CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD SAN FRANCISCO BAY REGION

Order No. R2-2010-0108
Waste Discharge Requirements and Water Quality Certification for:

U.S. Fish and Wildlife Service
Cullinan Ranch Restoration Project

The California Regional Water Quality Control Board, San Francisco Bay Region, hereinafter the Water Board or the Board, finds that:

Purpose of the Order

1. The U.S. Fish & Wildlife Service (US FWS or the Discharger) submitted a Report of Waste Discharge/Application for Water Quality Certification on May 7, 2010, to restore the former Cullinan Ranch located in Napa and Solano counties. The Cullinan Ranch Restoration Project (Project) will restore 1,575 acres of seasonal wetlands and uplands to tidal wetlands in the San Pablo baylands.

2. The U.S. National Wildlife Refuge System manages ecosystems to conserve and restore biological populations and their habitats. The San Pablo Bay National Wildlife Refuge (Refuge) is part of this system of hundreds of federal wildlife refuges charged with protecting, maintaining and creating habitat for species protected under the Federal Endangered Species Act. The purpose of the Project is to fulfill this federal mandate for the benefit of endangered and threatened salt marsh-dependent species. The property was purchased by the Refuge under the authority of the Endangered Species Act with the intent that it would be restored to support tidally-influenced habitats.

3. The objective of the Project is to increase suitable habitat for endangered species such as the salt marsh harvest mouse (*Reithrodontomys raviventris haliocoetes*), California clapper rail (*Rallus longirostris obsoletus*), soft bird-beak (*Cordylanthus mollis* spp.), the threatened species Delta smelt (*Hypomesus transpacificus*), and anadromous salmonids in the larger San Francisco Bay ecosystem. Specifically, the purpose of the Project is to:

   - Restore historic wetlands in San Francisco Bay, particularly in the Napa River Estuary;
   - Restore habitat to recover federal- and State-listed special status species;
   - Provide habitat for a broad range of marsh-dependent birds, mammals, fish and other aquatic organisms, and migratory shorebirds and waterfowl;
   - Improve connectivity between habitats at the site and adjacent sites to enable wildlife movement;
   - Sustain the Napa River estuarine environment with minimal intervention;
   - Provide wildlife-sensitive public access and recreation;

- Maintain existing levels of flood control;
- Reduce mosquito breeding habitat; and
- Minimize long-term management needs, including invasive species management.

Site Location and Description

4. The Cullinan Ranch Restoration Project is part of the San Pablo Bay National Wildlife Refuge (Attachment A, Figure 1) located on the northern shore of San Pablo Bay, bordered by South and Dutchman sloughs to the north and Highway 37 to the south. Cullinan Ranch was historically part of a much larger complex of estuarine tidal marsh in the lower Napa River floodplain, which included the adjacent Napa River wetlands complex, known as the Napa Sonoma Restoration Project (NSRP). NSRP is being restored to tidal marsh under Board Order Nos. R2-2004-0063 and R2-2007-0045 issued to the California Department of Fish and Game (CDFG) (hereinafter the NSRP orders). The latter order amends the earlier one to cover the Napa Plant Site. CDFG's request to conduct additional work in Pond 1 within the NSRP has been approved by Water Board staff as being consistent with the NSRP orders. Figure 2 shows the existing conditions at the Cullinan Ranch site and the adjacent NSRP restored and managed ponds. The Napa Sonoma wetland restoration projects surrounding Cullinan Ranch are shown in Figure 3.

5. Cullinan Ranch was diked and reclaimed for agriculture in the late 1800s and farmed for oats and hay through the 1980s. In 1987, a private proposal to develop the site into a residential community was defeated by several conservation groups. In 1991, the US FWS, under the authority of the Endangered Species Act, acquired the land and began to develop plans to restore it to tidal marsh. In 1994, the US FWS stopped pumping water off the site.

Existing Conditions

6. The Cullinan Ranch site has subsided on average 5-6 feet below sea level. It is currently a mix of upland and seasonal freshwater wetlands, including unvegetated drainage ditches, remnant non-tidal open water slough channels, and a relatively small amount of tidal marsh. The jurisdictional waters and wetlands were initially mapped in 2000, and the delineation and mapping were reconfirmed by the US Army Corps of Engineers (ACOE) on November 21, 2008. Approximately 1,370 acres are waters of the U.S. and within ACOE jurisdiction. Approximately 205 acres are upland. Table 1 provides a summary table of jurisdictional waters of the U. S.

Land Cover		Linear Feet	Acres	Percent
Open Water	Agricultural ditches	62,396	72.71	4.6%
	Remnant sloughs	13,439		
Coastal Salt Marsh		N/A	33.24	2.1%
Freshwater Marsh		N/A	1,264.36	80.3%
Upland		N/A	204.61	13.0%
Total			**1,574.92**	**100%**

Habitat Evolution

7. Long-term effects of the Project include a substantial increase in tidal marsh area, as well as reduced predator access. Tidal marsh and mudflat habitats at the site will be substantially increased over time. Mudflats and shallow water intertidal habitats are important foraging and resting habitats for shorebirds and waterfowl in the San Pablo Bay region during spring and fall migration, and during over-wintering periods. Tidal sloughs are also used by many important fish species.

8. Tidal habitats will increase from approximately 33 acres currently existing in the project area to 1,549 acres. Restoration will occur primarily through the process of natural sedimentation. After breaching the levees bordering South and Dutchman sloughs and the Guadalcanal Village mitigation project at five locations, the site will be muted tidal and remain largely inundated. A minimum of 30 acres (with the possibility of an additional 50 acres if funding and sufficient clean material is available) will be restored immediately to tidal marsh elevations. The remaining area will gradually transform from subtidal to tidal marsh over several decades.

9. Tidal marsh elevations and tidal marsh habitat are predicted to dominate the project area within approximately 60 years after the reintroduction of tidal circulation. However, predictions of future conditions are based on estimates of approximate rates of sediment accumulation, channel formation, and colonization by tidal marsh vegetation at a relatively low rate of sea level rise. Consequently, the actual rate at which tidal wetland habitats will evolve is somewhat speculative because of the uncertainties regarding the function and interaction of the parameters in a tidal system and the rate of climate change and associated sea level rise. At maturity, it is anticipated that the Project will consist of approximately 1,549 acres of tidal marsh habitat interspersed with channels and 26 acres of uplands and levees.

Project Description

10. The Project will consist of levee improvements, ditch blocking, internal site modifications, levee lowering, and construction of levee breaches to restore the hydrologic connection between the Cullinan Ranch site and adjacent sloughs. Restoration to tidal marsh will use both on-site and off-site material for ditch blocks, wetland creation, and to reinforce levees.

Wetland creation may include beneficial reuse of clean dredged material suitable for wetland surfaces to restore between 30 and 80 acres of salt marsh harvest mouse habitat at marsh plain elevation, where adjacent to a known source population of this endangered species. Some areas will be excavated to create channels and deep pools; these areas are intended to remain self-sustaining open water habitat, maintained by the daily tidal prism. If these channels or pools fill in with sediment, no maintenance (excavation/dredging) will be conducted. Construction may occur in several locations at once; however, all internal construction, and construction associated with the Highway 37 and Pond 1 levees will be completed before the site is breached.

11. The target habitat is coastal salt, or tidal, marsh. Some of the current 33 acres of existing coastal salt marsh along Dutchman and South sloughs may be lost or degraded during restoration as the tidal prism within this area increases, scouring the channels and altering sediment dispersal throughout the system. However, as sediment accumulates on the Cullinan Ranch site, the tidal prism within the system will stabilize, and erosion rates will decrease along these levees, allowing the formation of new tidal marsh fringe habitat. The potential loss of these habitats would be offset by the creation of a minimum of 30 acres of land at an elevation suitable for immediate tidal marsh habitat colonization. The creation of the tidal salt marsh will eventually improve habitat for special status and other salt marsh species.

12. The introduction of twice-daily tidal flows to the site will deposit sediments, subsequently raising the site to tidal marsh elevations with salt-tolerant marsh vegetation and meandering slough channels. Tidal mudflats and marsh vegetation, including pickleweed and cordgrass, will provide vital tidal marsh habitat for the endangered species.

13. The Project will protect Highway 37 from flooding by constructing an approximately 3,500-foot-long buttress levee on the north side of Highway 37, extending from the western Guadalcanal Village levee westward and tying into the Highway 37 embankment at the edge of the site, adjoining the Mare Island off-ramp from Highway 37. The remaining approximately 12,100 feet of highway embankment will be armored to prevent wind-wave erosion.

Benefits of Wetland Restoration

14. The Project will make a large and valuable contribution to tidal wetland restoration in the San Francisco Bay Estuary, which was recommended by the Baylands Ecosystem Habitat Goals Report (1999) and the Comprehensive Conservation and Management Plan (1993; updated 2007). Both studies encouraged the return of salt ponds and farmland to tidal marsh where feasible.

15. Restoring tidal wetland functions to former agricultural land will improve water quality in the San Francisco Bay Estuary by maximizing wetland ecotonal or edge habitat, and minimizing non-native vegetation (if appropriate management efforts are taken to control non-native species). Marsh systems that are tidally connected to the Estuary improve water quality by filtering and fixing pollutants, in addition to protecting beneficial uses by providing the following: nursery habitat and protection from predation for native fish species, significant biological productivity to the estuarine system, and habitat for rare and

endangered species. Successful restoration would also provide shallow-water habitat for migrating shorebirds and other water birds. In addition to habitat and water quality benefits, tidal marsh restoration will also help protect communities from floods, storms, and sea level rise.

16. The Project's goal to provide public access and recreation will help educate the public, achieve regional public access (e.g., the Bay Trail), and build public support for future phases of restoration.

Related Studies and Projects in the San Francisco Bay and Previous Board Orders

17. Other adjacent areas, such as CDFG's Ponds 2, 2A and 3 to the north, and Pond 1 to the west, in addition to San Pablo Bay and Highway 37 to the south, and Caltrans' Guadalcanal Village mitigation project to the east, will be compatible with the planned restoration at the Cullinan Ranch site. Once restoration begins, each of these adjacent restored areas will be either hydrologically connected to the Cullinan Ranch site or managed in conjunction with the Cullinan Ranch site as a contiguous wildlife habitat area.

18. In addition to the improvements on US FWS property, other improvements funded as part of the USFWS project are planned to CDFG's Pond 1 and the eastern Pond 1 levee (between Pond 1 and the Cullinan Ranch site). CDFG activities on its property will affect the Cullinan Ranch site, and are covered under the NSRP orders. Under the NSRP orders, three breaches along Pond 3 across Dutchman Slough from the Cullinan site will be made in the same vicinity as three of the planned Cullinan Ranch breaches.

19. The US FWS approved a Biological Opinion for Cullinan Ranch on May 7, 2010, which lays out conditions to protect biological species potentially affected by the Project. The National Marine Fisheries Service also sent a letter of approval on April 5, 2010, provided certain measures described in this Order are followed to protect water quality for fish habitat. Both federal agencies support the overall restoration to tidal marsh as a major benefit to biological species.

Overview of the Restoration Activities

20. A conceptual diagram of the Project shows the eight primary restoration components (Figure 4), which will culminate with lowering and breaching the Dutchman and South slough levees on the northern edge of the site. The components listed below are briefly summarized in Findings 21-28, and described in more detail in Attachment B(i), the FEIS/R (US FWS and CDFG 2009), and the NSRP orders. Attachments B(ii) contains the time line and the construction schedule.

    1 – Block existing drainage ditches to promote redevelopment of natural sloughs
    2 – Improve the Pond 1 levee and install water control structures
    3 – Protect Highway 37 from flooding and erosion
    4 – Construct public access areas
    5 – Pre-flood Cullinan Ranch site prior to breaching the levees
    6 – Lower levees for near-term habitat creation

7 – Breach the levees along Dutchman and South Sloughs and Guadalcanal Village
8 – Long-term monitoring and management

21. **Component 1: Block Drainage Ditches Created for Agriculture to Redevelop the Natural Channel Network.** Some of the former agricultural channels may be blocked by depositing soil and loosely compacting short sections of the channels. These ditch blocks will be constructed of on-site soils retrieved from the existing internal berms, or material from the excavation of the channel at CDFG Pond 1, if there is sufficient material available after the improvements to the Pond 1 levee are complete. The ditch blocks can be constructed at any time when suitable excavated material is available and will be constructed prior to breaching.

22. **Component 2: Improve the Pond 1 Levee and Install Water Control Structures**. This work will be addressed under the NSRP orders. The following changes will be made to Pond 1: a channel and two water control structures will be added to flood Cullinan Ranch before the planned breaches; the existing levee will be reinforced and raised; the borrow ditch on the eastern side of the levee that divides CDFG property from US FWS property will be filled with material from the channel excavation; and the eastern slope will be flattened. Excess material generated from the channel construction will be used on the Cullinan Ranch site. Material to raise the levee will likely have to be imported because the excavated material from Pond 1 will not have the proper geotechnical and engineering characteristics.

23. **Component 3: Protect Highway 37 from Flooding and Erosion**. Hydrologic studies determined that if the Cullinan Ranch site were restored without adequately protecting the embankment, the eastern portion of Highway 37 would likely be flooded during combined high tide and storm events and could undergo significant erosion. Tidal marsh restoration at the Cullinan Ranch site cannot be accomplished without protecting the Highway 37 embankment. The embankment will be protected by constructing an approximately 3,500-foot-long buttress levee on the north side of Highway 37, extending from the western Guadalcanal Village levee westward and tying into the Highway 37 embankment. The remaining approximately 12,100 feet of highway embankment will be armored to prevent wind-wave erosion. The buttress levee will be higher in elevation than the eastern section of Highway 37 that it is protecting. The buttress levee design will include a grassy swale below the highway shoulder to convey rainwater away from the embankment. Runoff from Highway 37 and the acceleration and deceleration lanes can be polluted with heavy metals, oil, cigarette butts, plastic bags, plastic containers, and other trash. Treatment to prevent polluted runoff from entering the restoration site will be proposed by the US FWS and approved by Water Board staff.

24. **Component 4: Construct Public Access Features**.
The Project will significantly improve public access. Although many such improvements are located on CDFG property, the improvements will be constructed as part of the Project. The Project will add the following public access improvements:

a. Acceleration and deceleration lanes from Highway 37 to provide safer vehicle access;
b. A kayak launch site previously approved under the NSRP orders;

c. A viewing platform with interpretive signs and benches;
d. A 100-foot long fishing pier;
e. Graded intertidal benches with pickleweed and other native tidal marsh plant species near an existing parking lot to provide interpretation opportunities; and
f. Resurfacing of 7,000 feet of the Pond 1 levee to improve the informal trail access previously approved under the NSRP orders.

Some planned public access funded by US FWS will occur on or adjacent to the CDFG Pond 1 levee. The public access improvements on CDFG property will be constructed pursuant to the NSRP orders, and the remaining public access improvements located on US FWS property are covered under this Order.

25. **Component 5: Pre-flood Cullinan Ranch Site Prior to Breaching the Levees.** The site has lain fallow for over a decade, allowing the formation of ruderal upland vegetation and wetland habitats, primarily seasonal wetlands. To allow slow emigration of animals from the site, flooding would be phased before full tidal flow is restored. In the first phase, not more than one month prior to breaching, the site will be slowly flooded in stages between October 1 and December 30 (when water naturally ponds in the site) using the water control structures installed in CDFG's Pond 1 levee for the Project (as proposed by CDFG under the NSRP orders). Once the site is flooded to a minimum depth of one foot and animals have had an opportunity to emigrate, the levee between the site and South and Dutchman sloughs will be breached as described in Component 7. Breaching must be completed between November 1 and January 30 to avoid migrating juvenile salmonids and comply with the National Marine Fisheries Service informal consultation dated April 5, 2010, and the US FWS Biological Opinion dated May 7, 2010. The Guadalcanal breach may also be opened at this time. This breach was constructed but not opened as part of the Caltrans Guadalcanal Village mitigation project. (see Provision E.14)

Anaerobic conditions may form during the pre-flood period depending on the length of time water is held in Cullinan Ranch before breaching the outboard levees. Water quality monitoring will be conducted at the site and in the adjacent sloughs both before and after the site is flooded to assess pre- and post- breach conditions. Monitoring will include dissolved oxygen, temperature, salinity, pH, turbidity, mercury, methyl-mercury (in water, sediment, and/or biosentinel species), and other components included in this Order's Specifications, Effluent Limits, Provisions, and the monitoring plan for Cullinan Ranch (see draft Monitoring Plan and Adaptive Management Plan in Attachment C, and Self Monitoring Program, Attachment E). Breaches will be phased, if necessary, to protect receiving water quality. The levee will be breached on an incoming tide, to drive higher quality water into the site prior to the initial discharge. The volume of water within the site is small compared to winter flows and daily tidal exchange in this part of the Napa River Estuary. Any discharge into the sloughs from the Cullinan Ranch site during breaching should be quickly diluted, and the water quality monitoring will confirm this.

26. **Component 6: Lower Levees for Near-term Habitat Creation.** To ensure the availability of habitat for salt marsh harvest mice in the near term, a minimum of 30 acres suitable for the immediate colonization by mid-to-high marsh vegetation will be created through levee lowering and grading along sections of the Dutchman and South Slough levees. The salt marsh harvest mouse habitat will be restored close to Guadalcanal Village

and Pritchett Marsh, where breeding source populations are likely, and proceed westward along Dutchman Slough. If sufficient clean material becomes available based on the Water Board's criteria for beneficial reuse of dredged sediments (Water Board Staff Summary Report, 2000), and funding allows, then up to 50 additional acres of habitat suitable for marsh colonization will be created adjacent to Guadalcanal Village. All imported soils or sediment will meet screening criteria for wetland surface material as described in Specifications B.1(a) & (b), B.2 and B.3 of this Order. Areas within the site will be raised with imported and/or on-site soil. These actions are intended to improve marsh plain continuity, increase tidal circulation, reduce predator access, reduce the opportunities for invasive species to colonize the site, and increase the area suitable for near-term establishment of tidal marsh vegetation. All soils will be placed before breaching the site. Any dredged material will not be allowed to dry out for more than two construction seasons.

The gradual upland-wetland transition zone that occurs in natural settings will be restored along a portion of the northern levee, as well as along the buttress levee adjacent to Guadalcanal Village and the Pond 1 levee. The buttress levee will have a 10:1 (H:V) slope and the Pond 1 levee will be flattened to a 7:1 (H:V) slope. All of these areas will provide additional acreage suitable for near-term establishment of tidal marsh vegetation.

Approximately 26,000 linear feet of the northern levee along Dutchman and South sloughs will be lowered to MHHW, elevation 3.5 ft NGVD 1929 (approximately +6.2 feet MLLW). The material generated from levee-lowering activities and breach construction will be placed on the southern (interior) side of the northern levee and used to flatten the levee slope.

27. **Component 7: Breach Levees along Dutchman and South Sloughs, and Guadalcanal Village**. To restore the tidal prism to the site, up to four breaches would be constructed between the Cullinan Ranch site and Dutchman and South sloughs and one between the Cullinan Ranch and Guadalcanal Village sites (Figure 4). Breach locations will be as close to historic channel mouths/alignments as practicable. South Slough and the lower portion of Dutchman Slough will serve as the primary channels for the property. Breaching will occur in the winter, but before January 30. Material from the breach construction will be placed on the interior levee slopes of the Dutchman and South Slough and Guadalcanal Village levees to provide additional wetland habitat. Breaches will be unarmored and allowed to widen naturally. The size of the breaches will initially result in a muted tidal prism within the site. Over time the breaches and sloughs will erode as the system reaches equilibrium.

    Breaching could inadvertently remove existing fringe habitats, including marshes and uplands that have established along the levees that support waterways adjacent to the Cullinan Ranch site. In particular, habitats along Dutchman and South sloughs, and the Napa River may be impacted. The removal of these habitats could occur as the tidal prism within this area increases, scouring the channels and altering sediment dispersal throughout the system. In addition, seasonal wetland and upland habitats on the Cullinan Ranch site would be permanently inundated. However, the replacement of predominantly seasonal wetlands with tidal wetlands will provide important tidal marsh functions, including wildlife habitat and water quality improvement.

28. **Component 8: Long-Term Monitoring.** Monitoring will document changes in tidal hydraulics, geomorphology, plant and wildlife species, water quality, and habitat types and functions as restoration progresses. The Project will use the NSRP monitoring plan as a model. The draft Monitoring and Adaptive Management Plan is included in Attachment C. Initiation of long-term monitoring of the Project will occur immediately following the north levee breach. Before initiating project construction, a detailed long-term monitoring plan outlining the duration of monitoring and tasks to be completed over the duration of the monitoring period will be completed.

Project Phasing and Schedule

29. Construction phasing will depend on funding and attaining enough suitable material to raise the levee at Pond 1 and construct the buttress levee. Construction may begin in early fall 2010 and be completed by December 2012. Project construction is broken down into four main components for phasing purposes: interior site work, Highway 37 improvements, Pond 1 levee improvements, and levee lowering and breaching. The first three components may occur in any order or on parallel paths, but all work within the future tidal area (i.e., the first three components) must be completed prior to levee lowering and breaching. The most critical component is the protection of Highway 37, so resources will most likely be directed to the buttress levee first.

Laws, Regulations, and Policies

30. Basin Plan: The Porter Cologne Act (Section 13240) authorizes the Water Board to develop a Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan), which is the Water Board's master water quality control planning document. It designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes implementation programs to achieve water quality objectives. The Basin Plan was duly adopted by the Water Board and approved by the State Water Resources Control Board (State Water Board), US EPA, and the Office of Administrative Law where required. The latest version can be found at the Water Board's website at http://www.waterboards.ca.gov/sanfranciscobay/basin_planning.shtml

31. The Basin Plan includes the following Beneficial Uses for San Francisco Bay and the Napa River: Ocean, Commercial and Sport Fishing; Estuarine Habitat; Wildlife Habitat; Cold and Warm Freshwater Habitat; Fish Spawning and Migration; Preservation of Rare and Endangered Species; Shellfish Harvesting; Industrial Service Supply; Navigation; Water Contact Recreation; Non-contact Water Recreation; and Agricultural Supply.

Consistency with Plans and Policies

32. The Project is consistent with the goals of the State Wetlands Policy: California Wetlands Conservation Policy (Executive Order W-59-93, signed August 23, 1993), which is incorporated in the Basin Plan, that includes ensuring "no overall loss" and achieving a "…long-term net gain in the quantity, quality, and permanence of wetland acreages and values…". Senate Concurrent Resolution No. 28 states that "it is the intent of the legislature to preserve, protect, restore, and enhance California's wetlands and the multiple

resources which depend on them for benefit of the people of the State." Section 13142.5 of the California Water Code requires that the "[h]ighest priority shall be given to improving or eliminating discharges that adversely affect …wetlands, estuaries, and other biologically sensitive areas."

33. Restoration of the Cullinan Ranch site to tidal action is consistent with the following plans and policies:
    - Comprehensive Conservation and Management Plan
    - San Francisco Bay Plan
    - San Pablo Bay Comprehensive Conservation Plan (Draft)
    - CALFED Bay-Delta Program and Ecosystem Restoration Program Plan
    - San Francisco Bay Area Wetlands Ecosystem Goals Project
    - Ecosystem Restoration Program Plan
    - Salt Marsh Harvest Mouse Recovery Plan
    - Solano County General Plan
    - Napa County General Plan
    - Vallejo General Plan

    The US FWS will consult with both the Solano and Napa mosquito abatement districts regarding mosquito abatement control measures during design and construction.

34. **California Wetlands Portal.** It has been determined through regional, State, and national studies that tracking mitigation/restoration projects must be improved to better assess the performance of these projects, following monitoring periods that last several years. In addition, to effectively carry out the State's No Net Loss Policy for wetlands, the State needs to closely track wetland losses, gains, and mitigation/restoration project success. Therefore, the US FWS will use the California Wetlands Standard Form to provide project information related to impacts and mitigation/restoration measures (see Provision E.10). An electronic copy of the form and instructions can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml . Project information concerning impacts and mitigation/restoration will be made available at the web link: http://www.californiawetlands.net .

CEQA

35. CEQA requires that project effects be analyzed to prevent significant avoidable impacts and reduce or mitigate unavoidable impacts. All projects approved by State agencies must be in full compliance with CEQA. As lead agencies, the US FWS and CDFG, certified a final environmental impact statement/report (EIS/R) for the Project in May 2009 that has been considered and relied upon in preparation of the Order. The Water Board, as a responsible agency under CEQA, finds that all environmental effects have been identified for project activities that it is required to approve, and that the Project will not have significant adverse impacts on the environment with the following stipulations: 1) the final monitoring and adaptive management further described in this Order must be approved by the Executive Officer (Attachment C – the draft Monitoring and Adaptive Management Plan will be finalized by the US FWS), and 2) the CEQA mitigation presented in the final EIS/R will be carried out as conditioned (Attachment D contains the EIS/R's Mitigation and Monitoring Reporting Program).

36. The EIS/R prepared for the Project includes specific impact analyses (Ducks Unlimited, April 2009 Final; April 2008 Draft). The EIS/R found that over a 60-year period the benefits from the Project would outweigh adverse environmental impacts, after CEQA mitigation measures are implemented and future monitoring and adaptive management are carried out.

Water Quality Issues under CEQA for the Project: DO, pH, turbidity, and mercury

37. Potential water quality impacts, their applicable proposed mitigation measures, and whether the impact duration is ongoing or only during the construction phase were found to be insignificant with the exceptions of dissolved oxygen (DO) and pH, which could be adversely impacted by the Project. In addition to these, the Water Board has found that wetland restoration projects can contribute to elevated mercury and methylmercury levels in biota and thus requires mercury monitoring of either sediment, water, and/or biosentinels. Dissolved oxygen, pH, turbidity, and mercury will be monitored along with other standard water quality measurements to protect water quality and are discussed below. Construction will be timed to minimize adverse impacts to water quality in South and Dutchman sloughs. Levee breaching will occur on a rising tide to allow mixing of water within the site before discharge to adjoining sloughs. The initial turbidity associated with construction would be carried into the site on the incoming tide. (see Provision E.14)

Dissolved Oxygen and pH

38. DO and pH will be monitored inside the site after it is pre-flooded and before it is breached. If levels harmful to aquatic life occur, the following management measures may be taken to minimize any potential threats to the receiving water: (a) breach after a major rain event; (b) add more water through the Pond 1 levee water control structures; and (c) lower some levee sections before breaching, to allow water from the adjacent sloughs to overtop into the site. A combination of these approaches could also be used. The Technical Advisory Committee used for the Project can help formulate a management response, if the need arises. (see Provisions E.7 and E.15)

39. Before breaching the South and Dutchman Slough levees, the site will be slowly pre-flooded, in stages, using water from CDFG Pond 1 delivered through the new water control structures. The goal will be to pre-flood the site between October 1 and December 31, not more than one month prior to breaching, to a minimum water depth of 12 inches. The water delivered from Pond 1 will likely be brackish, and the combined depth of water and slight brackish character will begin to kill the existing vegetation within the site. There would be no discharge from the site back into Pond 1. (see Provision E.14)

40. Decaying vegetation may deplete DO in the standing water, and may also lower pH relative to the incoming water pH levels. The degree of depletion will depend on a number of factors including: rates of precipitation and vegetation decay, daily temperatures, amount of wind-induced mixing of the standing water, and time the standing water remains in the site. For example, should the weather be unusually hot and/or dry during the pre-flood phase, DO concentrations are likely to be lower than they would be during the typically wet, windy, cool winter weather.

41. To avoid potential impacts from reduced DO and pH in the water, the levees will be breached on an incoming rising tide. This will allow the standing water from the pre-flooding phase to mix with water from the sloughs prior to discharge back into the sloughs on the low tide. The total estimated water volume in the site as a result of the pre-flood phase would be 820 acre-feet. The total capacity of the site at mean tide is estimated to be 5,050 acre-feet. Thus, even if DO concentrations were completely depressed (to 0 mg/L) the estimated DO concentration in the discharge would be reduced no more than 0.7 mg/L. Based on recent monitoring for the Napa River Unit of the Napa-Sonoma Marshes Wildlife Area, DO concentrations in local sloughs and the Napa River in the winter range from 8 to 10 mg/L, sometimes reaching 11 to 12 mg/L (CDFG 2009). Thus, the DO concentrations in the site, once the incoming water has mixed with the water from the sloughs, will still be well above the minimum threshold of 5.0 mg/L that has been the standard for recent Board actions in this area. The potential impact of the discharge from the site would be further reduced because the initial discharge (i.e., from the first breach) would be relatively small and the breaches would widen over time.

42. The site is expected to sufficiently fill with water within two to three weeks to encourage wildlife migration from the site. Once the site has been shallowly filled with water, DO concentrations are expected to remain at or above 5 mg/L throughout the remainder of the breaching period, and thereafter. The deep water in the site and the low water temperatures during the winter would help maintain acceptable DO concentrations until all breaches are constructed and effective tidal exchange occurs. Experience with the ponds in the Napa River Unit of the Napa-Sonoma Marshes Wildlife Area indicates that DO levels have never dropped below 5 mg/L, even in the summer.

Turbidity

43. The timed breaching process, combined with sequential installation of the breaches will also reduce potential concerns associated with suspended sediments (increased turbidity) resulting from breach construction. Breaching on an incoming tide will reduce turbidity effects to the sloughs because the incoming water will move suspended sediments resulting from the breach construction into the site, where they are expected to disperse and settle out. Ambient turbidity in the lower Napa River system varies widely, depending on water flow, water depth, and wind, among other factors. High run-off during winter months creates high levels of turbidity in the Napa River and tributary sloughs. High turbidity may be present year-round in the shallower sloughs and near-bank areas, because wind-driven circulation resuspends in-place sediments. This effect was noted during turbidity monitoring for the Napa Plant Site and the Napa River.

Mercury Methylation

44. Mercury occurs naturally in the San Francisco Bay environment and has been introduced as a contaminant in various chemical forms from a variety of anthropogenic sources. Total levels of mercury in ambient San Francisco Bay sediments are elevated above naturally occurring background levels. Although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into toxic methylmercury. Natural accretion processes in salt marshes continually supply fresh layers of mercury-

contaminated sediments that release mercury in a form that can become biologically available to mercury-methylating bacteria and subsequently bioaccumulate in the food chain. The resulting concentration of methylmercury depends on numerous variables, including: redox potential, salinity, pH, vegetation, sulfur (including sulfate derived from gypsum layers in pond bottoms), dissolved organic carbon, nitrogen, and seasonal variations in each of the identified variables.

45. The Basin Plan, which includes a TMDL for Mercury[1], states that wetlands may contribute substantially to methylmercury production and subsequent biological exposure to mercury within the Bay. Wetland restoration projects can, therefore, increase levels of methylmercury. Monitoring can evaluate whether this is occurring and suggest restoration techniques to discourage methylmercury production. Natural sedimentation occurring via sediments brought in by the tides and creeks may also provide a source of mercury that may be methylated in the site.

46. Breaching levees at the site could contribute methylmercury to the environment, even though the site does not have high levels of existing total mercury. The US FWS Biological Opinion and the Project application state that restoring the site is unlikely to produce high levels of mercury for the following reasons:

- mercury levels in the Napa River are below those considered impaired by US EPA (USGS 2000);
- the site is likely to be flooded once initially and remain under water for many years. UC Davis studies show lower mercury levels in fish in permanently flooded sites than in sites that undergo repeated wetting and drying (Slotton 2008), indicating that a site remaining under water for a relatively long time may have low methylmercury levels; and
- preliminary results from an ACOE study of mercury in the nearby Hamilton Restoration project also found levels to be lower in permanently flooded areas compared to sites that alternate between wet and dry cycles (Best 2005).

Given the possibility that mercury may be released from the site, the US FWS will show how habitats and species at the restored site will be monitored and how methylmercury can be minimized in a final Monitoring and Adaptive Management Plan (MAMP) subject to Executive Officer approval. Monitoring and the MAMP are further described in Provisions E.1-7.

47. The Project will monitor mercury and methylmercury concentrations in sediment, water, and/or methylmercury bioaccumulation in appropriate biosentinel species (e.g., water birds, fish, resident marsh birds, or brine flies). The US FWS will collect data at least biennially in conformance with the Napa Plant Site sampling plan for mercury and methylmercury. If feasible, different habitat types (e.g., subtidal, intertidal, marsh plain, sloughs or open water, etc.) will be sampled. The US FWS has proposed analyzing biosentinels three times per year for six years over the fifteen-year monitoring period, or as long as biologically justified, whichever comes first, to capture seasonal variability. The final sampling plan for mercury will be determined by the US FWS based on permit requirements, acceptable

[1] http://www.waterboards.ca.gov/sanfranciscobay/basin_planning.shtml

scientific methods, and available budget. The final plan will show how the proposed sampling will adequately protect waters of the State from increases in methylmercury and will be submitted for Executive Officer approval.

Other Water Quality Issues

48. Mosquito abatement: The proposed tidal wetlands at the restored site should have fewer mosquitoes than the current seasonal wetlands. The site is in the jurisdiction of the Napa and Solano County mosquito abatement districts. The US FWS will coordinate with the districts during design, implementation, and operation phases of the Project to mitigate for any increases in potential mosquito breeding habitat.

49. Bay Mud: The Water Board has found previously that if fine-grained dredged material (Bay Mud) is allowed to dry out on the surface, the following adverse effects on wetland environments can occur: it can harden, which makes it a poor substrate for wetland biota; it can develop deep cracks that harbor mosquitoes and increase the chances of acidification; and it can cause metals, including mercury, to become soluble, thereby increasing their potential to leach out when the site is re-flooded.

50. The Project may need to import dredged materials to provide suitable habitat for the salt marsh harvest mouse, and it may not be possible to shape and form that habitat without drying it to some degree. Partial drying should occur over not more than two construction seasons. The US FWS will consult with the Technical Advisory Committee for the Project and provide documentation to Water Board staff demonstrating that the net benefit of drying dredged materials will outweigh any harm to the environment. (see Provision E.7)

51. Invasive cordgrass was inadvertently introduced into San Francisco Bay tidal marshes in the 1970's (predominantly *Spartina alterniflora* and *S. densiflora)* and threatens the existence of the native cordgrass (*S. foliosa*) upon which many tidal marsh species depend. To mitigate for potential impacts from cordgrass, the US FWS is cooperating with the Invasive Spartina Project to eradicate invasive cordgrass and protect the native tidal marsh species (see Provision E.13). In particular, the US FWS collaborated with the Invasive Spartina Project to identify the following "Best Practices", which have been incorporated into the Project:

    a. No Spartina is proposed to be planted in the Project area. If circumstances arise where Spartina will be planted in the Project area, the plantings will be genetically verified to be Spartina foliosa.
    b. The Project area should be monitored annually for the presence of non-native or hybrid Spartina. In addition to field identification, representative samples of any found Spartina should be genetically analyzed to verify absence of S. alterniflora or S. densiflora genetic markers. Any found non-native or hybrid Spartina plants should be removed or killed before their first season of flowering and seed set.
    c. One measure of the Project's success in achieving the project objective regarding management of "the spread of non-native invasive species" is that there is no non-native or hybrid Spartina found in the Project area.

d. The Project will not initiate connection of ponds with tidal flows (full or muted) at locations where S. alterniflora or S. alterniflora x S. foliosa seed or propagules are likely to get into the Project area.
e. The Project will avoid introducing non-native Spartina seed or propagules into the Project area on contaminated excavators, dredges, or other equipment. The Project will require that all equipment be cleaned prior to entry into an intertidal part of the Project area if it has been in contact with non-native Spartina plants, seeds, or roots.
f. The Project will make sure that any dredged materials brought to the Project area do not contain non-native Spartina seed or fragments.
g. Variations to the above best practices may be appropriate based on site-specific conditions and scientific analysis. Proposed variations will be developed with assistance or review from the Invasive Spartina Project. Additionally, the US FWS will discuss any proposed variations with nearby marsh owners/managers, who could be affected by the actions of the Project.

Sources of Material

52. Sources of fill material will include excavated sediment from on-site breaches, borrow ditches, and levees. Imported fill material, consisting of either dredged sediments or upland soil, shall be determined to be acceptable for use based on criteria approved by Water Board staff, per Specifications B.1 - 2 and Provisions E.34 - 35. If upland material is imported, the US FWS must submit a Quality Assurance Program Plan for sampling and analysis that includes proposed acceptance criteria for Executive Officer approval prior to placement of the imported material within the Project site.

53. No dredging is proposed for the Project. Any dredged sediment brought to the site from other projects must be tested in accordance with existing Water Board regulatory standards and meet wetland surface material standards described in Specification B.1[2]. Thus, none of the potential excavated or imported dredged materials should have the potential to release pollutants to the Bay.

54. While no discharge of material is planned from the site, there is the potential, particularly during construction, for discharge material to enter waters of the State while the Project carries out the objectives of enhancing wildlife habitat, reinforcing levees, temporarily stockpiling excavated material, improving safety and public access, improving site access during and after construction, and constructing temporary construction-related roads.

55. Potential discharged material sources include: 1) native soils from onsite borrow areas, toe drains, existing stockpiles of material from the Pond 1 excavation under the NSRP orders, tidal channel excavation, levee breaches, and levee lowering, 2) imported riprap, and 3) pre-breach imported clean soil to increase the elevation of 30 acres, with the possibility of an additional 50 acres, to expedite wetland creation if funding is available. Table 2 lists the volume of discharged materials to be used.

[2] California Regional Water Quality Control Board, San Francisco Bay Region (RWQCB). 2000. Staff Report Summary Report –Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines.

Table 2. Proposed Discharge of Material to Waters of the U.S.

Type(s) of Material to be Moved	Volume (CY)
Native soils from onsite borrow areas, toe drains, Pond 1 levee stockpile, tidal channel excavation, levee breaches, and levee lowering, can be used for ecotone, ditch blocks, levee reinforcement, temporary road construction, 660 feet of the deceleration lane, and buttress levee construction	1. Interior Site Grading: 94,800 2. Lower perimeter levees: 110,500 3. Levee breaches: 61,000 4. Deceleration lane: 8,100 5. Buttress levee: 101,600 Total 376,000
Imported riprap for Highway 37 armoring	36,000
Imported material to elevate up to 50 additional acres of land to expedite marsh restoration if funding is available	405,000
	Total 817,000

56. To assure that the hydrology is proceeding as expected to achieve the habitat goals within 60 years, the MAMP (Attachment C) and SMP (Attachment E) outline the targets and performance criteria within that time frame. No penalties will be imposed for a failure to achieve the interim and final habitat goals, but an investigation of the causes will be undertaken by the US FWS and other agencies including the Water Board and ACOE, and management modifications will be made as necessary.

57. Imported soil, riprap and aggregate materials needed for construction related to highway protection may be brought to the site by barge via Dutchman Slough. Dredged materials for beneficial reuse for Component 6 (imported material to create up to 50 additional acres of salt marsh harvest mouse habitat) may also be imported by barge. If this occurs, a temporary offloading facility would be required. Since there are several approaches to the construction and operation of offloading facilities, the exact location and design would be determined once a construction contractor is under contract.

    An area within the site adjacent to Dutchman Slough would need to be temporarily improved to provide a sound foundation to support the offloading facility. In all cases the improvements would be contained to the site's uplands, being placed no lower than the high water mark on the slough side of the levee. Appropriate Best Management Practices would be employed to prevent sediment or debris from entering the Slough. The facilities would remain in place only as long as they are needed for import operations, which would constitute no more than 30 months. All temporary facilities would be removed prior to levee breaching.

    Provision E. 35 requires a final offloading facility construction and operation plan to be submitted for Executive Officer approval prior to the start of construction.

58. The Water Board notified the Discharger and interested agencies and persons of its intent to issue WDRs for the Project and provided them with an opportunity to submit their written views and recommendations.

59. The Water Board, in a public meeting on October 13, 2010, heard and considered all comments pertaining to the WDRs for the Project.

It is Hereby Ordered pursuant to the provisions of Division 7 of the California Water Code and regulations, and guidelines adopted thereunder, that the US FWS, its agents, successors, and assigns shall comply with the following:

A. PROHIBITIONS

1. Discharges of water, material, or wastes which are not otherwise authorized by the Order are prohibited.

2. The direct discharge of wastes to surface waters or surface drainage courses is prohibited, except as authorized by this Order.

3. It is prohibited to import dredged materials or upland soils without first following the testing and screening protocols described in Specifications B.1 and 2, below, and obtaining Water Board staff approval. Movement of on-site material is allowed.

4. The activities subject to these requirements shall not cause a condition of pollution or nuisance as defined in Sections 13050(i) and (m), respectively, of the California Water Code.

B. SPECIFICATIONS

1. Dredged Material Screening Procedures. Water Board staff shall review and approve data characterizing the quality of all dredged materials (Bay sediments) proposed for use as fill before placement at the Project site (see Findings 52-53). Sediment characterization shall follow the protocols specified in:

   (i) The Dredge Materials Management Office (DMMO) guidance document, "Guidelines for Implementing the Inland Testing Manual in the San Francisco Bay Region" (Corps Public Notice 01-01, or most current version), with the exception that the water column bioassay simulating in-bay unconfined aquatic disposal shall be replaced with the modified effluent elutriate test, as described in Attachment B of the Inland Testing Manual, for both water column toxicity and chemistry (DMMO suite of metals only); and,

   (ii) Water Board May 2000 staff summary report, "Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines," or most current revised version.

   Modifications to these procedures may be approved on a case-by-case basis pending the US FWS's ability to demonstrate that the dredged materials are unlikely to adversely impact beneficial uses. Only surface quality material as defined in the Water Board May 2000 staff summary report listed above will be used for the Project.

2. Imported Upland Soil Screening Procedures: Imported soil from upland borrow sites must be determined to be suitable based on the procedures and screening guidelines contained in a Quality Assurance Project Plan approved by the Executive Officer (see Provision E.34--35).

3. Appropriate soil erosion measures shall be undertaken and maintained to prevent discharge of sediment to surface waters or surface water drainage courses.

C. EFFLUENT LIMITS

1. All pond waters discharging to the Bay or sloughs shall meet the following limits:

Constituent	Instantaneous Maximum	Monthly Average	Instantaneous Minimum	Units
Salinity	<100	<50		ppt
Dissolved Oxygen[1]			5.0	mg/L
pH[2]	8.5		6.5	

[1] This limitation applies when receiving waters contain at least 5.0 mg/L of dissolved oxygen. In cases where receiving waters do not meet the Basin Plan objective, discharges must be at or above the dissolved oxygen level in the receiving water.

[2] The Discharger may determine compliance with the pH limitation at the point of discharge or in the receiving water.

2. Pond waters discharging to the Bay or sloughs shall not exceed the natural temperature of the receiving waters by 20°F, or more.

D. RECEIVING WATER LIMITATIONS

For the following Receiving Water Limitations, the Project boundary shall be defined as the limit of the receiving waters at mean lower-low water level, which is the topographic contour representing an elevation of 0 ft. NAVD88.

1. The Project activities shall not cause:

   a. Floating, suspended, or deposited macroscopic particulate matter or foam at any place more than 100 feet from the Project boundary or point of discharge, which persists for longer than 24 hours;
   b. Bottom deposits or aquatic growths to the extent that such deposits or growths cause nuisance or adversely affect beneficial uses;
   c. The temperature of any cold or warm freshwater habitat to be increased by more than 5 degrees Fahrenheit above natural receiving water temperature, unless a qualified biologist can demonstrate that such alteration in temperature does not adversely affect beneficial uses;
   d. Visible, floating, suspended, or deposited oil or other products of petroleum origin; and
   e. Toxic or other deleterious substances to be present in concentrations or quantities which will cause deleterious effects on wildlife, waterfowl, or other aquatic biota, or

which render any of these unfit for human consumption, either at levels created in the receiving waters or as a result of biological concentration.

2. The discharge of waters shall not cause the following limits to be exceeded in waters of the State at any one place within 1 foot of the water surface:
   a. Dissolved Oxygen: 5.0 mg/L, minimum
      When natural factors cause lesser concentrations, then these activities shall not cause further reduction in the concentration of dissolved oxygen.

   b. Dissolved Sulfide: 0.1 mg/L, maximum

   c. pH: Variation from normal ambient pH by more than 0.5 pH units

   d. Un-ionized Ammonia: 0.025 mg/L as N, annual median; and
      0.16 mg/L as N, maximum

   e. Nutrients: Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

3. Turbidity of the waters of the State, at any place more than 100 feet from the Project boundary or point of discharge, shall not increase by more than the following for more than 24 hours, to the extent practical:

Receiving Waters Background	Incremental Increase
< 50 NTU	5 NTU maximum
≥ 50 NTU	10% of background, maximum

4. The discharge shall not cause a violation of any particular water quality standard for receiving waters adopted by the Water Board or the State Water Board as required by both the State's Porter-Cologne Water Quality Control Act and the federal Clean Water Act and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Clean Water Act, or amendments thereto, the Water Board will revise and modify this Order in accordance with such more stringent standards.

E. PROVISIONS

Monitoring and Reporting

1. **Biennial Technical Monitoring Reports & Memos**: The US FWS shall submit biennial technical monitoring reports (every other year); if feasible, biennial memos will be submitted in the intervening years. The monitoring period shall cover fifteen years, beginning after construction and restoration are initiated. Baseline data shall be collected before the breaches to compare to the monitoring data. The biennial technical monitoring reports shall: i) analyze all physical and biological data collected to date, and contain appropriate figures, graphs, and photos; ii) assess progress toward target habitat acres and

functions; and iii) make recommendations for future monitoring and assessment. The biennial memos shall notify the Water Board of any sampling occurring during that period and any problems, and shall provide appropriate photos. Technical monitoring reports shall be due at the end of Year 2, 4, 6, 8, 10, 12, and 14 following each phase, and biennial memos shall be due in the intervening years (see schedule below). In years when no data is collected or analyzed, and aerial or satellite photo review shows no substantial changes, an email can be sent to the Water Board stating those findings. A final report for the Project shall be submitted in Year 15 after implementation of the Project.

Due Date, Memos: March 31 of Year 1, 3, 5, 7, 9, 11, 13.
Due Date, Biennial Technical Reports: March 31 of Year 2, 4, 6, 8, 10, 12, 14.
Due Date, Final Report: March 31, Year 15.

2. All required reports and documents submitted after Board approval of this Order will be subject to Executive Officer approval. No penalties will be imposed for failure to achieve performance standards since this is a restoration (not compensatory mitigation) project.

3. **Monitoring: (a) Self Monitoring Program**: The US FWS shall follow the Self Monitoring Program (SMP) in Attachment E and include SMP reports with the biennial reports. The SMP table presents the major monitoring elements for the site. Water quality monitoring related to construction will follow best management practices to avoid impacts to waters of the State (see Provision E.25**)**. Water quality monitoring related to breaching levees will be required immediately before the breach and over approximately ten monitoring events or until background levels are achieved, at which time the US FWS can notify the Water Board that the water quality provision for that breach has been met. If additional monitoring is conducted to show that the Project is not causing harm to the area (e.g., if ambient monitoring shows that similar water quality levels occur naturally in the area), or if the literature shows that water quality values are not likely to cause problems, then the US FWS can request approval from the Water Board to cease water quality monitoring. Data should be posted to the California Wetlands portal (see Provision E.10) according to the above schedule in Provision E.1.

4. **Monitoring: (b) Landscape, Habitat, and Biological Species Monitoring Plan:** To show progress toward achieving target habitats, monitoring will be required. Appropriate baseline data shall be gathered before construction begins to show the evolution from pre- to post-project restoration. General methods, locations, and sampling procedures are provided in the draft Monitoring and Adaptive Management Plan (MAMP) (Attachment C), which is modeled after the monitoring plans for the NSRP and the Napa Plant Site. The final Monitoring Plan will list:

   (a) target habitat goals and ranges for the site; and
   (b) parameters to be monitored including procedures and locations for assuring that the beneficial uses of water and habitat will be protected and/or improved.

   The final Landscape, Habitat, and Biological Species Monitoring Plan shall include the following as shown in the SMP table and report (Attachment E) and in the Monitoring and Adaptive Management Plan (Attachment C): water quality; mercury monitoring of water, sediment, or biosentinel species in accordance with regional programs, if available;

landscape mapping; physical and/or hydrogeomorphic development (i.e., channel and marsh development, tidal circulation); vegetation mapping; highly invasive (detrimental) species, which should include plants and introduced predators; specific target species monitored (endangered species) or groups such as birds, fish, mammals.

Due Date for Final Monitoring and Adaptive Management Plan: December 31, 2010.

5. **Mercury Monitoring**: Biosentinels and/or sediment and water will be monitored and baseline (i.e., pre-restoration) or ambient samples (i.e., reference site) will be collected, if available, as a basis for comparison. Post-restoration samples will be compared against these baselines and/or ambient samples to ensure methylmercury does not exceed agreed upon levels by the Technical Advisory Committee (see Provision E. 7 below). If the levels are exceeded, adaptive management will be triggered, as described in the MAMP. If feasible, biosentinels shall be chosen from the appropriate existing and target habitats. For example, if at the time of the first breach, the site has equal amounts of subtidal and intertidal habitats, then appropriate species that use those habitats should be selected as biosentinels. In addition, each habitat type should have 3-5 samples, which may be composited.

   Appropriate species and habitats include: Mississippi silversides (*Menidia audens*) for the subtidal areas; longjaw mudsuckers (*Gillichthys mirabilis*) for intertidal mudflats and channels; and Alameda song sparrows (*Melospiza melodia pusillula*) for the tidal marsh plain. Other species can be selected if they are common, reside primarily in the habitat, and are not a threatened population.

   The US FWS can propose a different sampling plan, which will be subject to Executive Officer approval. The selected sampling method will be determined in accordance with permit requirements, acceptable scientific methods, and available budget. Triggers and the final sampling plan will be subject to Executive Officer approval and triggers should be suggested by the Technical Advisory Committee (see Findings 38, 50; and Provision E. 7).

   Due Date for Mercury Sampling Plan: 60 days before construction starts

6. **Aerial or satellite photos** (such as those readily available on Google Maps, or IKONOS images using multispectral satellite imagery) shall be reviewed annually to ensure that habitat evolution is occurring without any associated significant adverse or unforeseen events, such as excessive scour or erosion, sedimentation, or establishment of highly invasive plants. Collecting and comparing annual satellite photos will depend on the availability of free imagery and is meant only for rough non-technical comparisons, not quantitative GIS analysis. If necessary and feasible, more detailed analysis of aerial or satellite photos shall be conducted every other year to allow measurements of channel widths, vegetation zones, and other important features listed in the MAMP. If habitat targets are not met by the end of the fifteen-year monitoring period, the Technical Advisory Committee (see Provision E. 7) shall determine whether aerial or satellite photos should continue for a specified period, such as every five years, until the target habitats are achieved, or whether the Project has successfully provided adequate wetland habitat benefits to justify discontinuing monitoring.

7. **A Technical Advisory Committee (TAC)** shall be organized and convened through a public process by the US FWS and shall, at a minimum, invite representatives from CDFG, the Water Board, the SF Bay Conservation and Development Commission, California Coastal Conservancy, ACOE, and the National Marine Fisheries Service. The purpose of the TAC shall be to assess progress of the Project by reviewing monitoring data, and to suggest adaptive management strategies. Results of the data analysis shall be presented to the TAC annually, or biennially, for discussion and comment. The TAC can include members of the Napa-Sonoma Marsh Restoration Group, the Wetland Monitoring Group of the San Francisco Bay Regional Wetland Monitoring Program, the San Francisco Bay Joint Venture, or any other appropriate forum for advice and review. The TAC should also advise on the acceptability of keeping dredged materials wet, the net benefit of drying dredged materials to establish salt marsh harvest mouse habitat, mercury triggers (see Findings 38, 50; and Provision E.15), and any other appropriate issues.

8. At the end of the monitoring period, the site shall be assessed for wetland functionality using a method approved by the Executive Officer.

9. The US FWS shall be responsible for all monitoring and reporting requirements at the site. The US FWS should coordinate with the Wetland Regional Monitoring Program run by the San Francisco Estuary Institute (SFEI) or any other regional entity that conducts regional wetland monitoring in the San Francisco Bay Region.

10. **California Wetlands Portal**. The US FWS is required to use the California Wetlands Standard Form to provide project information describing impacts and restoration measures within twenty-one days from the date of this order. An electronic copy of the form can be downloaded at: http://www.waterboards.ca.gov/sanfranciscobay/certs.shtml. The completed California Wetlands form shall be submitted electronically to habitatdata@waterboards.ca.gov or as a hard copy to both: 1) The Water Board, 1515 Clay Street, Suite 1400, Oakland, CA 94612, to the attention of California Wetlands Portal; and 2) San Francisco Estuary Institute, 7770 Pardee Lane, Oakland, CA 94621-1424, to the attention of Mike May. Project information concerning impacts and restoration will be made available at the web link: http://www.californiawetlands.net. (see Finding 34)

    Due Date for California Wetlands Form: 21 days after adoption of this Order.

11. **Submitting monitoring reports by uploading them to California Wetlands Portal.** Monitoring reports shall be submitted either by uploading them to the California Wetlands Portal website at http://www.californiawetlands.net/tracker/ba/list, via email, or via mail at the addresses listed in Provision E.10. The Water Board project manager will be notified if monitoring reports are uploaded to the California Wetlands Portal.

12. In addition to uploading the California Wetlands form and monitoring reports to http://www.californiawetlands.net/tracker/, the Discharger shall also send monitoring data and reports to the Water Board as one hard copy and one electronic copy. In the case of large files, the electronic copy shall be sent on a CD or DVD or placed on an FTP site.

13. **Aggressive non-native plant species** that threaten sensitive native tidal marsh communities, including those listed under Tier I (and to a lesser extent Tier II) of the Water

Board's "Invasive Non-Native Plant Species to Avoid in Wetlands Projects in the San Francisco Bay Region" (2006) should be kept off site to the extent feasible. [see: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stream_and_wetland_protection.shtml under "Fact Sheet for Wetland and Riparian projects, Appendix 1: Invasive Non-Native Plants"]. The US FWS should review the Tier I and Tier II lists and discuss with Water Board staff which species are feasible to keep off the Project site. Invasive cordgrass (*Spartina alterniflora*) is a high priority for preclusion from tidal wetlands restoration sites in the Region, and the US FWS shall coordinate efforts with the Invasive Spartina Project to eradicate this species as identified in Finding 51. Coordination with the Bay Area Early Detection Network (BAEDN) should help determine priority aggressive species for eradication.

14. The site will be pre-flooded between October 1 and December 31. Breaching will occur in winter between November 1 and January 30 on a rising tide. (see Findings 25, 37, 39)

15. If dissolved oxygen or pH are found at levels potentially harmful to aquatic life after the site is flooded and before it is breached, the following management measures will be considered before the breach: breaching after a major rain event; raising water levels from Pond 1 water control structures; and lowering some levees. The TAC or Water Board staff will be consulted about the best possible approaches to take. (see Finding 38).

16. The US FWS will provide a plan, including tasks and schedules, acceptable to the Executive Officer, to treat runoff from Highway 37 that drains into the Project site.

    Due Date for Plan to Treat Highway Runoff: 60 days before construction of levee breaching occurs.

17. The Discharger shall notify the Water Board by email when construction starts and ends and when levee breaching occurs. The following reports will also be required: i) a startup report analyzing the first month of data, and ii) an as-built report to note any changes that have occurred from the original design.

    Due Date for Notification: when construction begins, ends, and when breaches occur.
    Due Date for Startup (or Construction Completion) Report: no more than 45 days after levees are breached.
    Due Date for As-Built Report: 90 days after construction is completed.

Other Operations

18. The US FWS shall conduct periodic inspection and maintenance of restoration features to ensure that the restoration is performing as intended. For example, routine inspection of ditch blocks for unintentional channel bypassing or erosion shall be necessary, particularly following storm events. If bypassing or erosion occurs, maintenance of the ditch block shall be performed to prevent unintended channel formation. The US FWS shall summarize the results of these efforts in its biennial reports or memos.

19. Inspection of CDFG's Pond 1 water control structures shall be conducted prior to operation to ensure that they are functioning properly. Other water ways and canals on the Project

site will also be inspected periodically for debris or trash, and obstructions shall be removed to maintain desired flows. Potentially damaging obstructions shall be removed manually or mechanically to maintain flows. Routine inspection of the managed pond levees, trails and internal berms for unintentional breaching and erosion shall also be conducted. If unintentional breaching or erosion occurs, the berm or levee shall be repaired to maintain pond operations, prevent potential tidal inundation of adjacent areas, and maintain public access along the trails.

20. Viewing platforms, interpretive signs, trails, gates, and fences shall be inspected periodically and shall be repaired and maintained as needed.

Construction Operations

21. A qualified, US FWS-approved biologist shall conduct a tailgate talk to inform construction crews about sensitive wildlife resources and exclusion zones within proposed construction areas, and appropriate steps to take if special status species are encountered.

22. A qualified, US FWS-approved biologist shall monitor construction activities in or near areas known to be occupied by salt marsh harvest mice, California clapper rails, and soft bird's beak. The biologist shall have the authority to install or require wildlife protection measures such as fencing, noise buffers or noise level limitations during avian breeding seasons, and temporary halting or redirecting of construction activities to avoid impacts to sensitive species. Water Board staff shall be notified if construction activities are halted or redirected.

23. The US FWS developed conservation measures to protect special status species especially the California clapper rail, salt marsh harvest mouse, soft bird's beak, delta smelt, and others, which can be found in the Section 7 Biological Opinion for this project (Tracking #: SFB-2010-01/ May 7, 2010/ *Intra-Service Section 7 Consultation on Implementation of the Proposed Cullinan Ranch Restoration Project, Napa and Solano Counties, CA*). Water Board staff shall be notified if the work plan is modified because sensitive species are present.

24. The US FWS shall minimize in-water construction during periods when listed species may be present.

25. Since greater than one acre will be impacted, the US FWS will, before construction begins, submit a Notice of Intent (NOI) to the State Water Board for coverage under the General National Pollutant Discharge Elimination System construction permit, and shall implement required Best Management Practices (BMPs) to prevent water pollution from construction activities. The US FWS shall use both in-water and on-land BMPs, such as the use of coffer dams, and measures to prevent and control potential spills of hazardous material into creeks and sloughs. Contractors are required to implement BMPs identified in a Storm Water Pollution Prevention Plan (SWPPP) to control soil erosion and discharges of other construction-related contaminants such as fuel, oil, grease, paint, concrete, and other hazardous material. Emergency response, routine maintenance, and preventative activities should be included in the SWPPP. The SWPPP shall be submitted to the Water Board for

review and comment at least 30 days before construction begins and must be acceptable to the Executive Officer.

Due Date for SWPPP: at least 30 days prior to start of construction

26. The US FWS shall have a construction monitor onsite to ensure that the Project is constructed according to the design and construction plan. The construction monitor shall also resolve implementation questions and refer "Requests for Information" and "Submittals" to the design engineers. Biological monitors, either USFWS or CDFG staff or contractors approved by those agencies, shall be onsite during specific activities to ensure compliance with mitigation measures and protection of listed species, as discussed above. Construction monitoring notes and observations shall be maintained for five years after project construction is completed, and submitted to the Water Board upon request.

Soil Excavation and Placement Provisions

27. To minimize the effects on special status fish species of temporary increases in suspended sediment and turbidity, the use of BMPs for turbidity control shall be employed during all in-water work conducted in the sloughs or Bay, where appropriate.

28. To minimize the effects on special status fish species resulting from the loss of existing habitat, construction activities in river or slough areas having immersed or submersed aquatic plants shall be avoided to the maximum extent practical.

29. Ditch blocks shall be located in such a way as to not trap fish at low tide. Berms adjacent to starter channels shall be constructed on one side of the channel only, and shall be discontinuous, so that fish have easy access to the starter channels as the tide recedes.

30. Since the US FWS is the lead agency on the Project, it can follow its own protocols for species protection and choose to implement or not the following general provision, which is included as a general safety provision to protect biological species: "Construction activities shall be scheduled to avoid the local nesting periods of the special status wildlife species, to the extent practical. When construction is conducted during the nesting period of a special status species known to be present, the activities shall be restricted to maintain a 150-foot buffer between heavy equipment and the nesting sites. Construction activities shall be scheduled in such a way as to limit the period of disturbance in a particular area to as brief a time window as is practical."

31. Before constructing project components within tidal marsh habitat, the Discharger shall conduct clearance surveys for all species of concern in the construction area.

32. To the extent feasible, the Discharger shall avoid construction activities in or near marsh habitat suitable for the salt marsh harvest mouse.

Mosquito Abatement Provision

33. The Discharger shall coordinate with the county mosquito abatement districts during the design, implementation, and operations of the Project.

Potential Future Sediment or Soil Importation Provisions

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34. If sediment is imported, the instructions listed under Specification B.1 shall be followed. If upland soil is imported during or after the completion of the Project, the instructions listed under Specification B.2 shall be followed, including the preparation of a Quality Assurance Project Plan.

35. **Potential Future Offloading Facility**
Temporary Offloading Facility Construction and Operation Plan: The Discharger shall submit a plan, acceptable to the Executive Officer, describing the construction, operation, and demobilization of a temporary barge-accessible offloading facility adjacent to Dutchman Slough to be used for construction materials related to highway protection (riprap, aggregate, imported soil) and dredged material for habitat construction. At a minimum, the plan shall address all anticipated potential water quality concerns, including appropriate BMPs for preventing sediment or debris from entering the slough. (see Finding 57.)

Due Date: At least 30 days prior to start of construction

General Provisions

36. The Discharger shall comply with all the Prohibitions, Specifications, Limitations and Provisions of this Order, immediately upon adoption of this Order, unless otherwise provided below.

37. The Discharger shall notify the Water Board immediately whenever violations of this Order, for which the Discharger is responsible, are detected.

38. The Discharger shall remove and relocate any wastes that are discharged at any sites in violation of this Order.

39. The Discharger shall implement and comply with appropriate BMPs to prevent and control erosion and sedimentation.

40. No debris, soil, silt, sand, cement, concrete, or washings thereof, or other construction related materials or wastes, oil or petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed from the site by rainfall or runoff into waters of the State. When operations are completed, any excess material shall be removed from the work area and any adjacent area where such material may be washed into waters of the State.

41. Construction contractors working on the Project shall be required to provide their employees with spill prevention and response training, and shall be required to have spill

response equipment available at the job site, as directed by the Discharger. Contractors shall provide double containment for any hazardous materials or wastes at the job site. Contractors shall be prepared to respond to any spill immediately and to fully contain spills in the area, including any open-water areas.

42. The Discharger shall maintain a copy of this Order at the Headquarters of the US FWS San Pablo Bay National Wildlife Refuge, 7715 Lakeville Highway, Petaluma, CA 94954. The Order shall be available at all times to site personnel. The Discharger shall ensure that all individuals working on the site, including all contractors and sub-contractors, are familiar with the contents and requirements of this Order, and with all relevant plans and BMPs.

43. The Discharger shall permit the Water Board or its authorized representative, upon presentation of credentials:

    a. Entry onto premises on which wastes are located and/or in which records are kept.
    b. Access to copy any records required to be kept under the terms and conditions of this Order.
    c. Inspection of any monitoring equipment, construction area(s), or monitoring method completed as part of the Project.
    d. Sampling of any discharge or surface water covered by this Order.

44. This Order does not authorize commission of any act causing injury to the property of another or of the public; does not convey any property rights; does not remove liability under federal, state, or local laws, regulations or rules of other programs and agencies; nor does this Order authorize the discharge of wastes without appropriate permits from this agency or other agencies or organizations.

45. The Discharger shall immediately notify the Water Board by telephone or email whenever an adverse condition occurs as a result of the proposed discharge or construction activities. An adverse condition includes, but is not limited to, a violation or threatened violation of the conditions of this Order, significant spill of petroleum products or toxic chemicals, or other events that could affect compliance. Pursuant to CWC Section 13267(b), a written notification of the adverse condition shall be submitted to the Water Board within two weeks of occurrence. The written notification shall identify the adverse condition, describe the action(s) necessary to remedy the condition, and specify a time schedule for performance, subject to modification by the Water Board.

46. The Discharger shall halt work activities if dead or dying fish, or fish exhibiting stress, are observed within 1,000 feet of work activity or discharge. The Discharger shall immediately assign a qualified biologist to investigate the cause of the problem, and to identify an acceptable response, if the cause is determined to be the work activity or discharge. The Discharger shall immediately report all incidents of dead, dying, or stressed fish, as well as prescribed action plans, to the Water Board.

47. All reports pursuant to this Order shall be prepared under the supervision of a suitable professional in the State of California.

48. This Order is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Section 13330 of the CWC and Section 3867 of Title 23 of the California Code of Regulations (23 CCR).

49. This certification action is not intended and shall not be construed to apply to any discharge from any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to 23 CCR Subsection 3855(b) and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

50. An annual fee for WDRs pursuant to Section 13260 of the California Water Code is required.

51. The Water Board may modify, or revoke and reissue, this Order if present or future investigations demonstrate that the discharge(s) governed by this Order shall cause, have the potential to cause, or shall contribute to adverse impacts on water quality and/or beneficial uses of the receiving waters. The Water Board may reopen this Order to review results of the Discharger's and Water Board staff's studies and new data on Section 303(d) listed contaminants and decide whether effluent limits should be revised.

I, Bruce H. Wolfe, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on October 13, 2010.

Digitally signed by Bruce Wolfe
Date: 2010.10.14 11:14:41 -07'00'

Bruce H. Wolfe
Executive Officer

Attachments:

Attachment A: Figures
Attachment B: (i) Detailed Work Components; (ii) Time Line
Attachment C: Monitoring and Adaptive Management Plan
Attachment D: Monitoring and Reporting Plan from EIR
Attachment E: Water Quality Self Monitoring Program (SMP)

References Used:

Best, E., H.Fredrickson, V.MacFarland, H.Hintelmann, R.Jones, C.Lutz, G.Kiker, A.Bednar, R.Millward, R.Price, G.Lotufo, G.Ray. 2005. Pre-Construction Biogeochemical Analysis of Mercury in Wetlands Bordering the Hamilton Army Airfield Wetlands Restoration Site ERDC/EL TR-05-15. U.S. Army Engineer Research and Development Center. Vicksburg, MS.

Ducks Unlimited and GAIA Consulting, Inc. May 2010. 401 Water Quality Certification and Report of Waste Discharge Application for Cullinan Ranch Restoration Project, Napa and Solano Counties. Prepared for US Fish and Wildlife Service, Petaluma, CA.

Ducks Unlimited. Final Environmental Impact Report for Cullinan Ranch Restoration Project, Solano and Napa Counties, California. April 2009. Prepared for US Fish and Wildlife Service, Petaluma, CA and California Department of Fish and Game, Yountville, CA.

San Francisco Bay Regional Water Board. 2006, Basin Plan, Mercury TMDL. [http://www.waterboards.ca.gov/sanfranciscobay/basin_planning.shtml]

San Francisco Bay Regional Water Board. 2000. Staff Summary Report (draft). Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines.

Slotton, D. 2008. University of California, Davis. Fact Sheet: The Fish Mercury Project: The UC Davis Biosentinel Mercury Program. SFEI. No. 552. www.sfei.org.

U.S. Fish and Wildlife Service. 2010. Section 7 Biological Opinion for this project (Tracking #: SFB-2010-01/ May 7, 2010/ *Intra-Service Section 7 Consultation on Implementation of the Proposed Cullinan Ranch Restoration Project, Napa and Solano Counties, CA*).

U.S. National Marine Fisheries Service, Rodney McInnis, Regional Administrator. April 5, 2010. Letter to Christy Smith, U.S. Fish and Wildlife Service [regarding Cullinan Ranch Restoration project].

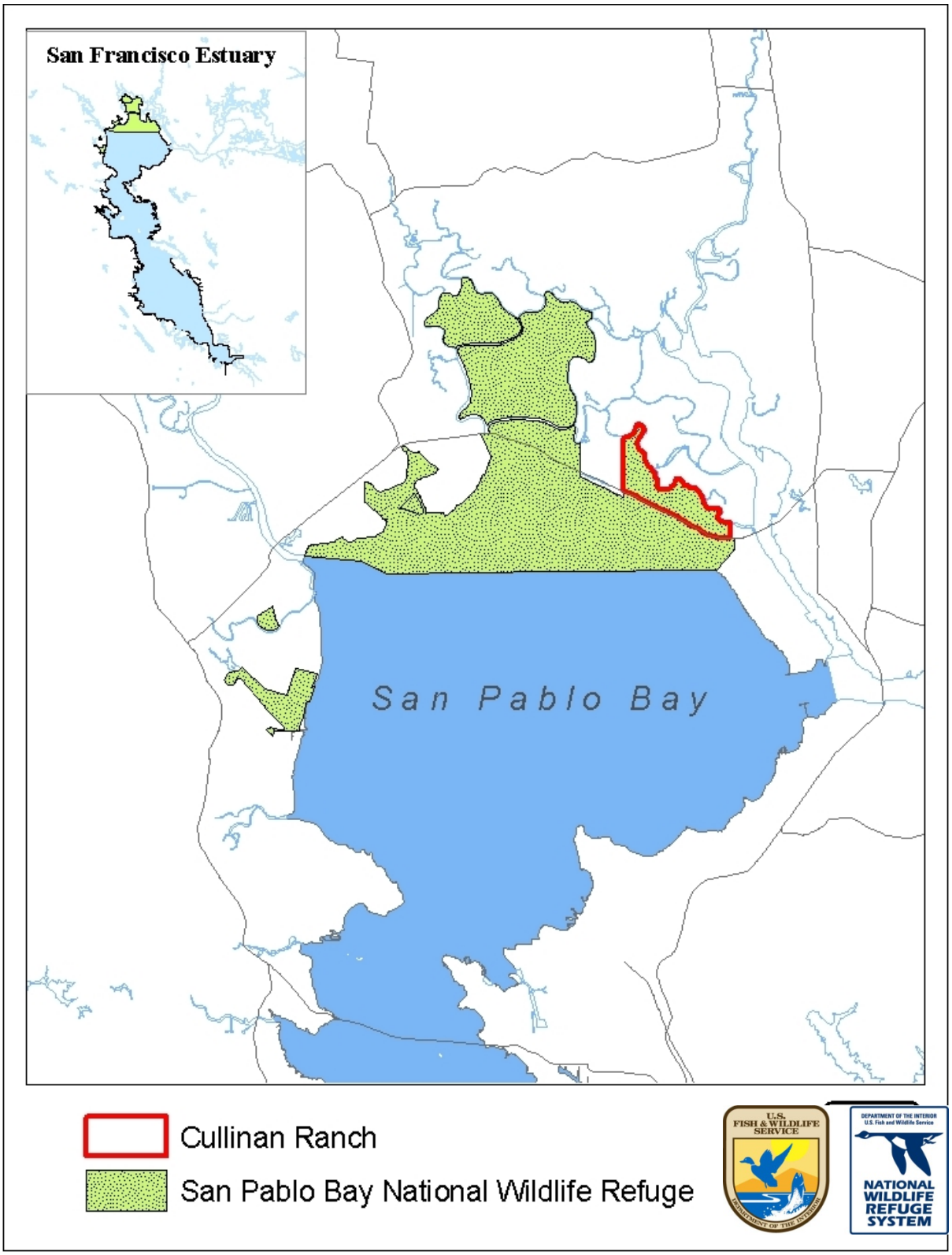

Figure 1: Cullinan Ranch as part of the San Pablo Bay National Wildlife Refuge, San Francisco Bay, CA. The acquisition boundary is shown here, and the actual boundary is shown as an inset in Figure 2.

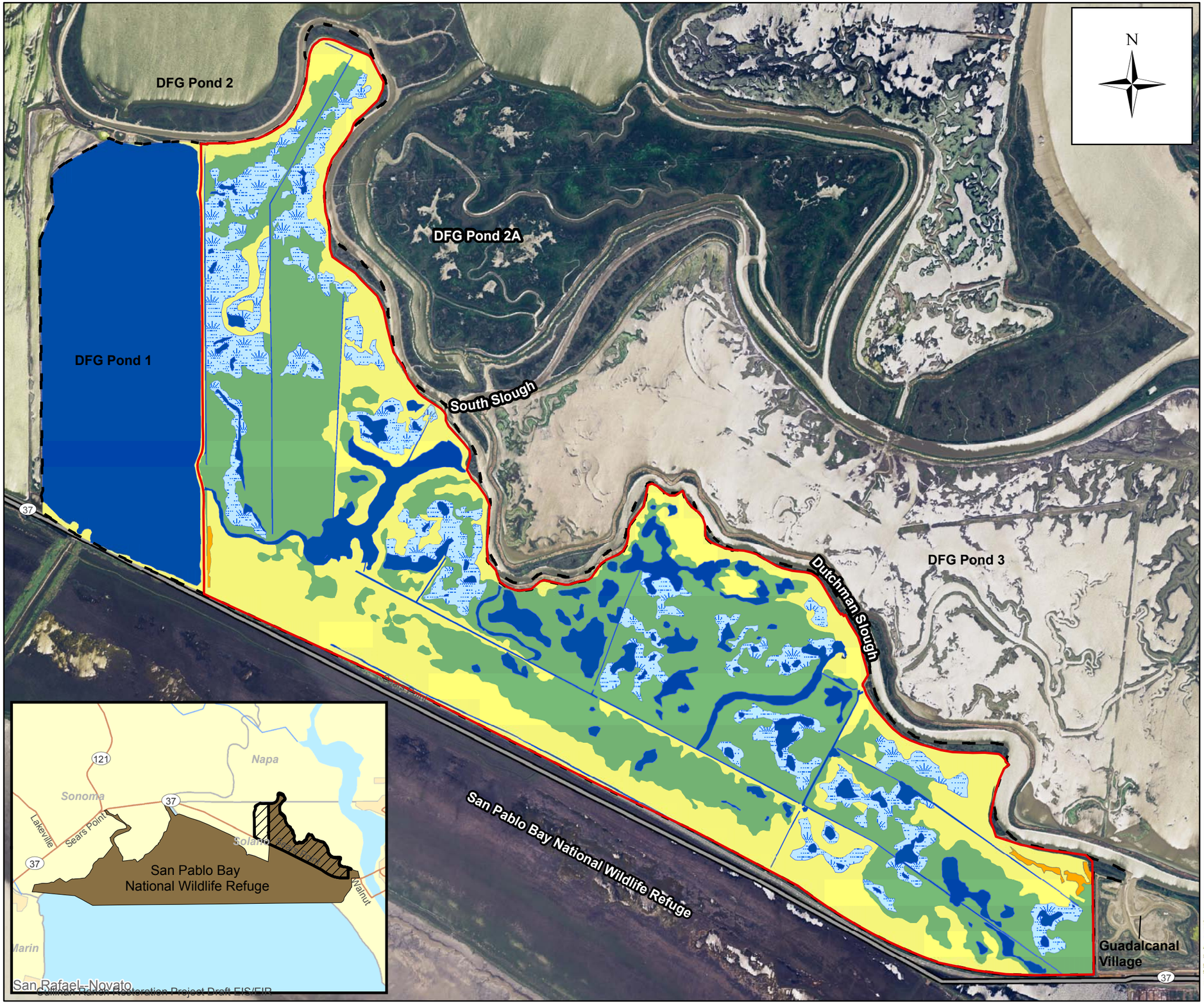

Figure 2

Existing Habitat Types in the Project Area

- Remnant Tidal Marsh
- Emergent Marsh
- Open Water
- Tidal Marsh
- Seasonal Wetland
- Upland
- Restoration Site
- Project Area

Approximate Habitat Acreages in the Cullinan Ranch Restoration Site*

Emergent Marsh	227
Open Water	172
Remnant Tidal Marsh	3
Seasonal Wetland	626
Tidal Marsh	5
Upland	495
Total	1528

* Habitats were mapped using aerial photo interpretation and minimal ground truthing, therefore acreages are an approximation. Wetland and water habitats were identified using hydrology and vegetation indicators only and are not meant to meet Corps delineation standards. Approximately 33 additional acres of remnant tidal marsh habitat, 11 acres of upland habitat, and 369 acres of open water habitat occur in the greater Project Area.

0 1,000 2,000 3,000 4,000 Feet

2/21/07

301 Howard St. Ste 1410
San Francisco, CA 94105
J. Zarnoch

NRM environmental consulting

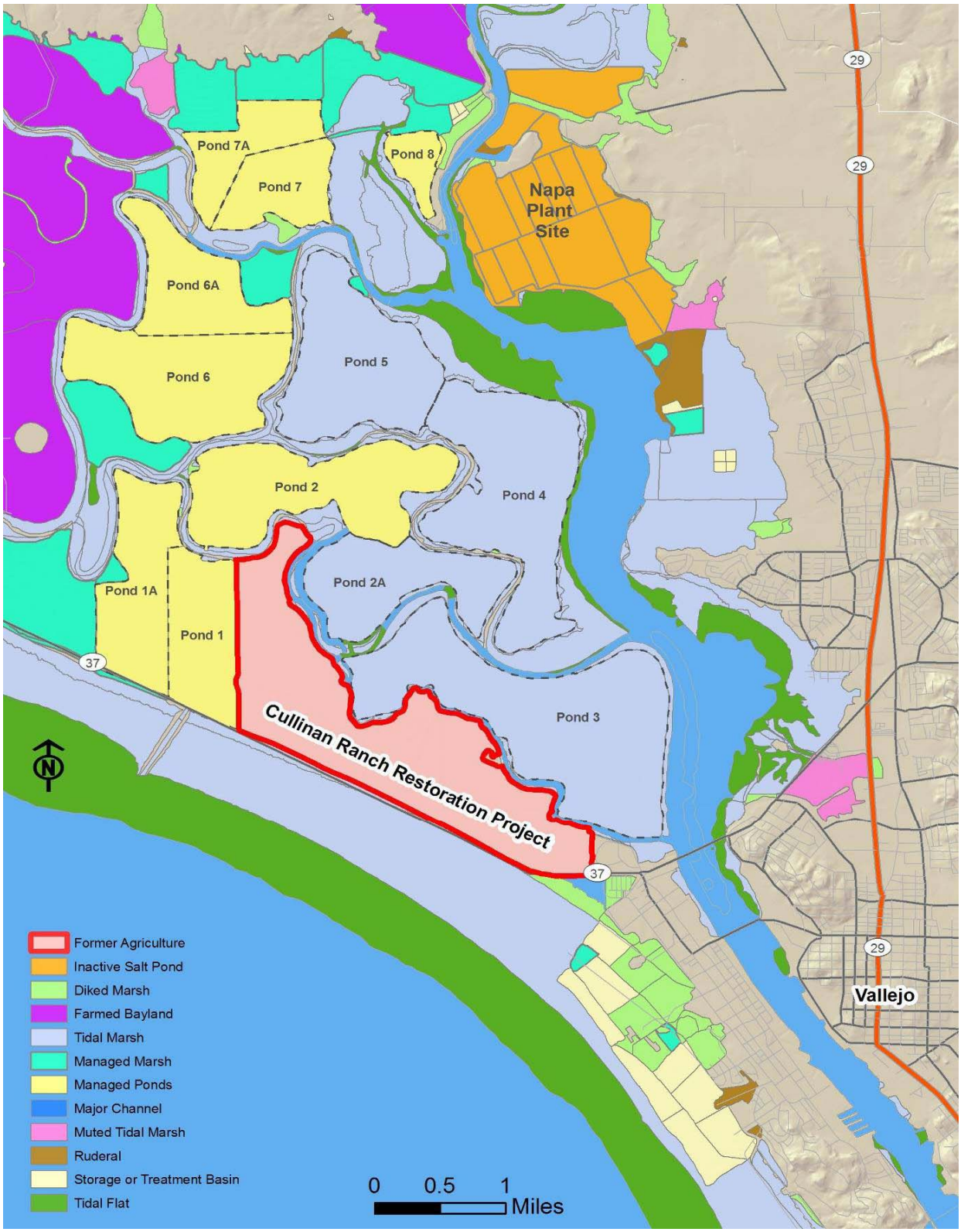

Figure 3: Napa Sonoma Wetland Restoration Projects

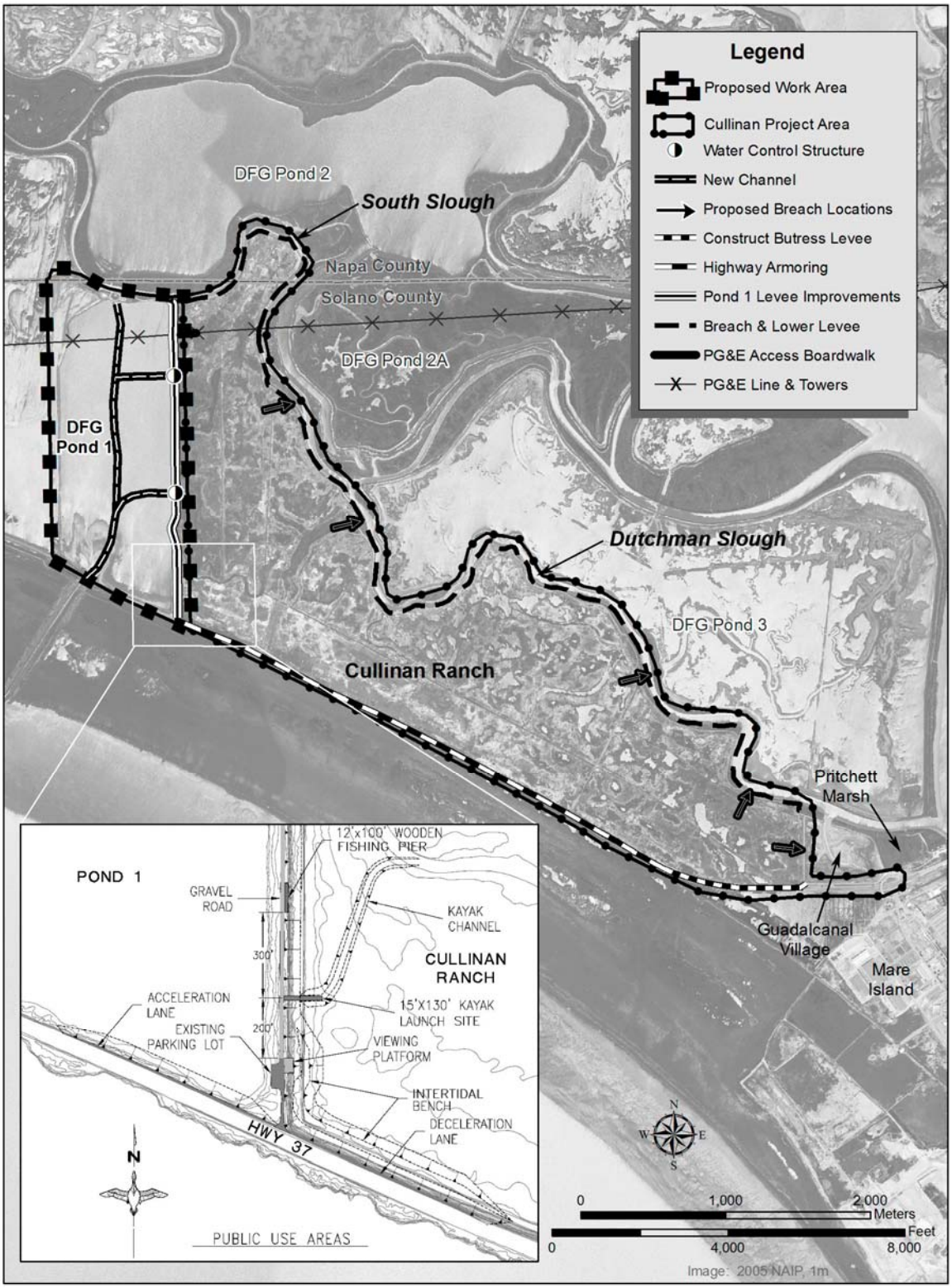

Figure 4: Conceptual Restoration Design for Cullinan Ranch showing adjoining Pond 1.

ATTACHMENT B (i): Detailed Descriptions of the Project's Components for the Cullinan Ranch Restoration Project

The following descriptions of the Project's components are from US FWS' application to restore the Cullinan Ranch site, as submitted to the Water Board by Ducks Unlimited. These components are summarized in Findings 20 through 29 in the Order for the Project and provided in more detail below. Some changes to the components have been made in the Order. The Order should take precedence over any of the descriptions contained in this attachment.

The Project will implement the following components:

Component 1 – Block existing drainage ditches to promote redevelopment of natural sloughs

Component 2 – Improve the Pond 1 levee and install water control structures

Component 3 - Protect Highway 37 from flooding and erosion

Component 4 – Construct public access areas

Component 5 – Pre-flood the Cullinan Ranch site prior to breaching the levees

Component 6 – Lower levees for near-term habitat creation

Component 7 – Breach the levees along Dutchman and South sloughs and Guadalcanal Village, and

Component 8 – Long-term monitoring and management

Component 1 – Block Drainage Ditches Created for Agricultural Purposes to Promote Redevelopment of the Natural Channel Network

As part of the historic agricultural operations at the site, linear drainage channels were excavated in some areas. These channels could act as preferred drainages once tidal action is reintroduced to the site, and could prevent or slow the formation of natural, meandering channel systems. Some of these channels may be blocked by depositing soil and loosely compacting short portions of the channels (typically 10 feet top width or less). These ditch blocks will be constructed of onsite soils retrieved from the existing internal berms, or material from the excavation of the channel at CDFG Pond 1, if there is sufficient material available after the improvements to the Pond 1 levee are complete. The ditch blocks will be constructed to an elevation equal to the adjacent land surface, and will be constructed prior to breaching. Because these ditch blocks are not a required element of any other construction component, they can be constructed at any time prior to breaching when suitable excavated material is available.

Component 2 – Improve the Pond 1 Levee and Install Water Control Structures

(Note: This work will be addressed under the Board's orders issued to the CDFG for the Napa Sonoma Restoration Project (hereinafter the NSRP orders)

A channel will be constructed in Pond 1 by CDFG to improve circulation in Pond 1, and to create a hydrologic connection to the Cullinan Ranch site. Two water control structures will be installed in the Pond 1 levee to provide pre-breach (flood-up) water and circulation between Pond 1 and the Cullinan Ranch site. The existing CDFG Pond 1 levee will be reinforced and

raised to elevation 8 feet NGVD 1929, where necessary. The borrow ditch adjacent to the Pond 1 levee on the Cullinan Ranch site will be filled with material from Pond 1, and the eastern slope of the Pond 1 levee will be flattened to approximately 7:1 (H:V). Excess material generated from the channel construction will be utilized on the Cullinan Ranch site. Material to raise the levee will likely have to be imported because the excavated material from Pond 1 will not have the proper geotechnical and engineering characteristics.

Component 3 – Protect Highway 37 from Flooding and Erosion[1]

The Highway 37 embankment forms the southern levee of the Cullinan Ranch property. The embankment elevation at the edge of the pavement ranges from 4 to 11 feet (NGVD 1929). Hydrologic studies conducted by Moffat & Nichol Engineers (Moffat & Nichol Engineers and Hydroikos Associates, 2004) determined that if the Cullinan Ranch site were to be restored without adequately protecting the embankment, it is likely that the eastern portion of Highway 37 would be flooded during combined high tide and storm events. In addition to flooding, inadequate protection of the Highway 37 embankment from wind-induced waves from within the Cullinan Ranch site could result in significant erosion of the highway embankment. Tidal marsh restoration at the Cullinan Ranch site cannot be accomplished without protecting the Highway 37 embankment.

The Highway 37 embankment will be protected by constructing a 3,500-foot-long buttress levee on the north side of Highway 37, at the eastern edge of the site. The existing drain at the toe of the embankment (toe drain) will be filled to match the adjacent field elevation as part of the buttress levee construction to provide a firm base for the armoring. The buttress levee will be constructed with a top elevation of 9.0 feet NGVD 1929, have a 5:1 horizontal to vertical slope from 9 feet to 8 feet, below which it will transition to a 10:1 slope. If practical, pickleweed will be collected from the toe drain along the Highway 37 embankment prior to construction, stockpiled, and planted on the finished slope. Planting plugs or hydroseeding with native species on the buttress levee may also be implemented to further enhance the embankment's habitat value and ability to resist erosion.

The remaining approximately 12,100 feet of highway embankment will be armored to prevent wind-wave erosion. Revetment above elevation 7 feet NGVD 1929 will be backfilled and covered with clean soil and planted with salt-tolerant native grasses or salvaged pickleweed to reduce habitat for non-native predators and reduce the establishment of non-native plant species. The intent of the grass cover is to minimize infestation by non-native or invasive plant species.

The buttress levee will be higher in elevation than the eastern section of Highway 37 that it is protecting. The buttress levee design will include a grassy swale below the highway shoulder to convey rainwater away from the embankment. A Stormwater Pollution Prevention Plan (SWPPP) will be developed prior to construction and will include BMPs to control construction-related runoff and prevent any discharges to surrounding water. The water will drain eastward into a detention basin constructed out of an abandoned ditch segment between Guadalcanal Village and Highway 37, where it will be held until it can drain into the Cullinan Ranch site at

[1] The levee on the Cullinan Ranch side of Highway 37 is within BCDC Shoreline Band jurisdiction.

low tide through tide gates. Discharge of both construction and post-construction stormwater runoff will comply with California Department of Transportation's (CalTrans) existing statewide permit for the discharge of stormwater runoff. Alternatively, the stormwater could potentially be diverted into the existing drainage canals located near Guadalcanal Village and the Mare Island Bridge.

The buttress levee, riprap armoring, deceleration lanes (discussed below with public access) are all located within CalTrans' right-of-way. As a matter of public safety, the design for these components will be closely coordinated with CalTrans. Construction-related vehicular routing will also be coordinated with CalTrans and other agencies as necessary. Design details, plans and other technical information will be submitted to CalTrans at appropriate design levels for its review and comment.

Component 4 – Construct Public Access Features

The Cullinan Ranch site is currently closed to the public except for docent-led bird tours. The project will significantly improve and add public access. CDFG's Pond 1 levee serves as the public access point to Cullinan Ranch site. During construction, access to the site via the Pond 1 levee will be restricted until augmentation of the Pond 1 levee is completed and access from Highway 37 is improved. Although many of the public access improvements are located on CDFG property, the improvements will be constructed as part of this project. The project will add the following public access improvements:

- Acceleration and deceleration lanes from Highway 37 to provide safer vehicular access,
- Construction of a kayak launch site previously permitted under the NSRP orders,
- Installation of a viewing platform with interpretive signs and benches,
- Construction of a 100-foot long fishing pier,
- Construction of graded intertidal benches with pickleweed and other native tidal marsh plant species near the parking lot to provide interpretation opportunities, and
- Resurfacing 7,000 feet of the Pond 1 levee to improve the informal trail access previously permitted under the NSRP orders.

Some of the planned public access that is part of the Project and funded by the USFWS will occur on or adjacent to the CDFG Pond 1 levee. Due to the landownership, such work will be performed pursuant to the NSRP orders (Table 3). The public access improvements located on USFWS property are included in this permit application.

A deepwater channel will be excavated prior to flood-up of the Project site to connect the kayak launch site to natural slough channels. The material will be side-cast and graded into the adjacent area and reused onsite to raise the marsh plain elevation or levees. The fishing pier will be constructed of onsite or imported material on CDFG property and extend out from the Pond 1 levee to a pile supported substructure.

Table 3. Location of Public Access Features

Public Access Feature	Located on USFWS Property (pursuant to this Order)	Located on CDFG Property (pursuant to the NSRP orders)
Parking lot		Entire lot (existing)
Acceleration Lane		Entire lane (750 feet)
Deceleration Lane	660 feet	90 feet
Kayak Launch Site		Entire launch site
Fishing Pier		Entire pier
Viewing Platform		Entire platform
Graded intertidal Benches	Approximately 2/3 (included in deceleration lane footprint)	Approximately 1/3 (overlaps with viewing platform footprint)
Resurfacing Pond 1 Levee		Entire levee

An existing wide section of the Pond 1 levee located close to Highway 37 includes a paved ten-vehicle parking area for recreational users. Access to or from Highway 37 can be hazardous due to the lack of acceleration and deceleration lanes (a sharp right, 90° turn is required to enter and exit the parking lot). Paved acceleration and deceleration lanes will be installed on the north side of Highway 37 as part of this project along the westbound lane, before and after the Pond 1 levee to facilitate safe highway deceleration and merging. The acceleration lane and a portion of the deceleration lane along the CDFG Pond 1 site is covered under the NSRP orders. The portion of the deceleration lane located on USFWS property is covered under this Order. Construction of the deceleration lane will necessitate the widening of the Highway 37 embankment along its path and the filling of approximately 0.30 acres of open water ditch adjacent to Highway 37.

Component 5 – Pre-flood Cullinan Ranch Site Prior to Breaching the Levees

The site has lain fallow for over a decade, allowing ruderal upland vegetation and wetland habitats, primarily seasonal wetlands, to form. Mammals that have populated the site will be displaced when tidal flow is restored. To allow slow emigration of animals from the site, the flooding of the site will be phased. In the first phase, the site will be slowly flooded in midwinter (when water naturally ponds in the site) using the water control structures installed by USFWS in CDFG's Pond 1 levee for the Project. Once the site is flooded to a depth of one foot and animals have had an opportunity to emigrate, the levee between the site and South and Dutchman sloughs will be breached as described in Component 7. The Guadalcanal Village breach opening may also be opened at this time. This breach was engineered but not opened as part of CalTrans' Guadalcanal Village mitigation project.

Anaerobic conditions may form during the pre-flood period depending on the length of time water is held onsite prior to breaching the outboard levees. Water quality monitoring (for

dissolved oxygen, temperature, salinity, pH, and turbidity, or as required under this proposed permit) within the site and in the sloughs adjacent to the site will be instituted before and after the site is flooded to assess pre- and post-breach water quality. Breaches will be phased, if necessary, to protect receiving water quality. In addition, the levee will be breached on an incoming tide, to drive higher quality water into the site prior to the initial discharge. The volume of water within the site is small compared to winter flows and daily tidal exchange in this part of the Napa River Estuary. Any discharge into the sloughs from the site during breaching will be quickly diluted.

Component 6 – Lower Levees for Near-term Habitat Creation

To ensure availability of habitat for salt marsh harvest mice in the near term, a minimum of 30 acres suitable for the immediate colonization by mid-to-high marsh vegetation will be created through levee lowering and grading activities along sections of the Dutchman and South Slough levees. Portions of the northern levee will be lowered to around mean higher high water, and material from levee lowering will be placed on some of the interior levee slopes to create additional acreage at the proper elevation for vegetation colonization. If sufficient clean material becomes available, including beneficial reuse of dredged materials, and funding allows, up to 50 additional acres of habitat suitable for marsh colonization will be created adjacent to Guadalcanal Village. All imported soils or sediment will have to meet "wetland surface material" screening criteria as described in the USFWS Biological Opinion.

To expedite the establishment of tidal marsh, the northern levee will be lowered, interior levee slopes will be flattened and select areas within the site raised with imported and/or on-site soil. These actions are intended to improve marsh plain continuity, increase tidal circulation, reduce predator access, reduce the opportunities for invasive species to colonize the site, and increase the area suitable for near-term establishment of tidal marsh vegetation. All soils will be placed prior to breaching the site.

The site has subsided significantly and is bounded by utilitarian levees with typical side slopes of 3:1 (H:V). Steep levee slopes such as these preclude the development of a gradual upland to wetland transition that is more representative of natural conditions in tidal marshes and provides important habitat for a variety of wildlife and plant species that can only occur in such habitats. The gradual upland-wetland transition zone that occurs in natural settings will be restored along a portion of the northern levee, as well as along the buttress levee adjacent to Guadalcanal Village and the Pond 1 levee. As noted earlier, the buttress levee will have a 10:1 (H:V) slope and the Pond 1 levee will be flattened to a 7:1 (H:V) slope. All of these areas will provide additional acreage suitable for near term establishment of tidal marsh vegetation.

Approximately 26,000 linear feet of the northern levee along Dutchman and South sloughs will be lowered to MHHW, elevation 3.5 ft NGVD 1929 (approximately +6.2 feet MLLW). The material generated from levee lowering activities and breach construction will be placed on the southern (interior) side of the northern levee and used to flatten the levee slope. This will create a minimum 30-acre area along Dutchman and South sloughs and Guadalcanal Village that will support near term establishment of mid-to-high marsh vegetation. As noted earlier, the buttress levee will have a 10:1 (H:V) slope and the Pond 1 levee will be flattened to a 7:1 (H:V) slope.

All of these areas will provide additional acreage suitable for near-term establishment of tidal marsh vegetation.

Component 7 – Breach Levees along Dutchman and South Sloughs, and Guadalcanal Village

To restore the tidal prism to the site, up to four breaches will be constructed between the site and Dutchman and South sloughs and one between the site and the Guadalcanal Village marsh mitigation site. Breach construction will be initiated at the west end of the site. Breach locations will be as close to historic channel mouths/alignments as practicable. South Slough and the lower portion of Dutchman Slough will serve as the primary channels for the property. Breaching will occur in the winter, but before January 30 when juvenile salmonids are expected to migrate in the general vicinity, or as specified in the National Marine Fisheries Service biological opinion and essential fish habitat consultation.

Where practical, there will be some levee recontouring near the breach locations. The hydrodynamic modeling investigation performed by Moffatt & Nichol (2004) was used to design breach size and depth of excavation. The sizes of the breaches are based on the breach locations, the amount of the tidal prism that will pass through the breach at each tide cycle, and the acreage and the elevation of the restoration area that each breach will be supporting. The elevation determined in the final hydraulic design will be carried through the levee footprint, then transition to the existing grade within the site. Material from the breach construction will be placed on the interior levee slopes of the Dutchman and South Slough and Guadalcanal Village levees to provide additional wetland habitat. Breaches will be unarmored and allowed to widen naturally to an equilibrium size.

The placement of the breaches will increase the capacity of South Slough over time. This will result in South Slough conveying a larger percentage of the tidal prism into the site, and will reduce physical effects to Dutchman Slough and Pritchett Marsh (located near the mouth of Dutchman Slough). The size of the breaches will initially result in a muted tidal prism within the site. This will result in lower tidal velocities, which in turn will reduce the adverse impacts to the adjacent slough system. Over time the breaches and sloughs will erode as the system comes into equilibrium.

Another levee, located along the eastern border of the Project site, separates the site from the Guadalcanal Village mitigation site. This levee was designed to resist tidal action. An armored spillway was installed in the levee and then backfilled during restoration of the Guadalcanal Village site. This armored breach may be opened to allow tidal flow between the Projects site and the restored Guadalcanal Village site.

Breach size and quantities associated with breach excavation are described in Table 4.

Table 4. Dimensions of Levee Breaches and Tidal Channel Excavation			
Breach (West to East)	**Bottom Width of Breach (Feet)**	**Channel Excavation[a,b] (Linear feet/cubic yards)**	**Associated Drainage Area (Acres)**
Dutchman/South slough Breach #1	100	160/3,800	~20-25% of site
Dutchman/South slough Breach #2	100	240/6,300	~20-25% of site
Dutchman/South slough Breach #3	100	80/1,250	~20-25% of site
Dutchman/South slough Breach #4	100	165/3,240	~20-25% of site
Guadalcanal Village Breach	Unknown	100/5,000cy	~20-25% of site
[a] Breach widths and channel excavation are based on preliminary calculations and modeling, and are estimates of the maximum that would be required for restoring tidal circulation.			
[b] Volumes represent breach excavation in waters of the U.S.			

Construction of the breaches will require excavation in uplands and pilot channel construction through outboard marsh as needed. Placement of temporary cofferdams or excavation from barges may also be necessary for breach construction. The majority of material excavated from the breaches will be used onsite for improvement of existing levees or to raise habitat elevations. Material excavated from breaches that is not suitable for onsite reuse (e.g., rebar and concrete debris) will be recycled or disposed of offsite. As discussed earlier, the levee will be breached on an incoming tide allowing water from the slough to first enter the site and dilute the water present within the site. The total quantity of water that will be present within the site at the time of breaching is small compared to both the total capacity of the site and the total tidal prism in the adjacent sloughs.

Component 8 – Long-Term Monitoring

Monitoring activities will be conducted to document changes in tidal hydraulics, geomorphology, plant and wildlife species, water quality, and habitat types and functions as restoration progresses. The Project will use the NSRP's monitoring plan as a basis for its monitoring plan. Initiation of long-term monitoring of the site will occur immediately following breaching of the north levee. Prior to initiating project construction, a detailed long-term monitoring plan outlining the duration of monitoring and tasks to be completed over the duration of the monitoring period will be completed.

Attachment B (ii). Tentative Timeline for Construction of the Cullinan Ranch Restoration Project*

	2010				2011												2012												2013
TASK	Sept	Oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec	jan
1. Pond 1 levee and water control structures																													
2. Block existing ditches																													
3. Hwy 37 protection																													
4. Construct public access																													
5. Pre-flood project site prior to breaching levees																													
6. Lower Dutchman levee																													
6A. Construct up to 50 acres SMHM habitat																													
7. Breach levees on Dutchman and South Sloughs and Guadalcanal Village																													
8. Monitorng and adaptive management																													

Attachment C: Monitoring and Adaptive Management Plan (MAMP) for the Cullinan Ranch Unit of San Pablo Bay National Wildlife Refuge (September 2010).

MONITORING

This document details the monitoring plan for construction and habitat evolution at the Cullinan Ranch Unit (Cullinan) of San Pablo Bay National Wildlife Refuge. The monitoring plan includes both biotic and abiotic parameters that would be monitored, performance standards, habitat targets, protocols, and sampling frequencies for the entire unit. This plan also identifies potential adaptive management triggers. The monitoring methods, schedule, and reporting system are also described in the Cullinan Ranch Mitigation, Monitoring, and Reporting Plan Table (Table 1), which summarizes parameters to be monitored, performance objectives, protocols, and monitoring frequency.

1.0 Background

A monitoring plan was developed in 2006 to track the progress of the Napa Plant Site project with input from the Water Board staff and the Bay Area Monitoring Review Team (MRT), which met on May 15, 2006 to discuss monitoring of the Napa Plant Site project. Because Cullinan Ranch is located adjacent to the Napa Sonoma Marshes and is a similar tidal restoration project we will use the same monitoring approach developed for the Napa Sonoma Marshes and approved by the Water Board and the MRT, with minor changes, as appropriate, to adapt the plan for the Cullinan Ranch site. In addition, we have reviewed and incorporated adaptive elements of the South Bay Salt Pond monitoring plan where feasible (e.g., see Table 2, Adaptive Management Strategy).

1.1 Monitoring Components and Performance Objectives

Over a 15-year period, chemical, physical, and biological project components will be monitored for the restoration project. In addition, aerial or satellite photos will continue to track tidal marsh development every 5-10 years until the final objective of tidal marsh is achieved (defined here as having 75% cover of native tidal marsh plant species).

1.2 Chronology

Project construction will be completed when tidal action has been restored. After construction has been completed the San Pablo Bay NWR will submit a construction completion report to the Water Board, Corps, and BCDC within 45 days and an as-built report within 45- 90 days. Upon approval of these reports (or after 45 days from submission), the monitoring period will commence.

2.0 Monitoring Methods and Schedule

This section presents monitoring protocols for water quality, biota, and geomorphic evolution. The monitoring schedule is also discussed and summarized in Table 1.

2.1 Water Quality

General Water Quality Parameters: Water quality monitoring is specifically associated with project construction to assess the effects of breaching on the receiving water quality. General

water quality parameters to be monitored include salinity, temperature, pH, dissolved oxygen (DO), and turbidity. Water quality parameters will be monitored *in situ* by collecting a grab sample and using a multi-parameter probe and flow cell (e.g., YSI 6820 or equivalent). Figure C-1 shows water quality sampling locations. Monitoring stations will be associated with the breach on South Slough and one of the three breaches on Dutchman Slough and receiving water upstream and downstream of the breaches (i.e., South Slough and Dutchman's Slough). In addition there will be a monitoring station inside one of the Dutchman Slough breaches. The sampling station locations will allow assessment of interior water quality, site effluent and receiving water quality, and provide the means for estimation of the attenuation of any water quality conditions that may exist (e.g., low DO concentrations).

Water quality data will be collected at one foot below the surface during an ebbing tide. Data will be collected at the following frequency:

- within 3 days prior to breaching of the pond levees;
- once during the first 24 hours after breaching, and again within 5 days after the breaching;
- weekly for the first month after breaching; and
- monthly until water quality performance objectives have been met for three consecutive months.

Water quality monitoring data will be evaluated for trends and compared to the performance objectives established for each parameter.

Mercury Monitoring: Water, sediment, and/or biosentinels should be monitored for mercury. If biosentinels are chosen they should ideally (but not necessarily) follow regional protocols used for similar sites such as Mississippi silversides sampled at the Napa Plant Site. If feasible, biosentinels should cover all existing and target habitats (e.g., mudflats, channels, vegetated tidal marsh plains, etc.) and each habitat should have between 3-5 samples collected from it). Appropriate species and habitats include: Mississippi silversides for the subtidal areas; mudsuckers for intertidal mudflats and channels; and song sparrows for the tidal marsh plain. Other species can be selected if they are common, reside primarily in the habitat, and are not a threatened population. A different monitoring plan can be proposed and presented to the Water Board and the Technical Advisory Team for this project. The Water Board must approve changes. If feasible, the frequency of mercury biosentinel monitoring should coincide with that of the Napa Plant Site which attempts to collect data annually. If annual collection is infeasible, then data can be collected biennially. The US FWS has proposed the following schedule to capture seasonal variability: 3 times annually in years 1, 2, 3, 5, 10. and 15. The selected sampling method will be determined in accordance with permit requirements, acceptable scientific methods, and available budget.

2.2 Biota

This section discusses biological monitoring, including avian monitoring, fish as used for biosentinel mercury monitoring, small mammals, and vegetation.

Birds

Avian surveys will be conducted four times a year in years 1-3 (focused on migratory and winter periods); and thereafter four times a year every 5 years (i.e., Years 8 and 13) or until vegetation cover reaches 75 percent and the predominant bird use shifts from shorebirds and waterfowl to resident marsh species (e.g., songbirds, rails), whichever is sooner. Surveys will occur during

migratory periods and encompass high and low tides. Wetland bird surveys will be conducted using the Wetland Regional Monitoring Program protocols (2002; http://www.wrmp.org/protocols.html) or other appropriate protocol. The Refuge will monitor California clapper rails when appropriate quantity and quality of habitat has developed (e.g., 300 acres of contiguous vegetated marsh).

Data from United States Geological Survey (USGS) bird surveys conducted at the Napa Sonoma Marshes project site between April 2003 and March 2006 will be used as a baseline for comparison of data collected in the post-project monitoring period. Other comparison data may include the estuary-wide shorebird surveys coordinated by Point Reyes Bird Observatory and the winter waterfowl surveys conducted by the United States Fish and Wildlife Service (USFWS). Data analysis will include an evaluation of species composition, abundance and trends in bird use relative to San Pablo Bay and the larger San Francisco Estuary. The Refuge will coordinate with the Napa Solano Audubon Society to add a Christmas Bird Count Station at the Cullinan Ranch Site.

Fish

The Refuge will coordinate with regional programs to conduct fish monitoring at the Cullinan Ranch site. Monitoring would occur once per year for the first three years; and thereafter one survey a year every 5 years or until the site supports fish communities similar to reference estuarine tidal marsh sites.

Small mammals

Tidal marsh habitats can support populations of special-status small mammals, including salt marsh harvest mouse (*Reithrodontomys raviventris*) (SMHM) and Suisun ornate shrew (*Sorex ornatus sinuosus*). It is the Refuge's responsibility as a federal agency to make efforts toward the conservation and recovery of these species. The Refuge will monitor or document the presence or absence of federally listed small mammals at Cullinan in accordance with the established recovery programs. Surveys for small mammals will be conducted 1 year prior to construction. If suitable habitat is present and vegetation cover averages at least 75%, post-construction surveys will begin in year 3 following construction, or as soon thereafter as suitable habitat is present, and will continue once every year until SMHM occupy available habitat for a period of at least 3 years.

Vegetation

Vegetation colonization in wetland areas will be monitored using aerial photography supported by ground-truthing. Aerial images will be interpreted with a Geographic Information System (GIS) to estimate percent cover in the wetland areas. Ground-truthing will be performed to verify vegetation signatures on the aerial photos, and to make qualitative assessments of species richness and community composition.

A minimum of 30 acres of habitat suitable for colonization by native marsh vegetation will be created along South and Dutchman Sloughs and along the buttress levee. Up to an additional 50 acres will be created next to Guadalcanal Village if funding and surface quality sediments are available. Vegetation colonization in these areas is expected to be fairly rapid, beginning within one year of project completion, and achieving 80% native tidal marsh vegetation cover within 3 to 10 years. The remainder of the site is expected to take approximately 60 years to meet the 75% cover success criterion for native tidal marsh vegetation.

Vegetation assessment will analyze species cover, richness, and composition. Vegetation assessment will begin when aerial imagery or ground-based observations suggest that tidal wetland-associated plant cover is approximately 20 percent. Prior to reaching the 20% level, the dominant pioneer species colonizing the marsh plain will be recorded.

The Refuge has an invasive plant management program to prevent and control non-native invasive plant species, including those listed under Tier I (and to a lesser extent Tier II) of the Water Board's "Invasive Non-Native Plant Species to Avoid in Wetland Projects in the San Francisco Bay Region"[1], that threaten sensitive native tidal marsh communities. The Refuge will review this list and determine which species will be feasible to keep off the wetland restoration site, and which will not. Invasive cordgrass species (e.g., *S. alterniflora, S. densiflora*) and *Lepidium latifolium* (perennial pepperweed) are currently high priority species for control or eradication on Refuge lands. The Refuge coordinates with the Invasive Spartina Project to control invasive *Spartina* species in San Pablo Bay.

2.3 Geomorphic Evolution

Protocols developed by the San Francisco Estuary Institute for mapping vegetation using aerial and satellite photos will be reviewed and followed if feasible[2]. The practicality of providing some form of habitat mapping including vegetation types and channel evolution is being investigated using aerial or satellite photos collected every 1, 3, or 5 years; easily accessible satellite photos such as Google Maps can be used, if they provide sufficient detail to assess the development of habitats including channels. A final plan will be submitted to and approved by the Water Board's Executive Officer.

2.3.1 Tidal Channel Evolution

Evolution of tidal channels will be evaluated using aerial imagery. The aerial images will be captured in the first year before construction is completed (the baseline), followed by the first year after construction is completed, and subsequently every five years during a spring low tide to increase visibility of channel network development, until the performance criteria are met or the Technical Advisory Team determines that the tidal channel networks had developed sufficiently. Aerial images will be interpreted with GIS to calculate: 1) overall channel density in the drainage basin associated with each breach; 2) channel width at each breach and at locations along the alignment of the restored historic channels. Density will be calculated as square feet of channel per square feet of marsh plain.

2.3.2 Sedimentation

Sedimentation in restored tidal areas will be monitored using sedimentation plates, pins, erosion tables or LiDAR. If sedimentation plates are used, each plate will be constructed of a square sheet of non-corrosive material. Sedimentation plates will be set flush with the marsh surface prior to restoration of tidal action. A rod will be placed through the center to anchor the plate and facilitate relocation for sampling purposes. Sediment accumulation on the plates will be

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[1] http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stream_and_wetland_protection.shtml under "Fact Sheet for Wetland Projects, Appendix I- Invasive Non-native Plants").

[2] In addition to protocols for tidal marsh vegetation mapping from aerial and satellite imagery, this site also has protocols for monitoring tidal marsh plants and animals, as well as sedimentation rates. (see www.wrmp.org/documents.html; under "Protocols".

measured in years 1, 5, 10, and 15. A total of 6 plates will be placed on the site before tidal action is restored, but only 3 of those need to be measured regularly; the remaining 3 will be kept in reserve for measuring, in case the predicted deposition fails to produce elevations at which vegetation develops. Initial elevations will be recorded for all plates.

3.0 Reports

The agencies will be notified by email when construction starts and ends, and when levee breaches occur. A start-up (or construction completion) report will be submitted within 45 days after construction stops. As-built plans will be submitted to the Corps, BCDC, and the Water Board within 45-90 days of the completion of construction. The plans will note changes from the final bid set of plans and will be accompanied by notes from the construction manager and monitor.

After construction is completed, biennial technical monitoring reports (every two years) will alternate with less technical memos to assess project success. The biennial technical reports will describe the data collected pursuant to the approved restoration plan and will be submitted in years 2, 4, 6, 8, 10, 12, and 14. Beginning on March 31st after construction is completed for 15 years post-construction. If feasible, the alternating biennial memos will be submitted by March 31st in the alternate years beginning with year 1 and ending with year 13. A final report will be due on March 31st of year 15. The memos and reports should, at a minimum, state whether review of easily accessible satellite photos looked at annually show any large-scale, unplanned, potentially troublesome occurrences such as excessive erosion, sedimentation, or invasions by unwanted plant species. Satellite photos are expected to be free from the website and no quantitative GIS analysis is expected for the annual review.

All reports will evaluate and discuss biotic and abiotic elements of the monitoring program. The monitoring reports will include the Corps, BCDC, and Water Board permit numbers, a list of the names of the persons who conducted the monitoring and prepared the report, a brief description of the restoration project, dates monitoring was conducted, photographs and figures identifying monitoring station locations and photo points. The biennial memos can be brief summaries of the previous year's data and can address problems and make recommendations for the project. Biennial post-construction technical monitoring reports will include monitoring results, analysis of quantitative monitoring data, an evaluation of performance objectives, suggested corrective actions, if appropriate, suggested changes in the monitoring program, and recommendations to guide this and future restoration projects. Results of the water quality sampling will be presented in the 1st year. Qualitative data and a qualitative review of sedimentation, tidal channel evolution, and vegetation colonization will be included in the Year 2 and Year 4 reports. Trend analysis of sedimentation, tidal channel evolution, and vegetation colonization will begin in Year 6, or as soon thereafter as sufficient data are available. Monitoring reports will include details of any adaptive management actions that have been implemented in the preceding year, if applicable. Monitoring reports will be submitted to the Corps, the Water Board, and BCDC.

4.0 Notification of Completion

The Refuge will notify the Corps, BCDC, and the Water Board at the end of the 15-year monitoring period, or when the performance objectives have been met. A site visit to confirm completion status will be scheduled. The hypothesized target of 75% cover of native tidal marsh plant species may not occur for 60 years or longer. If the site does not develop as expected after15 years of monitoring, then the Refuge will attempt to analyze habitat development and

report to the agencies every 5-10 years on the development of the site toward meeting that target. If monitoring commitments detailed above have been met and the site has not reached its expected long-term habitat goals, the Refuge will assess and possibly implement appropriate methods to meet existing goals. The Refuge may also need to revise habitat goals and associated project assessments to reflect changes occurring throughout the Estuary (e.g., declining sediment inputs, sea level rise, evolution of surrounding tidelands) that could limit the ability of the Project to evolve as originally predicted. The determination of whether to implement additional measures to meet existing goals, or to revise habitat goals to reflect regional changes in the estuary will be made in consultation with the technical advisory committee for this project and the restoration community at a forum such as the Napa Sonoma Marshes Restoration Group or the San Francisco Bay Joint Venture which includes scientists, practitioners, and regulators that are directly involved in tidal marsh restoration and monitoring.

5.0 Contingency Measures

Corrective actions, if necessary, will be suggested in biennial monitoring reports for performance objectives that are not being met. The responsible party for implementing and monitoring required contingency measures is the San Pablo Bay NWR, represented by:

Donald Brubaker, Refuge Manager
San Pablo Bay NWR
7715 Lakeville Highway
Petaluma, CA 94954
Don_Brubaker@fws.gov

6.0 Maintenance

The proposed project design minimizes operations and maintenance requirements, particularly because only two water control structures are included. Tidal restoration is self-sustaining and evolves to a dynamic equilibrium state without intervention. The project would require operation and/or maintenance of the following:

- Two water control structures on Pond 1 levee
- Buttress levee – weed control and mowing
- Public access features including the kayak launch, fishing/wildlife observation pier, kiosk and interpretive signs
- Invasive plant control and native plant restoration of the marsh-upland ecotone

The two water control structures and the buttress levee will be inspected for erosion, settlement, excessive burrowing animal activity, and/or presence of deep-rooted woody plants. Routine mowing and maintenance should forestall these problems. Trash receptacles would also require regular maintenance.

7.0 Adaptive Management

The ability to react to changing circumstances is the basis for adaptive management. The adaptive management premise is to address issues as they arise; developing solutions based on contemporary circumstances and available resources. Issues that may require adaptive management include mosquito abatement, invasive species, erosion, flooding, and others. The Refuge will develop solutions to management needs as they arise. The Refuge has developed a

set of restoration targets and triggers for potential management action (Table 2). An evaluation of tidal marsh evolution relative to stated projects targets and triggers will be presented in the biennial monitoring reports.

Mosquito Abatement

As vegetation becomes established on the site potential mosquito habitat may increase. During the time that the site is at or below mean high water it is predicted to drain well, even as vegetation begins to establish. The mature marsh plain has potential to include deep water pools connected by channels. Shrink/swell cracks that develop on mudflats or in vegetation could serve as mosquito breeding habitat. The project would lower the levees adjacent to the Dutchman and South Sloughs to mean higher high water level so that inundation will occur daily. These levees will also be breached at or below the thalwag of the connecting slough in numerous locations to facilitate adequate drainage. Most of Cullinan Ranch will be a deep body of water at high tide each day and will not support mosquito populations for at least 50 years.

Table 1. Cullinan Ranch Monitoring and Reporting Plan: a summary of 15-Year monitoring program parameters, performance standards, targets, protocols, and frequencies. The 15-year monitoring period will begin after construction is completed. In addition to the monitoring elements below, the use of best management practices and site monitoring to ensure that pollutants are not discharged to the Bay or Dutchman or South Sloughs will also be conducted during construction periods. The US FWS can propose changes to the monitoring program depending on its feasibility and cost over the anticipated 60-year evolution of the site.

Parameter	**Performance Standard**	**Target***	**Protocol**	**Frequency**
Field Photo Monitoring	None, purpose is documentation of tidal marsh evolution	Establishment of native tidal marsh plant communities	Establish photo monitoring points for ground images	• 1 yr pre-construction • Post-construction yrs 1, 5, 10, 15
Aerial or Satellite Photo Monitoring	Purpose is documentation of tidal marsh evolution and meeting vegetation performance standards (see below)	Establishment of native tidal marsh plant communities Mudflat and channel development	Obtain aerial images from sources explained in SFEI's** vegetation mapping protocol for aerial/satellite photos, or readily-available, free public source such as Google Maps®	If feasible, review annually through year 15 only for large-scale, unplanned changes to the site (no technical or quantitative review is required for the annual satellite or aerial image review.). If vegetation performance criteria not met after 15 years, then consult Technical Advisory Committee for this project. Thereafter every 5 years until vegetation performance standards are met (if feasible)

Dissolved oxygen (DO)	Outflow of water from the site will not decrease DO concentrations in the receiving waters during any tide cycle to a concentration lower than 5.0 mg/L (Basin Plan water quality objective downstream of Carquinez Bridge) or below the ambient concentration if the ambient concentration is less than 5.0 mg/L. The median DO concentration for any three consecutive months shall not be less than 80 percent of the DO content at saturation.	Maintain water quality in Dutchman and South Sloughs	Grab water sample/data collection using a multi-parameter probe and flow cell (e.g. YSI 6820 or equivalent) at monitoring stations associated with the South Slough breach and one of the three Dutchman Slough breaches, as shown in Figure 1. If feasible, data will be collected more than one foot below the surface during ebbing tide and more than one foot above the bottom.	• 3 days prior to breaching the levees • During the first 24 hours after breaching • 5 days post-breach • Weekly for the first month after breaching • Monthly until water quality performance objectives have been met for three consecutive months.
Salinity	Instantaneous maximum: < 100 ppt Monthly Average < 50 ppt	Maintain water quality in Dutchman and South Sloughs	Same protocol as for dissolved oxygen	See dissolved oxygen
pH	Outflow of water from the site will not cause changes greater than 0.5 units of pH in the receiving waters during any tide cycle. The pH shall not be depressed below 6.5 nor raised above 8.5, or below ambient pH if the ambient pH is less than 6.5, or above the ambient pH if the ambient pH is greater than 8.5	Maintain water quality in Dutchman and South Sloughs	Same protocol as for dissolved oxygen	See dissolved oxygen
Temperature	Outflow of water from the site will not increase temperature by more than 5°F (2.8°C) in the receiving waters during any tide cycle in the wet season, and 10°F in the dry season	Maintain water quality in Dutchman and South Sloughs	Same protocol as for dissolved oxygen	See dissolved oxygen

Turbidity	Outflow of water from the site will not increase turbidity in the receiving waters during any tide cycle by more than 5 NTU if the ambient turbidity is less than 50 NTU, or by more than 10% if the ambient turbidity is greater than 50 NTU (or as close to these targets as practicable given the likelihood of turbidity immediately post-breach and following heavy rainfall events)	Maintain water quality in Dutchman and South Sloughs	Same protocol as for dissolved oxygen	See dissolved oxygen
Methyl mercury	Mercury concentrations in water, sediment, and/or biota tissue samples over time are less than concentrations in samples collected from comparable habitats in the San Pablo Bay watershed. Methyl-mercury can be sampled in sediment or water but biosentinels are preferred.	Maintain water quality in Dutchman and South Sloughs and restored wetland.	Protocol acceptable to RWQCB, e.g. regional biosentinel fish tissue monitoring such as the one developed by UC Davis	If feasible, 1 sample for each habitat type (3-5 samples), annually; otherwise biennially. If funding allows, FWS has proposed 2-3 times per year in years 1, 2, 3, 5, 10, 15. Coordinate with other biosentinel fish or other biosentinel monitoring in the region (e.g., Napa Marsh, Napa Plant Site, South Bay Salt Pond, Bair Island, or Sears Point) to result in meaningful data
Birds	None, purpose is documentation of tidal marsh evolution	Bird use will increase, particularly among diving and dabbling ducks over the shorter term; and among shorebirds, songbirds, and rails over the longer term	Area bird surveys using WRMP wetland bird protocols, regional shorebird surveys (PRBO), winter waterfowl surveys (USFWS)	Years 1-3: four times a year Thereafter four times a year every 5 years (i.e., Years 8 and 13) or until vegetation cover reaches 75%, whichever is sooner

Vegetation	30-80 acres of habitat at marsh plain elevation with 80% cover within 3-10 years	Short-term: minimum of 30 acres of 75% native tidal marsh plant community cover Long-term: native tidal marsh plant communities occupy 75% of the project area (approx. 1,100 ac)	On-going observations (as part of routine site maintenance and control) to detect non-native invasive species; to the extent feasible control highly invasive species on the BAEDN list and RWQCB's Tier 1 list of species to keep out of wetland sites ***; Aerial photography or Google Maps® images and GIS to define extent of vegetation communities and total percent cover; ground-truth to identify dominant species, define communities, assess species richness & composition when vegetation cover reaches 20%; map vegetation when cover exceeds 20%	Biennial or annual observations (not technical surveys) of colonizing species to locate and eradicate invasive non-native species. Priority species to eradicate is up to FWS staff and is likely to include Spartina alterniflora, S.densiflora, Lepedium latifolium and species designated as high priority by Bay Area Early Detection Network. If feasible, mapping and reporting every 2 years after 20% plant cover is attained. Ground observations in conjunction with aerial imagery analysis once 20% plant cover is attained and thereafter every 10 years until plant communities occupy 75% of the project area

Salt Marsh Harvest Mice	None, purpose is documentation of tidal marsh evolution	Site will support and provide habitat for small mammals, including salt marsh harvest mice	Monitor or document the presence or absence of federally listed salt marsh harvest mouse at the project site in accordance with the established USFWS protocols and recovery plan. Salt marsh harvest mouse surveys will be completed 1 yr pre-construction; yr 3 post-construction, or as soon thereafter as vegetation cover reaches 75%; annually thereafter until 3 consecutive yrs of SMHM presence.	As determined by USFWS, see also Table 2.
California Clapper Rail and other Rail Species	None, purpose is documentation of tidal marsh evolution	Site will support rail species, including CA clapper rail and CA black rail, where adjacent source populations exist and adequate amounts of high quality habitat is present	Monitor or document the presence or absence of federally listed California clapper rails at the project site in accordance with the established USFWS protocols and recovery plan. Breeding season surveys will commence once 300 ac of contiguous habitat has developed	As determined by USFWS, see also Table 2 (likely to be passive or play-back method).
Estuarine Fish	None, purpose is documentation of tidal marsh evolution			As determined by USFWS, see also Table 2
Tidal channel evolution	None, purpose is documentation of tidal marsh evolution	Density and size of tidal channels will increase throughout the duration of the monitoring period	Aerial photograph; SFEI's recommended protocol**; or Google Maps® image interpreted with GIS to calculate overall channel density in the drainage basin associated with each breach (sq. ft. channel per sq. ft. of marsh plain). Top width of each breach measured in GIS from aerial images	Years 2, 5, 10, and 15

Sedimentation	None, purpose is documentation of tidal marsh evolution	The site will fill in with enough sediment within 60 years to support native tidal marsh vegetation through most of the site; some deeper areas may persist longer	Deposition resulting in marsh plain accretion to the MHW elevation will be mapped as vegetation germinates and colonizes the site. Sediment plates, pins, erosion tables or LiDAR will be used to monitor deposition. If sediment plates or pins are used, 6 monitoring locations will be established in appropriate areas throughout the site, and the 3 in the lowest areas will be measured. If vegetation establishment or sedimentation rates are below expectations, the remaining 3 locations will be monitored to determine sedimentation rates in those areas	Years 2, 5, 10, and 15

*No penalties for failure to achieve the targets in this column are expected since that would discourage important restoration projects. However, failure to achieve targets should prompt the USFWS to investigate the causes for failure, recommend management measures to protect beneficial uses, and report those recommendations to the resource agencies and the public.

**San Francisco Estuary Institute: http://www..wrmp.org/documents.html; under Protocols, "Tidal Marsh Vegetation Mapping"

http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/stream_and_wetland_protection.shtml under “Fact Sheet for Wetland Projects” (Appendix 1: Invasive Non-Native Plants).

Table 2. Cullinan Ranch Tidal Marsh Restoration: Adaptive Management Strategy.

Category	**Project Purpose**[1, 2]	**Restoration Target**	**Expected Timeframe**	**Monitoring Parameters and Methods**	**Management Threshold for Action**	**Potential Management Action**
Sediments	Sediment accreting at rates along a trajectory sufficient to support tidal marsh plant colonization	Project elevations capable of supporting tidal marsh vegetation over 75% of the project area (approx. 1,100 ac)	60 years[3]	Sedimentation rates, total accumulation, or bathymetry using sedimentation plates, pins, erosion tables or LiDAR; assessments at 2, 5, 10, and 15 yrs and 10-yr intervals thereafter	Projections based on data gathered in the 1st 15 years suggest elevations required for vegetation colonization are not likely to be achieved	Re-evaluate projections/timelines and likelihood of achieving tidal marsh elevation and associated habitat development relative to regional changes in sediment dynamics and sea level rise

Tidal Plant Community Development	• Restore habitat for the recovery of federally- and state-listed special status species • Provide habitat for a broad range of marsh-dependent birds, mammals, fish and other aquatic organisms, and migratory shorebirds and waterfowl	• Development of tidal marsh plant communities (e.g., channel edge, low/middle/upper marsh, pan, marsh-upland ecotone): evolution of native plant composition and structure similar to successful tidal marsh restoration projects of the North Bay or reference tidal marsh sites once appropriate elevations have been achieved • Short-term: 30-80 acres of habitat at marsh plain elevation with 80% cover • Long-term: achieve 75% cover of native tidal marsh plant communities (approx. 1,100 ac)	• 3-10 years (30-80 acres) • 60 years[3]: 75% cover of native tidal marsh plant communities	• Qualitative assessment of pioneering species and dominance prior to attaining 20% cover of tidal marsh plants (biennial for 15 years) • Acres of tidal marsh plant communities: aerial photo interpretation, ground-truthing, and GIS when vegetation cover is ≥ 20% (10-yr intervals) • Ground surveys (annual or biennial) for high priority[4] invasive plant species (e.g., Spartina alterniflora, Lepidium latifolium); priority species and timeframe for monitoring will be adapted through time as conditions change	• Invasive plant colonization and spread by high priority[4] invasive species • Lack of colonization by native halophytes once appropriate elevations have been reached	• Active revegetation from local plant sources • Increased invasive plant management

Salt Marsh Harvest Mice	Restore habitat for the recovery of federally- and state-listed special status species[1]	• Create 30 acres of new SMHM habitat at approximately MHHW in elevation • SMHM colonizes new SMHM habitat from surrounding source populations (e.g., Guadalcanal) • Acres of high quality SMHM habitat increase through time (see 'Tidal Plant Community Development')	3-10 years (30 ac) 10-60 years[3] (habitat acres increase relative to baseline)	• Acres and quality of SMHM habitat developed (See 'Tidal Marsh Plant Community Development' monitoring parameters and methods) • Assessment of SMHM habitat quality based on current literature • Small mammal surveys (Year 3 post-construction and annually until SMHM are present for 3 consecutive years)	• See triggers for 'Tidal Marsh Plant Community Development' • Lack of colonization by SMHM when appropriate habitat is present	• Active revegetation • Increased invasive plant management • Study of adjacent source populations and potential barriers to movement
California Clapper Rail	Restore habitat for the recovery of federally- and state-listed special status species[1]	• Acres of high quality CLRA habitat increases through time (see 'Tidal Plant Community Development') • Populations similar to reference tidal marsh sites of San Pablo Bay	10-60 years[3] (habitat acres increase relative to baseline)	• Acres and quality of CLRA habitat developed (See 'Tidal Marsh Plant Community Development' monitoring parameters and methods) • Assessment of CLRA habitat quality based on current literature (e.g., Tidal marsh recovery plan) • Breeding season surveys when ≥ 300 ac of contiguous habitat develops (e.g., cordgrass)	• See triggers for Tidal Marsh Habitat development • Lack of colonization by CLRA when appropriate amount (e.g., >300 ac) and quality of habitat is present	• Active revegetation • Increased invasive plant management • Study of source populations and potential barriers to movement

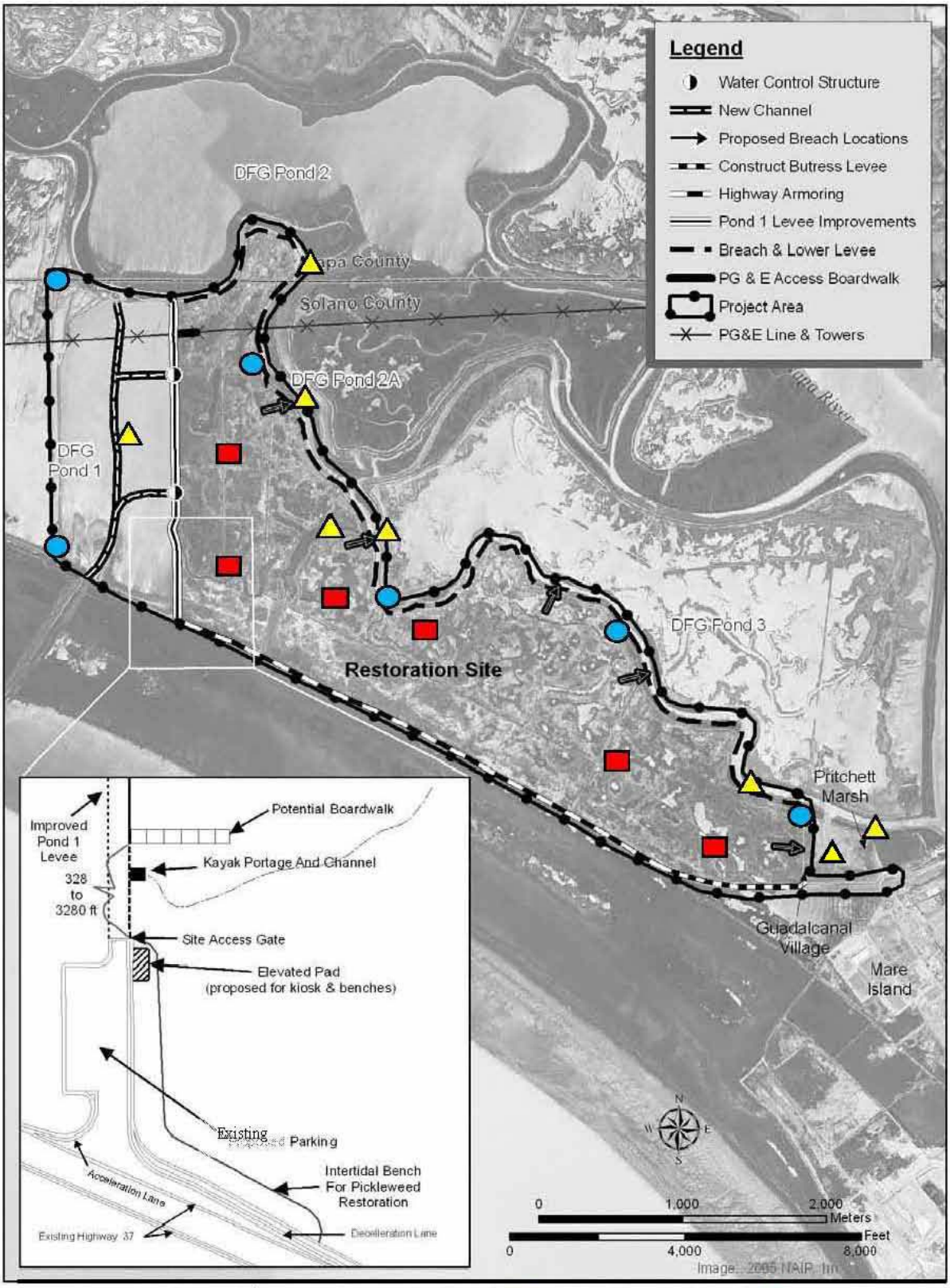
Water Quality	Water quality parameters in receiving waters meet RWQCB performance standards[5] (e.g., DO, pH, turbidity, salinity, etc.).	• Maintain water quality in Dutchman and South Sloughs and the Napa River • Water quality parameters in receiving waters meet RWQCB performance standards (e.g., DO).	< 1year	• Grab water sample/data collection using a multi-parameter probe and flow cell at monitoring stations associated with the South Slough breach and one of the three Dutchman Slough breaches • 3 days prior to breaching, first 24 hours after breaching, 5 days post-breach, weekly for 1st month after breaching, monthly until RWQCB objectives have been met for three consecutive months	Water quality parameters in receiving waters do not meet RWQCB performance standards)	Consider active management (e.g., re-aeration mechanisms to improve DO; decrease residence times; increase flows from Pond 1).)
Mercury	Hg levels in sentinel species of the project area are less than or equal to what is found in existing habitats of San Pablo Bay . Methyl-mercury levels can be monitored in water and sediment instead of biosentinels.	Mercury concentrations over time less than or equal to concentrations in samples collected from comparable habitats of San Pablo Bay		Bio-sentinel fish tissue monitoring	Sentinel species show higher than ambient levels of Hg in the project area relative to comparable habitats of San Pablo Bay	Work collaboratively with regulators and restoration community to determine next steps

[1] U.S. Fish and Wildlife Service and California Department of Fish and Game. 2008. Draft Environmental Impact Statement/Environmental Impact Report Cullinan Ranch Restoration Project Solano and Napa Counties, California. Available at: http://www.fws.gov/cno/refuges/cullinan/1-TOC-ES.pdf. Accessed 21 May 2009.

[2] Ducks Unlimited and Gaia Consulting. 2009. Draft Biological Assessment Cullinan Ranch Restoration Project Napa and Solano Counties. Prepared for USFWS.

[3] Moffat &Nichol Engineers. 2004. Hydrodynamic modeling investigation Cullinan Ranch Restoration Project. In: USFWS and CDFG. 2008.

[4] priority of invasive species based on potential effects to tidal marsh plant community development, effects on endangered species habitat, invasiveness (e.g., rate of spread), high priority species identified by the Bay Area Early Detection Network, and Tier I (and to a lesser extent Tier II) of the Water Board's "Invasive Non-Native Plant Species to Avoid in Wetland Projects in the San Francisco Bay Region.



W = waterquality (N = 8) △ , P = photopoint (N = 6) ●, S = Sediments (N = 6) ■

Figure C-1. Sampling locations for Cullinan Ranch Restoration Project

Environmental Consequence	Mitigation Measure	Components	Implemented By:	Timing			Monitored By:	Verified By:	Date Verified:
				Pre-Const.	Const.	Post-Const.			
Biological Resources									
BIO-3. Implementation of the Preferred Restoration Alternative could result in Temporary Loss of Salt Marsh Harvest Mouse Habitat and Potential Mortality of Individual Salt Marsh Harvest Mice	BIO-3.1:	Remove Salt Marsh Harvest Mice (SMHM) from Project Area: qualified biologists will flush SMHM in advance of construction equipment, in accordance with Biological Opinion. Trapping prior to construction will be used to evaluate populations to develop a monitoring baseline.	USFWS	X	X		US Fish and Wildlife Service (USFWS)		
		Remove Salt Marsh Harvest Mouse Habitat by weed-wacking or using mechanical equipment to remove pickleweed sod and placce on the inside of the lowered levee, place Barrier Fencing to preclude re-entry of SMHM in accordance with the Biological Opinion	Contractor		X		DU		
		Create a Minimum of Approximately 30 acres of new SMHM habitat that includes upland transition habitat along the buttress levee and adjacent to existing populations at Guadalcanal Village, and up to 50 additional acres using suitable imported material, if available and budget allows	Contractor		X		DU		
		Evaluate success of habitat development post-construction in accordance with Mitigation and Monitoring Plan	USFWS			X	USFWS		
	BIO-3.2:	Utilize water control structures in Pond 1 levee to slowly flood-up Cullinan Ranch to encourage a slow emigration of animals from the Site	Contractor		X		USFWS		
		Include language in bid documents and contract directing contractor implementation of relevant components of BIO-3.1 and 3.2	DU	X			DU		
BIO-4. Implementation of the Preferred Restoration Alternative would result in temporary habitat loss and could Disturb California Clapper Rails and Black Rails	BIO-4.1:	Avoid construction within tidal marsh habitat along Dutchman and South Sloughs, or within 700 feet from these areas, between February 1 and July 31 of each year, or perform surveys and proceed in accordance with Biological Opinion.	Contractor		X		DU		
		Include language in bid documents and contract directing contractor avoidance of construction in tidal marsh within restricted dates to implement BIO-4.1	DU	X			DU		
BIO-5. Implementation of the Preferred Restoration Alternative could Disturb San Pablo Song Sparrow and Result in Abandoned Nests and Mortality of Young	BIO-5.1:	In the year prior to breaching, a qualified biologist will remove, or oversee removal, of perferred nesting habitat (i.e. gumplant and coyote bush) from the vicinity of the proposed breaches, extending 50 feet beyond proposed breach locations in each direction	USFWS		X		USFWS		
	BIO-5.2:	A qualified biologist shall conduct pre-construction Surveys Prior to Breaching.	USFWS	X			USFWS		
		If San Pablo Song Sparrows are Present, Construct Breaches Outside of Breeding Season.	USFWS	X			USFWS		
		Include language in bid documents and contract directing contractor cooperation with USFWS implementation of BIO-5.1 and BIO-5.2	DU	X			DU		

Environmental Consequence	Mitigation Measure	Components	Implemented By:	Timing			Monitored By:	Verified By:	Date Verified:
				Pre-Const.	Const.	Post-Const.			
BIO-6. Implementation of the Preferred Restoration Alternative could result in Construction-Related Mortality of Salmonids and Other Special Status Fish	BIO-6.1:	Avoid Construction that Could Affect Tidal Aquatic Habitats when Salmonid species are Known to Occur between January 1 and July 31 of each year	Contractor		X		DU		
		Include language in bid documents and contract directing contractor cooperation with USFWS implementation of BIO-6.1	DU	X			DU		
BIO-10. Implementation of the Preferred Restoration Alternative would result in Permanent Loss of Burrowing Mammal Habitat and Potential Mortality of Individual Mammals	BIO-3.2:	Utilize water control structures in Pond 1 levee to slowly flood-up Cullinan Ranch to encourage a slow emigration of animals from the Site	Contractor		X		DU		
BIO-14. Implementation of the Preferred Restoration Alternative would result in the Potential Spreading of Invasive Non-Native Plants	BIO-14.1	Qualified botanist will conduct non-native plant assessment of areas where grading, earthwork, and other construction activities will occur, and will make recommendations to control spread of non-native species.	USFWS	X			USFWS		
		Include language in bid documents and contract to ensure contractor compliance with equipment cleaning provisions to minimize potential to spread non-native species; and with biologist recommendations to control spread of non-native plant species within the site.	DU		X		DU		
	BIO-14.2	Monitor areas graded or disturbed during construction for Infestations by Invasive Non-Native Plants	USFWS		X		USFWS		
	BIO-14.2	A long-term monitoring plan will be developed, subject to review and approval by USFWS and plan will be implemented.	USFWS		X	X	USFWS		
	BIO-14.2	Early detection and rapid response protocols will be incorporated into the monitoring plan	USFWS		X		USFWS		
Transportation									
TR-2. Implementation of the Preferred Restoration Alternative could diminish Overall Traffic Operations along Highway 372 or its Approaches during Importing Operations.	TR-2.1.	Develop and Implement a Traffic Control Plan in Coordination with California Department of Transportation (Caltrans). If possible, limit truck importing operations to non-peak hours.	DU	X	X		USFWS	Caltrans	
TR-3. Construction of Access Lanes to and from Highway 37 could result in Temporary Traffic Congestion along Highway 37	TR-2.1.	see above.	DU	X	X		USFWS	Caltrans	
		Include language in bid documents and contract directing contractor implementation of TR-2.1, development of a Traffic Control Plan	DU	X			DU		

Environmental Consequence	Mitigation Measure	Components	Implemented By:	Timing			Monitored By:	Verified By:	Date Verified:
				Pre-Const.	Const.	Post-Const.			
Noise									
N-2. Implementation of the Preferred Restoration Alternative could result in Temporary Increases in Noise Levels to more than 65 dBA during Construction Activities	N-2.1.	Conduct Noise Monitoring and Implement Noise Reducing Construction Practices if Needed.	Contractor	X	X		DU		
		Include language in bid documents and contract directing contractor implementation of N-2.1	DU	X			DU		
Air Quality									
AQ-2. Implementation of the Preferred Restoration Alternative would result in Construction-Related Emissions of PM10	AQ-2.1.	Implement Bay Area Air Quality Management District Standards **as necessary** to Control Particulate Matter 10 Emissions during Construction. Water all active construction areas twice daily; cover all trucks hauling soil, sand and other loose material or require all trucks to maintian at least 2 feet of freeboard; apply water 3X daily; or apply nontoxic soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites; sweep parking areas, and staging areas at construction sites with water seepers if visible soil material is carried onto adjacent public streets; hydroseed or apply non-toxic soil stabiliizers to inactive construction areas; enclose, cover, water twice daily, or apply non-toxic soil binders to exposed stockpiles; limit traffic speeds on unpaved roads to 15 mph; indstall sandbags or other erosion control measures to prevent silt runoff to public roadways; replant vegetation in disturbed areas as quickly as possible.	Contractor	X	X		DU		
		Also may further limit PM10 pollutants by using the following measures: install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site; install wind breaks, or plant trees/vegetative wind breaks at windward side(s) of construction areas; suspend excavation and grading activity when winds (instantaneous gusts) exceed 25 mph; limit the area subject to excavation, grading, and other construction activity at any one time	Contractor		X		DU		
		Include dust control requirements in bid documents and contract directing contractor implementation of AQ-2.1	DU	X			DU		

Environmental Consequence	Mitigation Measure	Components	Implemented By:	Timing			Monitored By:	Verified By:	Date Verified:
				Pre-Const.	Const.	Post-Const.			
AQ-3. Implementation of the Preferred Restoration Alternative would result in Minimal Emissions of Ozone Precursors from Construction Activity	AQ-3.1.	Implement BMPs **where feasible** to Ensure Ozone Precursors Emissions are minimized; including the following. Prior to construction contractor shall conduct inventory of all equipment and suitability of add-on emission controls for each piece of equipment will be identified prior to ground breaking. The contractor shall ensure the newest, cleanest equipment available meeting the most stringent of applicable or Federalor State Standards will be used to the extent feasible based on equipment availablility and in accordance with federal regulations. All engines will be maintained and tuned according to manufacturers specifications to perform at EPA certification levels. Periodic, unscheduled inspections will be conducted to limit unnecessary idling and to ensure that construction equipment is properly maintained, tuned, and modified consistent with the established specifications. EPA-registered particulate traps and other appropriate controls will be used where suitable to reduce emissions of diesel particulate matter and other pollutants at the construction site.	Contractor	X	X		DU		
		Include inventory requirements and add-on emmissions control equipment evaluation in contstruciton bid documents and construction contract. Provide for inspections and regular maintenance in contract as well, directing contractor implementation of AQ-3.1	DU	X			DU		
Cultural Resources									
CR-3. Implementation of the Preferred Restoration Alternative could Potentially Effect Subsurface Historic or Archaeological Artifacts	CR-3.1.	If Unanticipated historic or archeological artifacts are encountered during construction,all work within 50 feet of that area or that would affect that area shall stop until an archeological consultant assesses the artifacts. The USFWS will contact their Regional Office Cultural Affairs liaison. If human remains are encountered during construction, a Native American tribal representative and the County Coroner shall be Informed and consulted as required by state law. Subsequent activities in the area will be subject to the findings of the archeological consultant and other required parties.	Contractor	X	X		DU		
		Include provisions in bid documents and construction contract addressing encounters with historic or archeological artifacts and human remains.	DU	X		DU			

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

SELF-MONITORING PROGRAM

FOR

CULLINAN RANCH RESTORATION PROJECT

ORDER No. R2-2010-0108

A. GENERAL

1. Reporting responsibilities of waste dischargers are specified in Sections 13225(a), 13267(b), 13383 and 13387(b) of the California Water Code, and in this Water Board's Resolution No. 73-16.

2. The principal purposes of a monitoring program by a waste discharger, also referred to as self-monitoring program, are: (1) to document compliance with waste discharge requirements and prohibitions established by this Water Board, (2) to facilitate self-policing by the waste discharger in the prevention and abatement of pollution arising from waste discharge.

B. SAMPLING AND ANALYTICAL METHODS

1. Sample collection, storage, and analyses shall be performed according to Code of Federal Regulations Title 40, Section 136 (40 CFR S136), or other methods approved and specified by the Executive Officer of this Water Board.

2. Water and soil analyses shall be performed by a laboratory approved for these analyses by the State Department of Public Health (DPH), or a laboratory waived by the Executive Officer from obtaining a DPH certification for these analyses, or by properly calibrated field equipment when approved by the Executive Officer of this Water Board.

3. The director of the laboratory whose name appears on the certification, or his/her laboratory supervisor who is directly responsible for the analytical work performed shall supervise all analytical work including appropriate quality assurance/quality control procedures in his/her laboratory and shall sign all reports of such work submitted to the Water Board.

4. All monitoring instruments and equipment shall be properly calibrated and maintained to ensure accuracy of measurements.

C. DEFINITION OF TERMS

1. Grab sample is defined as an individual sample collected in a short period of time not exceeding 15 minutes. It is used primarily in determining compliance with daily maximum limits and instantaneous maximum limits. Grab samples represent only the condition that exists at the time the wastewater is collected.

2. Duly authorized representative is one whose:

   a. Authorization is made in writing by a principal executive officer or ranking elected official;

   b. Authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such chief engineer, project manager, or field supervisor.

3. Instantaneous maximum is defined as the highest measurement obtained for the calendar day.

4. Median of an ordered set of values is that value below and above which there is an equal number of values, or which is the arithmetic mean of the two middle levels, if there is no one middle value.

5. Receiving waters refers to any water that actually or potentially receives surface water discharged from the Napa Plant Site Project Area. The receiving waters in this case are the South and Dutchman sloughs, which flow to the Napa River.

6. Construction phase is defined as that period of time when the site is prepared for marsh restoration and includes all activities leading up to the restoration of tidal action.

7. Construction phase activities are defined as all site activities including the movement of soil or sediment, such as placement of dredged material via slurry techniques, excavation of trenches and toe drains, and all other soil handling such as berm and levee construction.

8. Post-construction phase is defined as the period of time beginning when site construction is substantially completed, and tidal action has been restored to the Cullinan Ranch site.

9. Post-construction phase activities are defined as all monitoring, site maintenance, and adaptive management activities which take place after construction is completed and tidal action has been restored to the Cullinan Ranch site.

10. Project boundary shall be defined as the limit of the receiving waters at mean low low water level, which is the topographic contour representing an elevation of 0 ft. NAVD88.

11. Monitoring period for purposes of reporting for water quality shall be defined as that period of time beginning on the day the levees are breached, and ending when the water quality objectives have been met for three consecutive months. Habitat and geomorphic

assessment monitoring period ends 15 years after breaching for each breach. Avian monitoring period ends at 15 years post breach or when vegetation cover reaches 80% or the predominant bird use shifts from shorebirds and waterfowl to resident marsh species, which ever is sooner. After 15 years, if vegetation cover does not reach 75-80% cover, the Discharger will attempt to analyze aerial or satellite photos once every 5 years and assess the extent of habitat development, if feasible, until 75-80% cover is reached or until the Technical Advisory Committee for this project determines that monitoring is not longer warranted.

12. Ambient Water Quality shall be defined as the water quality (salinity, dissolved oxygen, temperature, turbidity, and pH) measured in Dutchman Slough, South Slough, the Napa River, or other appropriate reference site at a point 50 feet upcurrent from the breach in the levee separating the Dutchman Slough from the Napa River.

D. SPECIFICATIONS FOR SAMPLING AND ANALYSES

The Discharger is required to perform sampling and analyses according to the schedule in **Table E-1** in accordance with the following conditions:

1. Pond Water

    a. Grab samples of pond water shall be collected during periods of maximum peak discharge flows, and shall coincide with receiving waters sample days.

    b. If analytical results are received showing any instantaneous maximum limit is exceeded for any organic constituent, a confirmation sample shall be taken within 24 hours and results known within 24 hours of the sampling.

    c. If any instantaneous maximum limit for a constituent is exceeded in the confirmation sample(s), then the discharge shall be restricted to the extent practical, until the cause of the violation can be found and corrected.

    d. For other violations, the discharger shall implement procedures that are acceptable to the Executive Officer on a case by case basis.

2. Receiving Waters

    a. Receiving water sampling shall be conducted on days coincident with pond water of effluent.

    b. In tidally-influenced receiving waters, samples shall be collected at each station on each sampling day during the period within 1 hour following low slack water. Where sampling at lower slack water period is not practical, sampling shall be performed during higher slack water period.

    c. Samples of downstream receiving water shall be collected within the discharge plume and down current of the discharge point so as to be representative, unless otherwise

stipulated.

d. Samples of background receiving water shall be collected upcurrent of the discharge point.

e. If feasible, samples shall be collected within one foot below the surface of the receiving water body and one foot above the channel or pond bottom.

E. DESCRIPTION OF SAMPLING STATIONS

1. A site plan drawing showing the location of all sampling points is included as Figure C-1 in Attachment C. A site plan drawing showing the location of all sampling points shall be submitted with all monitoring reports submitted under this Plan.

2. Receiving water sampling point NR-1shall be established at a point 100-150 feet upstream from the point of discharge into the receiving water, or if access is limited, at the first point upstream which is accessible.

3. Receiving water sampling points NR- 2, 3, 4 shall be established at points 100-150 feet downstream from the respective point of discharge into the receiving water, or if access is limited, at the first point downstream which is accessible.

F. STANDARD OBSERVATIONS

1. Receiving Water

a. Floating and suspended materials of waste origin (to include oil, grease, algae, and other macroscopic particulate matter): presence or absence, source, and size of affected area.

b. Discoloration and turbidity: description of color, source, and size of affected area.

c. Odor: presence or absence, characterization, source, distance of travel, and wind direction.

d. Evidence of beneficial water use: presence of waterfowl or wildlife, fishermen, and other recreational activities in the vicinity of the sampling stations.

e. Hydrographic condition, if relevant:

1) Time and height of corrected high and low tides (corrected to nearest NOAA location for the sampling date and time of sample and collection).

2) Depth of water columns and sampling depths.

f. Weather condition:

1) Air temperature.

2) Wind - direction and estimated velocity.

3) Precipitation - total precipitation during the previous five days and on the day of observation.

2. Pond Water

a. Floating and suspended materials of waste origin (to include oil, grease, algae, and other macroscopic particulate matter): presence or absence, source, and size of affected area.

b. Discoloration and turbidity: description of color, source, and size of affected area.

c. Odor: presence or absence, characterization, source, distance of travel, and wind direction.

d. Evidence of beneficial water use: presence of waterfowl or wildlife, fishermen, and other recreational activities in the vicinity of the sampling stations.

e. Hydrographic condition, if relevant:

1) Time and height of corrected high and low tides (corrected to nearest NOAA location for the sampling date and time of sample and collection).

2) Depth of water columns and sampling depths.

f. Weather condition:

1) Air temperature.

2) Wind - direction and estimated velocity.

3) Precipitation - total precipitation during the previous five days and on the day of observation.

G. REPORTS TO BE FILED WITH THE WATER BOARD

1. **Notifications and Reports:** The Water Board will be notified by email when construction starts and ends and when levee breaching occurs. The following reports will also be required:

(i) a startup (or construction completion) report analyzing the first 30 days of data collected after levees are breached; it should include the same elements stipulated in G. 3. below; and

(ii) an as-built report to note any changes that have occurred from the original design.

The startup report is due no more than 45 days after levees are breached. The as-built report is due between 45-90 days after construction is completed.

2. **Biennial Self-Monitoring Reports**: Written technical reports shall be submitted biennially, with intervening brief memos, if feasible, beginning on March 31st. The biennial memos will begin the first year and the technical reports will begin the second year following the completion of construction activities. The reports and memos will summarize the data collected and analyzed. The Biennial Self-Monitoring Reports (with brief intervening biennial memos, if feasible) should provide, at a minimum, a brief discussion of satellite photos comparisons based on the availability of free, non-technical imagery obtained from the web (such as Google maps). The purpose of looking at the satellite photos is to discover any unplanned, large-scale changes such as erosion, sedimentation, or non-native plant invasions that could have adverse environmental impacts. Biennial reports shall be submitted until Year 15 after construction for each phase, or until vegetation reaches 75%-80%, whichever occurs sooner. If vegetation does not reach that level before Year 15, the Water Board would like, if feasible, biennial memos and a status update every 5 years thereafter based on aerial or satellite photos documenting the types of habitats present on the site until the project goal is determined to be met by a Technical Advisory Committee for the site. The reports shall be comprised of the following: water quality data analysis and geomorphic and habitat assessments over a 15 year period for each phase beginning after each construction phase is completed.

The monitoring elements, schedule, performance criteria, and general protocols are contained in the attached MAMP (Attachment C) for the Project.

a. Letter of Transmittal: A letter transmitting self-monitoring reports should accompany each report. Such a letter shall include identification of changes to the project design, and any unplanned releases or failures that may have occurred since the preparation of the previous self-monitoring report. If unplanned releases are noted, then a discussion of the corrective actions taken or planned, and a time schedule for completion, shall be included.

b. Map or Aerial Photograph: A map or aerial photograph shall accompany the report showing sampling and observation station locations.

c. Results of Analyses and Observations: The report format shall be a format that is acceptable to the Executive Officer.

1) If the Discharger monitors any pollutant more frequently than required by this permit using test procedures approved under 40 CFR Part 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and

reporting of the data submitted in the Self-Monitoring Report.

2) Calculations for all limitations that require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this Order.

3) The report shall also include a table identifying by method number the analytical procedures used for analyses. Any special methods shall be identified and should have prior approval of the Water Board's Executive Officer.

4) Lab results shall be summarized in tabular form, but do not need to be included in the report.

3. **Final Report**: Reporting requirements under this Order will end a) for water quality when the water quality objectives have been met for three consecutive months; b) for habitat and geomorphic assessment the monitoring period ends 15 years after breaching for each unit; c) for avian monitoring period ends at 15 years post breach or when vegetation cover reaches 80% or the predominant bird use shifts from shorebirds and waterfowl to resident marsh species, which ever is sooner. If vegetation does not reach 75-80% in any phase, and the Discharger has the resources to analyze aerial or satellite photos every 5 years, then that analysis should be done until the target is reached, or until a Technical Advisory Committee determines that the site is unlikely to achieve that habitat. The Final Report will be submitted to the Water Board that contains both tabular and graphical summaries of the monitoring data obtained during the Project. In addition, the Final Report shall contain a comprehensive discussion of the compliance record and the corrective actions taken.

4. **Spill Reports**: If any hazardous substance is discharged in or on any waters of the State, or discharged and deposited where it is, or probably will be discharged in or on any waters of the state, the discharger shall report such a discharge to this Water Board, at (510) 622-2300 on weekdays during office hours from 8 a.m. to 5 p.m., and to the Office of Emergency Services at (800) 852-7550 during non-office hours. A written report shall be filed with the Water Board within five (5) working days and shall contain information relative to:

   a. nature of waste or pollutant,
   b. quantity involved,
   c. duration of incident,
   d. cause of spilling,
   e. Spill Prevention, Control, and Countermeasure Plan (SPCC) in effect, if any,
   f. estimated size of affected area,
   g. nature of effects (i.e., fish kill, discoloration of receiving water, etc.),
   h. corrective measures that have been taken or planned, and a schedule of these activities, and
   i. persons/agencies notified.

5. Monitoring reports, and letters transmitting monitoring reports, shall be signed by a principal executive officer or ranking elected official of the Discharger, or by a duly authorized representative of that person. The letter shall contain the following certification:

"I certify under penalty of law that this document and all attachments are prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who managed the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. RECORDS TO BE MAINTAINED

1. Written reports, laboratory analytical reports, maintenance records, and other records shall be maintained by the Discharger and retained for a minimum of five years. This period of retention shall be extended during the course of any unresolved litigation regarding this discharge or when requested by the Water Board or Regional Administrator of the U.S. EPA, Region IX. Such records shall show the following for each sample:

    a. Identity of sampling and observation stations by number.

    b. Date and time of sampling and/or observations.

    c. Method of sampling (See Section C - Definition of Terms).

    d. Complete procedure used, including method of preserving sample and identity and volumes of reagents used. A reference to a specific section of Standard Methods is satisfactory.

    e. Calculations of results.

    f. Results of analyses and/or observations.

I, Bruce H. Wolfe, Executive Officer do hereby certify the foregoing Self-Monitoring Program:

1. Has been developed in accordance with the procedure set forth in the Water Board's Resolution No. 73-16 in order to obtain data and document compliance with waste discharge requirements established in Water Board Order No. R2-2010-xxxx.

2. Was adopted by the Water Board on _____.

3. May be revised by the Executive Officer pursuant to U.S. EPA regulations (40 CFR 122.36); other revisions may be ordered by the Water Board.

_____
Bruce H. Wolfe
Executive Officer

Attachments: Table E-1
Figure C-1 (see Attachment C, the Monitoring and Adaptive Management Plan.)

TABLE E-1 - SCHEDULE FOR SAMPLING, MEASUREMENTS, AND ANALYSIS FOR CULLINAN RANCH						
(Final sampling plan can be altered by US FWS if funding or staff become limited.)						
SAMPLE POINT:		West-South Slough	South Slough Breach	Dutchman Slough Breach	East - Dutchman	East of Guadalcanal
	METHOD					
MATRIX: WATER						
Salinity [1]	multiparameter probe	D/M	D/M	D/M	D/M	D/M
pH [1]	multiparameter probe	D/M	D/M	D/M	D/M	D/M
Temperature [1]	multiparameter probe	D/M	D/M	D/M	D/M	D/M
Turbidity [1]	multiparameter probe	D/M	D/M	D/M	D/M	D/M
Dissolved oxygen [1]	multiparameter probe	D/M	D/M	D/M	D/M	D/M
Methyl mercury[2] if biosentinels are not chosen	EPA 1630 or other appropriate method	A or B			A or B	
MATRIX: Biosentinels		Cullinan Ranch	Pond 1	Pond 3	Pond 2a	Dutchman
Methyl mercury [2]	UC Davis method for biosentinel fish preferred; FGS 045 or other appropriate method for sediment and water; Annual preferred; Biennial acceptable.	If funding allows, 2-3 times/year for Years 1, 2, 3, 5, 10, 15.	If funding allows, 2-3 times/year for Years 1, 2, 3, 5, 10, 15.	If funding allows, 2-3 times/year for Years 1, 2, 3, 5, 10, 15.	If funding allows, 2-3 times/year for Years 1, 2, 3, 5, 10, 15.	If funding allows, 2-3 times/year for Years 1, 2, 3, 5, 10, 15.
BIOTA		Cullinan Ranch	Pond 1	Pond 3	Pond 2a	Dutchman
Fish	net sampling	S-A Years 1-3; Yr 8, 13	--	S-A Years 1-3; Yr 8, 13	S-A Years 1-3; Yr 8, 13	S-A Years 1-3; Yr 8, 13
Birds	area surveys	4XA Years 1-3; Yr 8, 13	4XA Years 1-3; Yr 8, 13	4XA Years 1-3; Yr 8, 13	--	--
Vegetation	1) Observations; 2) Mapping with aerial/satelite photos; 3) field observations	1) A; 2) biennial after 20% to 75%; 3) year n when 20% attained; Yr n+10	--	--	--	--
salt marsh harvest mice	area surveys	1 yr pre-construction; 3 yrs post-construction or when vegetation reaches 75%; annually thereafter until 3 consecutive years SMHM presence	--	--	--	--

California clapper rails and other rails	area surveys	As determined by FWS: breeding surveys will commence once 300 ac of contiguous habitat has developed (likely passive play-back)	--	--	--	--
Geomorphic Evolution						
Tidal Channels	measure breach top width	Yrs 2, 5, 10, 15	--	--	--	--
Sedimentation	a) deposition mapped as vegetation germinates; b) sediment plates, pins, erosion tables, or LIDAR	Yrs 2, 5, 10, 15	--	--	--	--
Field Photo Documentation	area surveys	1+ yr pre-construction (baseline); post-construction Yrs 1, 5, 10, 15				
Habitat Development	Rough comparison of aerial or easily accessible free satellite photos	1 yr pre-construction (baseline); A in yrs 1-15; thereafter every 5 years, if feasible, until 75-80% cover is reached	A in yrs 1-15; thereafter every 5 years, if feasible, until 75-80% cover is reached	A in yrs 1-15; thereafter every 5 years, if feasible, until 75-80% cover is reached	--	A in yrs 1-15; thereafter every 5 years, if feasible, until 75-80% cover is reached
Notes:						
*** This schedule can be changed with Water Board approval. If feasible, baselines should be conducted in cases where data does not exist. Where**						
data does exist, it should be compiled to compare pre- to post- restoration.						
[1] Field test only						
[2] Methyl mercury	Monitoring can include water, sediment, and/or biosentinels. If biosentinels are used, the fish protocol developed					
	by U.C. Davis (Slotton) is preferred, but not required, based on previous sampling. If biosentinels are					
	infeasible, then mercury and methyl-mercury can be sampled in water and sediment.					
	Mercury monitoring is preferred annually, but can be conducted biennially.					
A	Once per year					
B	Biennial (every 2 years) at a minimum; annually if feasible.					
D/M	Once within 3 days prior to breach; during the first and fifth day following breach; weekly during the first month;					
	monthly thereafter until performance objective met for 3 months					
FGS	Frontier Geosciences (or other approriate method)					
US FWS	U.S. Fish and Wildlife Service					
S-A	twice per year (semi-annual)					
4XA	four times annually					
yrs	years					

Inside Guadalcanal	Inside Cullinan	Inside Pond 1
D/M	D/M	D/M
D/M	D/M	D/M
D/M	D/M	D/M
D/M	D/M	D/M
D/M	D/M	D/M
	A or B	