter period through each tidal cycle. Based on average sedimentation of the Sonoma River restoration project of almost 2 feet in the first 2¼ years, it is estimated that within 5 years, there will be sufficient sedimentation to support the establishment of marsh vegetation (Siegel 1997).

c. Circulation Improvements.

Lower Tubbs Island, immediately to the west of the restoration project is managed as a muted, tidally-influenced marsh. The inflow and outflow of waters are controlled through several water control structures and are limited by the tidal exchange capacity of the culverts. The culverts are left open year round to facilitate maximum flow into and out of the unit. This increases circulation and reduces mosquito production.

Two culverts will be installed in the dike separating the parcels to increase the hydrologic circulation between the Lower Tubbs and Tubbs Island sites. The culverts will have combination

screw-flap gates on each end so that maximum flexibility in moving water between the parcels can be maintained. Cut off collars will be provided on the culverts at the center of the dike to prevent flow along the culvert that could lead to pipe and dike failure. Future hydrological improvements may involve connecting the project site with Tolay Creek by breaching the levee road in the location of the proposed culverts.

2. Lower Tubbs Island Levee Maintenance Project.

The purpose of the levee maintenance project is to continue management of Lower Tubbs Island as a muted tidal marsh. Levee maintenance will involve the placement of clean fill and rip rap along sections of the two-mile levee that surrounds the 248-acre muted tidal marsh. Work will include the reinforcement and/or replacement of existing water control structures at two sites recently damaged in winter storms. Material estimates are found in Table 4.

Table 4. Estimated materials for the levee maintenance project.

Levee Fill	12,000 cubic yards
Rock riprap	9,000 cubic yards
Filter fabric	1,000 square yards
Rock surfacing	450 cubic yards
Seeding	3 acres
Water control structure replacement	4 - 36" units per structure

E. Habitat Types and Associated Wildlife

The salt marsh restoration project area consists of a diked fallow agricultural field surrounded by a peripheral drainage ditch and levee on three sides. The fourth side borders an adjacent field that is actively farmed for oat-hay and other grains. The drainage ditch is vegetated with pickleweed that grades into shrubs and ruderal vegetation on the sides and tops of the levees. About small amount of seasonal wetland is found in a narrow swale that runs north to south through the property. The levee maintenance project involves approximately 2 miles of dike composed of onsite material, with additional fill and riprap. The levee encloses a muted tidal impoundment with 3 water control structures connected to the Bay. This bayward levee connects with the outboard levee of the marsh restoration project. The two sites are separated by a common levee. Wildlife information is taken from monthly bird surveys of the area.

1. Agricultural Fields.

The primary habitat affected by the Tubbs Island marsh restoration project is a fallow agricultural field. The proposed site was farmed from the early 1900s until 1984. It has since lain fallow. The site is dominated by ruderal species including coyote brush (*Baccharis pilularis*) several species of nonnative grasses such as (*Lolium perenne*), (*Bromus diandrus*) and (*Avena*

pautua), yellow star thistle (*Centaurea solstitialis*) and curly dock (*Rumex crispus*).

During monthly bird surveys, a predominance of upland associated bird species recorded from this area include: red-tailed hawk, turkey vulture, ring-necked pheasant, red-winged blackbird, song sparrow, white-crowned sparrow, Brewer's blackbird, house finch, western meadowlark, barn swallow, and American goldfinch.

Because of its lowered elevation due to subsidence, this restoration project will change the habitat from agricultural to tidally influenced open water habitat in the early phase of the project. It will then transform to mudflats, followed by the development of a low marsh, and then mature pickleweed-dominated salt marsh with tidal sloughs over a period of several decades.

2. Salt Marsh.

Small fringes of tidally influenced salt marsh are on the bay side of the existing outboard levee. At the eastern end of the outboard levee, a pocket of salt marsh has developed in a protective bend in the levee. Other salt marsh plants include saltgrass (*Distichlis spicata*), *Jaumea carnosa*, cordgrass (*Spartina foliosa*), alkali heath (*Frankenia salina grandifolia*), and *Atriplex patula*. Within the interior of the marsh restoration site, non-tidally influenced pickleweed (*Salicornia virginica*) borders the drainage ditch running parallel to the existing levee.

Tidally-influenced salt marsh habitat supports a wide variety of wildlife including the endangered California clapper rail, California black rail, sora, Virginia rail, snowy egret, great egret, great blue heron, white-tailed kite, northern harrier, several species of waterfowl, shorebirds, passerines, small mammals such as mice and voles, fish, and invertebrates. Because of the small size of the outboard salt marsh, its location next to an elevated levee, and its proximity to severe tidal action, its wildlife value is diminished as far as offering protection from the elements and predators. The pickleweed habitat within the levee may support endangered salt marsh harvest mice. The maintenance project is expected to affect no more than 0.2 acres of salt marsh. The restoration project is expected to impact 0.2 acres of saltmarsh on the outboard levee and restore 63 acres of fully tidal salt marsh habitat.

3. Seasonal Wetland.

Within the agricultural field is a narrow swale of habitat running north to south that bisects the property. This 2.2 acre swale may become seasonally wet as it is lower than the surrounding area and receives runoff from the surrounding higher ground. Vegetation is mostly nonnative grasses with some sparse growth of curly dock (*Rumex crispus*). The long linear shape of this wetland (approximately 50'x2000') suggests it may be the result of previous agricultural practices used to facilitate drainage of the site. During bird surveys of the area, primary use is by upland bird species associated with the agricultural fields.

4. Muted Tidal Marsh.

The Lower Tubbs Island levee maintenance project will support the continued management of 248-acres as a muted tidal salt marsh. Muted tidal marsh supports vegetation that is also found in a fully tidal marsh such as pickleweed, (*Salicornia virginica*), saltgrass (*Distichlis spicata*), and cordgrass (*Spartina foliosa*). However, tidal exchange is limited by the capacity of the water control structures that supply water to the site mimicking a higher marsh situation. This delays

the flow of water into and out of the site. Tidal channels that exist in this muted marsh are influenced by the size and location of the water control structures and the marshes may not always receive complete daily flushing.

Lower Tubbs Island provides an alternative habitat for many of the same species of wildlife including birds, mammals, fish and invertebrates that are found in fully tidal systems. This site provides an alternative feeding or roosting habitat when nearby fully tidal wetlands become flooded. It provides a flooded habitat for an extended period when adjacent mudflats drain quickly. The endangered salt marsh harvest mouse and California black rail use muted marshes, while endangered California clapper rails use is more limited (P. Baye pers. comm. 1998). Black rails were documented in the Lower Tubbs Island muted marsh in 1983 (Burns 1984) and 1988 (J. Evans pers. Comm.). A variety of birds including pied-billed grebe, double-crested cormorant, white pelican, waterfowl, shorebirds, and raptors such as white shouldered kite and northern harrier have been observed in the muted marsh during monthly bird surveys.

5. Levees.

Existing levees surrounding both sites are constructed primarily with onsite material. Additional fill and armoring have been added over the years to stabilize areas subjected to erosion. The levees support a narrow band of upland herbaceous and shrub species that offer minimal wildlife shelter including fennel (*Foeniculum vulgare*), mustard (*Brassica sp.*), and wild radish (*Raphanus sativus*). Levees are more commonly used as transitory corridors and provide transitional areas from the marsh. This transitional area is used by species such as the endangered California clapper rail and endangered salt marsh harvest mouse for refugia during high tides. The Tubbs Island marsh restoration project will result in approximately 2000 linear feet of new levee replacing agricultural ruderal habitat. It will remove about 150 feet of existing levee for a net gain of approximately 1850 linear feet of levee upland habitat. The Lower Tubbs Island levee maintenance project will only involve replacement and maintenance of the existing levee.

F. Monitoring

Marsh development and channel morphology of tidal sloughs will be monitored to determine the success of the Tubbs Island marsh restoration project. Monthly bird surveys have been conducted since 1993. These will continue and the following parameters will be monitored annually or at appropriate intervals for at least ten years after constructing the project. If monitoring suggests improvements to the hydrological and ecological functions of the site can be made by connecting it to Lower Tubbs Island and/or Tolay Creek, measures will be taken to restore flows between the sites by using culverts or levee breaches.

1. Endangered and Sensitive Species.

California clapper rail (*Rallus longirostris obsoletus*) and California black rail (*Laterallus jamaicensis coturniculus*) Once appropriate habitat has been established, call counts will be conducted according to USFWS protocol in the spring for the presence of California clapper rails. Call counts will also be conducted for black rails.

2. Birds.

Bird trends are expected to change from predominantly upland birds in the former agricultural fields to wetland-associated birds. Monitoring of both sites will continue to occur monthly.

3. Fish.

Fish will be monitored following restoration of tidal water to Tubbs Island. The main purpose will be to detect the presence of fishes. Monitoring will be conducted during neap tides. Replicate samples will be collected until no new species are captured. Collected fishes will be identified, counted, measured, and released. Thereafter, sampling will be conducted as needed to assess the general quality of the site and whether the restored marsh is providing the aquatic food chain support and nursery habitat functions of a tidal wetland.

4. Vegetation and Project Development.

Two photo points will be established for the restoration site with a 100-meter vegetation transect at each photo point. Each point will be monitored annually during the summer. Vegetation transects will be established to determine sediment deposition, channel scour, and vegetation composition. Transect will be surveyed for baseline condition. Cross sections will be taken to determine conditions immediately after construction of the project, six months after construction of the project and then annually for ten years.

G. Permits and Regulatory Requirements

Both projects will be subject to all necessary, regulatory permit and appropriate agency reviews. Following National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) guidelines, an environmental assessment for the Tubbs Island Restoration project follows. The Lower Tubbs Island maintenance project is categorically exempt under both NEPA and CEQA.

H. Implementation Schedule

The anticipated schedule for the project is as follows:

April 1998	Apply for Permits
Aug.- Oct. 1998	Construct new levee/Levee maintenance
Oct. 1998	Breach old levee
1998 - 2008	Monitor project

I. Summary

During fall 1998, construction of the Tubbs Island marsh restoration project will focus on building the new levee and breaching the existing dike to return tidal flows to diked historic tidal marsh adjacent to San Pablo Bay. Levee maintenance will be done on the dike enclosing the muted tidal marsh on Lower Tubbs Island. Water control structures may be installed to improve

circulation with wetland enhancement projects on Lower Tubbs and Tolay Creek.

The reestablishment of tidal flows to 72 acres of diked upland habitat is expected to provide the natural sedimentation needed in order for intertidal mudflats and salt marsh to develop (Table 5). The goal is to restore tidal marsh that will provide a source of food and cover for threatened and endangered species and a variety of other estuarine dependent species. This project will complement the restoration and enhancement projects that are occurring within the adjacent Tolay Creek floodplain.

The rate of marsh development will depend on many variables including sediment load, water velocity and direction, and plant establishment. Based on recent restoration projects such as the Petaluma River restoration site, a rapid response is predicted due to the direct source of sediment from San Pablo Bay. It is expected that elevations capable of supporting salt marsh vegetation will develop within 5-10 years.

The sequencing of the Tubbs Island and adjacent Tolay Creek restoration projects will provide a transition of habitat types within a localized area. The marsh restoration site will provide open water, intertidal mudflats, and salt marsh habitats, along with a minor amount of upland habitat on the surrounding levee. By leaving most of the existing levee in place, the site will provide important sheltered habitat for waterbirds during high tides and storm events. Continuing to manage Lower Tubbs Island as muted tidal marsh will provide established habitat for wildlife while marsh restoration and enhancement are occurring on Tubbs Island and within Tolay Creek.

Table 5. Habitat types within the Tubbs Island marsh restoration site.

Habitat Type	Current Acreage		Future Acreage (25 years)	
	Project Area	Proposed for Conversion	Restored or Created	Total
Ruderal fields	63.86	63.86	0.00	0.00
Levees	5.88	0.25	5.50	11.13
Drainage ditch/pickleweed	3.92	3.92	1.37	1.37
Seasonal Wetland	2.22	2.22	0.00	0.00
Salt Marsh	0.00	0.00	63.38	63.38