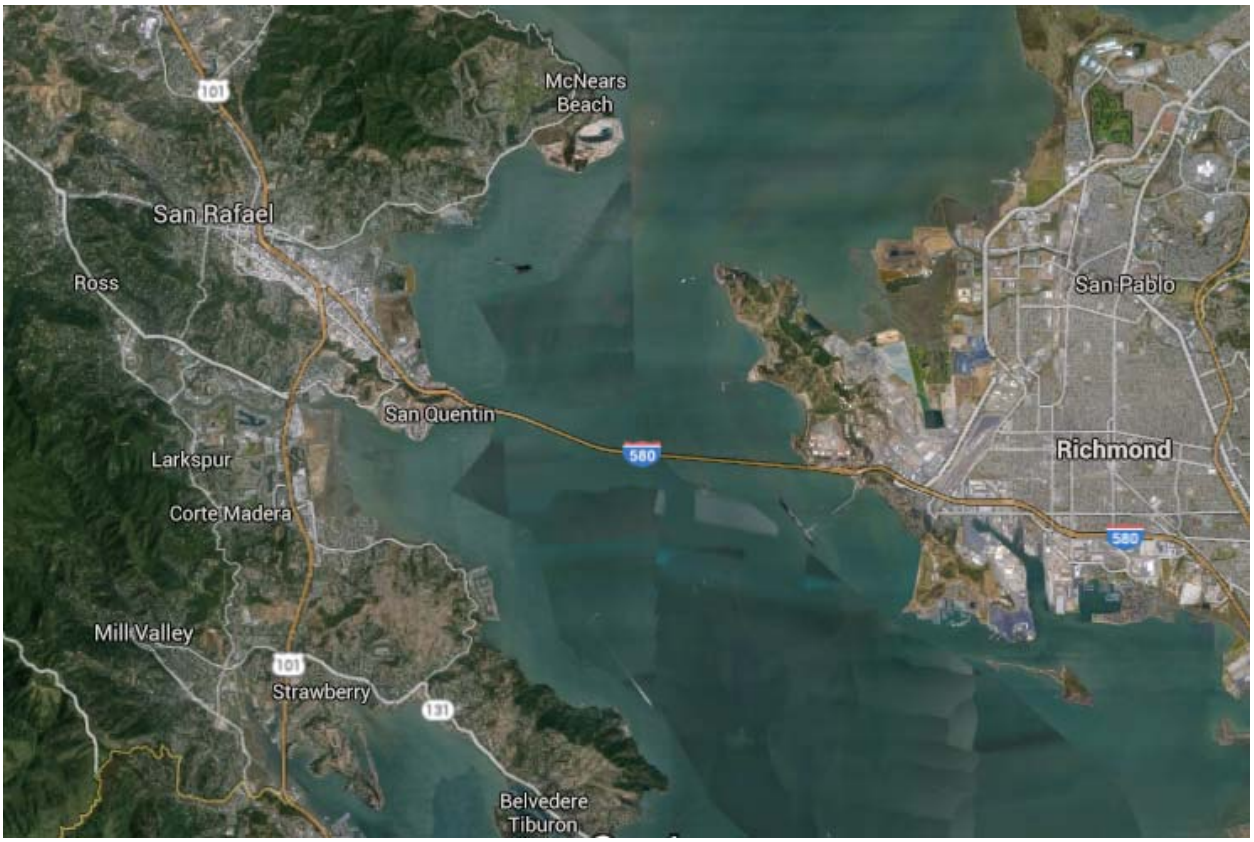
San Francisco Bay Creosote Removal and Pacific Herring Habitat Restoration Project

Draft Mitigation, Monitoring, and Reporting Program



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Acronyms and Abbreviations

BCDC	Bay Conservation and Development Commission
BMP	best management practice
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
EFH	Essential Fish Habitat
ELVS	Ecological Limits, Viability, and Sustainability
ESA	Federal Endangered Species Act
°F	degrees Fahrenheit
FMP	Fisheries Management Plan
GIS	geographic information systems
HAPC	Habitat Area of Particular Concern
MHHW	mean higher high water
MHW	mean high water
MLLW	mean lower low water
MLW	mean low water
MSA	Magnuson Stevens Fishery Conservation and Management Act
MSL	mean sea level
kPA	kilopascal
ND	Negative Declaration
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWFW	National Fish and Wildlife Foundation
PAH	polycyclic aromatic hydrocarbon
PJD	Preliminary Jurisdictional Determination
ppt	parts per thousand
Project	San Francisco Bay Creosote Removal and Herring Habitat Restoration Project
RWQCB	San Francisco Bay Regional Water Quality Control Board
SFEI	San Francisco Estuary Institute
SFEP	San Francisco Estuary Partnership
SPCC	Spill Prevention Control and Countermeasure
SCC	California State Coastal Conservancy
Subtidal Goals Report	San Francisco Bay Subtidal Habitat Goals Report

This document is the Mitigation, Monitoring, and Reporting Program (MMRP) for the San Francisco Bay Creosote Removal and Herring Habitat Restoration Project (project). Following an overview of the project itself, it presents the required environmental protection measures as well as the monitoring and reporting processes. In its present form, the MMRP is a draft because neither the California Environmental Quality Act (CEQA) document nor the various permits and other regulatory agreements have been finalized. The contents of this draft plan will be revised based on the contents of those completed regulatory processes.

Chapter 1 Introduction

A large percentage of San Francisco Bay shorelines have been stabilized or developed through the use of hardened structures, such as creosote-treated piles, which were historically used to support piers, wharfs, bridges, and navigational aids. Many of these wooden piles were injected with creosote, a substance used from the mid-1800s into the 1950s to preserve wooden marine structures from decay. Creosote is an oily product distilled from crude coal tar and contains hundreds of chemical compounds. The primary constituents of creosote are polycyclic aromatic hydrocarbons (PAHs) and alkylated PAHs, many of which are identified as toxic to organisms that come into direct, extended contact with creosote-treated piles. Such harmful levels of contact may occur if organisms feed on prey species inhabiting the surface of the piles or if organisms lay eggs directly on piles, and creosote-treated wood has been shown to negatively impact the early life stages of Pacific herring (*Clupea pallasi*).

The California State Coastal Conservancy (SCC) has a successful history of working with multiple stakeholders to acquire, restore, enhance, and manage subtidal and tidal wetland habitat in San Francisco Bay. The SCC acquired a grant from the National Fish and Wildlife Foundation (NFWF) to support a creosote-treated pile removal and Pacific herring restoration pilot project in the San Francisco Bay. This project is a collaborative effort involving the SCC, the San Francisco Bay Conservation and Development Commission (BCDC), the National Oceanic and Atmospheric Administration (NOAA), and the San Francisco Estuary Partnership (SFEP).

The proposed project is considered to be a pilot project which will be undertaken to further the objectives of or to achieve consistency with requirements of many environmental laws and regulations. The proposed project would increase the overall ecological health of portions of San Francisco Bay by removing derelict creosote-treated piles and collapsed decking (Phase 1) in combination with a living shoreline restoration design that will use natural bioengineering techniques (such as eelgrass (*Zostera marina*) plantings and reef structures for native Olympia oysters (*Ostrea lurida*)) to enhance habitat and prevent shoreline erosion (Phase 2). Creating or expanding eelgrass beds would provide substrate for Pacific herring and other organisms to attach their eggs to and food resources for commercially important species such as groundfish and salmon (*Oncorhynchus* spp.).

The project in total would:

Phase 1

- Remove several hundred individual piles that are expected to consist of more than 180 tons of creosote-treated wood;
- Remove several thousand square feet of collapsed concrete decking and other types of marine debris; and

Phase 2

- Establish at least 1 acre of beneficial habitat enhancements including eelgrass, rockweed, and reef structures for oysters and other species.

The project would take place at the Red Rock Warehouse site on Point San Pablo in the City of Richmond (Contra Costa County). There are approximately 350 creosote-treated piles and a small amount of collapsing creosote-treated decking that is likely to eventually drop into the Bay.

Both phases of the project would require surveys prior to construction, biological monitoring during construction, and monitor reef structures for 5 years to ensure placement of reef structures meet the adopted success criteria.

1.1 Project Goal

The goal of the San Francisco Bay Creosote Removal and Pacific Herring Habitat Restoration Project is to remove artificial structures and creosote-treated piles at targeted sites in combination with a living shoreline restoration design that will use natural bioengineering techniques (including native oyster reefs, eelgrass plantings, and rockweed (*Fucus gardneri*) enhancements) to improve habitat for spawning herring and provide protection from shoreline erosion.

Once the living shoreline restoration is installed; the reef structures elements, eelgrass plantings, and rockweed relocation would allow for a more diverse benthic habitat and will support the colonization of native oysters and organisms associated with eelgrass beds. The overall ecological health and habitat complexity within the project area will be improved by removing creosote-treated wood pilings and providing additional habitat enhancements that benefit herring, salmon, native oysters, and other species. In addition, the project would likely increase the ecological functioning of adjacent marshes and fish and wildlife resources by providing additional habitat for marine organisms and sources of food for shorebirds or other natural predators.

Fabricated reef structures would not only provide a secondary spawning substrate for herring but would also provide the necessary hard substrate for native Olympia oyster settlement and growth and other species, and help trap and stabilize sediments in the areas formerly occupied by creosote-treated pilings. Such structured habitat provides important refugia and foraging areas for Pacific groundfish. Extending the range of rockweed in the intertidal zone would further provide an additional spawning substrate for herring and further enhance the overall habitat complexity and diversity at the restoration site. Further, the establishment of oyster and eelgrass beds may help to improve water quality by acting as a natural filter and/or sink for water contaminants.

The project will likely increase the fertility of adjacent marshes and fish and wildlife resources by providing additional habitat for marine organisms and sources of food for shorebirds or other natural predators. The increase in biological diversity at the project site will improve the natural appearance of the shorelines both above and below the waterline. The overall increase in biological diversity and activity will provide public benefit through the enjoyment of natural shoreline appearance and wildlife viewing.

The proposed project development process would fall into the following activities relevant to this MMRP (pre-construction, construction, and post-construction) and directly related to these activities are implementation mechanisms and incorporation of mitigation and avoidance and minimization measures into project design and construction contracts.

1.2 Purpose of the Mitigation Monitoring and Reporting Program

The purpose of this MMRP is to establish procedures to manage and track compliance with design specifications and regulatory requirements to avoid and minimize adverse environmental impacts including harm of or disturbance to special-status species, aquatic and terrestrial habitats, water quality, and so on.

The objectives of this monitoring and mitigation plan are to:

- Establish parameters to monitor site locations for the disturbance of species, habitats and water quality during the proposed activity as described in the project description.
- Avoid injury to fish through visual monitoring of identified zones of influence and provide ancillary observations of aquatic species in adjacent to work areas.
- Conduct field operations to obtain data as follows:
    - Make daily observations and record presence or absence of species observed;
    - Establish/confirm threshold distances delineated in pertinent permit conditions;
    - Record behavioral and/or injury observations;
    - Record functionality of equipment being used during project activities; and
    - Quantify and record progress of the proposed project in order to identify whether pre-established success criteria are being met.

1.3 Regulatory Requirements

Joint Aquatic Resource Permit Application

The SCC has streamlined the permitting process by preparing a Joint Aquatic Resource Permit Application (JARPA) for this proposed project and submitted to other agencies that will have permitting approval or review authority over portions of the project. These agencies and permits are listed below:

- U.S. Army Corps of Engineers (USACE) – Section 404 of the Clean Water Act and Section 10 of the River and Harbors Act. Because the project will get its National Environmental Policy Act (NEPA) clearance through the Section 404 permit process, the USACE is also the federal lead agency for NEPA and for consultation with federal agencies.
- National Marine Fisheries Service (NMFS) – Section 7 of the Endangered Species Act (ESA)
- California Department of Fish and Wildlife (CDFW) – Scientific Collection Permit
- Regional Water Quality Control Board (RWQCB) – Section 401 of the Clean Water Act
- California State Lands Commission – Letter of Non Objection or Lease
- San Francisco Bay Conservation and Development Commission (BCDC) – Minor Permit

The JARPA provides a delineation of jurisdictional waters of the United States at the project site in Contra Costa County, California. The objective of the delineation was to locate, delineate, and map the portions of the project that qualify as wetlands and/or non-wetland waters of the U.S., under federal jurisdiction, pursuant to Section 404 of the CWA, and to request a Preliminary Jurisdictional Determination (PJD) per Regulatory Guidance Letter No. 08-02 (June 26, 2008). The USACE provided a PJD on January 27, 2016.

To comply with the ESA, the SCC and the USACE have consulted with NMFS about effects on ESA-listed anadromous fish species. The USACE determined that the project may affect but is not likely to adversely affect those species and has requested concurrence with that decision.

The remaining permits and other regulatory agreements requested under the JARPA are still pending.

Essential Fish Habitat

The Magnuson-Stevens Fisheries Conservation and Management Act (MSA) designates Essential Fish Habitat (EFH) for commercial fisheries in U.S. waters. The project footprint contains EFH under three different Fisheries Management Plans (FMPs): the Pacific Coast Salmon FMP, Coastal Pelagic Species FMP, and Pacific Groundfish FMP. It also provides suitable foraging and migration habitat for commercially important fish species.

To comply with the EFH, the SCC and the USACE have consulted with the National Marine Fisheries Service (NMFS) for EFH managed under these three FMPs. The USACE determined that the project would not have substantial adverse impacts on EFH and has requested concurrence with that decision.

California Environmental Quality Act

The primary purpose of CEQA document is to present decision makers and the public with the environmental consequences of implementing the project. Information contained in the CEQA document is used to determine whether the proposed project would have significant environmental impacts. An Initial Study (IS) was prepared and circulated to the public and various agencies. Following public and agency comment, the document was revised, finalized, and certified by the SCC in March of 2016. In accordance with State CEQA Guidelines Section 15070: the SCC determined that there would be no significant environmental impacts after mitigation. Therefore, the SCC adopted a Mitigated Negative Declaration (MND) that would enable moving forward with the project. This IS and the MND conform to these requirements and to the content requirements of Section 15071 of the State CEQA Guidelines.

Best management practices and avoidance and minimization measures will be implemented at the project site following the regulatory requirements from all permits. The sedimentation and erosion control measures provided will also be applied at the upland staging area(s) at the Red Rock Warehouse site, and will apply to any materials stored on barges at either site.

1.4 Project Location and Ownership

The Red Rock Warehouse site is located within the Central / San Pablo Bay portion of San Francisco Bay (Figure 1), as described in detail below. It is on the northeastern tip of Point San Pablo in the City of Richmond. This site is in Contra Costa County, and the coordinates of the central point of the site are 37.965507, -122.426429. The City of Richmond itself owns the terrestrial and aquatic portions of the site, which spans two main assessor's parcels.

At this site, there are approximately 350 creosote-treated piles and a small amount of collapsing creosote-treated decking that is likely to eventually drop into the Bay (Figure 2). Large slabs of concrete decking are also present at the site, some of which may be removed during construction. Red Rock Warehouse contains no known piles made of or wrapped in concrete or steel. Other debris near the site includes a large steel lattice structure in the center of the warehouse site, a submerged vessel hull at the northeastern margin of the pile field, and large portions (approximately 10,000 square feet) of the original concrete decking.

There are additional parcels onshore at Point San Pablo, also owned by the city, some of which may be used as staging areas. These staging areas are all on paved or hard-packed dirt areas that have been used by the landowner and its tenants for similar short- and medium-term stockpiling of similar construction materials. No environmental impacts from use of these staging/stockpiling areas are anticipated, and they are not included in the project footprint areas below. However, many of the environmental protection measures described below are about the on-land activities (e.g., storm water management, vegetation clearing for construction access, preconstruction surveys, etc.) that would be conducted at or from the staging areas. These are described below.

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Figure 1. Project Location

INSERT FIGURE 1 HERE (from the project description document)

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Figure 2. Detailed Project Location

INSERT FIGURE 2 HERE (from the project description document)

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1.5 Dates and Duration of Construction

The construction schedule for this project is subject to regulatory constraints, seasonal weather conditions, and the intent to avoid potential impacts to special-status species by avoiding certain seasonal migrations. The project is scheduled in two phases to avoid or reduce environmental impacts, as discussed below.

In principal, pile removal activities could be conducted from June 1 to November 30 when migrating salmonids are not present in the bay. This work window would also avoid the herring spawning season and the periods of eelgrass inflorescence. However, the in-water portions of the pile and debris removal phase of this project is scheduled to take place in September-October of 2016 – to fit within the NMFS work windows for projects that involve dredging within San Francisco Bay. Even though this project involves no dredging, that general work window does minimize the potential for adverse impacts on marine or estuarine species in the bay.

Following that project construction phase, the placement of the reef structures and the transplanting of eelgrass and rockweed would occur the following spring and early summer, in April-June of 2017. During those months, the eelgrass and rockweed would be inflorescence and most obvious for the harvesting of transplant material. Other steps in the construction (e.g., mobilization and demobilization) would start earlier and end later than these listed dates.

Within that general framework, tides and day-to-day winds and weather conditions are an inevitable source of variability and possible changes to this planned project implementation schedule. The approximate schedules for each of the two project phases are presented in **Table 1** and **Table 2**. Note that the pile removal schedule is based on the construction contractor(s) being able to remove 50 piles per day at each site, which is an assumption based on experience from a number of contractors in similar projects in the Bay in recent years. Similarly, the restoration phase of the project is based on assumptions that 10 reef structures could be placed each day at each site and that one acre of eelgrass transplants could be conducted in a 5-day work week.

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Table 1. Estimated Construction Schedule for Pile Removal Activities

Item	Description	Aug 2016		Sep 2016		Oct 2016		Nov 2016	
1	Submittals								
2	Mobilization								
3	Demo Remaining Wharf Decking								
4	Demo Pilings*								
5	Remove Bay Floor Debris								
6	Site Restoration								
7	Demobilization								

*Assumes Contractor can pull 50 piles a day.

Table 2. Estimated Construction Schedule for Restoration Activities

Item	Description	Feb. 2017		Mar. 2017		Apr. 2017		May 2017		Jun. 2017		Jul. 2017	
1	Submittals												
2	Mobilization												
3	Fabricate Reef Structures												
4	Place Reef Structures												
5	Eelgrass Harvest and Transplant												
6	Rockweed Collection and Relocation												
7	Site Restoration												
8	Demobilization												

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Chapter 2 Responsibilities, Qualifications, and Coordination

2.1 Responsibilities

The SCC will issue a grant to a non-profit organization that will lead the process and issue the construction contract to the actual Construction Contractor. This entity or their representative, referred to as the "Contract Owner or its representative", shall be responsible for ensuring that all permitting requirements, including applicable avoidance, minimization, and mitigation measures, are appropriately implemented.

The Contract Owner will supply a qualified biological monitor (Biological Monitor) to assist ensure such conditions are met. The qualifications of the Biological Monitor shall be supplied to CDFW, USFWS, and NMFS for approval prior to the start of work. The Contract Owner or its representative and Biological Monitors and will be responsible for the timely review and reporting of monitoring data to pertinent regulatory agencies. Implementation of this monitoring program will involve close coordination among contractors, monitors, and regulatory agencies. The Contract Owner's representative and Biological Monitor will have the authority to stop or delay any construction activity, if deemed necessary.

The Contract Owner or its representative may also supply other specialists, such as engineers, as needed to provide guidance to the Construction Contractor and inspections of work material and products.

2.2 Coordination

Prior to the start of any activity for each phase, a coordination meeting will be held between the construction supervisors and crews, the monitoring team, and Contract Owner. The purpose of the briefing will be to establish responsibilities, discuss safety issues, define the chains of command, discuss communication procedures, and review operational procedures. New personnel will be briefed before they join the work in progress.

The Contract Owner or its representative and the Construction Contractor will coordinate with resource agencies as required by the project permits (Attachments A through F), and will be available for agency site visits if needed.

All monitoring personnel will be provided a copy of this monitoring plan and pertinent permits. Monitoring personnel must read and understand the contents of this plan—as well as all the pertinent permits—as they relate to coordination, communication, and identification and reporting of observations required.

2.3 Qualifications

To be considered qualified to monitor, survey, and record observations regarding the project, Biological Monitors must meet the following criteria in order to be approved by responsible agencies:

- Visual acuity in both eyes (correction is permissible) sufficient for discernment of moving targets at the water's surface, with ability to estimate target size and distance; use of binoculars may be necessary to identify species and any changes in the habitat from construction activities.
- Experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience).
- Experience or training in the identification of listed species and behaviors.

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- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations.
- Writing skills sufficient to prepare a report of observations, including species observed within the exclusion and behavioral disturbance zones.
- Ability to communicate orally, by radio, and in person with project personnel to provide real-time information on observations in the area, as necessary.

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Chapter 3 Monitoring Protocols

This chapter will discuss the protocols and procedures that will be used to perform all required preconstruction surveys and construction monitoring during both phases of the project – pile removal and restoration treatment.

3.1 Project Footprint and Monitoring Areas

The total project footprint area is 4.18 acres for the Red Rock Warehouse site. Of that total, 3.89 acres are in the bay, and the rest is on-land (**Figure 3**). Note that these acreages include not only the existing or proposed features (such as piles or reef structures for oysters), but the areas between individual piles or restoration treatments and a buffer distance around them. The project work footprints have been drawn to exclude known cultural resources. There are known submerged vessels at the site. The contractor will use the mapped locations of these vessels in the project design plans to mark the extent of sunken vessels with buoys and avoid causing them damage.

There are suitable locations for staging and for stockpiling and drying removed piles immediately landward (south) of the Red Rock Warehouse Site. The exact location of the staging area will be determined in collaboration with the City of Richmond as the project proceeds through final design stages. The total footprint of the potential staging areas is 1.23 acres. All of these staging areas are either paved or are hard-packed dirt. The most likely staging area is the large one immediately to the southeast of the project footprint, where the "beach access" callout is shown on the map in **Figure 3.**

The on-land portion of project activities at the Red Rock Warehouse site may include clearing and grubbing a small amount of vegetation (less than 0.25 acre) to allow construction equipment access from the existing roadway to the beach and revetted areas along the shore there. The existing vegetation is a mix of native (e.g., coyote brush, *Baccharis pilularis*) and invasive ruderal species (e.g., fennel, *Foeniculum vulgare*; black mustard, *Brassica nigra*). The vegetation on that access route that would be cleared from the staging is almost entirely fennel plant. No actual trees will be removed. All areas on which vegetation was removed would be replanted with native plants following project activities.

The primary source of disturbance during construction will be pile removal and restoration actions within the waters of San Francisco Bay. Monitoring will occur prior to pile removal activities and restoration actions in order establish baseline conditions, during pile removal and restoration actions, and to post restoration monitoring of the restoration treatments.

3.2 Preconstruction Surveys and Protective Measure Implementation

Preconstruction surveys will be conducted by a biologist approved by USFWS and/or CDFW for such surveys to establish baseline conditions during various tides and to verify that no special-status plant species will be disturbed. The information collected from these surveys will be used as baseline condition for comparison with results of monitoring during project activities. The preconstruction surveys will also enable compliance with the avoidance and minimization measures for terrestrial and avian species. Activities prior to construction include vegetation clearing to help the construction contractor select the precise beach access path from the roadway that will minimize impacts to vegetation and habitat.

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Figure 3. Red Rock Warehouse Site Bathymetry, Structures, and Substrate
(Figure 17 of the MND)

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Nesting Bird Surveys

A qualified biologist will conduct a nesting bird survey 14 days prior to the start of demolition. In the event that an active nest (including osprey (*Pandion haliaetus*) nests, which are known to nest on Point San Pablo) is found in the project vicinity, the Contract Owner or its representative (in consultation with the CDFW and USFWS to prevent disturbance or destruction of the nest) will direct Contractor to establish the appropriate no-work buffers. If the nest(s) cannot be avoided, they will be relocated according to measures approved for MBTA-protected species. There are USFWS- and CDFW-approved protocols for relocation of unoccupied nests between nesting seasons.

The nesting bird surveys would also verify that no least terns are in the immediate vicinity. The biological monitoring during construction would be sufficient to ensure that the construction contractors follow the approved route and to notice if an individual of this species enters the project's work area. In that case, the monitor would stop work as needed to protect individuals of the species.

Baseline Turbidity Monitoring

No more than a week before each phase will commence, baseline monitoring of turbidity will be conducted at representative eelgrass beds in the vicinity of the project footprints. Only healthy eelgrass beds in a depth range similar to that of the project footprint will be utilized for establishing this baseline. It may be necessary to re-establish a baseline as the seasonal change in light availability progresses over the construction period.

Demarcation of Eelgrass Beds

No more than a month before work for each phase will commence, eelgrass beds will be surveyed and the boundary between the eelgrass beds and work areas will be marked with temporary buoys or flagged PVC poles. Work activities within the perimeter marked by the buoys are prohibited unless necessary to complete pile removal activities.

3.3 Worker Training

Before any construction occurs, the contractor's field staff will attend a mandatory environmental-education program for construction personnel, designed and conducted in the field by the Contract Owner or its representative and the Biological Monitor. The training is to cover all of the special-status species that could potentially occur on-site (e.g., marine mammals, osprey, green sturgeon, longfin smelt, Chinook salmon, and steelhead). That program will include:

- A description, representative photographs, and the legal status of each of species,
- The restrictions and guidelines that must be followed by all construction personnel to avoid or reduce effects on special-status species during project implementation,
- Cultural or archaeological resources that may be uncovered on-site and what to do in the event any such resources are found,
- Terms and conditions of the permits, and
- The penalties for not complying with biological conservation measures.

All construction workers of the contractor or its subcontractors will be required to receive the training, and when new workers are added to the crew, they will receive the training before being allowed to work on-site. The training will be up to 1 hour in duration and held at the meeting room in the Contract Owner's or Construction Contractor's facilities. After each training session is administered, the contractor will submit the sign-in sheets showing which employees and subcontractor employees received the training, when the training was conducted and who conducted the training. Construction workers identified onsite as not having had the training can be removed from the worksite.

3.4 Construction Best Management Practices

This section describes the avoidance and minimization measures that the contractor will utilize during both phases of construction to minimize environmental effects of the project, such as best management practices (BMPs), erosion and sedimentation control, and spill prevention practices. Optionally, silt curtains may be used, if needed to prevent turbidity generated during demolition activities from impacting nearby eelgrass beds.

A Spill Prevention Control and Countermeasure (SPCC) plan will be prepared to address the emergency cleanup of any hazardous material and will be available on site. The SPCC plan will incorporate SPCC, hazardous waste, stormwater and other emergency planning requirements.

Precast concrete items will be allowed to fully cure before placement in San Francisco Bay. Construction waste will be collected and transported to an authorized upland disposal area, as appropriate, and per federal, state, and local laws and regulations.

Minimization of Disturbance (Section 02220 of Attachment G)

The following basic construction measures shall be implemented by the Contractor to minimize the disturbance of sensitive species during the demolition operations:

- The Project disturbance area shall be limited to the minimum required to complete the Project.
- Vessel traffic and movements shall be minimized to reduce potential physical displacement or injury of fish.

Erosion and Sedimentation Control Measures (Section 02270 of Attachment G)

- Implement BMP measures prior to clearing or grading the site.
- Protect stockpiled areas prior to forecast storm events using polyethylene covers and/or other appropriate cover systems.
- Protect disturbed areas prior to forecast storm events using geotextile blankets, straw rolls, and/or other appropriate blanket systems.
- Protect disturbed areas from overland sheet flow from adjacent areas prior to forecasted storm events using curbs, swales, dikes, berms, inlets, drains, and/or other appropriate stormwater diversion systems.
- Trap any loose sediment from disturbed areas before discharging any stormwater using silt fences, filter fabric, straw rolls, and/or other appropriate sediment trapping systems.
- Dissipate the velocity of the discharged stormwater to prevent erosion using rock, grouted rip rap, rubble, and/or other appropriate stormwater velocity dissipation systems.
- Confine construction materials that have the potential to contribute pollutants to storage and handling areas shown on the vicinity map. Provide adequate cover from the rain and wind to these storage areas using polyethylene covers and/or other appropriate cover systems. Contain areas where liquids are stored and handled using geomembranes, sandbags, berms, dikes, and/or other liquid containment systems.
- Confine garbage to the storage and handling areas shown on the vicinity map. Provide adequate shelter from the rain and wind using containers.
- Protect municipal storm sewer systems shown on the vicinity map from discharge of pollutants and sediment from the construction site using sandbags dams fitted with filter fabric, oil absorbent sock filters, and/or other appropriate oil and sediment filtering systems.
- Stabilize inactive disturbed areas as soon as feasible after the cessation of construction activities.
- Preserve existing vegetation to the extent feasible to minimize surface area of exposed soil.

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- Preserve condition of haul routes and access roads from tracked sediment using vehicle tire washers, street sweepers, and/or other appropriate sediment tracking control systems.
- Immediately notify the City Representative of any situation requiring additional erosion control devices to prevent soil erosion or sedimentation into any area beyond the project limits.
- Immediately repair, restore, and/or replace any low performing BMP identified in the high wind and rain storm reports. Immediately implement additional BMP in construction areas with insufficient BMP as identified in the high wind and rain storm reports. Repair, restore, and/or replace any deficiencies noted in scheduled inspections prior to forecast storm events.
- Inspect straw rolls after significant storms. Ensure straw rolls are in contact with the soil. Replace straw rolls after 1 year or sooner if required.
- Seed and protect any areas that remain unworked for more than 30 days.
- At no time shall the Contractor apply fertilizers, pesticides, or herbicides other than those specified to any of the planted or hydro seeded areas unless directed by the City Representative.
- Operate and maintain storm and surface water facilities as follows:
    - Remove sediment from behind silt fences and straw rolls to prevent overtopping.
    - Prevent sediments from being flushed to the downstream system during cleaning.
    - Sediment, trash, and debris shall be removed from catch basin grate surfaces when blocking more than 20 percent of the grate surface.
    - Sediment, trash, and debris shall be removed from catch basin interiors when debris exceeds 1/3 of the depth from bottom to pipe invert.
    - Sediment, trash, and debris shall be removed from rock dams, ponds, and traps when more than 1 foot of sediment has accumulated.
- During dry weather conditions, take preventative measures to minimize the wind transport of soil. Use water sprinkling, temporary enclosures, and other methods to minimize dust and dirt migration.

Clean-up and Disposal (Section 02270 of Attachment G)

- All work areas shall be kept clean, neat and orderly at all times.
- Remove all stockpiles from the site upon completion of the work.
- Remove all temporary erosion and sediment control devices from the site upon completion of the work.
- Upon completion of work, remove rubbish, trash, debris resulting from operation. Remove unused equipment and implements of service; leave worksite in neat, acceptable condition as to meet approval of the City Representative.

Hazardous Materials (Section 01140 of Attachment G)

Contractor-generated hazardous wastes shall be removed on a daily basis to the extent possible. If waste is stored onsite, the contractor will take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. Hazardous waste will be stored, transported and disposed of in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials must be immediately reported to the Owner.

Storage, fueling and lubrication of equipment, boats, barges and motor vehicles must be conducted in a manner that affords the maximum protection against spill and evaporation. Manage and store fuel, lubricants and oil in accordance with all Federal, State, Regional, and local laws and regulations. Storage of fuel on the project site is not allowed. Fuel must be brought to the project site as needed.

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Contractor shall clean all previously used construction equipment prior to bringing it onto the lands and waters of the project site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, invasive species and invasive plant seeds. Consult with the USDA jurisdictional office for additional cleaning requirements.

Well-maintained equipment will be used to perform the work and, except in the case of a failure or breakdown, equipment maintenance will be performed off site. Equipment will be inspected daily by the operator for leaks or spills. If leaks or spills are encountered, the source of the leak will be identified, leaked material will be cleaned up, and the cleaning materials will be collected and properly disposed of.

Fueling of land and marine-based equipment will be conducted in accordance with procedures to be developed in the SPCC.

Invasive Species Control (Section 02220 of Attachment G)

The following BMPs shall be implemented by the Contractor for ballast water management and biofouling removal to reduce the potential for introducing aquatic invasive species to a less-than significant level:

- Vessels over 300 gross tons in size shall be regulated under the State's Marine Invasive Species Program.
- Project vessels less than 300 gross tons in size shall be inspected and biofouling shall be removed from vessels less than 300 gross tons prior to travelling to the Project area.

Monitoring and Reporting (Section 02270 of Attachment G)

Monitor each BMP measure, storage and handling area for construction materials that have the potential to contribute pollutants, and areas for garbage storage and pickup during storm events involving high wind and rain to ensure that they function properly and are adequate for the work. Provide performance details for each BMP in the required reports as specified in the SWPPP.

Monitor construction site areas for adequacy of BMP implementation. Provide details for each area monitored in the high wind and rain storm report.

Monitor each municipal storm sewer system, known well, wetland, and body of water shown on the vicinity map for adequacy of BMP implementation. Provide details in the high wind and rain storm report.

Optional - Silt Curtains (Section 02220 of Attachment G)

Silt Curtain Product Information and Deployment Plan: If required, the Constriction Contractor shall submit for review and approval, by the Contract Owner or its representative, a Silt Curtain Deployment Plan addressing the following:

The location, type, size, positioning/anchoring, and characteristics of proposed silt curtains and oil booms and schedule for deployment, maintenance and repositioning. Include manufacturer's product information/cut sheets.

Provide shop drawings and design calculations for the curtain itself, attachments and anchoring plan. The drawings shall be prepared, signed, and stamped by a Professional Engineer registered in the State of California.

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3.5 Pile Removal and Disposal Methods

Most of the piles would be removed from a construction barge in San Francisco Bay. However, it is feasible to remove some of the piles from land, particularly at low tide. The construction contractor will have the option to do that, as long as there is no additional removed vegetation beyond that needed to provide access from the staging area to the shoreline.

For the majority of the project, removal of the pilings and other debris would be carried out using an excavator mounted on a shallow-draft barge equipped with both grappling and shearing attachments. Shallow-draft barges generally require at least 5 feet of water above the sea floor or any submerged debris. Depending on specific site conditions and the construction barge chosen, it may be possible to float the barge into position at high tides, let it settle on the intertidal mudflats to continue working at low tides, and then be lifted by the next high tide. In particular, existing eelgrass or oyster beds would be avoided, which would limit the extent to which this approach could be used. When depths limit access to barges or sensitive resources are present, piles may be manually cut by divers using a pneumatic or hydraulic saw or shears. Once the piles are cut, they may be towed out to deeper water to a waiting barge or to a landside staging area for loading and removal.

The piling removal approach in this project is as based on guidance provided by the RWQCB to minimize resuspension of sediments, bay muds, and any contaminants in them. The Construction Contractor shall submit for review and approval, by the Contract Owner or its representative, a Demolition and Bay Floor Debris Removal Plan which shall include Contractor's quantities of materials to be demolished for each site, based on a careful land and water-based inspection, procedures for complying with permit conditions for all demolition activities, procedures for removal of the different types of piles present to minimize turbidity generation to the greatest extent possible, and proposed locations for disposal of all site materials.

The Contractor will attempt to remove the pilings in a variety of ways, depending on the contamination of the surrounding sediments or muds. Details of the pile removal methods are as follows:

- If the sediment is known or thought to be contaminated, the Contractor will cut the piling at the mudline.
- If the sediment is not contaminated, the Contractor will attempt to remove the entirety of each piling by pulling the piling straight out. Contractor is prohibited from using vibration or a back-and-forth, rocking movement intended to snap the piling because this increases turbidity.
- If, prior to attempting to remove the entire piling, visual inspection of the pilings indicates that the pilings lack the necessary integrity to be pulled without splintering, crumbling, or otherwise disintegrating, the Contractor will cut the remaining pile to a level 2-3 feet below the surrounding existing sediment or mudline..
- If, during attempts to use direct pulls on the piling to remove it, the piling breaks at a level higher than 2 feet below the mudline, the Contractor will cut the remaining pile to a level 2-3 feet below the surrounding existing sediment or mudline.
- The removal method(s) utilized for each site will be described and provided to the Contract Owner or its Representative for approval in the Demolition and Bay Floor Debris Removal Plan.
- The removed piles will be loaded onto a barge and transported back to the staging area where the concrete will be separated from the other materials and recycled or disposed of offsite as appropriate at a permitted facility. The construction barge will be designed in such a way as to prohibit sediment or debris from falling back into the water. The work surface on the barge deck will include a containment basin for piles, concrete, and any mud or sediment removed during pulling. Upon removal from substrate, the piles will be moved expeditiously from the water into the containment basin.

- Jetting away the sediments around the piles is not allowed. Where the method selected is expected to generate concrete chips or dust in the water, a special curtain will be deployed around the individual pile so the contractor may capture any concrete pieces for offsite disposal.
- Intentional breaking of timber piles above the mudline is prohibited.
- The piles will not be shaken, hosed-off, stripped or scraped off, left hanging to drip or any other action intended to clean or remove adhering material from the pile.
- Any sediment accumulated from the pile removal operations will be assumed to contain creosote and will be contained and eventually tested and disposed offsite in an appropriate landfill.

As noted above, the removed creosote-treated piles, decking, and other material would be transported by barge to an on-land drying area. They would be placed into containment basins that would collect the water, residual creosote, and other materials that may drain off of them. The collected water would eventually evaporate, and the residual creosote and other materials would be placed into barrels for disposal at an appropriate Class 2 landfill as described below. Following drying, the piles themselves would be disposed of at a Class 2 (non-hazardous) landfill, with clean demolition debris disposed of at a Class 3 (inert) landfill.

3.6 Bay Floor and Shoreline Debris Removal

In addition to removing standing creosote-treated piles, the demolition phase of the project would also include the removal of debris on the bay floor and shorelines. They are as follows:

- Bay floor debris including fallen timber piles, steel piping, concrete, and other miscellaneous items, as shown on the design plans (Attachment G) or as encountered during demolition activities, will be removed.
- All bay floor debris within the project limits that is not treated with creosote will be removed unless it would involve the disturbance of eelgrass. Timber piles not shown on the design plans encountered during operations will be removed. Other items not shown on the design plans or mentioned in the specifications, which are encountered during the contractor's operations, will be brought to the attention of the Contract Owner or its representative, who will determine the disposition of the items.
- All removed debris will be transported to the contractor’s staging area and recycled or disposed at a permitted landfill facility.
- The contractor owner will confirm bay floor debris removal by conducting a post-construction side-scan sonar study.
- Existing concrete slabs and concrete debris along the shoreline will be left in place to avoid destabilizing the embankment. All other timber and metal debris along shoreline will be removed and disposed.
- On-shore piping will be removed or left in-place as indicated in the design plans.

3.7 Construction Monitoring – Pile Removal Phase

The contractor will conduct daily inspections of the water quality in the work area to ensure that discharge of construction sediments or materials do not cause the following conditions:

- Floating, suspended, or deposited macroscopic particulate matter or foams;
- Bottom deposits or aquatic growths to the extent that such deposits or growths cause nuisance or adversely affect beneficial uses;
- Alteration of temperature, turbidity, or apparent color beyond present natural background levels;
- Visible, floating, suspended, or deposited oil or other products of petroleum origin; and

- Toxic or other deleterious substances to be present in concentrations or quantities that cause deleterious effects on wildlife, waterfowl, or other aquatic biota, or that render any of these unfit for human consumption, either at levels created in the receiving waters or as a result of biological concentration.

The contractor will record observations of the above and note work completed daily. Information will be collected and presented on the daily form provided in the plans and specifications (Table 1 of Attachment G) or in an alternate format approved by the Contract Owner's Representative. Forms will be compiled on a daily basis, converted to a single file in pdf format, and provided via email to the Owner's representative the following day.

The Owner's Representative will be notified immediately if any adverse conditions (floating or suspended materials, unusual discoloration or turbidity, or odors) are noted or any special status species are observed adjacent to or within the work area.

There are one or more known submerged vessels at the Red Rock site, and other unknown vessels may be encountered during project work. The Contractor will mark the extent of sunken vessels with buoys and avoid damaging it.

Biological Monitoring

The Biological Monitor will be present to monitor impacts to eelgrass and benthic habitat during pile removal and restoration activities to ensure that eelgrass beds are avoided to the maximum extent practicable. The Biological Monitor will observe work activity and record the presence and behavior of wildlife in the area, and through coordination with the Construction Contractor, ensure that disturbance of sensitive areas is minimized. The Biological Monitor will also ensure that the contractor applies the proper avoidance and minimization measures in accordance with all permitting requirements (see Attachments A through F).

The Biological Monitor will inspect the pile storage and drying area daily to ensure that any materials draining or falling off the piles are properly contained. The Owner's Representative will be notified immediately if any adverse conditions (floating or suspended materials, unusual discoloration or turbidity, or odors) are noted or any special status species are observed adjacent to or within the work area.

Turbidity Monitoring

The project designs also include construction best management practices (BMPs) and other conservation measures to reduce impacts from turbidity during pile removal. For example, the Regional Water Quality Control Board has already provided guidance on how to measure changes in turbidity to protect water quality and prevent unsafe increases in turbidity. This guidance has been incorporated into the design specifications for the construction contractor (Attachment G).

The contractor is required to perform water quality monitoring to monitor turbidity during pile removal. The contractor will prepare a turbidity monitoring plan, including product information on monitoring equipment, proposed monitoring locations and procedures to follow, should turbidity increase above background levels. The turbidity monitoring plan will include the following provisions:

- Prior to beginning work, the contractor will monitor turbidity and light levels at the level of the eelgrass to establish a baseline, as described in Section 2.2.1. During construction, the contractor will also set buoys out to establish background water quality monitoring points upstream and downstream (based on existing currents and tides at the site) of the site. The contractor will monitor turbidity and light at low, middle, and high tide during typical work hours for several

days prior to beginning work. The contract owner's representative will review and approve the background monitoring station locations prior to monitoring.

- During piling removal, Contractor will monitor turbidity and light levels at the frequency required by the project permits, at the same locations as the baseline monitoring plus within the work area.
- In accordance with the project permits, light level (H_{sat}) must not fall below 5 hours a day or turbidity will not rise to more than 10% above background levels. The contractor will notify the Contract Owner or it's representative and Biological Monitor immediately when permit water quality criteria are exceeded. If it is determined that the water quality criteria have indeed been exceeded, demolition activities must cease until turbidity is reduced and H_{sat} increases above 5 hours. The contract owner may elect to exercise deployment of the silt curtain.

As described in Section 2.4, there is an optional bid item for the contractor to deploy a silt curtain around the work area. The contract owner may exercise this optional bid item if observations or turbidity monitoring during the work indicate that the silt curtain is needed to protect the eelgrass. If silt curtains are utilized, turbidity monitoring will occur outside of the enclosed area.

Post-Demolition Surveys

Upon completion of demolition and removal of pilings and other debris, the Contractor will perform a post-demolition diver survey within the project areas. The survey will document the quantity and type of pilings stubs above the mudline, the condition of the Bay's floor and identify quantities and types of debris from previous operations and/or from the demolition activities remaining on the Bay floor. The Contractor will submit the results of the survey to the Contract Owner or its representative with descriptions of their approach to removal of the piling stubs and debris. The Owner may elect to leave some debris in place if it has established eelgrass growing on it. After this submittal is approved by the Owner, then the Contractor can proceed with piling stub and debris removal. Identified piling stubs will be cut off at 2-3 feet below mudline if possible. Following completion by the Contractor of demolition activities, Owner or its representative shall conduct a sidescan sonar survey of the work area to confirm that the project's pile removal requirements have been met.

Restoration of Disturbed Upland Areas

Following the completion of work, all disturbed upland areas will be returned to stable grade and planted as described in Section 02950 of Attachment G. Planted areas will be monitored and maintained for one year following construction to ensure the successful establishment of plants.

3.8 Construction Monitoring – Restoration Phase

Phase 2 would begin in February of 2017, but the restoration treatments and other in-bay work would occur between April and June of 2017. Restoration at the project site is intended to improve spawning success of Pacific herring by providing necessary subtidal structures, including eelgrass beds, rockweed, and oyster reef habitat, on which they can lay eggs, and to provide additional habitat enhancements that not only bring the herring-related benefits described above but also benefit other species and increase the overall habitat complexity of the Bay. The restoration treatments to be used are described briefly below, and described in detail in Attachment G.

Eelgrass Plantings

The eelgrass portion of the habitat restoration project will involve harvesting eelgrass shoots and roots from existing healthy eelgrass donor beds, tying several of them to a light anchor to form a planting unit, and then planting them in a new location. This approach is called a bare-root transplant. Harvesting of the eelgrass shoots would done by hand by trained divers who selectively extract shoots from moderate to

dense eelgrass beds. To reduce overall impact on the source location(s), harvest of donor material from the donor beds would be restricted to 10% or less of total rhizome count per square meter. Extraction density is managed on an area (square footage) basis and not in aggregate.

Reef Balls

Reef balls are hollow and roughly hemispherical structures cast from Baycrete. Reef balls have holes on the sides and top to increase flow through them and to enhance the three-dimensional complexity of the habitats they provide.

Shell Bag Mounds

Shell bag mounds are the most successful and widely used method to create oyster reefs in San Francisco Bay. To construct these, clean Pacific oyster half shells are placed in plastic mesh bags and stacked directly on the substrate or on a base. The stacked bags are placed in a pyramidal mound and affixed to the base with nylon cords or other ropes.

Reef Block Stacks

Reef block stacks consist of interlocking blocks cast from Baycrete that can be stacked in a variety of configurations. The height, width, and length of reef block stacks installations can be varied to meet site-specific considerations.

Rockweed Plantings

Two methods of rockweed planting will be utilized, whole thalli transplant and Whole rockweed thalli attached to rock or riprap will be moved to allow colonization of new patches of intertidal shoreline and fill in voids that are too distant from existing plants for effective colonization. The rocks or other substrate supporting mature thalli would be collected and relocated to the restoration site where they would be placed at the appropriate tidal elevations in a manner that wedges the substrate in to hold the transplant unit in place. The second method involves translocation of reproductive material taken from the tips of mature thalli. Reproductive portions of adult rockweed would be clipped and placed in mesh bags. The bags would be secured in the intertidal zone, allowing natural fertilization and zygote establishment processes to occur.

Table 3 summarizes the quantities and areas associated with the proposed restoration actions at the Red Rock Warehouse site.

Table 3. Summary of Restoration Action Treatments

Restoration Component		Red Rock Warehouse Site	
		Number	Area (acre)
Eelgrass bare-root transplants		2,597	0.64
Reef structures	Reef balls	49	0.07 Total
	Reef block stacks	98	
	Shell bag mounds	49	
Rockweed	Whole thallus transplants and Translocation of mature thalli tips	310	0.08

The reef structures will be placed with a crane or similar equipment working from a construction barge. The eelgrass and rockweed planting units will be collected and hand-placed by divers and/or waders as depth and tides permit. The contractor will place each of these restoration treatments in accordance to the plans and specs (Attachment G), and will avoid placing structures on existing eelgrass beds.

Biological Monitoring

The agency-approved Biological Monitor must implement the following:

- The Biological Monitor will be on-site during the harvest of donor eelgrass and rockweed. The monitor will verify that material is harvested, transported, and planted in the manner prescribed in the plans and specs (Attachment G).
- The Biological Monitor will verify that the harvest of donor eelgrass and rockweed is done in accordance with stipulations of the CDFW scientific collectors permit and any other permitting requirements.
- Monitor the eelgrass planting, rockweed planting, and the placement of reef structures to ensure that restoration is properly implemented and that no special-status species are affected.
- The existing eelgrass and rockweed in the project footprint will be avoided to the maximum extent feasible.

Turbidity Monitoring

During the placement of reef structures, turbidity monitoring will be conducted by the Contractor using the same methods employed during pile removal.

3.9 Restoration Surveys and Monitoring

Once installed, the reef structures elements, eelgrass plantings, and rockweed relocation are intended to provide a more diverse benthic habitat that would support the colonization of native oysters and organisms associated with eelgrass beds. This is intended to improve overall spawning habitat for Pacific herring and improve habitat complexity for other species. Once installation activities are complete, Restoration Surveys and Monitoring will be conducted to ensure the treatments are functioning as intended and that the success criteria of the restoration are met. Overall, the restoration monitoring will focus on the four topics described below:

- **Restoration Unit Establishment and Stability –** Early stage monitoring to determine the level of success achieved in establishing planting units and reef structures at different elevation ranges. Monitoring will be conducted early and often in the restoration period to capture stability and recruitment on reef structures and transplant mortality events associated with the restoration methods.
- **Long-term Establishment** – Establishment monitoring to determine which planting units expand and monitoring of reef structures to track colonization by oysters and other organisms that will develop increased cover at elevations suitable to support Pacific herring spawning. This will occur over multiple growing seasons within the 5-year monitoring period.
- **Pacific Herring spawning** – Pacific herring spawning use of the restoration treatments relative to spawning in the vicinity. Monitoring for expansion and densification of eelgrass, oyster reefs, algae, and other spawning habitat within spawning zones and for Pacific herring spawning use will be extended over a 5-year period.
- **Ecosystem Monitoring –** Monitoring to assess the diversity and density of fish and invertebrates utilizing the restored area and use of the restoration area by other wildlife such as birds over the 5-year monitoring period.

The methods developed to meet these monitoring goals have been tailored to suit the success criteria of the project, which are described in the following section.

Success Criteria

The overall goal of monitoring is to determine if the restoration treatments are functioning on a trajectory that will result in achievement of the success criteria. The project will be deemed successful if one or more of the following criteria are met within the five-year period following construction:

- Eelgrass transplants establish and spread to at least 25% above initial planting densities;
- For each style of reef structure (reef balls, reef block stacks, and shell bag mounds), any of the below criteria apply:
    - native oysters recruit with densities of >10,000 oysters per acre of substrate after 5 years **or**
    - after 5 years, macroalgae and sessile invertebrates colonize the structures with at least 50% surficial coverage.
    - Observation shows that the reef structures are providing the kinds of tidal and wave dampening that allows or enhances successful eelgrass establishment in the zones behind them and/or can be shown to protect the shoreline from undue erosion.
- Rockweed will establish and spread to at least 25% above initial planting densities.
- If herring spawning occurs within the project site, herring will utilize eelgrass, oyster reef structures, or rockweed as spawning substrate at an equal or greater rate compared to their historic use of the creosote-treated piles during at least one spawning event.
- There is no indication of increased shoreline erosion due to removal of the creosote piles.
- There is no indication of adverse sedimentation or scour resulting from installation of the reef structures.

The SCC will report the success or failure of the project to the permitting agencies. Unsuccessful oyster reef structure types will be removed after five years. For example, if reef ball structures do not recruit >10,000 oysters per acre of substrate during at least one year of the five years following construction **or** after 5 years, macroalgae and invertebrates colonize the structures with at least 50% surficial coverage, they will be removed. Any successful oyster reef structure types will be left in place.

The following monitoring methods detail the processes that will be used to collect data sufficient to demonstrate that the success criteria have been met, and to allow for adaptive management responses and adjustments in the event of poor performance of the restoration treatments.

Monitoring of Installed Reef Structures

Monitoring of oyster restoration will be completed at multiple stages to serve differing assessment functions. These are briefly identified as follows:

- Physical integrity – Assess settlement of each unit and degradation of physical structure over time
- Scour – Assess the loss of sediment from around the base of the structure to ensure that the structure does not tilt or become unstable
- Sedimentation and shoreline stability – Assess whether or not the placed structures are not causing substantial sediment accumulation and are protecting against shoreline erosion.
- Epibenthic community development and sedimentation – Directly evaluate settlement and growth of oysters, kelp, mussels, and other organisms as a self-propagating habitat feature, assessment of mortality and causative agents. Will also assess the accumulation and purging of sediment on the surfaces of the structure as a controlling factor in the settlement, growth, and survival of oysters and other sessile organisms.

- Associated community development – Evaluate the development of associated fish, invertebrate, and algal communities around the reef structures relative to reference conditions.

The methods, frequency and timing of monitoring for these various functions are described below.

- **Physical integrity** – Each structure grouping will be visually assessed for physical integrity, uneven settlement, or movement from their placed locations. Physical integrity monitoring will start upon initial construction and will be completed at a diminishing schedule as early stability of the units is achieved. It is recommended that this monitoring be performed at a frequency of 0, 1, and 24 months. Settlement will be assessed by measuring reef base layer settlement using a total station from a fixed reference point on the adjacent shoreline. Erosional loss or structure degradation will be assessed by measurement from the top of the structures to the shoreline reference point and comparing the differences between the base and top of the structures to detect deterioration of the structures.
- **Scour** – To assess the loss of sediment from around the base of the structure in order to ensure that the structure does not tilt or become unstable, PVC poles will be set deep into the substrate to the point of stability adjacent to structures anticipated to within the areas of the highest potential for wave and current energy. The PVC poles will be placed at each of the four corners of the "high risk" reef units (This includes units that are in corner locations, on the outside edge receiving prevailing wind, etc.). The distance from the top of the pole to the sediment surface will be measured to the nearest 0.5 cm during the monitoring events. At least 6 structures will be monitored in this fashion. Changes in depth of sediment will be used to assess structure mediated scour and subsidence of the structures. Scour monitoring will start upon initial construction and will be completed at a diminishing schedule as early stability of the units is achieved. It is recommended that this monitoring be performed at a frequency of 0, 1 and 24 months. It is anticipated that effects will be observed early on in the monitoring and will diminish with time.
- **Epibenthic community development** – Epibenthic community development will be assessed in two ways. The first is consumptive sampling using sacrificial sampling units hung on the reef structures to be collected and examined in the laboratory at discrete sampling intervals. The second is to collect field photographs of 100 cm^2 (10 cm x 10 cm) quadrats that will be analyzed for oyster abundance, size classes, degree of sedimentation, and other organism presence.
    - Consumptive Sampling – To characterize the community on the reef structures, 10 half oyster shells will be placed in mesh bags of the type used to construct the reef units. The weight and volume of the bags will be individually determined and bags will be tagged with an identifier to track the individual bags upon retrieval. These will be individually wired (top and bottom) to the exterior of the structures by stainless steel wire or UV-stabilized cable ties at least 5 inches apart from each other at the same level and orientation. At least 8 bags will be attached at the horizontal top, vertical high, and vertical low positions of three each protected and expose reef structures (144 individual sample bags). During each sampling event, one sampling bag from the horizontal, and two vertical positions (high and low) elevations of three structures at exposed and protected orientation of the reef units will be removed (18 individual bags). Bags will be removed by clipping the bottom and top ties and carefully removing and placing the bag into a sealed collection bag to take to the laboratory for subsequent analysis. The bag will be preserved with a 10% formalin preservative for later laboratory analysis. Bags will be rinsed to determine mass and volume of trapped sediment as a function of the original mass and volume. Within the bags, the number and size of oysters will be determined and the diversity and richness of the invertebrate community within the bags will be determined. The community metrics will be analyzed over time to evaluate the effects of time, position on the reef, energy exposure level, and sediment load on the developed community,

- Photographic Quadrats – Concurrent with sample collection, photographs will be taken of randomly placed quadrat frames on a fixed orientation and distance from a macro-lens camera. A minimum of 5 photographs will be taken on exposed and protected vertical faces of reef structures at top, middle, and bottom elevations- a total of 30 photos for each of the three monitored structures. In addition, photos will be taken on the horizontal surface of the reefs. Photographs will be analyzed for percent organism cover, oyster abundance and size classes, presence of other taxa, and percent cover of sediment. The photographs will be analyzed in parallel with the bags and will be used as a secondary tool for assessment of changes.
- This monitoring will be conducted annually for the 5-year monitoring period.

Monitoring of Eelgrass Plantings

After planting of eelgrass is completed, monitoring will be conducted to determine the level of successful establishment, recruitment, and to determine if any remedial actions are necessary to improve establishment success. Verification of the extent of planting will occur within one week of the completion of eelgrass planting. Monitoring of the planting areas will be performed at two scales. The first is at the scale of the planting units and is intended to provide insights into growth, mortality, plant stress, and causality of successes and failures of plantings. The second is at the eelgrass bed scale and is intended to document changes in spatial extent of the restoration relative to reference bed conditions. This monitoring schedule and sample size will be applied individually to each site.

- **Planting Unit Establishment Monitoring** – The planting unit monitoring will be completed by examining performance of individual units through time. Monitoring will be conducted for plants within belt transects 2 meter wide belt transects extending parallel to shore at depth intervals of one foot (i.e., 0, -1, -2, - ft MLLW, as available in the planting area). A total of three permanent 20 meter belt transects will be established at each available planting depth and the ends of transects will be monumented by PVC poles for future relocation and sampling of the same transects over time. Similar numbers of belt transects will be installed into reference sites and will be coincidently monitored. Non-consumptive sampling will include assessment of the following within the belt transect (40 m^2): 1) plant count; 2) plant size (ellipsoid area, longest axis x perpendicular max axis); 3) percent reproductive; 4) color and turgor of leaves; 5) shoot density (turions/m^2); 6) seedling recruitment; 7) evidence of herbivores or herbivory; 8) sediment ORP; 9) observations of other stressor effects. Data will be used to evaluate survival over time by depth and restoration location, plant expansion rates, recruitment into restored areas, and any stressor impacts to the restoration. Establishment monitoring shall be completed at 0 month (starting condition), 1, 12, and 24 months post-planting.
- **Bed Monitoring** – The restoration areas will be monitored for bed establishment using submeter accurate sidescan sonar mapping methodologies. The sidescan will be used to map the restoration and reference bed areas and track the development of restored beds relative to natural variability of the reference sites. Sonographic data will be used to prepare spatial distribution maps of the beds and data will be presented graphically and in charts over the monitoring period. Bedform alteration within the survey area will also be tracked using high spatial density single-beam sonar (10-foot or less transect spacing), multibeam sonar, or interferometric sidescan sonar. These data will supplement the land based survey transects and will be used to identify substantive changes in sediment erosion or accretion that falls outside of the surveyed transects or provides spatial context to the transect data. Bed establishment monitoring shall be completed at 24 and 60 months post-planting.

Monitoring of Rockweed Plantings

After placement of rockweed is completed, monitoring will be conducted to determine the level of successful establishment, recruitment, and to determine if any remedial actions will improve establishment success. Rockweed will be monitored by plots that are marked by epoxy set tags or GPS waypoints that will be established for 10% of the whole thalli translocations and 50% of the propagule bags. Because rockweed is proposed to be introduced as discrete whole thalli translocations or propagule bags and rockweed has a short dispersal distance, monitoring will be conducted within a 3 meter radius around the initial point of introductions. Plots will be identified immediately at the time of translocation establishment as a bench mark. Information on all existing thalli will be collected using a pole camera to collect a vertical plot photo with a centered plot label board. The photograph along with close up photographs with scale bars of the translocated thalli will be used to assess, survival, mortality, growth, and reproduction. Data will also be collected on naturally occurring rockweed and translocated thalli and propagule bag performance will be assessed against established thalli performance for all of the same metrics. Rockweed will be monitored at 1 week and 24, and 60 months. This monitoring schedule and sample size will be applied individually to each site.

Monitoring of Substrate Utilization during Herring Spawn

CDFW has conducted herring research in San Francisco Bay since 1972 as part of its ongoing monitoring and management of the commercial fishery. Independent monitoring of herring spawning activity is not needed for this project. When CDFW has reported herring spawning in the vicinity of the project site, a site investigation will be conducted to determine if herring have utilized the restoration treatments as a spawning substrate. This investigation will be carried out at a suitably low tide within 7 days of the reported spawning event. In order to capture these potential events, it will be necessary to stay closely coordinated with CDFW herring monitors. Monitoring will be completed annually for 5 years following completion of the project.

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Chapter 4 Reporting Requirements

The following sections detail the reporting requirements and how they are to be implemented during each of the two phases of construction: pile removal and restoration actions.

4.1 Preconstruction Survey Reporting

The Contract Owner or its Representative shall supply the following to the SCC prior to the start of construction:

- Certification of Contractor review of permits
- Biological Resources Training log sheets
- Summary of nesting bird survey results
- Baseline turbidity and light data in nearby representative eelgrass beds
- A map of the eelgrass beds in the project footprint

4.2 Construction (Phase 1 and 2) Monitoring Reporting

Daily Monitoring logs will be supplied to the SCC daily from both the contractor's monitor as well as the Biological Monitor.

The Biological Monitor will submit a summary of impacts to eelgrass and benthic habitat to the resource agencies within 30 days of demolition completion, and within 30 days of restoration completion.

A draft construction monitoring report will be submitted to SCC within 90 days after completion of each phase. The draft report will include a description of the materials and methods used in monitoring, an overall summary of the project results, a discussion of the compliance record over the course of the entire program, success criteria, follow–up monitoring survey reports, and a discussion of the effectiveness of monitoring methods.

A final report will be prepared and submitted to NMFS and CDFW within 30 days following receipt of any comments on the draft report. Copies of the final report will be issued to pertinent regulatory agencies by SCC.

4.3 Restoration Monitoring Reports

Restoration monitoring reports will be completed on a yearly basis, with the first being due 90 days after the 12-month monitoring session. Additional reports will be produced 90 days after the 24, 36, 48, and 60 month monitoring sessions. The draft report will include a description of the materials and methods used in monitoring, an overall summary of the project results, achievement of success criteria, follow–up monitoring survey recommendations, recommendations for remedial actions or adaptive management to ensure success criteria are met, a discussion of the effectiveness of monitoring methods, and data sheets collected for that period.

A final report will be prepared and submitted to NMFS and CDFW within 30 days following receipt of any comments on the draft report. Copies of the final report will be issued to pertinent regulatory agencies by SCC.

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Attachments

Provisional List:

Attachment A	U.S. Army Corps of Engineers Permit
Attachment B	National Marine Fisheries Service concurrence letter
Attachment C	California Department of Fish and Wildlife Scientific Collection Permit
Attachment D	Regional Water Quality Control Board Permit
Attachment E	California State Lands Commission – Letter of Non Objection or Lease
Attachment F	San Francisco Bay Conservation and Development Commission Minor Permit
Attachment G	Plans and Specifications
Attachment H	Daily Construction Monitoring Log for Biological Monitor
Attachment I	Turbidity Monitoring Log
Attachment J	Restoration Monitoring Log

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