

Draft
**SS Cape Mohican Oil Spill
Restoration Plan and
Environmental Assessment**

Prepared by the SS Cape Mohican Trustee Council:

United States of America
National Park Service
Fish and Wildlife Service
National Oceanic and Atmospheric Administration

State of California
Department of Fish and Game
Department of Parks and Recreation

September 10, 2001

PREFACE

I. Public Meeting

There will be a public meeting held on this draft Restoration Plan/Environmental Assessment (RP/EA) in:
San Francisco, California

Date: September 26, 2001

Time: 7:00 p.m. – 9:00 p.m.

Location: Building 201, Fort Mason, Golden Gate National Recreation Area - Park Headquarters
(Intersection of Franklin and Bay Streets)

The Trustees will provide a general overview of the plan and accept both oral and written comments on the plan at that time. Persons attending the Public Workshop may present oral and/or written comments on the draft RP/EA or present additional restoration projects. This document can also be reviewed at the following Websites: www.dfg.ca.gov/Ospr/index.html and www.darcnw.noaa.gov/mohicn.htm.

II. Comments

Following a public notice, this draft RP/EA will be available to the public for a 45-day comment period beginning September 10, 2001 and ending October 25, 2001. The Trustee Council will review all public comments received during the review period and before completion of the final RP/EA. In addition, public comments will be included in the Administrative Record.

Comments should be submitted to:

Mr. Dan Welsh
U.S. Fish and Wildlife Service
California-Nevada Operations Office
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Sacramento, California 95825

Comments can also be submitted by e-mail at: daniel_welsh@fws.gov

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DISTRIBUTION

LIST OF ACRONYMS

BCDC	San Francisco Bay Conservation and Development Commission
Caltrans	California Department of Transportation
CCC	California Coastal Conservancy
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
CRMP	Coordinated Resources Management Process
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DOC	U.S. Department of Commerce
DOI	U.S. Department of the Interior
DRMR	Duxbury Reef Marine Reserve
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FMR	Fitzgerald Marine Reserve
FMSH	Farallones Marine Sanctuary Association
FONSI	Finding of No Significant Impact
FPNHS	Fort Point National Historic Site
GFNMS	Gulf of the Farallones National Marine Sanctuary
GGBR	Golden Gate Biosphere Reserve
GGNRA	Golden Gate National Recreation Area
ICS	Incident Command System
IFO	Intermediate Fuel Oil
MHHW	Mean High High Water

MLT	Mean Low Tide
MOU	Memorandum of Understanding
MARAD	Maritime Administration
NCP	National Contingency Plan
NMS	National Marine Sanctuaries
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRD	Natural Resource Damage
NRDA	Natural Resource Damage Assessment
NWR	National Wildlife Refuge
OPA	Oil Pollution Act of 1990
OSPR	Office of Spill Prevention and Response
PRBO	Point Reyes Bird Observatory
PRNS	Point Reyes National Seashore
PSU	Practical salinity units
RP/EA	Restoration Plan/Environmental Assessment
SOHP	State Office of Historic Preservation
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 INTRODUCTION

1.1 Purpose

This draft Restoration Plan and Environmental Assessment (draft RP/EA) presents information to the public regarding the affected environment, the determination of natural resource injuries, and proposed restoration actions to compensate for natural resource injuries and lost human-use caused by the October 28, 1996, SS Cape Mohican oil spill. The oil spill adversely affected resources in San Francisco Bay (Bay) and along the California coast.

This draft RP/EA is intended to comply with the Oil Pollution Act (OPA) of 1990, 33 U.S.C. 2701, et seq. This document also serves, in part, as the trustee agencies' compliance with the National Environmental Policy Act (NEPA), 42 U.S.C. 4321–4370d, the California Environmental Quality Act (CEQA), Public Resources Code §§ 21000–21178.1; and their implementing regulations, to the extent that they apply. The Trustees also intend to use the final RP/EA in place of the "Initial Study" requirement of CEQA.

The purpose of Restoration Planning is to evaluate the potential injuries to natural resources, and natural resource services, and use that information to determine the need for and scale of restoration actions. Natural resource services are the ecological and public services that natural resources provide. Examples of ecological services are the services that one natural resource provides for another, such as food and nesting habitat. Public services include such things as nature photography, education, fishing, swimming, and hiking.

Restoration Planning provides the link between injury and restoration and has two basic components: (1) injury assessment and (2) restoration selection. The goal of injury assessment is to determine the nature and extent of injuries to natural resources and services, thereby providing a factual basis for evaluating the need for, type of, and scale of restoration actions. Consistent with the OPA, the goal of the proposed restoration actions presented in this draft RP/EA is to make the environment and the public whole for injuries to, or lost use of, natural resources and services resulting from the Cape Mohican oil spill. This will be accomplished through the restoration, rehabilitation, replacement, or acquisition, collectively referred to as restoration, of equivalent natural resources and services. The specific goals for this incident are to restore the following natural resources affected by the oil spill: birds, fisheries and water quality, sandy shorelines, wetlands/mudflats, and rocky intertidal habitat. In addition, restoration projects to compensate for the lost use of public areas and public services will be implemented. Additional environmental compliance may be required prior to actual implementation of the proposed projects described herein.

Restoration for each of these habitats will be accomplished by implementing several restoration projects at specific locations throughout the Bay and the California coast. The replacement of lost human-uses, primarily lost recreation uses, will be accomplished by enhancing the experience and use of natural resources at public parks. This draft RP/EA provides a description of each of the proposed restoration projects including the objectives, success criteria, monitoring, and environmental consequences.

1.2 Overview/Summary of Incident

On October 28, 1996, at approximately 3:30 p.m., the SS Cape Mohican, a 725-foot Maritime Administration (MARAD) vessel, discharged an estimated 96,000 gallons of Intermediate Fuel Oil (IFO) 180, a heavy bunker fuel oil, into a floating dry dock during routine maintenance at the San Francisco Drydock Shipyard. Approximately 40,000 gallons of fuel escaped Drydock #2 and spilled into the Bay at

Pier 70. The spill is believed to have occurred when an opened valve discharged stored fuel during the transfer of oil from a stabilization tank.

At the time of the discharge, the wind was blowing at 14 knots from the south-southwest; shortly after the discharge, the wind speed increased to 25-knot gusts and it began to rain heavily. Dispersed by an early-season storm, the discharged oil spread through portions of San Francisco Bay. Oil spread from Pier 70 south to offshore of Hunter's Point and north into the central Bay to the Richmond-San Rafael Bridge, making landfall at Alcatraz, Yerba Buena, Treasure, and Angel islands. The Tiburon Peninsula and San Francisco waterfront were also oiled. The oil traveled outside the Golden Gate, oiling beaches as far north as Drakes Beach in the Point Reyes National Seashore (PRNS) and as far south as Pillar Point (Figure 1).

Oil spill response organizations and contractors conducted on-water and shoreline cleanup actions. Management of the spill response operations was directed by an Incident Command System (ICS), which included the United States Coast Guard (USCG), San Francisco Drydock, and California Department of Fish and Game's (CDFG) Office of Spill Prevention and Response (OSPR). The ICS staff included representatives from the USCG, CDFG-OSPR, United States Fish and Wildlife Service (USFWS), National Park Service (NPS), National Oceanic and Atmospheric Administration (NOAA), Gulf of the Farallones National Marine Sanctuary (GFNMS), California Department of Parks and Recreation (CDPR), Bay Area Conservation and Development Commission (BCDC), California Conservation Corps (CCC), and local government agencies.

1.3 Natural Resource Trustees and Authorities

Both federal and California statutes establish liability for natural resource damages to compensate the public for the injury, destruction, and loss of such resources and their services resulting from oil spills. Natural resource trustees are authorized to act on behalf of the public under state and federal statutes to assess and recover natural resource damages and to plan and implement actions to restore natural resources and resource services injured or lost as a result of a discharge of oil. The Trustees are following guidance concerning Restoration Planning and implementation contained in the following:

- Oil Pollution Act (OPA) of 1990 (*33 U.S.C. 2701 et seq.*)
- Natural Resource Damage Assessment Regulations under the Oil Pollution Act of 1990 (*15 CFR Part 990*)
- National Park System Resource Protection Act (*16 U.S.C., Section 19jj-4*)
- National Oil and Hazardous Substances Pollution Contingency Plan (*NCP; 40 CFR 300.600*)
- Executive Order 12777 (implements Section 311 of the Water Pollution Control Act of 1972 and OPA)
- The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (*California Government Code Section 8670.1 et seq.* and *California Public Resources Code, Division 7.8*)

This draft RP/EA was prepared jointly by the United States Department of the Interior (DOI), represented by the National Park Service and the United States Fish and Wildlife Service; the Department of Commerce (DOC), represented by the National Oceanic and Atmospheric Administration; and the State of California, represented by the Department of Fish and Game Office of Spill Prevention and Response and the Department of Parks and Recreation. These agencies formed a "Trustee Council" to work cooperatively and evaluate natural resource injuries, assess damage, and identify the potential restoration

actions presented in this document. A Memorandum of Understanding (MOU) between these federal and state Trustees was entered into to ensure coordination and cooperation in restoring natural resources injured as a result of the Cape Mohican oil spill.

1.4 Coordination with Responsible Parties

The OPA natural resource damage (NRD) regulations provide for the Trustees to invite the Responsible Party to participate in the natural resource damage assessment process. Although the Responsible Party may contribute to the process in many ways, final authority to make determinations regarding injury and restoration rests solely with the Trustees.

On November 8, 1996, the Trustees for the Cape Mohican oil spill invited the responsible parties to participate in a cooperative natural resource damage assessment (NRDA). The Maritime Administration, owner of the vessel, provided funding to the Trustees to undertake studies and related activities. The other responsible party, San Francisco Drydock, Inc., accepted the invitation, but expressed concerns related to its potential share of damage assessment costs. Although an “Agreement for an Assessment of Injuries” was developed, it was not implemented because the parties were able to negotiate an early resolution of the NRD claim. Nevertheless, the Trustees shared data related to the damage assessment with the responsible parties.

1.5 Settlement of Natural Resources Claims

The United States and State of California entered into a consent decree with the responsible parties that resolved claims asserted by both governments. The terms of the settlement are set forth in that consent decree entered by the United States District Court for the Northern District of California (a copy is located in the Administrative Record). The settlement covered claims for oil spill response costs; natural resource damage assessment costs; civil penalties, damages for injuries to birds, mammals, shoreline and aquatic habitats; and lost human-use of natural resources.

The consent decree required the Trustee Council to develop a Restoration Plan for the natural resources and resource services that were affected by the oil spill, and to provide an opportunity for public input on the draft RP/EA. This document addresses that requirement by providing the draft RP/EA to the public for input.

A total of \$3,625,000 was awarded to the Trustees under the consent decree for the design, implementation, permitting, monitoring, and oversight of restoration projects. In accordance with the settlement consent decree, settlement funds are to be allocated towards the restoration resource categories injured as a result of the oil spill (Table 1).

Table 1. Allocation of settlement award funds according to type of restoration project.

Resource Category	Amount of allocation (\$)
Wetland habitat	400,000
Sandy shoreline & rocky intertidal habitat	500,000
Bird restoration	800,000
Fisheries and water quality	425,000
Lost and diminished human-uses	1,030,000
Restoration planning	470,000
Total	3,625,000

1.6 Public Participation

Public review of a draft RP/EA is an integral aspect of the OPA Restoration Planning process (*33 U.S.C. § 2706 [C][5]*). The NRDA regulations, which implement the trustee provisions of OPA, provide for the Trustees to solicit the public to comment on a draft RP/EA and consider the comments during the preparation of a Final RP/EA (*15 C.F.R. 990.55[c]*). In addition, public review of this draft RP/EA is consistent with NEPA as amended (*42 U.S.C. 4321 et seq.*) and its implementing regulations (*40 C.F.R. Parts 1500–1508*). It is also consistent with the requirement of CEQA (*Pub. Res. Code Sections 21000–21177.1*).

The initial action taken to involve the public in the restoration planning process for this spill was the public scoping process held during the spring 1999. The Trustee Council prepared and circulated a public scoping document, which described injuries associated with the oil spill and summarized potential restoration projects that were identified during settlement negotiations. The scoping document solicited input from both the public and other interested parties who could provide additional expertise and perspective to the planning process. A public scoping meeting was held on May 10, 1999, in San Francisco. All comments received during the public scoping process were considered by the Trustees in the preparation of this document.

The second action to involve the public in Restoration Planning is to seek public comment and input on the suite of proposed projects described in this document. This draft RP/EA summarizes the available information concerning the nature and extent of the natural resource injuries, the Restoration Planning process, and the restoration projects being considered to restore injured resources or lost human-use services resulting from the Cape Mohican oil spill.

1.7 Administrative Record

The Trustee Council for this Restoration Planning process established an Administrative Record. The Administrative Record contains documents relied on by the Trustee in identifying, evaluating, selecting, and implementing restoration projects.

Comments received during the public review period for this draft RP/EA, the final RP/EA, and other restoration planning documents will become part of the Administrative Record. The Administrative Record can be viewed at the following locations:

- Building 201, Fort Mason, Golden Gate National Recreation Area - Park Headquarters
(Intersection of Franklin and Bay Streets)
- Websites: www.darcnw.noaa.gov/mohicn.htm and www.dfg.ca.gov/Ospr/index.html.

2.0 THE AFFECTED ENVIRONMENT

This section describes the physical environment, biological resources, federal and state endangered and/or threatened species, human-use resources, and protected areas affected, or within the area affected, by the Cape Mohican oil spill. The description of these resources focuses primarily on the natural resources and services that are relevant to the discussion of injuries and restoration projects presented in this document.

The physical environment addressed in this section includes the open water and shoreline habitats of San Francisco Bay, and intertidal and shoreline habitats of the Pacific Ocean (including the Farallon Islands) from Pacifica (San Mateo County) to Point Reyes (Marin County). The biological resource section describes a variety of seabirds, shorebirds, fish, mammals, and other organisms that live in the Bay and the California coast habitats. The federal and state recognized endangered California brown pelican (*Pelecanus occidentalis californicus*) is one example of a particularly sensitive species residing in the Bay and the California coast region.

The areas impacted by the spill include four units of the National Parks System: Golden Gate National Recreation Area (GGNRA, which includes Alcatraz Island, and Presidio of San Francisco), Fort Point National Historic Site (FPNHS), San Francisco Maritime National Historic Park, and Point Reyes National Seashore (PRNS). Additional areas impacted included three state parks: Angel Island, Candlestick Point, and Thornton State Beach; and two national marine sanctuaries (NMS): GFNMS and Monterey Bay NMS. The affected area (San Francisco Bay and surrounding ocean waters and coastline) includes four sub-units of the San Francisco Bay National Wildlife Refuge (NWR) Complex (Don Edwards San Francisco NWR, Marin Islands NWR, San Pablo Bay NWR, and Farallon NWR).

2.1 Physical Environment

The area impacted by the Cape Mohican oil spill is geologically and biologically diverse. The tidal cycles are mixed semi-diurnal. Currents and eddies are particularly variable depending on the specific location, and current velocities generally exceed three knots in the main channel of the Bay. Although winds are unpredictable, they predominately originate from the northwest. The mean year-round water temperature inside the Bay is 55° F.

Approximately ninety percent of the fresh water entering the Bay comes from the Sacramento and San Joaquin rivers, which provide drainage for nearly half of the state of California. The remaining 10 percent comes from smaller streams draining into the Bay from local watersheds. At the Golden Gate, seawater is approximately 33 parts sea salt per 1000 parts water (practical salinity units, psu) and decreases to 2 psu's in the delta of the north Bay (Caffrey et. al. 1994). Tidal action delivers salt water well up into the Sacramento-San Joaquin Delta and the salt water mixes with fresh water flows and returns to the Bay diluted (California Coastal Commission, 1987). This process creates some of the State's most unique and delicate habitats. These habitats are essential to the health of the diverse fish and wildlife populations of the Bay.

San Francisco Bay

San Francisco Bay is the largest estuarine/bay ecosystem on the Pacific coast of the United States and is considered one of the finest natural harbors in the world. The fish and wildlife habitats that characterize the Bay are invaluable resources that provide tremendous benefits to the people of the Bay Area and the State of California. The health of the Bay continues to receive pressure from industrial, residential, and commercial development of wetlands and adjacent uplands, and this trend threatens to irreversibly alter the ability of these habitats to support fish and wildlife resources.

The Central Bay consists of submerged lands, wetlands, uplands, and the main body of the San Francisco Bay. This sub-region expands along the west shore from Point San Pedro to Coyote Point, and the east shore from San Pablo to the San Leandro Marina and includes Alcatraz, Angel, Yerba Buena, and Treasure islands. Steep watersheds draining into broad alluvial fans characterize this sub-region. At their bayside boundaries, there are small tidal marshlands, sandy beaches, and lagoon habitats that are fed by small drainages, with areas of tidal flats and tidal marsh habitat. The habitats in the Central Bay sub-region have a stronger marine influence than the San Pablo and South sub-regions of the Bay. The Central Bay includes portions of San Francisco, Marin, Contra Costa, Alameda, and San Mateo counties.

Open Water. The open water of the Bay occupies a surface area of approximately 420 square miles, and the opening to the Pacific Ocean at the Golden Gate is approximately 1 mile wide (*USGS, 1973*). Open water areas include all areas below the line of mean lower low water (MLLW) that are not exposed during daily tides, including deep bays, shallow bays, deep major channels, and shallow major channels. Waters tend to be somewhat more turbulent in these areas because of the rip and long shore currents and shallow waters. Open water of the Bay provides habitat for numerous species of resident and migratory fish and wildlife.

Tidal Salt Marshes. Tidal salt marshes are found along the Bay edge between the mean tide level (MTL) and just above mean higher high water (MHHW). They are located in areas completely open to tidal influence and also include areas where culverts reduce the range of tides but still allow frequent inundation and exposure. The Emeryville Crescent, Berkeley and Albany shores are examples of tidal salt marshes within the spill area.

Much of the ecological value of the Bay is due to its wetlands, which are essential to the diverse and abundant fish and wildlife that occur in the area. The Bay's tidal salt marsh habitat supports a myriad of fish and wildlife, many of which are special status species, such as the federally endangered salt marsh harvest mouse (*Reithrodontomys raviventris*) and the federal and state endangered California clapper rail (*Rallus longirostris obsoletus*). Voles, shrews, and other small mammals also inhabit the salt marsh and are the main food for wetland raptors (e.g., northern harrier [*Circus cyaneus*], red-tailed hawk [*Buteo jamaicensis*]), and black-shouldered kite (*Elanus caeruleus*). Upland mammals (e.g. striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and red fox (*Vulpes fulva*)) forage at the upland transition, and occasionally into salt marsh, preying on resident rodents, birds, and invertebrates. Many species of fish and invertebrates utilize tidal salt marshes as nursery areas. Larval, juvenile, adult fish, inhabit tidal salt marshes at various stages of their life history. The Bay's tidal salt marshes also are used by harbor seals (*Phoca vitulina*) for haul-outs and breeding.

Tidal salt marshes in the Bay are dominated by two primary plant species: cordgrass (*Spartina spp.*) and pickleweed (*Salicornia virginica*). Cordgrass grows at the lower margins of the marsh, particularly along channels and in sheltered areas along the Bay margin. Common pickleweed occurs just above the zone of tidal inundation in saturated soils of relatively high salinity. Both of these species can occur as monotypic stands over many acres. Other plant species associated with pickleweed marsh include marsh jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), and marsh dodder (*Cuscuta salina major*). Saltgrass (*Distichlis spicata*), marsh gumplant (*Grindelia stricta angustifolia*), and coyote bush (*Baccharis pilularis*) often occupy a band at the upper elevation limit of the salt marsh.

Tidal Mudflats. Tidal mudflats are lands above MLLW but below the MTL and are exposed at low tides, constituting a true transitional area between open water habitats and marshes and channels leading into the Bay. Tidal mudflats like those in the Emeryville Crescent provide foraging areas for California halibut (*Paralichthys californicus*), sharks, sturgeons, and shorebirds. Invertebrates also inhabit tidal mudflats.

Tidal mudflats are intensely used as feeding grounds for shorebirds [e.g., godwits (*Limosa fedoa*) and willets (*Catoptrophorus semipalmatus*)] and nursery habitat for several species of fish including the Pacific herring (*Clupea pallasi*), which were affected by the spill. Staghorn sculpin (*Leptocottus armatus*), starry flounder (*Platichthys stellatus*), leopard shark (*Triakis semifasciata*), and California skate (*Raja inornata*) are other common fish found over mudflats. Harbor seals also forage over mudflat habitats for various fishes. An estimated 99 acres of mudflats were oiled by the spill.

Tidal Inlets and Lagoons. Lagoons are small areas of shallow water that are subject to occasional or sporadic connection to the Bay by full or mild tidal action. The inlet or lagoon may or may not receive stream or other forms of upland runoff, and it can be formed behind a barrier beach along an indented shoreline or artificial berm. Tidal inlets and lagoons provide habitat for shorebirds and wading birds.

Rocky Shores. Rocky shores within the Bay include boulder talus at the base of bedrock cliffs and cobble shores. Rocky shores can result from the combination of parent material, erosion, and drainage from adjacent land. Cobble Beaches, like those on Angel Island, are examples of rocky shores within the spill area. Rocky shores provide habitat for crab and snails, as well as foraging areas for shorebirds and wildlife. Approximately 516 acres of rocky intertidal habitat in the Bay and along the coast were oiled as a result of the spill.

Riprap, piers, pilings, and seawalls. Riprap, piers, pilings, and seawalls are man-made, and occur in many developed areas of the Bay. These constructed habitats may support a large diversity and abundance of marine life including fish and invertebrates. Mussels use the vertical substrates and Pacific herring use the pier pilings and shallow rocky substrate for spawning. Approximately 69 acres of this habitat type was oiled.

Salt Ponds. Salt ponds in the Bay are a constructed habitat. They are lands that have been diked and converted to produce salt. Prior to conversion, these areas were almost all former tidal wetlands, mudflats, and open water. The area surrounding the mouth of Alviso Slough is an example of a salt pond. Salt ponds provide valuable foraging areas for many species of shorebirds.

California Coast

The coastal areas affected by the oil spill included the Golden Gate south to Pillar Point (approximately 21 miles of coastline); the coastal area from the Golden Gate north to Drakes Beach in the PRNS (approximately 34 miles of coastline); and the Pacific Ocean immediately offshore from these areas.

The physical environment of the area consists of open water, submerged lands of the Pacific Ocean, and coastal shoreline habitats. The California shoreline affected by the oil spill is a high-energy environment that experiences nearly constant wind, intense wave action, salt spray, and constant erosional processes. These forces limit the distribution of plants and animals to only those relatively few capable of withstanding the harsh conditions and unstable substrates.

North and south of the Golden Gate, the immediate shoreline is interspersed with rocky hills that terminate in vertical cliffs and coastal bluffs; rocky headlands; coastal strands; sandy beaches; sandy dunes; tidal inlets; rocky intertidal zones; and in-water artificial habitats including rock shoreline protection (concrete and boulder riprap), piers, wood, concrete pilings, and seawalls. The following describes habitats that characterize the affected physical environment of the California coast.

Coastal Bluffs. Coastal bluffs are the seaward edges of marine terraces uplifted from the ocean floor and shaped by ocean waves and currents. Coastal bluffs are generally subject to ongoing erosion and occasional mass movement (e.g., Devil's Slide on Highway 1 and Palomarin). Vegetation on the cliffs and bluffs tends to be low growing and tolerant of constant wind and salt spray. Iceplant (*Carpobrotus*

spp.), coyote brush, wildflowers (e.g. poppies, irises, and lupines), introduced annual grasses, and native fescues have adapted to grow on steep bluffs.

Sandy Beaches. Beaches are dynamic landforms altered by wind and waves in a continual process of accretion and erosion. Seasonal cycles of sand deposition and loss severely affect the appearance of beaches from summer to winter. In the summer they are wide and gently sloping, and in the winter they become steep and narrow. Violent storm waves can erode a beach overnight. Sand removed from winter beaches is deposited in offshore sandbars and is returned to the beach during the summer months by gentle swells that push the sand to the exposed shore. River sediments are the source of 80 to 90 percent of beach sand. Stinson Beach is one example of a sandy beach formed by a bar across the mouth of Bolinas Lagoon. Sandy beaches provide foraging and nesting habitat for shore and wading bird species. An estimated 56 miles, or 1,124 acres, of sandy beach habitat were oiled by the spill.

A coastal strand is a form of a sand beach and is located between the base of cliffs or bluffs and the active surf zone. Coastal strands tend to be narrow and may advance or retreat in any given year, depending on the frequency and intensity of winter storms. They tend to erode back toward the bluffs with the winter storm season and slowly rebuild over the summer and fall months. Longshore flows carry sands from river and creek mouths along the coast to build or rebuild coastal strands. Coastal strands often appear sterile, supporting little in the way of plant life. However, different types of invertebrates live in these sand beaches and surf zones, and provide a food source for shorebirds and fish. Thornton State Beach is an example of a coastal strand.

Sand Dunes. Sand dune complexes will form when the correct combinations of sand and wind patterns occur. Offshore sandbars and sediment from rivers are the most important sources of sand for dune building. Longshore currents carry sediments until they are trapped and deposited on the beach by wave action. Wind will then blow sand into dunes. Sand dune contours shift over time until hardy dune plants take hold in the drifting sand and create a stable landform. However, dunes can change form quickly under the stress of storm waves and wind, or the traffic of human activity. Baker Beach, within the GGNRA, is an example of a small dune complex. Sand dunes provide habitat for a variety of shorebirds, mammals, and reptiles.

Rocky Shores. Rocky shores along the coast include headlands, intertidal and uplifted benches, boulder talus at the base of bedrock cliffs, and cobble shores. Rocky shores often occur in areas where there is sufficient water movement to facilitate erosion and prevent sand deposition. Headlands, such as the Point Reyes Headlands in Marin County occur, anywhere that erosion-resistant igneous rocks (e.g., granite and basalt) are found along the shore. The rocky intertidal zone is located on the shoreline between the high and low tide levels and is frequently covered and uncovered by the advance and retreat of the tides (e.g., Duxbury Reef and Fitzgerald Marine Reserve). “Seastacks” are remnant, resistant rock outcrops, that occur offshore at several locations throughout the area. Rocky shores are important areas for algae, echinoderm, arthropod, and mollusk species as well as the shorebirds and wildlife that prey upon them. Approximately 516 acres of rocky intertidal habitat in the Bay and along the coast were oiled from the spill.

Tidal Inlets and lagoons. Tidal inlets along the shores are the primary conduits for sediments and nutrients between the ocean and estuary. They also are very significant for adjacent shorelines because they trap and retain huge reservoirs of sand and periodically release sediment to the beach. Examples in the spill area include Rodeo Lagoon and Redwood Creek. These coastal features are extremely important areas for wildlife such as migratory shorebirds and waterfowl, salmonids, and nursery areas for fish and invertebrates.

Farallon Islands. The Farallon Islands are a group of four island/rock groups located 26 nautical miles directly west of the Golden Gate. These small islands range in size from approximately 2 acres (Noonday

Rock, when exposed) to 120 acres (Southeast Farallon including Maintop Island and associated rocks). Other Islands in the group are North Farallon rocks (61 acres) and Middle Farallon rocks (28 acres, when completely exposed). The Farallon Islands were not directly affected by the Cape Mohican oil spill. However, birds that inhabit these islands were affected by the spill and restoration is proposed to occur on one of the islands.

2.2 Biological Resources

San Francisco Bay

The Bay contains approximately 1,600 square miles of wetlands and open water and is the largest estuary on the Pacific coast of the United States. The Bay and California coastal areas impacted by the Cape Mohican oil spill lie within the Golden Gate Biosphere Reserve (GGBR). This designation has been given to 300 reserves worldwide by the United Nations to recognize certain areas as models of how to protect their extraordinary resources of wildlands and sensitive areas while ensuring their non-destructive human-use and enjoyment. The international recognition designation confirms its importance to the conservation of biodiversity, sustainable development, research, and education. The GGBR is unique because it includes marine, coastal, and upland resources adjacent to a large metropolitan area, thus providing easy access to outdoor education and recreation for the people of the Bay Area and its visitors. This section describes the biological resources that use the Bay and California coast physical environments discussed above.

Birds. All of the shoreline habitats of the Bay and California coast provide essential habitat for seabirds, waterfowl, wading birds, and shorebirds. The habitats are used by a variety of waterbirds and shorebirds for nesting, resting, and foraging during migration stopovers and the winter months. Many species are year-round residents.

The Bay and the California coast are critical areas for birds using the Pacific Flyway. The Bay's 1,600 square miles of wetlands and open water are home to approximately 800,000 waterbirds at any given time and to millions during peak migration (USFWS, 1987). Some of these birds are permanent residents and a few come to the Bay only to breed. Most, however, use the Bay as a resting and feeding stop on their long migrations. Approximately 70 percent of the birds that migrate along the Pacific Flyway use the Bay for some period each year (Blake and Steinhart, 1987). Scientists have identified at least 281 species of birds that use the Bay, not including species that inhabit adjacent upland areas (USFWS, 1987).

Habitats of the Bay support a large variety of resident and migratory waterbird species including waterfowl, gulls, terns, murres, cormorants, loons, egrets, and herons. Numerous species of waterfowl use the Bay such as canvasback (*Aythya ferina*), pintail (*Anas acuta*), bufflehead (*Bucephala albeola*), goldeneye (*Bucephala clangula*), and gadwall (*Anas strepera*). In fact, close to one-half of the migratory populations of the west coast waterfowl winter in the Bay. As a result, the Bay is identified by the North American Waterfowl Management Plan as one of 34 waterfowl habitats of major concern (San Francisco Bay Joint Venture, 2001).

The Bay and California coast also provide essential nesting, resting, and foraging habitat for several state and federally protected bird species. These include species such as the California brown pelican, California least tern (*Sterna antillarum browni*), western snowy plover (*Charadrius alexandrinus nivosus*), California clapper rail, and California black rail (*Laterallus jamaicensis coturniculus*).

The Bay supports more shorebirds than all other estuaries in California combined, and nearly one million shorebirds have been counted in a single day during migration. The Bay is designated as a site of "Hemispheric Importance" because of the large populations of shorebirds that depend on the Bay

(*San Francisco Bay Joint Venture, 2001*). A study by Page et al. (1999) of shorebird abundance and distribution showed that the Bay was a critically important wetland because of the high number of shorebirds present throughout the year. For the 13 shorebird species surveyed in this eight-year west coast study, between 24 and 96 percent of the populations of these species occurred in the Bay in all seasons of the year.

Marine mammals. Several species of marine mammals utilize the Bay. The most abundant species is the harbor seal, which uses deep and shallow habitats for foraging and is a resident of the Bay. Hundreds of animals use Castro Rocks and other rocky outcroppings, as well as mudflats and marsh areas in the South Bay to haul out and breed. Other marine mammals can occasionally be found in the Bay including: northern elephant seals (*Mirounga angustirostris*); California sea lions (*Zalophus californianus*); humpback whales (*Megaptera novaeangliae*); California Gray whales (*Eschrichtius robustus*); harbor porpoise (*Phocoena phoconeia*).

Fish. The Bay provides resident and migratory habitat for numerous species of important and sensitive fish species. The Bay is used as a migratory corridor by anadromous fish species including protected steelhead (*Oncorhynchus mykiss irideus*); Coho salmon (*Oncorhynchus kisutch*); Winter-run chinook salmon (*Oncorhynchus tshawytscha*); spring-run chinook salmon (*Oncorhynchus tshawytscha*). Other special status species that reside in the Bay include the Delta smelt (*Hypomesus transpacificus*), and Sacramento splittail (*Ogonichthys macrolepidotus*).

Pacific herring and California halibut (*Paralichthys californicus*) use the Bay as a nursery, and rockfish (*Sebastodes spp.*), sculpin, American shad (*Alosa sapidissima*) also live in the Bay. Sturgeon (*Acipenser transmontanus* and *A. medirostris*) and Striped bass (*Morone saxatilis*) typically live in the Bay and migrate upstream into rivers and the Delta to reproduce.

Seaweeds and Seagrasses. A variety of seaweeds and seagrasses occur in several different habitats within the Central Bay. Rocky intertidal areas, such as the Tiburon Peninsula and Alcatraz provide substrate for many seaweeds like rockweed (*Fucus distichus*) and Sea lettuce (*Ulva spp.*), and surfgrass (*Phyllospadix torreyi*). In deeper subtidal rocky areas, many other species of seaweeds such as kelp, fleshy reds, articulated coralines, and green seaweeds occur. Seaweeds and surfgrass provide structural habitat for many species of fish and invertebrates, as well as a food source and spawning substrate.

In soft bottom, shallow areas of the central Bay, eelgrass (*Zostera marina*) and a few seaweeds (*Gracilaria sp.*, *Ulva sp.*) occur. Eelgrass serves as a very important habitat for spawning fishes (herring, surf perch [*Amphistichus spp.*]); living habitat for a variety of shrimp and Bay fish; forage for fish and waterfowl; and as a nursery area for many species of crab, shrimp, and fish (e.g. California halibut, surf perch).

California Coast

Birds. Many bird species use the open ocean of the California coast including common murres (*Uria aalge*), several gull and tern species, pelagic cormorants (*Phalacrocorax pelagicus*), Brandt's cormorant (*Phalaacrocorax penicillatus*) (state species of concern), several species of auklets (*Aethia spp.*), and federally threatened and state endangered marbled murrelet (*Brachyramphus marmoratus*). The California brown pelican, numerous species of waterfowl, and wading birds such as egrets and herons use the near-shore waters lagoons and tidal inlets along the coast. The California least tern, western snowy plover, and many other shorebird species use the sand dunes for shelter and breeding areas. Many shorebird species also can be found foraging along sandy beaches and rocky shores.

Marine mammals. An abundance of marine mammal species forage, breed, or migrate along the California coast. Six species of pinnipeds inhabit in the area including: Steller sea lions (*Eumetopias*

jubatus), California sea lions, northern elephant seals, harbor seals, northern fur seals (*Callorhinus ursinus*), and Guadalupe fur seals (*Arctocephalus townsendi*). Whales, including California gray, humpback, blue (*Balaenoptera musculus*), fin (*Balaenoptera physalus*), dolphins and porpoise migrate and forage along the coast. Sea otters (*Enhydra lutrus*) are observed in the Gulf of the Farallones a few times a year.

Fish. Numerous resident and migratory fish species use the nearshore area, tidal inlets, and lagoons for nursing, feeding, and spawning areas. Several species of surfperch, over three dozen species of rockfish (*Sebastodes spp.*, *Sebastolobus spp.*), lingcod (*Ophiodon elongatus*), cabezon (*Scorpaeni marmoratus*), kelp greenling (*Hexagrammos decagrammus*), and several species of sharks, rays, and eels are included. California halibut forage in sandy bottom areas just outside the active surf zone and enter the Bay to spawn over shallow mudflats. Northern anchovy (*Engraulis mordax*), an important forage fish in California waters, spawn in the open ocean. Upon hatching and spending time in open water as planktonic larvae, the juveniles move into the Bay to use the shallow areas for protection and feeding. Tidal inlets provide habitat for sensitive aquatic species such as salmon, steelhead trout, striped bass, and the federally endangered tidewater goby (*Eucyclogobius newberryi*). The tidewater goby, a special status species, is known to inhabit in Rodeo Lagoon.

Invertebrates

Hundreds of species of invertebrates occur along this spill-affected coast in sandy and rocky habitats from the high intertidal zone to the surf zone to the subtidal benthos. In sandy habitats, a variety of clams and crustaceans can be found, including the Dungeness Crab (*Cancer magister*) an important commercially harvested species. On sandy beaches, a variety of crabs, amphipods, flies, and beetles live in the surf zone and on kelp wrack that drifts ashore. These organisms provide an important food source for shorebirds. On sandy reefs and rocky intertidal areas, a wide variety of invertebrates exist, including red abalone (*Halvotis rufescens*) an important recreational species, other snails, limpets, mussels, barnacles, worms, sponges, and other types of crustaceans. All of these species exist to form a complex ecosystem along the California coast.

Vegetation. The California coast harbors an impressive assemblage of seaweeds, from the high intertidal zone to subtidal zones of 100 feet deep. Those species found in the Bay can also be found along the coast and hundreds of other species. Canopy forming kelp forests are found along the coast in lower intertidal and subtidal nearshore zones. Some species include: seagrass (*Phyllospadix spp.*) and seaweeds such as rockweed that cling to rock faces just at and below the high tide line. In addition, canopy forming kelp occurs in the lower and upper intertidal zone of the California coast, including: giant kelp (*Macrocystis pyrifera*), bull kelp (*Nereocystis luetkeana*), intertidal giant kelp (*Macrocystis integrifolia*) and feather boa kelp (*Egregia menziesii*). Kelp forests provide essential habitat for many species of fish, invertebrates, seabirds and marine mammals. They are a source of nutrients for subtidal and beach ecosystems. They buffer coastal areas from ocean waves and swells, reducing erosion of shoreline areas.

On the high beach and into the sand dunes, a variety of vascular terrestrial plants grow. Providing habitat for birds, mammals, and reptiles, sand dune vegetation also stabilizes blowing sands. Native dune plants along the coast include sand verbena (*Abronia latifolia*), dune wild rye (*Elymus mollis*), and sandbur (*Ambrosia chamissonis*). Sand dunes support many rare and listed species as well, such as: Sonoma spine flower (*Chorizanthe valida*), presidio clarkia (*Clarkia franciscana*), Santa Cruz tarplant (*Holocarpha macradenia*), beach layia (*Layia carnosa*), and California seablitz (*Suaeda californica*). In recent times much of the native dune plant species have been reduced, or completely displaced, by introduced iceplant and European beach grass (*Ammophila arenaria*). These invasive species create dense monotypic stands, reducing ecological diversity.

Farallon Islands. The Farallon Islands and the waters surrounding them are part of a highly productive ecosystem. They are located at the edge of the continental shelf where nutrient-rich bottom waters upwell into the shallow photic zone where plants and animals flourish. Zooplankton such as krill appears in abundance in most years, attracting seabirds such as Cassin's auklet (*Ptychorocamphus aleuticus*) and tufted puffin (*Fratercula cirrhata*). Additionally, the abundance of food draws many whales to the area. Seabirds and mammals have historically taken advantage of the islands isolation and lack of predatory pressure to nest and breed. The Farallon Islands support 12 nesting seabird species (e.g., common murre, cassins auklet, and western gull [*Larus occidentalis*]) and six breeding species of pinnipeds (e.g. harbor seal, Steller sea lion, and northern fur seal). Over 430 species of land birds, shorebirds, and seabirds have been recorded on the islands, mostly as stopovers during migration.

2.3 Endangered and Threatened Species

The United States Endangered Species Act (ESA) of 1973 and the State of California ESA of 1970 direct federal and state agencies to protect and conserve listed endangered and threatened fish, plants, and wildlife. The habitat of endangered, threatened, and rare species takes on special importance because of these laws, and the protection and conservation of these species requires diligent management of their habitat. Species that appear on the endangered and threatened lists were historically more widespread in their distribution, but are currently restricted to diminishing habitat.

As illustrated in Table 2, the shoreline, open water, marsh, and estuarine habitats of the Bay and California coast support numerous endangered and threatened fish and wildlife species. Two special status species were adversely affected by the oil spill; the California brown pelican and western snowy plover. Oiled pelicans were observed at many locations in the Bay and along the outer California coast during the spill. Five dead pelicans were found during the spill, and 15 live oiled pelicans were captured, cleaned at the rehabilitation center, tagged with radio transmitters, and released back into the Bay. The California brown pelican is listed as "Endangered" on both federal and state listings (Listed: *CDFG, 1978; USFWS, 1979*) and occurs along the Pacific coast from Canada to Mexico. Pelicans are seasonal migrants to the Bay and California coast during late summer, fall, and winter months and feed throughout the Bay and nearshore coastal waters.

Nine western snowy plover were observed oiled on Ocean Beach. The western snowy plover is listed as "Threatened" under the federal ESA (Listed: *USFWS, 1993*). The western snowy plover spends as much as 10 months on the California coast. They require unpolluted feeding areas on sand beaches and in lagoons and estuaries all year. They prefer undisturbed nest sites on open, sandy, or gravelly shores near shallow water feeding areas in estuaries. San Francisco Bay is considered important for these species. The restoration of habitat for special status species that use the Bay and coast will enhance populations of these species.

**Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill
(USFWS, 2001; CDFG, 2001)**

Species (E = Endangered, T = Threatened, F = Federal, S = State)

Common Name	Scientific Name
Birds	
California black rail	(ST) <i>Laterallus jamaicensis coturniculus</i>
California brown pelican ¹	(FE, SE) <i>Pelecanus occidentalis californicus</i>
Bald eagle	(FT) <i>Haliaeetus leucocephalus</i>
California clapper rail ²	(FE) <i>Rallus longirostris obsoletus</i>
Western snowy plover ¹	(FT) <i>Charadrius alexandrinus nivosus</i>
California least tern	(FE) <i>Sterna antillarum browni</i>
Marbled murrelet ²	(FT, SE) <i>Brachyramphus marmoratus</i>
Fish	
Winter-run chinook salmon ²	(FE, SE) <i>Oncorhynchus tshawytscha</i>
Central Valley spring-run chinook salmon	(FT, ST) <i>Oncorhynchus tshawytscha</i>
Coho salmon	
Central California ESU	(FT) <i>Oncorhynchus kisutch</i>
Steelhead ²	
Central California Coastal ESU	(FT) <i>Oncorhynchus mykiss irideus</i>
Delta smelt	(FT, ST) <i>Hypomesus transpacificus</i>
Tidewater goby ²	(FE) <i>Eucyclogobius newberryi</i>
Sacramento splittail	(FT) <i>Pogonichthys macrolepidotus</i>

**Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill
(USFWS, 2001; CDFG, 2001)**

Species (E = Endangered, T = Threatened, F = Federal, S = State)		
Common Name	Scientific Name	
Mammals		
Salt marsh harvest mouse ²	(FE)	<i>Reithrodontomys raviventris</i>
Guadalupe fur seal	(FT, ST)	<i>Arctocephalus townsendi</i>
Steller (=northern) sea-lion ²	(FT)	<i>Eumetopias jubatus</i>
Southern sea otter ²	(FT)	<i>Enhydra lutris nereis</i>
Sei whale ²	(FE)	<i>Balaenoptera borealis</i>
Blue whale ²	(FE)	<i>Balaenoptera musculus</i>
Finback (=fin) whale ²	(FE)	<i>Balaenoptera physalus</i>
Right whale	(FE)	<i>Eubalaena glacialis</i>
Sperm whale	(FE)	<i>Physeter catodon</i> (= <i>macrocephalus</i>)
Humpback whale ²	(FE)	<i>Megaptera novaeangliae</i>
Reptiles		
Green sea turtle	(FT)	<i>Chelonia mydas</i> (incl. <i>Agassizi</i>)
Loggerhead turtle	(FT)	<i>Caretta caretta</i>
Olive (=Pacific) Ridley sea turtle	(FT)	<i>Lepidochelys olivacea</i>
Leatherback turtle ²	(FE)	<i>Dermochelys coriacea</i>
Alameda whipsnake	(FT, ST)	<i>Masticophis lateralis euryxanthus</i>
San Francisco garter snake	(FE)	<i>Thamnophis sirtalis tetrataenia</i>

Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill (USFWS, 2001; CDFG, 2001)

Species (E = Endangered, T = Threatened, F = Federal, S = State)	
Common Name	Scientific Name
Amphibians	
California red-legged frog ²	(FT) <i>Rana aurora draytonii</i>
Invertebrates	
California freshwater shrimp	(FE, SE) <i>Syncaris pacifica</i>
Mission blue butterfly	(FE) <i>Icaricia icarioides missionensis</i>
San Bruno elfin butterfly	(FE) <i>Incisalia (=Callophrys) mossii bayensis</i>
Bay checkerspot butterfly	(FT) <i>Euphydryas editha bayensis</i>
Callippe silverspot butterfly	(FE) <i>Speyeria callippe callippe</i>
Myrtle's silverspot butterfly	(FE) <i>Speyeria zerene myrtleae</i>
Plants	
Sonoma alopecurus ²	(FE) <i>Alopecurus aequalis</i> var. <i>sonomensis</i>
Presidio manzanita	(FE, SE) <i>Arctostaphylos hookeri</i> ssp. <i>ravenii</i>
San Bruno Mountain manzanita	(SE) <i>Arctostaphylos imbricata</i>
Pacific manzanita	(SE) <i>Arctostaphylos pacifica</i>
Marsh sandwort	(FE, SE) <i>Arenaria paludicola</i>
Tiburon mariposa lily	(FT, ST) <i>Calochortus tiburonensis</i>
Tiburon Indian paintbrush	(FE, ST) <i>Castilleja affinis</i> ssp. <i>neglecta</i>
Robust spineflower	(FE) <i>Chorizanthe robusta</i>
Sonoma spineflower	(FE) <i>Chorizanthe valida</i>
Presidio clarkia	(FE, SE) <i>Clarkia franciscana</i>
Marin dwarf-flax	(FT, ST) <i>Hesperolinon congestum</i>
Santa Cruz tarplant	(FT, SE) <i>Holocarpha macradenia</i>
Beach layia ²	(FE, SE) <i>Layia carnosa</i>

Table 2. Animal and Plant Species Presently Listed Under The Federal and/or State Endangered Species Acts Occurring Within The Affected Area of The Spill (USFWS, 2001; CDFG, 2001)

Species (E = Endangered, T = Threatened, F = Federal, S = State)		
Common Name		Scientific Name
Plants		
San Francisco lessingia	(FE, SE)	<i>Lessingia germanorum</i>
White-rayed pentachaeta	(FE, SE)	<i>Pentachaeta bellidiflora</i>
San Francisco popcorn-flower	(SE)	<i>Plagibothrys diffusus</i>
Hickman's potentilla (=cinquefoil)	(FE, SE)	<i>Potentilla hickmanii</i>
Tiburon jewel-flower	(FE, SE)	<i>Streptanthus niger</i>
California seablite	(FE)	<i>Suaeda californica</i>
Showy Indian clover	(FE)	<i>Trifolium amoenum</i>

1 Species directly affected by Cape Mohican oil spill.

2 Species likely affected by Cape Mohican oil spill.

2.4 Protected Areas

There are numerous federal and state parks, refuges, marine sanctuaries, and several municipal shorelines, beaches, and waterfronts in and around the Bay and the California coast. Several of these protected areas were directly impacted by the oil spill or were within the area affected. These protected areas were established to protect and conserve natural resources, scenery, historic objects, cultural resources, threatened and endangered plants and animals, and environmentally sensitive habitats. The protected areas also provide a valuable resource for public use, and comprise a substantial year-round element of the Bay Area economy. Common recreation activities on many of these areas includes beach-going, picnicking, wildlife viewing, environmental interpretation, sport fishing, boating, surfing, boardsailing, sightseeing, and similar activities. The effects of the oil spill on these areas included oiled shorelines, adverse impacts to natural resources that use these areas, and lost public use.

This section identifies and provides a brief description of the protected areas that occur within the area affected by the oil spill or where restoration projects are proposed to be implemented. A brief description of the environmental values and human-use activities of each area is presented.

2.4.1 Federally Protected Areas

National Parks

The National Park Service (NPS) was established to conserve the scenery, natural and historic objects and wildlife within its parks and to protect and preserve these natural and cultural resources for the public. The following describes each national park affected by the spill.

Golden Gate National Recreation Area (GGNRA)

The Golden Gate National Recreation Area designation was October 27, 1972. Located where the Pacific Ocean meets San Francisco Bay, GGNRA is the largest urban national park in the world and includes 74,000 acres of land and water and approximately 28 miles of coastline. Spanning the entrance to the San Francisco Bay, and three counties (San Francisco, Marin and San Mateo), the GGNRA includes Alcatraz Island and the Presidio of San Francisco. The GGNRA also manages FPNHS and Muir Woods National Monument. The park offers a combination of natural beauty, historic features, and public recreation facilities. Reaching north and south of the Golden Gate along the Pacific shoreline, GGNRA includes a significant coastal preserve and numerous public recreation areas including redwood forests, grassy hillsides, beaches, marshes, and rocky shorelines. The park provides habitat for a variety of wildlife including seabirds, hawks, deer, occasional bobcats (*Felis rufus*), seals, and whales.

Activities at GGNRA range from urban recreation to semi-wilderness hiking and camping in the Marin Headlands. Alcatraz Island, Fort Point National Historic Site, and the Presidio of San Francisco were affected by the spill. Portions of GGNRA were closed to visitors during oil spill cleanup operations including Aquatic Park/Municipal Pier, Baker Beach, China Beach, Crissy Field, Fort Point Pier, Land's End Beaches, Ocean Beach, East Fort Baker/Horseshoe Cove, East Fort Baker Fishing Pier, Kirby Cove to Point Bonita, and Rodeo Beach. Further, the quality of park visits was diminished as a consequence of the spill due to oiled beaches and spill response cleanup activities.

Alcatraz Island National Historic Landmark

One of the GGNRA's most popular destinations, Alcatraz Island is located in the middle of the Bay and is the site of the historic Alcatraz federal prison. Visitors to the island can explore the remnants of the prison, learn about the Native American occupation of 1969 through 1971 and early military fortifications, and visit the West Coast's first and oldest operating lighthouse. The island is approximately 1 mile in circumference and rises 130 feet above the Bay.

The island also features gardens, tide pools, bird colonies, and Bay views. It is also the only location in the Bay where Brandt's cormorants nest. Because of its isolated location, Alcatraz Island has developed a unique flora and fauna. Plant communities on the island have adapted to numerous niche environments as have animal inhabitants such as the deer mouse (*Peromyscus maniculatus*), which has developed a lighter coloring that blends in with the concrete of the prison buildings.

Presidio of San Francisco

The Presidio of San Francisco was designated a National Historic Landmark District in 1962 and is located along the south shore of the entrance to San Francisco Bay. On October 1, 1994, the Presidio became part of the GGNRA. For thousands of years, the Ohlone Tribe managed and harvested the natural bounty of the Presidio area. In 1776, arrival of Spanish soldiers and missionaries marked the beginning of 218 years of military presence in the area. The Presidio served as a military post under the flags of Spain (1776 through 1822), Mexico (1822 through 1848), and the United States (1848 through 1994).

The Presidio's 1,480 acres afford visitors a variety of historic and natural attractions including more than 500 historic buildings, a collection of coastal defense fortifications, a national cemetery, an historic airfield, a saltwater marsh, forests, beaches, native plant habitats, coastal bluffs, miles of hiking and biking, and spectacular ocean and Bay views.

Fort Point National Historic Site (FPNHS)

The FPNHS, managed by GGNRA, was designated as a National Historic Site in 1970 and consists of 29 acres bordering the mouth of San Francisco Bay at the south side of the Golden Gate. Fort Point was constructed by the U.S. Army Corps of Engineers between 1853 and 1861 to prevent entrance of a hostile fleet into San Francisco Bay. The Fort was occupied throughout the Civil War. Today the site receives over 1.5 million visitors a year. Fort Point is particularly noteworthy for several rare and endemic plant

species. Native plant communities still cling to the precipitous slopes above the Fort. Freshwater seeps at Fort Point support the rare San Francisco fork-tailed damselfly (*Ischnura gemina*). The site also includes the waters of the Bay within ¼ mile of shore, which serves as an important wintering site for thousands of loons, grebes and cormorants. Recreational fishing and crabbing are popular resource dependent activities at Fort Point.

Point Reyes National Seashore (PRNS)

The PRNS was established on September 13, 1962, and is located north of the Golden Gate on the coast of Marin County. The PRNS consists of 72,000 acres of land and 20,000 acres of water, and the boundary extends approximately 10 nautical miles offshore. The PRNS encompasses 80 miles of shoreline and several estuaries, including Tomales Bay. PRNS also contains open grasslands, hillsides, coastlines, and forested ridges with unique elements of biological and historical interest.

Because of its location at the midpoint of the California coast and the many distinct habitats that exist within its borders, PRNS supports a wide range of species including 37 native land mammal species and more than 23 marine mammal species recorded. PRNS has breeding colonies of harbor seals, the largest concentration in California, elephant seals, and large nesting colonies of 12 seabird species. Over 45 percent of the bird species in North America have been sighted at PRNS and 20 percent of the state's flowering plant species are represented on the peninsula. PRNS is also a popular recreation area with approximately 2.6 million visitors each year. Recreation includes activities such as surfing, swimming, beach combing, fishing, and boating.

National Wildlife Refuges (NWR)

Several NWR units administered by the USFWS occur in San Francisco Bay and nearby areas of the Pacific Ocean. The NWRs were created to preserve the diversity of natural flora and fauna in the Bay Area region, with particular attention given to protection of vulnerable migratory bird resources. The following describes each NWR in the area affected by the oil spill.

The San Francisco Bay NWR Complex

The San Francisco Bay National Wildlife Refuge Complex includes four sub-units that occur in the affected area: Don Edwards San Francisco NWR, Marin Islands NWR, Farallon NWR, and San Pablo Bay NWR.

Don Edwards San Francisco NWR

The Don Edwards San Francisco NWR includes 25,000 acres in south San Francisco Bay. The refuge provides habitat for many species of migratory birds, as well as the endangered California clapper rail, California least tern, California brown pelican, and salt marsh harvest mouse. Visitors to the refuge can learn about the Bay environment, attend naturalist programs, observe wildlife, hike, fish, and hunt.

Marin Islands NWR

Marin Island NWR consists of the West Marin and East Marin islands. The refuge objectives are to protect nesting waterbirds and other wildlife from disturbance; enhance native habitat for nesting and roosting birds; and to protect tidal mudflats and the islands' ecosystems.

Farallon NWR

Located 26 nautical miles west of the Golden Gate, the Farallon NWR encompasses the largest seabird breeding colony on the Pacific Coast south of Alaska, supporting over 300,000 birds in the summer. Although the refuge islands are closed to public access, wildlife can be observed, studied, and photographed at a distance from boats. The Farallon Islands are part of the Farallon Ridge and include 211 acres of rocky islands. Where shallow soils occur on parts of the south Farallones, vegetation is

dominated by Farallon weed, which is used by cormorants and gulls for nest building material. Although refuge lands were not oiled by the spill, birds that utilize the Farallon NWR were oiled.

Proposed Alameda NWR

The proposed Alameda NWR includes the site of a nesting colony of 200 pairs of California least terns that is among the top three colonies for chick production in California. The DOI has requested 900 acres (525 acres of land and 375 acres of open water) from the 2,796-acre Naval Air Station Alameda, which was closed on April 25, 1997. The breakwater within the proposed Alameda NWR is a summer and fall roost site for more than 2,400 endangered California brown pelicans and is considered the most important roost, and the only known night roost, in the Bay. The breakwater is also the site of one of the largest western gull colonies in central and northern California. The breakwater is also used by harbor seals, including pups, as a haul-out area. Wetland areas within the proposed refuge boundaries support one of the largest Caspian tern nesting colony (1,000 nests) on the Pacific coast, and nesting ducks, geese, shorebirds, and other waterbirds.

National Marine Sanctuaries (NMS)

In 1972, Congress established the National Marine Sanctuary Program. Today, marine sanctuaries encompass whale migration corridors, nearshore coral reefs, deep-sea canyons, and underwater archeological sites. Two NMS were directly impacted by the oil spill and include the GFNMS and the Monterey Bay NMS.

Gulf of the Farallones NMS (GFNMS)

The majority of the Gulf of the Farallones was designated in 1981 as the Gulf of the Farallones National Marine Sanctuary. The GFNMS is located west of the Golden Gate out to 50 nautical miles offshore and includes 1,255 square miles of Pacific Ocean along with nearshore tidal flats, rock intertidal areas, wetlands, subtidal reefs, and coastal beaches. The Farallon Islands, located 26 nautical miles west of the Golden Gate in the south central part of the sanctuary, is a federal wildlife refuge offering resting and breeding sites for marine mammals and seabirds. The sanctuary provides refuge for 36 marine mammal species, thousands of seals and sea lions, and is home to the largest concentration of breeding seabirds in the continental United States.

Monterey Bay NMS

In 1992, the waters of Monterey Bay and the adjacent Pacific Ocean off the central California coast were designated and protected as the Monterey Bay NMS. The sanctuary runs 400 nautical miles north to south, extends 35 nautical miles offshore, and covers over 5,300 square miles. The goal of the sanctuary is to protect natural resources, water quality, habitats, cultural resources, and resident and migratory marine life.

2.4.2 State Protected Areas

Many state-owned lands occur within the spill area. They are managed by several different state agencies including the CDFG, CDPR, and State Lands Commission. The CDFG manages the Corte Madera Marsh Wildlife Area and the Albany Marsh Wildlife Area. The CDFG also includes the Marin Islands as a State Refuge, however, it is managed by the USFWS. The CDPR manages Angel Island, Candlestick Point, and Thornton Beach State parks. Other protected areas exist, but are owned and managed by regional or local municipalities. One of the largest is the East Bay Regional Parks District whose lands include Brooks Island, Miller/Knox Park, Pt. Isabel, and Crown Beach. All of these parks were within the spill area.

California State Parks

The mission of the California Department of Parks and Recreation is to provide for the health, inspiration, and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high-quality outdoor recreation.

The State Park system includes approximately one-third of California's scenic coastline and many of the state's finest coastal wetlands, estuaries, beaches, and dune systems. The following describes each California State Park that was impacted by the oil spill.

Angel Island State Park

Established as a State Park in 1961, Angel Island is located north of San Francisco in the central sub-region of the Bay. Consisting of 740 acres, it is the largest island in the Bay and offers spectacular views of the San Francisco skyline, Marin Headlands, and Mount Tamalpais. It is accessible only by private boat or public ferry.

The historic island has served as a Civil War fort, a stone quarry, a major military embarkation point, and a Chinese immigration station. The island has a long history of human-use beginning 3,000 years ago when the island was used by Miwok Indians as a hunting and fishing site. In more recent times, it was a refuge for Spanish explorer Juan de Ayala, a U.S. Army post, and, from 1910 to 1940, an immigration station. During World War II, it served as a holding site for Japanese and German prisoners of war and a debarkation point for American soldiers returning from the Pacific. In the 1950s and 1960s, the island was home to a Nike missile base. Today, there are two active U.S. Coast Guard stations on the island: Point Blunt and Point Stuart.

Visitors can bird watch, enjoy nature, camp, sunbathe, beachcomb, participate in environmental educational activities, hike foot trails and fire roads that circle the island, and climb to the 781-foot high summit of Mount Caroline Livermore as well as visit the immigration station, which has a museum in the barracks building. Angel Island was closed during cleanup operations from the oil spill, resulting in lost visitor use. Areas closed included: China Cove, Quarry Beach, Perle's Beach, Ayala Cove Beach, West Garrison Beach, and East Garrison Beach.

Candlestick Point

Candlestick Point is located next to 3Com Park in San Francisco. Candlestick Point Park offers beautiful views of the Bay as well as picnic areas, hiking trails, shoreline fishing sites, and two fishing piers. Depending on the season, fish catches include halibut, shark, striped bass, sturgeon, perch, and flounder. The park features a variety of flowers including the California golden poppy (*Eschscholzia californica*). A good site for winter bird watching, the park also supports owls, crows, hawks, pelicans, egrets, and other species, which can be seen throughout the year.

The park offers special cultural and educational events including guided nature walks, fishing instructions, bird walks, tidepool and mudflat walks, and Bay ecology talks. It was first established during World War II by the U.S. Navy as 170 acres of landfill to be used as a shipyard. After the war, the landfill remained. In 1973, the California legislature set aside \$10 million to purchase the land and, in 1977, it voted to develop the land as the first urban state recreation area.

Thornton State Beach

Thornton State Beach is located at the end of Thornton Beach Road in Daly City, San Mateo County. The length of the Thornton's shoreline is approximately $\frac{1}{2}$ mile long. The Beach is currently closed and is in the process of being transferred from the State to the GGNRA.

2.5 Historic and Cultural Resources

The prehistory and history of San Francisco Bay includes a variety of historical and cultural resources. The Bay and coast were used extensively by Native American groups whose ancestral village sites are located along the Alameda, Contra Costa, Marin, and San Mateo coastlines. These sites were evaluated during the spill by archeologists from the Northwest Information Center on behalf of the State Office of Historic Preservation (SOHP) and were determined not to be at risk. There are many additional historic structures in the cities around the Bay, but these were not affected by the oil spill.

However, vessels at the San Francisco Maritime National Historic Park were oiled. The Park was dedicated on June 27, 1988 and is located at the west-end of Fisherman's Wharf. The park includes the Maritime Museum, Maritime Museum Library, and several historically significant vessels, five of which were oiled by the spill. The cleaning of the oiled vessels and equipment was funded with a separate part of the oil spill settlement and was not part of the NRDA claim.

3.0 INJURED RESOURCES

3.1 Intertidal habitat and shorelines

The Cape Mohican oil spill injured a large variety of habitat and marine life in the Bay and along the California coast. Approximately 120 miles of Bay and California coast shoreline and in-water structures were oiled by the oil spill. An estimated 1,978 acres of shoreline habitat were oiled including 1,294 acres of sandy beach, 516 acres of rocky intertidal habitat, 99 acres of mudflats and wetlands, and 69 acres of riprap and other artificial habitat. The oil also spread to public areas, marinas, piers, seawalls, and other areas of the City of San Francisco. The waterfront between the San Francisco Drydock and Aquatic Park received heavy and continuous oiling. Shoreline oiling in most other areas was in the form of tarballs and tar mats.

3.2 Birds

Approximately 600 birds representing over 40 species were estimated to have died and washed up on beaches as a result of the spill. In addition, field observations during the spill identified several thousand live oiled birds that could not be captured. The trustees believe that many of these birds suffered lethal or sub-lethal affects based on scientific studies of the effects of oil on birds. The birds most affected by the spill were gulls, loons, grebes, cormorants, pelicans, waterfowl, alcids (murrels, auklets, and related species), and shorebirds including willets, marbled godwits, and western snowy plovers. Fifty-seven live oiled birds were captured and included gulls, loons, cormorants, grebes, and pelicans. Of the birds captured, 34 were cleaned, rehabilitated, and released back to the wild and 23 died in captivity. The released birds included 14 federally endangered brown pelicans.

The number of oiled live or dead birds collected following an oil spill commonly represents only a portion of the number actually affected. Dead birds may then be washed out to sea, scavenged, never found during shoreline search and collection efforts, or live oiled birds may fly out of the spill area before succumbing to the effects of ingested oil or hypothermia. Based on the number of birds collected dead, observations of live oiled birds, and computer simulation modeling, approximately 4,000 birds were adversely impacted by the oil spill. The habitats of many bird species that utilize the Bay and California coast for nesting, foraging, and resting were oiled. Important habitats include wetlands, mudflats, sandy and rocky shoreline, surface water, and intertidal areas, all of which were oiled by the spill.

3.3 Fish, marine mammals, and marine organisms

The Cape Mohican spill oiled Pacific herring spawning habitat in several regions of the Bay within a few weeks of the onset of the spawning event. The physical and chemical characteristics of the spilled oil are such that immediate and long-term injuries to herring were expected. Exposure calculations using pilings and other artificial surfaces along the San Francisco waterfront indicated that 45 acres of the 300 acres of spawning habitat at the waterfront were oiled. It was estimated that 246,900,000,000 (2.469×10^{11}) herring eggs were exposed to oil on these surfaces, which represents approximately 8 percent of the total eggs estimated to have been spawned in the Bay in 1997. Herring injuries included loss of herring embryo viability, contaminated food, and decreased habitat quality.

The spilled oil caused extensive injury to intertidal organisms such as algae, barnacles, snails, and crabs due to smothering by the oil. Where hot water washing of shorelines and structures occurred, the cleaning process likely killed sessile plants and animals not directly impacted by the oil. It was estimated

that injuries to these organisms would occur for several months to years before the natural recovery process occurs. In areas where oil remained, reoccupation of these areas would be slow.

Direct impacts to fin fish were not observed. Significant adverse effects to fish were not expected due to the small fractions of oil expected to have been dispersed into the water column and the dilution caused by waves, tides, and currents during the spill.

Twelve oiled harbor seals were observed, and their conditions were monitored as they moved between Yerba Buena Island and Point Bonita. Their haul out sites at Yerba Buena Island, Point Bonita, and Angel Island also were oiled, but no mortalities due to oil exposure were observed.

3.4 Lost human-use

Substantial adverse impacts on the human-use of public federal, state, and municipal resources and other recreational activities occurred due to the presence of oil on the waters and shorelines of the Bay and the California coast. The oil spill adversely impacted several public facilities and areas including: Golden Gate National Recreation Area, Point Reyes National Seashore, San Francisco Maritime National Historical Park, Angel Island State Park, and Fort Point National Historic Site, Gulf of the Farallones National Marine Sanctuary, Monterey Bay National Marine Sanctuary, and municipal shorelines and waterfronts. Lost human-use of some of these public resources occurred because of the closure of these areas. The quality of visitation by park visitors was also diminished because of shoreline oiling or response operations. The Trustees estimated that total damages resulting from lost human-use and the diminished quality of human-use due to the oil spill ranged from \$1.1 to \$1.4 million.

Portions of Angel Island State Park and GGNRA were closed to visitors during cleanup operations and the quality of visits to these parks was diminished as a result of the spill. Angel Island, located in San Francisco Bay approximately one mile southeast of Tiburon in Marin County was one of the areas most affected by the oil spill. All of the beaches on Angel Island were closed for 10 to 43 days because oil deposited on them during the spill and the public was denied access to these beaches until they were cleaned and declared safe for use. Closure of Angel Island State Park resulted in 4,698 lost or canceled visits by the public, and an additional 535 visits were diminished in value. Six areas at Angel Island State Park were closed for a total of 93 days (Table 3). Human-use damages resulting from both lost and diminished quality of visits at the park was calculated to range from approximately \$161,700 to \$461,700.

Table 3. Angel Island State Park Official Closures.

Area Closed	Duration (days)
China Cove	10 days
Quarry Beach	10 days
Perle's Beach	10 days
Ayala Cove Beach	10 days
West Garrison Beach	10 days
East Garrison Beach	43 days
Total	93

As a result of the oil spill, eleven facilities or areas within the GGNRA were closed between one and six days, and these areas were closed for a total of 44 days as shown in Table 4. Within the GGNRA, Crissy Field Beach was the site most adversely impacted, and approximately 7,000 linear feet of beach and

associated shorelines were heavily oiled. The trustees estimated that 127,904 visits to the GGNRA were diminished in value due to the spill. Human-use damages resulting from both lost and diminished quality of visits at the GGNRA was calculated to be approximately \$938,300.

Table 4. Golden Gate National Recreation Area Official Closures

Area Closed	Duration (days)
Aquatic Park/Municipal Pier	2
Baker Beach	4
China Beach	4
Crissy Field	2
Fort Point Pier	5
Land's End Beaches	5
Ocean Beach	1
E. Fort Baker/Horseshoe Cove	4
E. Fort Baker Fishing Pier	6
Kirby Cove to Point Bonita	6
Rodeo Beach	5
Total	44

4.0 RESTORATION PLANNING

4.1 Restoration Strategy

The goal of the Oil Pollution Act of 1990 (OPA) is to make the environment and public whole for injuries to natural resources and services resulting from an incident involving the discharge or substantial threat of a discharge of oil. OPA recommends that this goal be achieved by returning injured natural resources to their baseline condition and by compensating for any interim losses of natural resources and services which occur during the period of recovery to baseline.

Restoration actions under OPA are either primary or compensatory. Primary restoration is action(s) taken to return injured natural resources and services to baseline on an accelerated time frame. The OPA regulations recommend that trustees consider natural recovery under primary restoration. The trustees may select natural recovery under three conditions: (1) if feasible, (2) if cost-effective primary restoration is not available, or (3) if injured resources would recover quickly to baseline without human intervention. Alternative primary restoration activities can range from natural recovery to actions that prevent interference with natural recovery to more intensive actions expected to return injured natural resources and services to baseline faster than natural recovery.

Compensatory restoration is action taken to compensate for the interim losses of natural resources or services pending recovery. The type and scale of compensatory restoration may depend on the nature of the primary restoration and the level and rate of recovery of the injured natural resources or services given the primary restoration action. When identifying the compensatory restoration components of the restoration alternatives, the trustees should first consider compensatory restoration actions that provide services of the same type and quality and of comparable value as those lost. If compensatory actions of the same type and quality and comparable value cannot provide a reasonable range of alternatives, trustees then consider other compensatory restoration actions that will provide services of at least comparable type and quality as those lost.

When services of the same type and quality and of comparable value can be provided, the OPA regulations prescribe the “service-to-service” scaling approach to determine the appropriate scale of compensatory restoration.

The Trustee Council determined that “services of the same type and quality, and of comparable value” as the lost ecological and recreational services could be provided through appropriate habitat enhancement projects. For this spill, the Trustee Council considered the area affected by the oil, estimates of initial lost ecological and recreational services, and recovery periods of each impacted habitat type. In accordance with the scaling approach, the Trustee Council relied on available data, applicable literature, experience and best professional judgment. Precise scaling calculations are often not possible because knowledge of relevant physical and biological processes is not sufficient. Accordingly, some general assumptions were adopted by the Trustee Council to allow an estimation of scale of restoration necessary to compensate for injuries resulting from this spill.

The Trustee Council developed criteria to evaluate alternative restoration projects identified during the scoping process as well as restoration alternatives identified by the Trustee Council (hereafter collectively referred to as “restoration alternatives” or “projects”). The criteria include relevant federal and state statute provisions governing use of recoveries for natural resource damages.

4.2 Evaluation Criteria

The OPA regulations (*15 CFR 990.54*) recommend that Trustees develop a reasonable range of primary and compensatory restoration alternatives, and then identify the preferred restoration alternatives based on specified selection criteria. The Trustee Council for the Cape Mohican oil spill developed selection criteria separated into two categories, the first being described as “threshold” and the latter described as “additional” criteria. Restoration project alternatives must achieve a minimum level of acceptance on the threshold criteria in order to receive further consideration under the additional criteria. The Trustee Council used the evaluation criteria listed below to consider and prioritize all restoration project alternatives, including alternative projects that were proposed by the public. The criteria are not ranked in order of priority.

Threshold Criteria

Technical feasibility:

The project alternative must be technically sound. The Trustees consider the level of uncertainty or risk involved in implementing the project. A proven track record demonstrating the success of projects utilizing a similar or identical restoration technique can be used to satisfy this evaluation criterion.

Consistency with the Trustees’ restoration goals:

The proposed alternative must meet the Trustees’ intent to restore, rehabilitate, replace, enhance or acquire the equivalent of the injured natural resources or the services those resources provided.

Compliance with laws:

The proposed alternatives must comply with all applicable laws.

Public health and safety:

The proposed alternative cannot pose a threat to the health and safety of the public.

Additional Criteria

Relationship to injured resources and services:

Projects that restore, rehabilitate, replace, enhance or acquire the equivalent of the resources and services injured by the spill are preferred to projects that benefit other comparable resources or services. The Trustees consider the types of resources or services injured by the spill, the location, and the connection or “nexus” of project benefits to those injured resources.

Avoidance of further injury:

Proposed project alternatives should avoid or minimize adverse impacts to the environment and the associated natural resources. These adverse impacts may have resulted from the original oil spill incident or may be caused in the future by collateral injuries when implementing, or as a result of implementing, the proposed project alternative. The Trustees consider the avoidance of future short-term and long-term injuries as well as mitigating past injuries when evaluating projects.

Likelihood of success:

The Trustees consider the potential for success and the level of expected return of resources and resource services. The Trustees also consider the ability to monitor and evaluate the success of the project; the ability to correct any problems that arise during the course of the proposed project alternative; and the capability of individuals or organizations expected to implement the alternative. Performance criteria should be clear and measurable.

Multiple resource benefits:

The Trustees consider the extent to which the proposed project alternative benefits more than one natural resource or resource service. These benefits are measured in terms of the quantity and associated quality of the types of natural resources or services expected to result from the project.

Time to provide benefits:

The Trustees consider the time it takes for benefits to be provided to the target ecosystem and/or public. A more rapid response to providing benefits is favorable.

Duration of benefits:

The Trustees consider the expected duration of benefits from the proposed project alternative. Projects that provide long-term benefits are favorable.

Protection of alternative:

The Trustees consider the opportunities to protect the implemented alternative and resulting benefits over time through conservation easements, land acquisition, or other types of resource dedication. Long-term protection of the project site and the benefits it provides are favorable.

Opportunities for collaboration:

The Trustees consider the possibility of matching funds, in-kind services, or volunteer assistance, as well as coordination with other ongoing or proposed projects. External funding and support services that reduce costs or extend benefits are favorable.

Benefits relative to costs:

The Trustees consider the relationship of expected resource and service benefits to the expected project costs from each alternative. Trustees seek projects with the least costly (i.e. most cost-efficient) approach to deliver an equivalent type and amount of benefits.

Total cost and accuracy of estimate:

The Trustees evaluate the estimated total cost of each project alternative and the validity of the estimate. The total cost estimate should include costs to design, implement, monitor, and manage the alternative. The validity of cost estimates are evaluated based on the completeness, accuracy, and reliability of methods used to estimate costs, as well as the credentials of the person or entity submitting the cost estimate to accurately estimate costs.

Comprehensive range of projects:

Trustees evaluate the extent to which a project contributes to a more comprehensive restoration package. Proposed project alternatives are evaluated for the degree to which it benefits any uncompensated spill injuries.

4.3 Evaluation of Environmental Restoration Alternatives

To reduce transaction costs and avoid delays in restoration, OPA regulations encourage trustees to conduct the NEPA process concurrently with the development of the Restoration Plan. To comply with the requirements of NEPA, the Trustee Council analyzed the effects of each Proposed Restoration Alternative on the quality of the human environment. NEPA's implementing regulations direct federal agencies to evaluate the potential significance of proposed actions by considering both the context and the intensity of the action. For most of the actions considered in this draft RP/EA, the appropriate context and area of potential significance of the action is regional, as opposed to national or worldwide. Several restoration alternatives included in this section are based on conceptual designs rather than detailed engineering design work or operational plans. Therefore, details of specific projects may require additional refinements or adjustments to reflect site conditions or other factors, and individual projects

may require preparation of additional NEPA/CEQA documents. The Trustee Council assumes that implementation of the restoration projects would begin in 2002.

Following settlement for environmental damage claims for the Cape Mohican oil spill, the Trustees signed an MOU to guide the Restoration Planning and implementation process. The MOU specifies that the settlement will be allocated to four ecological resource categories (birds, fish, wetlands/mudflats, and beaches), and lost recreational use (Table 5). As illustrated in Table 5, except for lost and diminished human-use, the cost of the proposed restoration projects exceeds the amount available for each resource category.

Table 5. Comparison of Settlement Allocation to Proposed Restoration Projects

Resource Category	Available Funds (\$)	Proposed Restoration (\$)
Wetland habitat	400,000	935,348
Sandy shoreline & rocky intertidal	500,000	869,214
Bird restoration	800,000	1,974,545
Fisheries and water quality	425,000	1,044,217
Lost and diminished human-use	1,030,000	1,030,000
Total	3,155,000	5,853,324

In accordance with the consent decree, the MOU, OPA, and the Cape Mohican Trustee Council's Resolution, expenditures from the Cape Mohican oil spill restoration fund are limited to restoring injured natural resources and lost or diminished services. To restore injured natural resources and lost human-use of the natural resources that resulted from the Cape Mohican oil spill, the Trustee Council ranked proposed Restoration Alternatives into three Preferred Status categories as follows:

- Highly Preferred
- Moderately Preferred
- Non-preferred.

The Restoration Planning process has resulted in the identification of 16 proposed restoration projects, listed in Table 6, and there are insufficient funds available to implement all of the projects. The Trustees have placed several projects in the non-preferred category due to these financial constraints. In addition, some of the projects in the preferred categories may only receive partial funding. The public is encouraged to provide comments on the projects that it prefers to be implemented. The following section describes 14 Proposed Restoration Alternatives being considered for implementation to compensate for injured natural resources.

Table 6. Summary of Potential Restoration Projects for the Cape Mohican Oil Spill.

Project No.	Restoration Category and Project	Estimated Cost	MOU Status ¹	Preferred Status ²
	Birds			
1	Shorebird Habitat Protection at GGNRA	\$23,500	Y	H
2	California Least Tern Habitat Enhancement at Alameda Point	\$141,000	N	M
3	Acquisition, Enhancement, and Management of Red Rock Island	\$800,000	Y	M
4	Restoration of Shorebird Foraging Habitat through Control of Exotic Cordgrass in San Francisco Bay Wetlands	\$246,000	N	M
5	Farallon Seabird Restoration: a) Exotic vegetation control in nesting areas b) Removal of concrete slabs from nesting areas c) Control of exotic mice	\$143,750 \$143,750 \$390,195	N	M N N
6	Restoration of Injured Bird Species through Native Vegetation Restoration at Marin Islands NWR	\$86,350	N	N
	Fisheries and Water Quality			
7	Pacific Herring Spawning Habitat Enhancement in San Francisco Bay	\$456,597	N	H
8	Wetland Restoration at Pier 98, India Basin, San Francisco	\$146,920	N	H
9	Steelhead Stream Habitat Enhancement at San Francisquito Creek	\$40,000	N	H
10	Wetland and Water Quality Enhancement at Pier 94	\$400,700	N	N
	Wetlands and Mudflats			
11	Giacomini Coastal Wetlands Restoration Project	\$435,348	Y	H
12	Hamilton Wetlands Restoration	\$500,000	N	N
	Sandy Beach and Rocky Intertidal Habitat			
13	Sandy Beach Habitat Restoration at PRNS	\$303,214	Y	H
14	Protection of Duxbury Reef Through Education	\$566,000	Y	H
	Human-use			
15	Angel Island Foot Trail Enhancement	\$180,000	Y	H
16	Crissy Field Habitat Stewardship Program	\$850,000	Y	H
	TOTAL	\$5,853,324		

¹ A 'Y' means the trustees relied on the project to develop the damage claim and agreed in a Memorandum of Understanding to consider the project during development of the Restoration Plan if the project is feasible. A 'N' means the trustees did not rely on the project to develop the damage claim.

² H – highly preferred project, M- moderately preferred project, N – non-preferred project.

4.3.1 BIRD RESTORATION

4.3.1.1. #1 – Restoration Alternative: Shorebird Habitat Protection at Golden Gate National Recreation Area

Project Description

Trustee analysis of injuries to wildlife indicates that approximately 4,000 birds were impacted by the Cape Mohican oil spill. The majority of these oiled birds observed during the oil spill were shorebirds, including: willets, western sandpipers (*Calidris mauri*), marbled godwits, sanderlings (*Calidris alba*), dunlin (*Calidris alpina*) and the federally threatened western snowy plover. A substantial number of these oiled birds were observed on Ocean Beach within GGNRA. Two primary causes for declines in shorebird populations include the loss or degradation of sandy beach habitat (e.g., from development and invasion of non-native plants), and disturbance by humans. Habitat protection and public outreach, as described below, is very effective at reducing human-related disturbance to shorebirds.

The restoration project will be implemented at Ocean Beach. Ocean Beach is approximately 4 miles long and is located within the city and county of San Francisco and entirely within GGNRA. It is an important site for shorebird resting and foraging activities and provides habitat for tens of thousands of wintering and migrating shorebirds, including western snowy plovers, which inhabit the beach for up to 10 months of the year. This restoration project entails improving habitat protection by reducing the level of human-caused disturbance to wintering and migratory shorebirds.

The GGNRA installed 12 interpretive and regulatory signs at major beach entrances to inform the public of the presence of western snowy plovers and other shorebirds, and their vulnerability to disturbance by humans and recreational activities. An interpretive bulletin on protecting western snowy plovers, shorebirds and sandy beach habitat also was published. Due to insufficient funds, however, GGNRA has been unable to update and replace damaged or missing signs, or update and reproduce interpretive bulletins. This project component will allow updating and replacement of damaged or missing signs and re-printing of interpretive bulletins for up to 10 years. The project includes costs for design and text changes that may be required.

Restoration Objectives

This restoration project is intended to achieve improved habitat protection and reduce disturbance to wintering and migratory shorebirds at Ocean Beach. This objective will be accomplished by reducing disturbance of shorebirds from human recreation. This project involves public outreach. The public outreach project will increase protection of shorebirds and enhance visitor understanding of the importance of urban beach habitat for wintering and migratory shorebirds through the use of signs and educational bulletins.

Scaling Approach

Numerous shorebirds, including the federally threatened western snowy plover, were observed to be oiled during the spill. Ocean Beach provides important habitat for wintering and migratory shorebirds for foraging and resting, important for building necessary fat reserves for migration and reproduction.

This project will compensate for impacts to shorebirds not addressed by the enhancement and restoration tasks of other projects.

There are numerous site-specific environmental and human-related factors that influence shorebird survival and reproductive success. These include factors such as human disturbance, predation, invasive non-native vegetation, weather, natural events, oil spills and other contamination. It is difficult to measure productivity fluctuations based on modifications to only one of these influencing factors. The Trustees have not quantified the extent of potential benefits that will result from this habitat protection action. This project, however, will aid in reducing human-related disturbance to wintering and migrating shorebirds.

Although it is proven that public outreach programs are effective, it is very difficult to quantify the benefits. Based on the results of similar projects and best professional judgement of the Trustees, this scale of habitat protection and public outreach undertaken to protect shorebirds and enhance visitor understanding of the importance of urban beach habitat for shorebirds is expected to compensate for injuries to shorebirds.

Probability of Success

The probability of success for this habitat protection project is high. Implementation of similar shorebird management/outreach programs have been successful in increasing shorebird protection and in enhancing understanding by the public. The Trustees expect that similar benefits will be accomplished through this project.

Success Criteria and Monitoring

The success criterion will be the reduction in incidence of disturbance to shorebirds, production of public education bulletins, and placement of interpretive signs on Ocean Beach. As part of this project, the Trustees will continue to monitor disturbance impacts on wintering and migrating shorebirds at Ocean Beach.

Approximate Project Cost

Habitat Protection at Ocean Beach

Expenditure	Quantity	Unit Cost	Total Cost
<i>Replacement of Interpretive Signs Over 10 Years</i>			
Wooden frames and plexiglass covers	50	\$275	\$13,750
Interpretive panels	50	\$65	\$ 3,250
Minor re-design and text updates	5	\$250	\$ 1,250
<i>Reprinting of Interpretive Bulletins</i>			
5,000 copies of 4-color, 2-sided, folded (3 printings @ \$1500 each)	3	\$1500	\$ 4,500
Minor re-design and text updates of interpretive bulletin	3	\$250	\$ 750
Total Project			\$23,500

Environmental Consequences

This project will result in environmental benefits by reducing the level of human-caused disturbance to wintering and migrating shorebirds, including the federally threatened western snowy plover, in a national park. Because this project provides for continuation of an existing program, the project is not expected to result in any significant adverse environmental impacts.

Evaluation

Ocean Beach provides important resting and foraging habitat for wintering and migrating shorebirds, including western snowy plovers. Shorebird feeding patterns and resting behavior have been adversely affected by human and domestic animal disturbance. Increased habitat protection and public outreach are practical and effective methods to improve conditions for shorebird resting and foraging, and have been successfully implemented at Ocean Beach and other sites in California. Although accurate quantification of the success and benefits of this project is difficult, this project is expected to be successful in reducing human disturbance to shorebirds at Ocean Beach.

The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select restoration projects and determined that this project is consistent with these selection factors. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for injuries to shorebirds that occurred as a result of the oil spill.

4.3.1.2. #2 - Restoration Alternative: California Least Tern Habitat Enhancement at Alameda Point

Project Description

At the time of the oil spill, California least terns that nest in San Francisco Bay were wintering in Central America and, therefore, this species was not directly impacted by the Cape Mohican oil spill. However, the shoreline areas near their nesting habitat at Alameda Point were oiled. California least terns are listed as a federal and state endangered species. Because of their special status, California least tern habitat enhancement at Alameda Point is proposed as a surrogate for injuries that occurred to several species of gulls and terns including Bonaparte's gulls (*Larus philadelphia*), California gulls (*Larus californicus*), glaucous-winged gulls (*Larus glaucescens*), Heermans's gulls (*Larus heermanni*), herring gulls (*Larus argentatus*), mew gulls (*Larus canus*), ring-billed gulls (*Larus delawarensis*), western gulls, Caspian terns (*Sterna caspia*), elegant terns (*Sterna elegans*), and Forster's terns (*Sterna forsteri*).

The California least tern colony at Alameda Point is the northernmost breeding colony along the California coast and the only substantial colony in San Francisco Bay. For the past 10 years, the colony has achieved high reproductive success and has an increasing number of breeding pairs. In several years, the colony size has the potential to expand beyond the suitable nesting habitat currently available at the site if additional and suitable offsite habitat is available.

The project will create new nesting habitat to accommodate approximately 150 additional pairs of terns, which will increase the carrying capacity of this colony site by 60 percent. The current colony consists of approximately 250 pairs. The current 4-acre colony site will be enlarged to 6 to 8 acres. Suitable nesting substrate (e.g., pea gravel and oyster shell) will be added along the side of the existing colony site. The shape of the site will be altered from the current triangle to a rectangle or oval to eliminate the confining triangle corners. Maintenance of the newly created habitat will consist of the removal of undesirable vegetation and addition of pea gravel where needed. This 3-year project will fund annual maintenance activities, which will take place each year prior to tern arrival. In subsequent years, maintenance will be incorporated into general refuge operations funding. The project will be conducted at Alameda Point, within the proposed boundaries of the Alameda National Wildlife Refuge in Alameda, California (Figure 2).

Restoration Objectives

The objective of this project is to increase the size and productivity of the California least tern colony at Alameda Point. This will be accomplished by expanding the amount of suitable habitat currently available to terns through habitat enhancement methods described above.

Scaling Approach

The Trustees estimate that between 130 and 150 additional California least tern nests will occur as a result of creating an additional 2 to 4 acres of suitable nesting habitat. The Trustees believe that the amount of increased nesting and productivity expected to result from this project will provide appropriate compensation for injuries to 11 species of terns and gulls.

Although difficult to predict precisely, the Trustees expect increased reproductive success to occur as a result of predator control measures instituted as part of this project.

Probability of Success

The probability of success for this project is very high. The nesting habitat requirements of California least terns are well known, and habitat enhancement methods prescribed for this project have proven to be

successful in other projects. Similar projects to enhance nesting habitat have successfully increased colony size and productivity. The addition of the White Beach habitat enhancement at Camp Pendleton, California, has increased the fledgling production (Chris Bandy, personal communication). Similar habitat management practices implemented at the Alameda Point colony site are expected to have similar success.

Success Criteria and Monitoring

To consider the program a success, it must produce 100 active nest initiations at the Alameda Point colony within six years of project initiation. Creation and maintenance of suitable habitat for three years will also be a criterion for project success. To evaluate and document the success of the project, a monitoring program to assess habitat conditions and nesting increases will be conducted for three years and again at six years.

Approximate Project Cost

Expenditure	Total Cost
Fencing (1,200 feet @ \$10/ft.)	\$ 12,000
Shell and pebbles (1,600 cu yds. @ \$46/cu yd)	\$ 73,600
Environmental compliance & Project management	\$ 5,500
Monitoring (3 mos./yr. for 3 yrs. @ GS-5 rate)	\$ 20,000
Maintenance of habitat & fence (\$10,000/yr. for 3 yrs.)	\$ 30,000
TOTAL	\$141,000

*Note: After three years monitoring and maintenance will be incorporated into normal operations.

Environmental Consequences

Vegetation removal and placement of pea gravel will be conducted during the non-nesting season. The effectiveness of the 3- to 4-foot tall fence will be monitored. If unacceptable adverse impacts result to predators, modification to the fence will be evaluated. The project is not expected to have any significant adverse environmental or economic impacts.

Evaluation

Implementation of this project will result in positive benefits by increasing the amount and quality of least tern nesting habitat at Alameda Point. Habitat enhancement is the only practical means available to increase the size of the Alameda Point California least tern colony and has proven to be successful in the past. Monitoring of the colony site will enable agency biologists to assess and document the success of the project. No significant adverse environmental or economic impacts are expected to occur as a result from this project.

The Trustees have evaluated this project against all Threshold and Additional screening criteria developed to select restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for injuries to terns and gulls that occurred as a result of the oil spill.

4.3.1.3. #3 – Restoration Alternative: Acquisition, Enhancement and Management of Red Rock Island

Project Description

Trustee analysis of injuries to wildlife indicates that approximately 4,000 birds were impacted. The most direct evidence of acute injury is reflected in the documentation of dead and live stranded birds. It is estimated that 593 birds were killed and of these, 80 percent were seabirds. The predominant bird species killed were loons, grebes, pelicans, cormorants, gulls and alcids. San Francisco Bay is a critical area for waterbirds to nest, forage, and roost. Oil contamination in San Francisco Bay extended as far north as the Richmond-San Rafael Bridge and came within close proximity of Red Rock Island and other islands that support colonial nesting waterbirds. As a result, two sensitive seabird species suffered significant injuries including the California brown pelican (federally listed) and the double-crested cormorant (*Phalacrocorax auritus*) (California Species of Special Concern).

This project would provide direct in-kind, on-site compensation and replacement of ecological services through the creation or enhancement of seabird nesting and roosting habitat consistent with the injuries that were claimed by the trustees. This project served as the basis for the settlement and Red Rock was incorporated as a Preferred Project.

Project Description

The project would be conducted at Red Rock, which is a 9-acre island located in San Francisco Bay approximately 2 kilometers south of the Richmond-San Rafael Bridge at the intersection of San Francisco, Marin, and Contra Costa counties. This project proposes to accomplish several things to benefit waterbirds resources of San Francisco Bay including: (1) provide funding to acquire the island to ensure protected habitat; (2) create and enhance nesting habitat for several waterbird species impacted by the spill, including double-crested cormorants; (3) establish a breeding bird monitoring program; (4) create protected and suitable roosting habitat for the California brown pelican; (5) provide educational materials to the public regarding the valuable natural resources on Red Rock Island; and (6) provide for enforcement and management efforts.

At this time the California Department of Fish and Game is exploring a variety of options for acquisition and long-term management of the Island. Thus far, the National Audubon Society has indicated their interest in participating in or coordinating this project (Personal communication, Dan Taylor, National Audubon). The specific details of this potential collaboration are being explored.

The proposed project will enhance and create new nesting habitat through vegetation management, including eradication of non-native species. Coyote brush or other native shrubs will be planted to provide new nesting substrate. Some wooden nesting platforms would be constructed to accelerate re-colonization by cormorants.

Social attraction techniques which have been used successfully to restore seabird colonies at several other locations in the nation, will be employed to attract and establish a double-crested cormorant nesting colony on Red Rock Island and encourage pelican roosting. This will entail the use of decoys and recordings of courtship vocalizations.

Human disturbance from boaters and fisherman who currently use the island cause problems for nesting waterbirds, therefore, this project includes measures to control human-use of the island. This would be accomplished in part through public outreach and education. Signs placed at key marinas and boat launch ramps would enlist the public support in complying with restrictions on landing on the Island and provide information on the sensitivity of the habitat and the wildlife. Pamphlets would target boaters, sea

kayakers, and other user groups. Enforcement personnel would contact boaters and fisherman to reinforce awareness of restrictions. Signs on the island and seasonal placement of buoys would make the public aware of closures and restriction.

Restoration Objective

There are several objectives of this proposal. Supporting details are provided below. The first objective is to increase the productivity and population size of colonial nesting waterbirds, particularly double-crested cormorants, in San Francisco Bay. Two hundred cormorant nests will be established in five years. The double-crested cormorant is a fish eating diver that has historically occurred as a resident breeding species in marine, estuarine, and fresh waters along the California coast. Over the last century, it has experienced a population decline, probably due to pesticides and human disturbances, at 37 coastal and island breeding colonies. At Southeast Farallon Island, for example, thousands of double-crested cormorants nested in the mid-1800's, but only about 50 nests remained by 1972. Breeding populations increased on the island (250 nests in 1991) and elsewhere in California in the 1980's and 1990's and were estimated at about 5,000 breeding pairs by 1991 (*Carter et al., 1992*).

In San Francisco Bay, cormorant colonies are located on the Bay Bridge, the San Rafael-Richmond Bridge, and in the Napa salt ponds. None of these sites are considered to have long term security. For example, the Bay Bridge Colony, with 794 nests in 1999, will be lost due to the scheduled rebuilding of the bridge structure. It is unclear whether cormorants will be accommodated on the new structure, as conflicts over design, bridge maintenance activities and concerns about collisions between cormorant fledglings and autos would likely continue. This example shows that man made structures are temporary opportunities at best, and illustrates the need for more secure nesting areas. The Red Rock Island project fills this need by establishing natural nesting habitat for cormorants and other colonial nesting birds.

The second project objective is to provide protected, disturbance free roost sites for brown pelicans and other waterbirds. San Francisco Bay is an important post-breeding dispersal area for California brown pelicans. Other than protecting foraging habitat and pelican food resources the most important management tool available for pelican management in San Francisco Bay is the creation/protection of roosting habitats. This is the only project proposed that addresses injuries to this Endangered Species. Specifically, this project seeks to enhance, create, and protect roosting habitat.

Communal roost sites are essential habitat for brown pelicans (*Gress and Anderson 1983, Jaques 1994*). Brown pelicans are unlike many other seabirds in that they have wettable plumage (*Rijke, 1970*). Their feather structure is such that they will take on water, become soaked to the skin, and hypothermic if they do not come ashore regularly to dry out and restore their plumage. Brown pelicans are also among the earth's heaviest flying birds (*Pennycuik, 1972*). They have evolved a series of behavioral adaptations to conserve energy in flight, and spend a large portion of their daily time budget resting onshore at terrestrial roosts. Roost site selection is based on proximity to prey resources, isolation from potential predators and human disturbance, and microclimate features that aid in thermoregulation. Pelicans spread out at a larger number of roosts by day and gather into a smaller number of traditional night roosts at dark, when they are more vulnerable to mammalian predation. An island-type habitat like Red Rock is generally required at night. Major night roosts may support hundreds to thousands of pelicans on a given night (*Briggs, 1987; Jaques and Anderson 1988; Jaques et al. 1996*).

Improvements in the network of communal roosts in San Francisco Bay will have a positive influence on the energy budgets of pelicans by reducing energy costs associated with (1) commuting between prey and roosts, (2) flushing and relocating due to human disturbance, and (3) use of sub-optimal microclimates within roosts. Pelicans migrating along the California mainland will also benefit from increased availability, quality, and capacity of a new stopover site. Cumulative energy reductions will result in

improved body condition of individual birds. Population-level effects from improving the condition of individual birds should include increased juvenile and adult survival.

Pelican distribution and abundance in San Francisco Bay varies according to stage in the breeding cycle, breeding success, influx of birds from Mexico, large-scale migration patterns along the Pacific coast, distribution and abundance of prey, and roost site availability (*Anderson and Anderson, 1976; Briggs, et al., 1981; Anderson and Gress, 1983; Jaques, et al., 1996*). Briggs et al. (1981) found that distance to the nearest large roost was perhaps the most important factor governing pelican distribution along the shore. Currently the availability of roost sites limits the foraging range of brown pelicans and may limit the carrying capacity of San Francisco Bay. Prior to intensive human settlement and alteration within the Bay, brown pelicans would have had ample, suitable sites for roosting within wetlands, on sandy beaches, rocky shorelines, and islands. The loss of habitat from human encroachment has been somewhat offset by the addition of artificial structures, such as jetties, breakwaters, and floating structures. Pelicans now rely heavily on these types of structures for roost sites. Artificial structures were found to support about 65 percent of all pelicans roosting along the mainland (*Jaques, et al., 1996*). Few roosts along the mainland fall under the jurisdiction of natural resource agencies; several major roost sites on privately owned structures have been lost in recent years, and human disturbance at many existing roost sites is high.

The third objective is to educate the public regarding the sensitive and valuable natural resources at Red Rock, and the fourth objective is to minimize human disturbance. Red Rock offers a unique opportunity to enhance seabird nesting and roosting habitats especially for double-crested cormorants and California brown pelicans. As the last remaining privately owned large island in central San Francisco Bay, it has been subjected to a long history of human disturbance including mining operations and intermittent human residence. In recent years, unauthorized human visitors have undoubtedly caused the greatest problems for the nesting birds. Even occasional human intrusions on the island would dramatically reduce nesting habitat values. In spite of these problems, some seabird nesting and roosting values have persisted. The island supports one of the largest western gull colonies in the Bay as well as smaller numbers of nesting snowy egrets (*Egretta garzetta*) and black-crowned night herons (*Nycticorax nycticorax*) (*Schoenherr, A.A., C.R. Feldmeth, and M.J. Emerson, 1999. Natural history of the islands of California. California Natural History Guides, 61. Univ. of California Press, Berkeley, California*). Black Oystercatchers (*Haematopus bachmani*) and Canada geese (*Branta canadensis*) have also nested on the island. Prior to human disturbance, harbor seals were observed hauling out. Harry Carter (pers. comm.) observed California brown pelicans, Brandt's cormorants, pelagic cormorants, and double-crested cormorants roosting on the island. The establishment of a managed island seabird colony would ensure long-term stability for these important San Francisco Bay natural resources.

Scaling Approach

During the settlement process, the trustees estimated that within five years, with appropriate management and enhancement actions, 200 nests of double-crested cormorants could be established on Red Rock. Recolonization by double-crested cormorants would encourage roosting by California brown pelicans and possibly nesting by Brandt's cormorants. The existing Western gull, snowy egret and black-crowned night heron colonies would be protected and enhanced. The trustees estimated that the benefits to waterbirds at Red Rock would approximately replace the ecological services lost due to spill injuries to waterbirds and seabirds in particular.

Probability of Success

The probability of success for this project is high. Steven Kress, of the National Audubon Society, has successfully utilized similar seabird colony management and social attraction techniques with terns, tubenoses, alcids, and more recently with pelecaniforms (gannets; *personal communication, March 26, 2001*). Kress believes the proximity of an existing double-crested cormorant colony (Richmond Bridge) and the existing gull, heron, and egret colonies at Red Rock, will facilitate

recolonization by double-crested cormorants and encourage pelican roosting. In many respects this project is more straightforward than the nearby successful Devil's Slide common murre recolonization project. At Devil's Slide, murres nested in the first year of the project.

Success Criteria and Monitoring

The success criteria for this project will be the establishment of a double-crested cormorant colony on Red Rock, the attraction of roosting brown pelicans, and the enhancement of the existing Western gull, black-crowned night heron, and snowy egret colonies. Success will be determined through a monitoring program similar to that used in the Devil's Slide monitoring program.

Approximate Project Cost

The following table describes a cost estimate to implement a five-year project to acquire, enhance, and protect seabird-nesting habitat at Red Rock. Cost estimates were derived from actual expenses incurred by the trustee agencies for similar projects including the Apex Houston murre recolonization project and US Fish and Wildlife expenses associated with the operation of the Oregon Coast National Wildlife Refuge. Additional cost information was obtained from the National Audubon Society.

Phase	Expenditure	Total Cost
Phase I	Appraisal	Completed
Phase II	Acquisition	\$350,000
Phase III	Development of Management Plan	\$5,000
Phase IV	Public Education and Enforcement Signs 4 ft x 8 ft (4) Signs 24 in x 24 in and posts (16) Pamphlets and Fliers Boat Patrol and public contact (\$18,240/yr)	\$6,000 \$800 \$2,000 \$91,200
	Total (over 5 years)	\$100,000
Phase V	Nesting Habitat Enhancement Exotic plant control (2 years): Labor (CCC) Native plantings (3 years): Materials & Labor Cormorant nesting platforms (20): Materials, Construction, and Installation Total (over 3 years)	\$8,000 \$32,500 \$4,500 \$45,000
Phase VI	Social Attraction and Monitoring Program Decoys (100 @ \$60 ea.) Sound system (batteries, solar panel, CD player) Salaries and benefits (1 full time biologist/5yrs) Salaries and benefits (1 seasonal part-time/5 yrs)	\$6,000 \$4,500 \$225,000 \$64,500
	Total (over 5 years)	\$300,000
	Total	\$800,000

Environmental Consequences

The project will provide positive benefits to nesting and roosting waterbirds in San Francisco Bay. The project will protect, enhance and restore additional nesting habitat for double-crested cormorants, black-crowned night herons, snowy egrets, and western gulls. It will provide important roosting habitat for California brown pelicans and other waterbirds. The island will provide additional habitat for these birds should they ever be forced from the bridge nest sites or from other Bay islands. Removal of exotic vegetation and the restoration of native flora will enhance the island ecosystem. All construction and vegetation management work will be done when birds are not nesting during periods of low wildlife use. Potential short-term adverse environmental impacts will be limited to intermittent disturbance during construction and re-vegetation phases. No significant adverse economic impacts are anticipated to occur as a result of this project.

Evaluation

This project would provide direct in-kind, on-site compensation and replacement of ecological services through the creation and enhancement of seabird nesting and roosting habitat consistent with injuries to specific waterbirds and seabirds that were claimed by the trustees. The probability of success for this project is high. Other restoration projects throughout the nation have successfully utilized similar seabird colony management and social attraction techniques with terns, tubenoses, alcids, and more recently with pelecaniforms (gannets). The proximity of an existing double-crested cormorant colony (Richmond Bridge) and the existing gull, heron, and egret colonies at Red Rock, will facilitate recolonization by double-crested cormorants and encourage pelican roosting. Cost estimates have been derived from actual expenses incurred by trustee agencies for similar projects and are therefore thought to be practical and cost-effective. No long-term adverse environmental or economic impacts are expected to result from this project.

This project served as the basis for the settlement and was incorporated as a Preferred Project. The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select preferred restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project would effectively provide appropriate compensation for waterbirds injured as a result of the oil spill.

4.3.1.4. #4 – Restoration Alternative: Restoration of Shorebird Foraging Habitat through Control of Exotic Cordgrass in San Francisco Bay Wetlands

Project Description

The Cape Mohican oil spill impacted 99 acres of intertidal mudflat habitat that was used extensively by shorebirds as foraging habitat. The majority of the estimated 4,000 oiled birds observed during the oil spill were shorebirds, including willets and marbled godwits. As described below, habitat restoration and protection is a preferred restoration alternative for these shorebird impacts. In San Francisco Bay, intertidal mudflats and tidal salt marshes provide essential foraging areas for large numbers of shorebirds, between 500,000 to 1 million, that migrate through or winter in the Bay annually. These habitats are also important to wintering waterfowl and other waterbirds for foraging, and to many fish species as spawning and nursery habitat.

Throughout San Francisco Bay, exotic smooth cordgrass (*Spartina alterniflora*) has invaded habitats including: intertidal mudflats, suppressing algae and eelgrass; tidal salt marsh plains, replacing native marsh plants such as pickleweed and Pacific cordgrass (*Spartina foliosa*); and tidal marsh sloughs, decreasing intertidal shorebird foraging areas and increasing sedimentation, which eventually reduces tidal flow. As a result, important native habitat for shorebirds, waterbirds, waterfowl, and marine organisms is lost or its quality is lowered, which results in reduced diversity and abundance of these species. Mudflats in the project area function as high-use shorebird foraging areas, and control of smooth cordgrass in this area will result in substantial benefits for shorebirds.

This project involves eradication of smooth cordgrass from mudflats and tidal salt marshes in the central and south portions of San Francisco Bay, between the Bay Bridge and the Dumbarton Bridge. Control methods include hand pulling, hand mowing, and application of Rodeo herbicide. Natural revegetation will be allowed to occur after control measures are implemented. The work will be conducted between June and November each year, prior to smooth cordgrass seed-set for maximum effectiveness. Landowners of smooth cordgrass invaded marshes, qualified contractors working for these landowners, or other parties who obtain landowner permission will conduct the control work.

Restoration Objectives

The objective is to remove smooth cordgrass from intertidal mudflats to create conditions that will provide native vegetation (e.g., algae and eelgrass) an opportunity to naturally revegetate. In fact, microalgae provide the basis for the estuarine food web, forming dense patches on mudflats and representing a readily available food source for invertebrates (e.g., worms and clams) that are then consumed by shorebirds and waterfowl.

Removal of smooth cordgrass from tidal marshes and tidal sloughs will allow native plants to reestablish on the tidal marsh plain, and will restore shorebird foraging and fish nursery habitat in the tidal sloughs. As a result, this project will increase the amount of productive native foraging habitat available to wintering and migrating shorebirds and wintering waterfowl, and should enhance the condition, survival, and productivity of these species.

Scaling Approach

The project will restore intertidal mudflat similar to that injured in the spill. The restored habitat will benefit shorebirds, waterfowl, and other waterbird species as well as marine animals throughout San Francisco Bay.

Probability of Success

The probability of success for this project is high. Herbicide control of smooth cordgrass conducted in south San Francisco Bay by San Francisco Bay National Wildlife Refuge and East Bay Regional Park District has resulted in 75 to 95 percent control effectiveness after only one year of control, and nearly complete control in three years, with retreatment. Hand mowing and hand pulling are less effective and much less time and money efficient, but these methods will be used when herbicide application is not advisable or necessary. It is likely that similar results will be achieved with the proposed project.

Success Criteria and Monitoring

In order to ensure successful eradication of exotic cordgrass, control measures will continue for three years. Control areas will be monitored and repeated the following year as necessary. Biologists will establish monitoring transects, quadrats, and photopoints in the control areas, and will collect baseline data prior to implementing the control project. Each spring (after control is initiated), vegetation monitoring will be conducted and photographs will be taken at each established photopoint to determine the success of the control program. In addition, the project area will be searched for new smooth cordgrass invasions, which will then be targeted for control. The project will be determined successful if complete control of cordgrass is achieved within three years of project initiation.

Approximate Project Cost

Table 1 presents the approximate project cost for a 3-year program to restore and protect 100 acres of intertidal mudflat and tidal salt marshes. Smooth cordgrass control includes labor, equipment, materials, project management, and monitoring. Labor includes hiring a contractor (with a truck-mounted sprayer) to conduct herbicide application, backpack spraying, or hand mowing. Equipment necessary for the control consists of hand-mowers and backpack sprayers. Materials include herbicide (Rodeo), surfactant, and indicator dye. Monitoring will be conducted by a field technician. Environmental compliance and project management will be conducted by a biologist from Don Edwards San Francisco Bay NWR.

Table 1. Estimated Cost to Control Smooth Cordgrass

Expenditure	1st Year	2nd Year	3rd Year	Total Cost
Labor (\$100/hr for 2 person crew @ 4 hours/acre)	\$40,000	\$20,000	\$10,000	\$70,000
Materials (herbicide @ \$800/acre)	\$80,000	\$40,000	\$20,000	\$140,000
Equipment (mowers, backpack sprayers, protective gear)	\$2,000	\$1,000	\$1,000	\$4,000
Project Management (GS-11: 2 mo. Yr 1, 1 mo. in Yrs. 2 and 3)	\$8,500	\$4,250	\$4,250	\$17,000
Monitoring (2 mo. @ GS-5/Year)	\$5,000	\$5,000	\$5,000	\$15,000
TOTAL	\$135,500	\$70,250	\$40,250	\$246,000

Environmental Consequences

This project will result in positive benefits by restoring high-quality shorebird foraging habitat in San Francisco Bay. No significant adverse environmental or economic impacts are expected to result from this project.

To minimize the potential for impacts to native wildlife in the control areas, control work will not be conducted during nesting season for the endangered California clapper rail (which resides in the tidal marshes) or during native fish spawning season, unless these species do not inhabit the control area. In addition, disturbance to wildlife and habitat will be minimized during all control work. The type of control method to be used will be determined on a site-specific basis, depending on extent of smooth cordgrass invasion, access, and landowner input.

Potential impacts of a large scale, San Francisco Bay-wide control program are currently being assessed by the “Invasive Spartina Project,” managed by the California Coastal Conservancy. An environmental document, an EIS/EIR, is currently being written to fulfill NEPA/CEQA requirements and U.S. Fish and Wildlife Service is being consulted on potential endangered species impacts. The proposed project activities will be covered under this program.

Evaluation

Restoration of shorebird foraging habitat offers an effective means of increasing the survival of wintering and migrating shorebirds. This proposed control method for smooth cordgrass has been proven to be effective in restoring invaded intertidal areas. The project will restore a habitat similar to the one that was injured and will achieve an important conservation goal.

4.3.1.5. #5 - Restoration Alternative: Farallon Seabird Restoration Projects

Project Description

Three separate restoration projects were considered within this Restoration Alternative:

- A. Exotic Vegetation Control in Nesting Areas
- B. Marine Terrace Habitat Restoration
- C. Control of Exotic Mice

The restoration projects are presented under one Proposed Restoration Alternative because they have the same restoration objective, which is to restore burrow-nesting seabirds injured due to the oil spill, through the restoration of burrow nest habitat. The projects are identified separately because they use different methods to achieve the restoration objective, and have different preferred status (Table 6).

Trustee analysis of impacts to resident and migratory waterbirds indicated that of the 593 estimated birds lost, 80 percent were waterbirds. Seabird species injured included loons, grebes, pelicans, cormorants, alcids, and tubenoses. The impacts occurred in San Francisco Bay and the marine environment of the adjacent California coast. As described below, habitat creation and protection is a preferred restoration alternative for seabird injury.

The Farallon Islands comprise the largest seabird nesting colony complex on the Pacific Coast of North America south of Alaska. Populations of seabirds such as rhinoceros auklet (*Cerorhinca monocerata*), Cassin's auklet, and ashystorm-petrel (*Oceanodroma homochroa*) have declined in recent years. Exotic plants, including New Zealand spinach (*Tetragonia tetragonoides*) and *Malva* spp. have become established on Southeast Farallon Island and are potentially detrimental to nesting seabirds. More recently, non-native grasses have also begun invading prime seabird nesting habitat. These non-native species are extremely invasive and out-compete the endemic Farallon weed (*Lasthenia maritima*), an important seabird nest-building material. Exotic species also tend to be perennial, and consequently obstruct nesting crevices. In contrast, the native Farallon weed dies back during the nesting season, allowing seabirds access to crevice and soil nesting areas.

Southeast Farallon Island was formerly used as a base for lighthouse operations and military activities and a number of buildings and dwellings were constructed to support these uses. Obsolete buildings have been removed, but concrete foundations, walkways, and pads remain. These paved areas occur on the marine terrace and reduce the amount of deep soil habitat available for burrow-nesting seabirds, such as Cassin's and rhinoceros auklets. The house mouse (*Mus musculus*) is an introduced species to the Farallon Islands as a result of human activities. Mice can be an effective predator of eggs and chicks of small seabirds, such as storm-petrels and auklets. Mice have a more serious indirect effect on seabirds by causing predatory owls to overwinter. Owls do not breed on the island, but dispersing individuals arrive in fall when mouse populations are high, and when mice populations decline in late winter, owls switch their diet to seabirds. Cassin's auklets and ashystorm-petrels, eaten by owls, are declining at an alarming rate on Southeast Farallon Island. This Restoration Alternative consists of three separate projects that will be implemented on Southeast Farallon Island to restore burrow-nesting seabirds and are described below.

A. Exotic Vegetation Control in Nesting Areas

This restoration project involves the control of exotic vegetation. The primary species of concern are non-native New Zealand Spinach and *Malva* spp. A combination of chemical and mechanical methods

of control will be used to control exotic vegetation. Personnel will apply a solution of Round-up herbicide to plants in late August and early fall (before germination of native plants) to eradicate adult seed bearing and young plants. This work cannot be conducted during spring or summer due to disturbance to breeding seabirds. Throughout the winter and early spring, when native Farallon weed is growing, personnel will monitor and manually extract any spinach or *Malva* plants observed on the island. Just prior to the seabird breeding season, personnel will spend a minimum of 2 weeks, during peak spinach germination, canvassing the island and manually pulling spinach and *Malva* plants in areas of high seabird breeding density. Methods to control invasive grass species will be evaluated and the most effective method, or combination of methods, will be implemented. Seeds will be collected from native Farallon weed and used to re-seed bare soil areas created when large amounts of exotic plants are removed.

B. Marine Terrace Habitat Restoration

This restoration project involves breaking up concrete in approximately 10 paved areas on the marine terrace using hand tools (jack-hammer and concrete saw) and manual labor. Habitat will be restored and created in three ways: (1) concrete will be removed from potential burrow nest sites in areas where soil lies under the concrete; (2) rock walls will be constructed with broken concrete to create nesting crevices, and (3) nest boxes will be constructed and installed to promote seabird colonization, population growth, and facilitate monitoring.

C. Control of Exotic Mice

The house mouse is the only non-native mammal remaining on the island. Mice control measures involving poison bait traps or similar methods will be evaluated and used to control their population. The project will be completed in three phases.

Phase I (first year):

- Conduct a pilot study to identify a feasible means to control mice;
- Study the annual cycle of the island mice population to determine timing for control;
- Determine the growth pattern and cycle of important mice food plants,
- Determine other ecological factors important for effective control; and
- Identify permit requirements.

Phase II (years 2 and 3):

- Prepare a mice control plan;
- Continue studies of annual mouse cycles and plant interactions
- Conduct pilot bait drops;
- Conduct preliminary scoping to assess potential public interest and controversy;
- Obtain the necessary permits; and
- Complete environmental documentation and public involvement.

Phase III (year 4):

- Implement the mice control plan
- Monitor seabird population and effectiveness of mice control.

The project is located on Southeast Farallon Island, which is approximately 26 nautical miles west of San Francisco in the Pacific Ocean. (Figure 1). Southeast Farallon Island is part of the Farallon National Wildlife Refuge managed by the USFWS. The surrounding waters are part of the Gulf of the Farallones National Marine Sanctuary (GFNMS), which is managed by the National Oceanic and Atmospheric Administration (NOAA). Southeast Farallon Island is also within the Farallon Islands Ecological Reserve, which is managed by the California Department of Fish and Game (CDFG).

Restoration Objectives

Each of the three restoration projects focus on restoring burrow-nesting seabirds that were lost due to the oil spill which swept through ocean waters between the Farallon Islands and the Golden Gate before stranding on nearby beaches. These projects will increase the number of burrow-nesting seabirds on the Farallon Islands through the restoration of burrow nest habitat, removal of exotic plants that inhibit nesting, or the reduction or removal of mice as predators. Populations of seabird species have declined recently, and this restoration action will help mitigate the decline by increasing the size of the local nesting population of species that use the Farallon Islands.

Scaling Approach

The projects will increase the high-quality habitat for seabird nesting, improve the quality of existing habitat and increase population sizes through reduced predation. Long-term monitoring studies indicate that the Cassin's auklet nesting population has averaged 22,146 nesting individuals on Southeast Farallon Island over the past 10 years, and that this population has suffered at least a 70 percent decline over the last 25 years. Removal of pavement and creation of nesting crevices are expected to create approximately 300 square meters of new habitat. It is expected this action will create high quality habitat for up to 120 breeding pairs of burrow nesting seabirds. The control and removal of exotic vegetation are expected to increase the quality on approximately 50 acres of habitat. This will allow seabirds to increase densities to levels in areas without exotic vegetation. In addition, the removal of mice predation is expected to positively influence seabird survival and productivity to levels on islands without introduced non-native predators.

Probability of Success

Non-native mammals (e.g. feral cats and rabbits) have been successfully eradicated from Southeast Farallon Island, indicating that this project has potential for success. In addition, predator eradication and/or control projects on islands in Alaska, Florida, New Zealand and the Galapagos have been extremely successful at eradicating/controlling non-native mammals (e.g. rats, mice and foxes) and increasing populations and/or breeding success of seabirds (Taylor and Thomas 1989, Murphy and Ohashi 1991). A similar project, currently being implemented on California's Anacapa Island in the Channel Islands National Park, has been successful in controlling rodents during the pilot/test phase. As such, the probability of success for this project to accomplish the restoration objective is high.

Furthermore, controlling exotic vegetation has proven successful for restoring and increasing seabird populations in the Gulf of Maine (Kress et al. 1992). Thus, each of these habitat enhancement and predator control projects are likely to provide similar benefits to seabirds on Southeast Farallon Island.

Success Criteria and Monitoring

These projects will be determined successful through the creation of additional nesting habitat by either the removal of non-native vegetation or removal of concrete from nest sites and creation of new crevice-nesting habitat. The Control of Exotic Mice project will also be deemed successful if mice populations

are substantially reduced, or eliminated, and reproductive success of seabirds is increased to levels documented on other seabird islands that do not have introduced non-native predators.

Thirty years of pre-project seabird breeding population and productivity data collected from Southeast Farallon Island will also allow comparisons of pre-and post-project changes in reproductive parameters, and colonization of newly created habitat. Reproductive success of burrow and crevice nesting seabirds will be monitored annually during the seabird breeding season. In addition, counts of active burrows will be conducted in newly created habitat during the peak of the breeding season. The success of the exotic vegetation control project will be monitored by photo-points. These photo-points have been in place for over ten years, allowing pre- and post-project comparisons. Seabird monitoring will be conducted by biologists from the Point Reyes Bird Observatory through a cooperative agreement with the U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex. Refuge staff will monitor vegetation photo-points. Monitoring will take place for 5 years.

Approximate Project Cost

A. Exotic Vegetation Control in Nesting Areas

Expenditure	Quantity	Unit cost	Total cost
Personnel cost (removal)	5 years	\$16,500/yr	
Personnel cost (planting)	5 years	\$5,500/yr	
Herbicide cost	5 years	\$3,000/yr	\$125,000
Contingency (15%)			\$18,750
Total	5 years		\$143,750

B. Removal of Concrete Slabs from Nesting Areas

Expenditure	Quantity	Unit cost	Total cost
Remove concrete foundations	2 years	\$56,250/yr	
Construct rock walls	2 years	\$6,250/yr	\$125,000
Contingency (15%)			\$18,750
Total	2 years		\$143,750

C. Control of Exotic Mice

Expenditure	Quantity	Unit cost	Total cost
Mice Control - Phase 1			
Personnel cost	1 year	\$49,100/yr	
Equipment & supplies	1 year	\$9,000/yr	\$58,100
Mice Control - Phase 2			
Personnel cost	2 years	\$75,200/yr	
Equipment & supplies	2 years	\$24,700/yr	\$199,800
Mice Control - Phase 3			
Personnel cost	1 year	\$49,100/yr	
Equipment & supplies	1 year	\$32,300/yr	\$81,400
Contingency (15%)			\$50,895
Total	4 years		\$390,195

Environmental Consequences

To avoid disturbance to seabird nesting activities and brood rearing, each of the restoration projects will be implemented when seabirds are not nesting on the island. If toxic baits are used to control mice, they will be deployed during October and November, after all seabirds have left the island, and before the onset of the rainy season. Baits will be applied at the minimum rate needed to be effective on mice, and will be preceded by small-scale pilot test applications to insure that impacts to non-target species are avoided. Impacts to non-target plants or animals are expected to be minimal. The use of herbicides will be consistent with product application specifications, and the low volume to be used is expected to have minimal, if any, adverse environmental consequences. With the implementation of these mitigation measures and any other permit requirements, none of the three restoration projects are expected to result in any significant adverse environmental or economic impacts.

Evaluation

Each of the three restoration projects will provide positive benefits to several nesting seabird populations that have been declining in recent years. Habitat enhancement will also help restore natural environmental conditions on Southeast Farallon Island, which is a National Wildlife Refuge and is located within a marine sanctuary and ecological reserve.

Habitat enhancement and predator controls are feasible, practicable, and cost-effective methods to increase seabird productivity. Monitoring of seabird population size and productivity will enable agency biologists to determine the success of the project. Similar restoration projects to improve seabird productivity have been successful in the past and the Trustees anticipate similar success for this project.

The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select restoration projects and determined that this project is consistent with these selection factors. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for seabird injuries that occurred as a result of the oil spill. Due to financial constraints, Task A (exotic vegetation control) has been placed in the moderately preferred category and Tasks B and C have been placed in the non-preferred category.

4.3.1.6. #6 - Restoration Alternative: Restoration of Injured Bird Species through Native Vegetation Restoration at Marin Islands National Wildlife Refuge

Project Description

Oil from the Cape Mohican spill extended as far north as the Richmond-San Rafael Bridge, adversely affecting colonial nesting bird species. Established in 1992, the Marin Islands National Wildlife Refuge and Ecological Reserve (Refuge/Reserve) protects the largest egret and heron rookery in the Northern San Francisco Bay. Several species of birds impacted by the spill depend on this Refuge/Reserve for nesting. These species include black-crowned night heron, great blue heron (*Ardea herodias*), snowy egret, and western gull. As described below, habitat restoration with follow-up monitoring and protection is the preferred restoration alternative for this resource injury.

Conditions that inhibit the ability of herons and egrets to construct nests, such as insufficient habitat size or quality, are limiting population factors in San Francisco Bay. Human disturbance and predation are two main causes of reproductive failure and low reproductive success for herons, egrets, and other colonial nesting birds. The proposed project will increase reproductive success and the size of the heron and egret population in San Francisco Bay through habitat restoration and reduction of human disturbance and predation. The proposed project will focus on increasing productivity at an established nesting colony and creating habitat for colony growth. Specifically, the project will include the following:

- Development of a management plan to ensure proper compliance and review for all aspects of the project. This includes the removal of non-native plants, primarily by hand, on West and East Marin Islands to enhance dominance of native species. Large trees will be treated with herbicide and left standing to provide potential nesting platforms.
- Planting native coastal scrub vegetation including trees such as buckeyes (*Aesculus spp.*), live oaks and scrub oak (*Quercus spp.*) in cleared areas and areas currently shaded by exotic vegetation.
- Removal and discouragement of avian predator nesting and roosting sites on West Marin Island. Aerial predators will be trapped and removed from the island; nests will be removed.
- Supplementation of nesting sites at the West Marin rookery by planting additional native vegetation that supports nesting egrets and herons (see above).
- Protection against human disturbance to encourage expansion of the West Marin rookery to East Marin Island. Informational signs will be posted notifying the public that the island is closed to prevent disturbance to nesting birds.

The project will be conducted within the Marin Islands National Wildlife Refuge and State Ecological Reserve, which is located approximately one mile north of the Richmond-San Rafael Bridge immediately offshore of the town of San Rafael (Figure 2). The project will be implemented at West Marin Island, which currently supports nesting herons and egrets. Restoration will also be conducted at East Marin Island, which is currently used for juvenile dispersal, and has recently experienced nesting attempts by great blue herons. The U.S. Fish and Wildlife Service (USFWS) currently manages the Marin Islands National Wildlife Refuge and Ecological Reserve in cooperation with California Department of Fish and Game (CDFG). A management plan will be developed and implemented in cooperation with the State. The California Conservation Corps (CCC), through a contract with the Refuge, will conduct the removal of non-native plant species. Monitoring will be coordinated with Audubon Canyon Ranch.

Restoration Objective

The objective of this project is to help compensate for impacts of the spill on aquatic birds by increasing the productivity and population size of herons and egrets in San Francisco Bay. This will be accomplished by enhancing the reproductive success and increasing the nesting capacity of these species. This project will enhance heron and egret productivity through the implementation of management practices proven to be successful for these bird species (*Bousman, W., in Goals Project, 2000*). This heron and egret rookery site is only one of two remaining large rookeries in San Francisco Bay. A third colony at Bair Island was recently abandoned by the birds largely because of predation by red fox. This restoration project will help provide compensation for aquatic birds lost and injured by the oil spill and replace the lost productivity of these species.

Scaling Approach

In 2000, the West Marin Island heron and egret rookery supported 59 great egret, 9 great blue heron, 156 snowy egret, 50 black-crowned night heron, and 43 western gull nests. Researchers monitoring the colony have on several occasions documented a pair of ravens feeding on eggs and prey from the colony. Monitoring of a sample of the nests indicate that the overall productivity of the great egret in the 2000 season was 1.36 (SE=0.13) young per nesting attempt (*Kelly, 2000*). Up to 300 black-crowned night herons and 500 snowy egrets were estimated on the islands as recently as the 1980s (*Bousman, W., in Goals Project, 2000*). This project will result in the potential addition of several hundred nests on the West Marin and East Marin islands. The Trustees estimated that approximately 4,000 birds were impacted as a result of the oil spill, and this project will help compensate for injuries to aquatic birds that resulted from the spill.

Probability of Success

The probability of success for this project is very high. Management techniques to remove non-native vegetation and competing native plant vegetation (i.e. live oak, scrub oak, and buckeye), reduce human disturbance, and reduce avian predators have proven to be successful in the past. Predator control has been successfully used to increase productivity of California clapper rails and least terns in the San Francisco Bay (USFWS unpublished data). Herons and egrets are a flexible species when a prey base exists and there are secure nesting sites (*Bousman W. in Goals Project, 2000*.) Applications of these management techniques on the Refuge/Reserve are expected to achieve similar success.

Success Criteria and Monitoring

The success criteria for this project will be an increase in the size of the West Marin Island rookery and the establishment of nesting birds on East Marin Island. The success of the project will be documented through a 3-year monitoring program conducted in cooperation with Audubon Canyon Ranch. Baseline information of nesting estimates from the Point Reyes Bird Observatory in the 1980s and more recent detailed monitoring conducted by Audubon Canyon Ranch staff since the 1990s will be used to document increased nesting and productivity.

Approximate Project Cost

Expenditure	Quantity	Unit Cost	Total Cost
Habitat enhancement			
Remove non-native plants & Planting native plants-CCC	3 weeks	\$6,000/week	\$18,000
Plants-supplies	600 plants	\$5.00/plant	\$3000
Habitat protection			
Signs, buoys, etc.	4 signs	\$250/ea	\$1000
Installation	4 signs	\$250/ea	\$1000
Project Implementation			
Planning, environmental compliance, project management	1 staff	\$47,000/1yr	\$47,000
Supplies, equipment			
boat fuel, tools	Misc.	\$1,000/3 yrs.	\$1,000
Monitoring			
plant success, nest success	3 years	\$2,500/yr.	\$7,500
Contingency (10%)			7,850
Total			\$86,350

Environmental Consequences

Implementation of this project will result in positive benefits by increasing the amount of available nesting habitat for herons and egrets on the Marin Island National Wildlife Refuge and Ecological Reserve. The removal and planting of trees will be conducted during the non-nesting season to avoid impacts to nesting birds. Herbicides will be applied in a manner to avoid or minimize adverse impacts. Only targeted aerial predators will be relocated to avoid impacts to non-target animals. This project is not expected to have any significant adverse environmental or economic impacts.

Evaluation

Habitat enhancement and protection offer an effective and practical means of increasing heron and egret productivity. The Marin Islands offer one of only a few remaining places within the Bay with the potential for increasing suitable nesting habitat that is protected, isolated, and can be secured from most predators. With the recent increase in predation to colonial nesting birds in the San Francisco Bay, this island offers a secure habitat that can provide significant nesting habitat for egrets and herons. It will also increase nest productivity by reducing predation. An established ongoing monitoring program will provide an excellent baseline to assess success of the project and for use in conducting comparisons with other nesting locations within the Bay Area. This is a “non-preferred” project based on the Evaluation Criteria because few herons and egrets were affected by the spill.

4.3.2 FISHERIES AND WATER QUALITY RESTORATION

4.3.2.1. #7 - Restoration Alternative: Pacific Herring Spawning Habitat Enhancement in San Francisco Bay

Project Description

Entire communities of aquatic organisms using rocky shore and pier piling habitats in the middle-to-upper intertidal zones of the San Francisco waterfront were affected by the Cape Mohican oil spill. Of particular concern were Pacific herring, a commercially harvested fish and important component of the ecosystem, which use the pier pilings and shallow rocky substrate as spawning habitat. As a result of the spill, herring-spawning habitat was coated with oil only a few weeks before spawning began.

The proposed project location is within the Port of San Francisco where herring are known to have spawned in past years. This area was affected by the Cape Mohican oil spill (Figure 1). This project will replace existing creosote-covered pilings at the Port's Pier 94 with chemenite-treated woodpiles. Studies have shown that creosote, a petroleum compound, is toxic to eggs and larvae of fish and invertebrates causing mortality, developmental problems, and reduced viability. The Port has identified pile replacement at Pier 94 as a high-priority, but currently unfunded, project.

Project Objectives

The primary objectives of this project are to enhance water quality by removing creosote-covered pilings and to provide a non-toxic surface for encrusting organisms to attach and for spawning of herring. Additional objectives and benefits of the project are to substantially improve the general health of marine organisms that will utilize the pier pilings and minimize potential toxicological affects to predators that forage on the encrusting organisms. Further, the Regional Water Quality Control Board and the Department of Fish and Game now prohibit installation of creosote piles on the basis of protecting water quality and habitat for encrusting organisms. The project objectives will be accomplished by removing creosote-covered pilings and replacing them with chemenite-treated woodpiles.

Scaling Approach

The Trustees determined during the injury assessment following the spill that 516 acres of rocky intertidal habitat and 24 acres of riprap and pier piling habitat throughout the Bay and coast were impacted. In addition, injuries regarding Pacific herring in particular were estimated at 45 acres of potential spawning habitat inside Bay being affected, much of that along the San Francisco waterfront. This acreage represents 15 percent of potential spawning habitat along the San Francisco waterfront and is equivalent to 8 percent of the total spawning egg count in the Bay during the 1996 season. A combination of several proposed projects contained within this draft RP/EA is proposed as compensation for injuries to intertidal and associated organisms.

To compensate for this injury to herring spawning habitat, the Trustees evaluated several projects. The original project used to scale the injury for settlement damages (dollars) was the creation of 21.5 acres of eelgrass beds in San Francisco Bay. Another proposal was to use native oyster shells to create shallow subtidal shell mounds in several locations in the Bay where herring spawn. Both eelgrass and shell debris are known spawning substrates. For a variety of reasons: excessive cost; permitting; technical feasibility; and questionable success, these projects were abandoned. This project proposal to replace pier pilings is the most direct approach to compensate for herring and intertidal community injuries. In combination with other similar restoration projects, this project will provide compensation for injury to these resources.

Probability of Success

Evaluations conducted by the Trustees concluded that this project has a very high probability of success. This project will provide a clean and nontoxic surface for herring to spawn on and for encrusting invertebrates (e.g. mussels, anemones, sponges, barnacles, worms) to grow on, thereby enhancing ecological services for the entire pier piling community. The chemenite-treated piles have been approved for use in State waters.

Success Criteria and Monitoring

This project will have several benchmarks for success. The first will be when creosote pilings are removed and replaced. The second will be when encrusting organisms begin to settle on the new pilings and a community reestablishes itself. The third will be when herring spawn and hatch eggs on the new substrate.

Project monitoring will evaluate the use of the new piles by herring for spawning and the settlement of other encrusting organisms. Monitoring will also examine the survival rate of herring eggs on chemenite vs. creosote pilings. The Port will contract monitoring surveys to the city of San Francisco's staff of marine biologists at the waste treatment facility. The CDFG herring project staff will also consult on the monitoring and provide assistance as needed. Together, they are familiar with the waterfront and have the tools to sample and analyze the data. Monitoring will continue for three to five years until the aquatic piling community has established itself comparable to undisturbed pilings, and herring use is documented.

Approximate Project Cost

Requested funding is for purchase of piles and related construction materials. Construction funded by the Cape Mohican oil spill fund will be performed by the Port of San Francisco. Planning, permitting, and environmental compliance will also be completed by the Port at no cost to the Trustee Council.

Expenditure	Quantity	Unit Cost	Total Cost
Chemenite-treated piles	295	\$1,276.60/ea.	\$376,597
Labor	To be provided by Port		
Monitoring: Develop protocol, monitor growth, spawning, survival, produce annual report	5 years	\$16,000/year	\$80,000
Total			\$456,597

Environmental Consequences

Positive environmental benefits will be provided to the entire marine community utilizing the pier pilings as well as the water resource in the immediate vicinity of the pilings. Potential short-term adverse environmental impacts may occur during the implementation of the project. These include increased water turbidity, disturbance of wildlife resources using the pier and adjacent areas, and the loss of the encrusting community using the pilings at the time they are removed. It is expected that permit requirements will substantially minimize these short-term adverse impacts, except for the loss of the

current encrusting community. No long-term significant adverse environmental or economic impacts are expected to result from this project.

Evaluation

Trustee analysis of this project indicates that removing creosote pier pilings is a feasible and practical method of improving the quality of marine natural resources. A monitoring program will document the success of the project. The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select preferred restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation for water quality, fisheries and other aquatic resources injured as a result of the oil spill.

4.3.2.2. #8 – Restoration Alternative: Wetland Restoration at Pier 98, India Basin, San Francisco

Project Description

Wetlands provide spawning and nursery habitat for many fishes and invertebrates, foraging and roosting habitat for shorebirds, wading birds, waterfowl, passerines, and raptors. Wetlands are an important source of primary productivity, organic carbon, and nutrients for estuarine and Bay ecosystems. They also play an important role in water quality by trapping sediments from runoff and turbidity, filtering metals and other contaminants.

This project involves a rare opportunity to enhance a new saltmarsh with the propagation and planting of 13 less abundant transition zone native plants (e.g., *America maritima*, *Cordylanthus maritimus*, and *Suaeda californica*). Transition zone native plants are rare in San Francisco Bay wetlands due to habitat destruction, levee construction and invasion by non-native plant species. This is a rare opportunity to reintroduce rare native plants to the Bay ecosystem. The site, known as Heron's Head Park was created in 1999, and encompasses approximately one acre in a narrow strip along the length of 8 acres of wetland/upland interface.

The project restoration site is located on a 25-acre peninsula consisting of 8 acres of salt marsh and 14 acres of scrub-shrub upland (See Figure 3). The specific project site is at Pier 98, which is on the north side of India Basin in San Francisco. Numerous species of shorebirds, wading birds, and waterfowl frequently use the peninsula. Public use is high and the site is considered a good fishing location and natural area.

Successful revegetation will require materials and labor for at least five years to promote establishment of the native transition zone species and remove invasive non-native plant species. This type of revegetation offers a rare opportunity for local students and community members to participate in an environmental restoration project. Since the original proposal was submitted to the Trustee Council, the salt marsh and tidal inundation channel were constructed in 1999. The site was renamed "Heron's Head Park" and re-opened to the public in October 1999.

Local non-profit organizations - the San Francisco League of Urban Gardeners (SLUG), Literacy for Environmental Justice (LEJ), and City College of San Francisco Center for Habitat Restoration - have undertaken maintenance and stewardship of the site with funding support from the Port and other organizations. The LEJ and City College have developed on-site education and service-learning programs that bring students from grade school through college to the site for education and volunteer work, primarily weeding, planting, and general site cleanup.

In 1999, SLUG received a grant from the National Fish and Wildlife Foundation to begin propagation and planting of less common transition zone species, but its scope is limited. The grant allows for the restoration of a small percentage of the new transition zone area. Without significant maintenance during the first two to three years after planting, the native transition zone species are less likely to successfully compete against invasive non-native species to establish self-sustaining populations.

Restoration Objective

By enhancing this wetland several other objectives of this project will be met. The objectives are to provide: spawning and nursery habitat for fish; foraging and roosting habitat for shorebirds, wading birds, waterfowl, passerines, and raptors; another source of primary productivity, organic carbon, and nutrients to the Bay ecosystem. Additional objectives are to improve Bay water quality by trapping sediments

from runoff and filtering out contaminants and provide environmental public use, education, and volunteer opportunities in an industrialized portion of the Bay. This will be accomplished by restoring rare native transition zone saltmarsh plants into this wetland, which in itself is a project objective.

Scaling Approach

Trustee analysis concludes that this wetland restoration project, in combination with other similar wetland restoration projects, will provide appropriate compensation for water quality, fishery resources, wetlands, and other biological resources injured as a result of the oil spill. The wetland is an extremely valuable resource in a very industrialized portion of the Bay.

Probability of Success

Monitoring of restoration efforts recently implemented at the site have documented good colonization of salt marsh vegetation in the new marsh plain. Based on these results, the project is on target to achieve its restoration goals of 70 percent vegetative cover, adequate tidal circulation, and increased bird use within five years. Consequently, although restoration of transition zone plants species is not common, the potential for successful restoration at this site are good.

Success Criteria and Monitoring

If the one-acre of restored wetland transition zone is established with native species, the project will be determined successful. Implementation of public involvement in restoring and maintaining the wetland through a stewardship program will also be a measure of project success.

Monitoring the success of the wetland creation and revegetation efforts will continue for five years. This will involve local nonprofit organizations such as the San Francisco League of Urban Gardeners and students from the community college to maintain and monitor the success of the revegetation effort. Monitoring will focus on species' growth and survival at different elevations within the transition zone to determine optimal planting location for each species. After initial planting, monitoring in subsequent years will evaluate overall density of transition zone species and whether species seed or propagate independently. This will provide valuable information about how the transition zone plant community establishes over time, indicate modifications that may be needed, and may inform other transition zone restoration efforts.

Approximate Project Cost

The Port has contracts for native vegetation maintenance in the upland and for wetland restoration monitoring. Based on the contracts and actual expenditures, a more accurate cost estimate to complete the work originally proposed can be prepared. Updated project costs are presented below. These costs do not reflect the contribution of thousands of hours of student and volunteer labor by local groups: Literacy for Environmental Justice and City College of San Francisco Center for Habitat Restoration.

Expenditure	Quantity	Unit Cost	Total Cost
Transition zone vegetation To be planted over two years; includes labor and materials for seed collection and propagation prior to out-planting.	2,000 plants	\$9.90/ea.	\$19,800

Maintenance 4-person crew, 2 days/month; 25% replacement of plants during first year + unpaid volunteers	5 years	\$13,824/yr.	\$69,120
Monitoring: develop protocol, monitor growth, spawning, survival, produce annual report	5 years	\$11,600/year	\$58,000
Total			\$146,920

Environmental Consequences

The project will provide positive benefits to the wetland habitat as well as marine fish resources that depend on wetlands for foraging, roosting, spawning, nursery, nutrients and water quality. The wetland will also provide positive human recreation use benefits. Potential short-term adverse environmental impacts that may occur during the removal of exotic vegetation will be addressed through permit requirements for this project. No significant long-term adverse environmental economic impacts are anticipated to occur as a result of this project.

Evaluation

Wetland restoration by the removal of exotic wetland plants is a feasible, practical and cost effective restoration method. This restoration method has been successful in restoring impacted wetlands, and other resources that depend on wetlands such as fish, in other areas of the Bay and nationwide. The project will replace lost ecological services of the same type lost as a result of the oil spill. In addition, public education through a local stewardship program and public use due to the proximity of the project to populated areas will also provide positive benefits. No long-term adverse environmental impacts are expected to result from this project.

The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select preferred restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of project would effectively provide appropriate compensation for marine fish resources, water quality and wetland resources lost or injured as a result of the oil spill.

4.3.2.3. #9 – Restoration Alternative: Steelhead Stream Habitat Enhancement at San Francisquito Creek

Project Description

The Cape Mohican oil spill impacted shorelines and surface waters throughout central San Francisco Bay, the San Francisco shoreline south to Candlestick Point and many coastal beaches. During the fall and winter months (during the spill), several species immigrate into and through the Bay to reproduce. Anadromous fishes such as steelhead trout, chinook and coho salmon, striped bass, and sturgeon spawn in the Bay and its tributaries.

Not far from the documented spill area, steelhead trout spawn in several South Bay creeks, such as San Francisquito, Guadalupe, Coyote, and Alameda. Steelhead trout are sea-run rainbow trout. They are an important ecological species as well as a valuable recreational resource. Steelhead trout are listed as endangered under federal and state endangered species statutes. Once abundant throughout the San Francisco estuary and Delta, their abundance has declined due to habitat loss and reduced habitat quality causing reduced reproductive failure. The run at San Francisquito Creek is one of the best in the Bay Area and the best in South San Francisco Bay. This run has good potential for sustaining itself with habitat conservation and restoration efforts.

This project will enhance spawning habitat of San Francisquito Creek in San Mateo and Santa Clara counties used by steelhead trout. This project consists of two basic enhancement elements: fish barrier removal and native plant revegetation. The first element of the project will involve the removal of barriers that restrict upstream migration of migrating steelhead. Over the last few years the San Francisco Coordinated Resources Management Process (CRMP), a non-profit group active in restoring the creek, has begun several aspects of stream rehabilitation including: stream mapping; barrier identification; plant removal; construction of a native plant greenhouse; building partnerships with surrounding governments, land owners, and trustee agencies; and implemented monitoring and volunteer programs. Thus far they have identified 34 fish barriers along nearly 30 miles of stream, 14 of these need improvement or removal, several have been completed, five remain in need of enhancement. Enhancement of these fish barriers may include complete removal, redesign and reconstruction, or construction of step pools around the barrier. Creating fish passage around these five barriers will allow fish access to approximately 10 to 12 miles more stream habitat. Monies from the Cape Mohican oil spill settlement would be used to pay for permitting and designing barrier removal or alternatives. Most construction costs will be donated by local city maintenance departments or water agencies.

The second phase of the project includes the removal of exotic vegetation and the propagation and planting of native plants. This will occur throughout the length of the San Francisquito Creek watershed, approximately 35 to 40 miles. The predominant exotic plants being targeted are giant cane (*Arundo donax*) and cape ivy (*Delairea odorata*). Vegetation removal will be done manually with chain saws and weed whackers, and using approved herbicides. This phase will be implemented concurrently with barrier removal activities. Monies from the Cape Mohican oil spill settlement would be used to pay for seed collection, propagation, weed removal, and plant maintenance.

Restoration Objectives

The primary project objective is to increase the size and quality of habitat available for steelhead trout spawning in the San Francisco Bay Area. This will be accomplished by rehabilitating steelhead spawning habitat in San Francisquito Creek. A second objective is to restore and provide additional habitat for several other animal species that utilize the creek and riparian corridor, such as birds, mammals, aquatic insects, and other fish, for nesting, foraging, and living areas.

Scaling Approach

The natural resource Trustees documented injuries to aquatic resources and a degradation of water quality as a result of the oil spill. Many anadromous fish species were moving through the Bay at the time of the spill. The endangered steelhead trout was one of those species. This project has the potential to yield great results for a relatively small amount of money. Enhancement of San Francisquito Creek will affect nearly 40 miles of stream and riparian habitat. The steelhead run in this watershed is one of the strongest in the Bay Area and has the greatest potential for increasing population size and attaining sustainability.

Probability of Success

The probability of success for this project is high. Similar projects employing the removal of stream barriers to anadromous fish migration and increasing the riparian habitat along a stream have successfully increased the amount of quality habitat available for spawning. Other steelhead habitat enhancement projects in the south Bay include Alameda Creek watershed, Coyote Creek and Guadalupe Creek. Coyote and Guadalupe Creek enhancement projects have included step pools or other structures to help fish around barriers. The Trustees believe that this project will achieve similar success.

Success Criteria and Monitoring

The success criteria for this project will be an increased availability of spawning habitat, increased reproductive success, and improved riparian habitat to benefit stream and spawning conditions. A variety of efforts are already in progress to monitor the health of the stream and watershed, as well as reproductive success of spawning steelhead. Partners in the restoration effort include Stanford University, Golden Gate National Recreation Area (GGNRA), the CRMP, the Joint Powers Authority, and volunteers. Stanford and GGNRA are currently monitoring the stream, the steelhead and associated wildlife. The CRMP is monitoring revegetation progress. These monitoring efforts will continue at no cost to the Cape Mohican oil spill settlement.

Approximate Project Cost

The following table identifies the requested project costs to enhance San Francisquito Creek for steelhead spawning habitat. These costs are twice that originally requested two years ago. The restoration effort has evolved and the managing organization (CRMP) now has better estimates of projects and what procedures are required to complete them. Other project partners and volunteers will supply in-kind materials, labor and equipment. Additional cash flow will be obtained through donations and grants.

Expenditure	Quantity	Unit Cost	Total Cost
Fish Barrier Removal (permitting and reconstruction design)	One year	\$20,000/yr.	\$20,000
Native Plant Propagation and Planting/Exotic Plant Removal (this is half of operating expenses for 1 yr)	One year	\$20,000/yr.	\$20,000
TOTAL			\$40,000

Environmental Consequences

This project will result in positive environmental benefits by increasing the quality and quantity of San Francisquito Creek habitat available for spawning steelhead and other associated wildlife in the riparian corridor and watershed. All construction and destruction activities to fish barriers will occur during periods of least impact to steelhead and other wildlife. Creek bank exotic plant eradication and native plant revegetation will occur primarily during the spring and summer months, while plant propagation will occur year-round. Any disturbance to wildlife or sediments either in the creek bed or along the banks will be short-term and will be offset by the long-term habitat restoration benefits. Any potential impacts to the creek or its banks will be addressed through the permit process. No significant adverse socio-economic impacts are expected to occur as a result of this project.

Evaluation

Trustee analysis indicates that removing fish barriers and planting native vegetation to enhance the riparian corridor is a feasible and practical method of improving quality and quantity of suitable steelhead spawning habitat. The project is cost-effective in that there are many volunteers and partner organizations that provide additional cash and in-kind services. The project will work to remove or modify three to five remaining barriers opening more than 10 miles of additional spawning habitat, and work on revegetation along more than 40 miles of the creek. Monitoring programs already in place will document the success of the project.

The project is not expected to have adverse economic impacts. Potential short-term environmental impacts will be addressed through permit requirements. The steelhead run at San Francisquito Creek is one of the best in the Bay Area and has the best chance for recovery in South San Francisco Bay. This run has good potential for sustaining itself with continued habitat conservation and restoration efforts.

The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select preferred restoration projects and concluded that this project is consistent with these selection factors. The trustees determined that this type and scale of project will help compensate for fish and water resources impacted as a result of the oil spill.

4.3.2.4. #10 – Restoration Alternative: Wetland and Water Quality Enhancement at Pier 94, San Francisco

Project Description

The wetlands at the proposed project site were oiled by the Cape Mohican spill incident and required cleanup during spill response.

Wetlands provide spawning and nursery habitat for many fishes and invertebrates as well as foraging and roosting habitat for shorebirds, wading birds, waterfowl, passerines, and raptors. Wetlands are an important source of primary productivity, organic carbon, and nutrients for estuarine and Bay ecosystems. They also play an important role in water quality by trapping sediments from runoff and turbidity, filtering metals and other contaminants.

This project consists of the restoration of a 3 to 4 acre salt marsh, of which approximately 1 acre has been filled with concrete, asphalt and tires. The restoration will be conducted in three phases. Phase I: A delineation of the wetland and upland areas and a hydrology assessment. Phase II: Debris removal (hundreds of yards of concrete, asphalt, tires, and metal) from the wetland and tidal flow enhancement area. Phase III: Construction of a low post-and-cable fence to mark the area and prevent neighboring industrial uses from encroaching on the site. Upon removal of the debris and the fencing of the entire wetland and upland habitat, there is a high potential that the wetland will recover naturally.

The wetland restoration site is located along the northern and eastern shore of Pier 94 in San Francisco. (See Figure 3.) This small wetland is an extremely rare and valuable resource in a very industrialized portion of the Bay. The pickleweed marsh, mudflat, and gravel beach offer foraging and roosting habitat to several species of birds and other wildlife. A dense coyote bush upland plant community of approximately two acres backs the wetland, which provides habitat for passerine birds and small mammals. This wetland is on the San Francisco Bay Joint Venture list of priority sites targeted for restoration.

Restoration Objective

The primary objectives are to provide additional spawning and nursery habitat for marine fish species; provide foraging and roosting habitat for shorebirds, wading birds, waterfowl, passerines, and raptors; and improve water quality by trapping sediments from runoff and filtering out contaminants. By restoring the wetland, it will serve as another source of primary productivity, organic carbon, and nutrients to the Bay ecosystem. A final objective is to provide environmental public use opportunities in a developed area of the Bay. The project objectives will be accomplished by removing debris from the wetland that inhibits tidal flows and reduces space for wetland organisms.

Scaling Approach

Trustee analysis concludes that this wetland restoration project, in combination with other restoration projects, will provide partial compensation for water quality, fisheries, and wetlands injured as a result of the oil spill. The wetland restoration site was oiled by the spill incident. The wetland is an extremely valuable resource in a very industrialized portion of the Bay.

Probability of Success

The probability that this wetland will recover is very high. The topography and channels have not been significantly altered; therefore water still flows throughout most of the site. Debris removal will increase the area available for plant colonization and wildlife use. A similar project was completed in 1999 by the

Port of San Francisco at Heron's Head Park (Pier 98) where the habitat was much more disturbed. Restoration included debris removal, grading, and channel construction. Thus far, the Heron's Head Park project is on target to meet its restoration goals of 70 percent vegetative cover, adequate tidal circulation, increased bird use within five years. In addition, fencing of wetland areas is commonly successful in deterring future adverse human impacts following restoration. The Trustees expect that the application of these wetland restoration and protection approaches will achieve similar success for this project.

Success Criteria and Monitoring

If the 1-acre of filled wetland recovers to natural conditions of adjacent wetland areas within three to four years of restoration, the project will be determined successful. Successfully preventing future placement of construction debris in the wetland will also be a measure of project success. The Port of San Francisco will complete monitoring in conjunction with monitoring of the nearby Heron's Head Park restoration project. This is expected to reduce the cost of \$50,000 for monitoring proposed here (actual estimated cost should be identified below).

Approximate Project Cost

Expenditure	Quantity	Unit Cost	Total Cost
Planning Wetlands delineation, hydrology assessment, permitting, construction plans and specs	Lump sum	\$15,000 ea.	\$15,000
Fence Post and cable, plastic wood, materials and labor	1100 lf.	\$10.00/ lf.	\$11,000
Earthwork Debris removal and disposal, grading, excavation	Lump sum	\$282, 000	\$282,000
Monitoring Vegetation, bird use, hydrology, annual report	5 years	\$10,000/yr.	\$50,000
Contingency (15% of earthwork)			\$42,300
Total			\$400,700

Environmental Consequences

The project will provide positive benefits to the wetland habitat as well as the natural resources that depend on wetlands for foraging, roosting, spawning, nursery, nutrients and water quality. The wetland will also provide positive human recreation use benefits. Potential short-term adverse environmental impacts that may occur during the removal of debris will be addressed through permit requirements for this project. No significant adverse economic impacts are anticipated to occur as a result of this project.

Evaluation

Removal of debris from filled wetlands is a feasible and practical restoration method. This restoration method has been successful in restoring impacted wetlands in other areas with the Bay and nation-wide. The project will replace lost ecological services of the same type lost as a result of the oil spill. No long-term adverse environmental impacts are expected to result from this project.

The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select preferred restoration projects and concluded that this project is consistent with these selection factors. However, the Trustees evaluation of this proposal placed it in the “non-preferred” category because it is not as cost-effective as other restoration projects considered.

4.3.3 WETLAND RESTORATION

4.3.3.1 #11 - Alternative: Giacomini Coastal Wetlands Restoration Project

Project Description

The Cape Mohican spill oiled an estimated 99 acres of wetlands and mudflats in San Francisco Bay. Wetlands provide spawning and nursery habitat for numerous species of fish and foraging and roosting habitat for shorebirds, wading birds, waterfowl, passerines, and raptors. In addition, wetlands provide an important source of primary productivity, organic carbon, and nutrients to estuarine and marine ecosystems and play an important role in promoting water quality by trapping sediments from runoff and filtering contaminants. Introduction of contaminants into wetlands can substantially reduce wetland productivity and filtering functions and potentially introduce a new source of toxins that may become available to higher-order trophic organisms such as birds, fish, and mammals through "bioaccumulation." Restoration of wetlands allows for replacement of some of the wetland and mudflat functions and values that were impaired by contamination.

The National Park Service (NPS) is proposing to restore wetlands at a former coastal salt marsh site in Tomales Bay that was diked in the 1940's to provide pasture for dairy cattle. Restoration of the 563-acre Giacomini property (Project Area) is expected to provide tremendous benefits by increasing habitat for shorebirds, waterfowl, and fish, as well as for special status species such as California brown pelican, American peregrine falcon (*Falco peregrinus*), coho salmon, steelhead, tidewater goby, freshwater shrimp, and Pacific herring. Many of these wildlife species were injured, or potentially injured, as a result of the oil spill. Furthermore, restoration is expected to help increase habitat quality of Tomales Bay as a whole, which has been declared as an "impaired" water body by the San Francisco Bay Regional Water Quality Control Board. By boosting primary productivity and water quality within Tomales Bay, the Giacomini Coastal Wetlands Restoration Project (Proposed Project) may also have a positive effect on additional marine species such as seabirds and harbor seals, which will benefit from increased fish production.

The NPS is proposing to restore both tidal and freshwater hydrologic processes to the diked pasture. As National Environmental Policy Act (NEPA) documents have not been completed yet for the Proposed Project, the exact method by which restoration will occur has not been identified. The Proposed Project will most likely result in restoration of a number of habitat types, including salt marsh, brackish marsh, freshwater marsh, riparian, mudflat, and open water.

Project Description

The Proposed Project will be conducted at a 563-acre site at the headwaters of Tomales Bay, Marin County, California. The property is located within Golden Gate National Recreation Area (GGNRA) and was acquired by the NPS in February 2000. The land will be managed under reservation of use by the former landowners until 2007, when full management of the land will be transferred to the NPS. In the interim, the NPS will be conducting environmental planning and permitting processes for the Proposed Project, including preparation of documents required for NEPA, Endangered Species Act, and Clean Water Act (CWA) Section 404 and 401 compliance. In addition, long-term monitoring efforts both in the Project Area and at "reference" sites will be initiated to allow the NPS to fully assess wetland and estuarine functions and values both before and after project implementation. While a restoration alternative has not been selected yet, the NPS anticipates some degree of levee and berm alteration within the Project Area that would allow for restoration of natural hydrologic processes and promote development of a variety of habitat types, including salt, brackish, and freshwater marsh, riparian habitat,

mudflat, and open water. Wildlife use and recreational opportunities for the public will be balanced to the extent possible through exploring avenues for development of a public access trail and educational signs and displays, as well as for non-motorized boat access.

Restoration Objectives

More than 95 percent of California's coastal wetlands have been lost to development. These wetlands play a vital role in both providing habitat and foraging opportunities for wildlife and improving the quality of existing habitat within the ecosystem as a whole through functions such as nutrient and sediment retention, contaminant uptake, and floodwater storage. Through restoration of this 563-acre site, the amount of wetlands present in Tomales Bay, as well as along the California coast, will be increased substantially. The restored wetlands will provide habitat for numerous common and special status wildlife species and may benefit current community efforts to improve water quality within Tomales Bay. Traditionally considered one of the more pristine estuaries, Tomales Bay was actually recently declared impaired for sediment, nutrients, and fecal coliform by the San Francisco Regional Water Quality Control Board under CWA Section 303(d).

One of the primary objectives of the Proposed Project is restoration of natural hydrologic processes within the Project Area. Through restoration of natural hydrologic processes, the restored wetland is expected to be more likely to develop not only the morphological structure expected in natural wetlands, but the function and values of these systems, as well. For example, one of Tomales Bay's largest drainages, Lagunitas Creek, actually dissects the Project Area. The creek has been effectively channelized through this portion of Tomales Bay by construction of levees on either side of the creek, which has resulted in sediment from the watershed being directly deposited into Tomales Bay rather than being deposited on adjacent floodplains during high flows. This sediment discharge is increasing sediment levels within the water column of Tomales Bay and causing the Bay to become shallower.

Restoration alternatives for the Proposed Project may include either complete removal, partial breaching, or lowering of levees to allow for reestablishment of a more natural creek geomorphology and/or overflow of sediment-laden floodwaters onto adjacent floodplains during storm events. Levees and berms that have been used to redirect or manage other creeks that discharge into the Project Area (e.g., Tomasina Creek) may also be removed, thereby allowing these creeks to reestablish more natural geomorphologic processes (e.g., meandering) that could create more optimal conditions for establishment of disturbance-oriented special status salt marsh plant species such Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris*) or Humboldt Bay owl's-clover (*Castilleja ambigua* ssp. *humboldtiensis*) (Peter Baye, USFWS, pers. comm.). In addition, reestablishment of tidal exchange within the Project Area through either natural development or construction of a tidal creek network will promote development of many key functions and values of the wetland systems, including export of nutrients to Tomales Bay and foraging for special status species such as juvenile coho salmon and steelhead.

Scaling Approach

The NPS is proposing to restore both tidal and freshwater hydrologic processes to the diked pasture. As NEPA documents have not been completed yet for the Proposed Project, the exact method by which restoration will occur has not been identified. It is likely that the alternatives will involve either complete breaching, partial breaching, and/or lowering of levees or berms that constrict meandering and overflow of creeks in the Project Area, including Lagunitas and Tomasina Creeks. The Proposed Project is expected to result in restoration of a number of habitat types, including salt, brackish, and freshwater marsh, riparian, mudflat, and open water.

Agencies such as the San Francisco Regional Water Quality Control Board typically request a 2:1 mitigation ratio for filling or elimination of wetlands, while the U.S. Army Corps of Engineers

mandates a 1:1 mitigation ratio. As wetlands impacted by the oil spill were not filled, but rather impaired by contamination, the Trustees have determined that partnering in the restoration of 563 acres of wetlands will provide the appropriate compensation for the 99 acres of wetlands and mudflats that were oiled as a result of the Cape Mohican oil spill.

Probability of Success

The probability of success for this wetland restoration is high. The project area is actually a former salt marsh that has been converted to pasture through diking. The watershed for many of the drainages has changed since diking was implemented, but the hydrologic sources themselves (e.g., Lagunitas Creek, Tomasina Creek, etc.) remain intact, if modified. While some subsidence has occurred (estimated 1 to 2 feet), the land within the Project Area does not appear to have excessively subsided since levees were constructed in the 1940's, unlike many areas in the San Francisco Bay – Sacramento/San Joaquin Delta (Bay-Delta). If subsidence is minimal, restoration of natural wetland structure and processes may be achieved without the need to replace subsided material with sediment from outside source areas, as sometimes occurs during restoration of heavily subsided areas in the Bay-Delta. In many areas where irrigation has not been performed and where the land has subsided slightly, the vegetation community has already begun to revert to salt marsh. Remnants of former tidal sloughs can be found in many portions of the Project Area, and these remnants may speed the process of reestablishing a tidal connection or exchange. As part of the purchase process for the property, the NPS contracted environmental consultants to determine the feasibility of restoring the Project Area to wetlands, and the consultants concluded that feasibility was extremely high.

In projects where subsidence has been minimal, wetland restoration can often be achieved very rapidly. For example, wetland restoration following breaching of levees at California Department of Fish and Game's (CDFG) Pond 2A (Napa-Sonoma Marsh Complex) proceeded extremely rapidly, with a salt marsh appearing structurally similar to natural ones developing in the former salt pond within only five to six years. Across the Napa River from Pond 2A, reestablishment of wetlands at the Port of Oakland's American Canyon marsh, a former pasture that had subsided moderately (4-5 feet) since diking, has also progressed quickly since partial breaching of the levee only three years ago (T. Huffman, CDFG, Napa-Sonoma Marsh Complex, pers. comm.). While the Proposed Project may not proceed as rapidly as some of the above referenced projects, the NPS does expect wetlands to rapidly develop should subsidence be minimal as expected, given the fact that hydrologic sources and networks remain, to a large degree, intact. By using some of the lessons learned from early restoration efforts within the Bay-Delta and elsewhere, the NPS expects that the Proposed Project will result in a wetland complex with functions and values similar to those achieved by other restoration projects and, perhaps more importantly, by other natural wetland systems.

Success Criteria and Monitoring

Based on the restoration alternative that is chosen during the NEPA process, success criteria will be developed to enable NPS managers to determine if the restoration is successful. To assist in developing success criteria, monitoring will be conducted prior to project implementation in both the Project Area and selected "reference" wetlands. Monitoring of reference wetlands will enable the NPS to develop a range of values for various parameters of ecological structure and function, such as vegetation cover and species composition, nutrient levels in water and sediment, flood water retention, and wildlife use. In addition, implementing monitoring in the Project Area during the environmental compliance phase of the Proposed Project will enable a comparison of pre-project and restored conditions. The Project Area will be monitored for approximately three years prior to project implementation and at predetermined intervals after construction is completed (e.g., Years 1, 2, 3, 5, 7, 10, 15, 20). The exact post-construction monitoring schedule will be determined during design of the long-term monitoring program.

Approximate Project Cost

Funding from the Cape Mohican settlement would be used to partially pay for wetland restoration at the Project Area. Purchase of the property, which was completed in February 2000, was funded by \$4.2 million in mitigation monies from the California Department of Transportation (Caltrans) and \$1.6 million in federal appropriations. Total cost of the property was \$4.6 million. Following hiring of a project manager, the NPS is now initiating planning for the environmental compliance, design, and long-term monitoring components of the Proposed Project. A preliminary cost estimate for implementation of the Proposed Project is approximately \$2.8 million. This estimate includes all phases of environmental compliance (e.g., development of restoration alternatives, preparation of an Environmental Impact Statement (EIS) and public scoping, Section 7 consultation with U.S. Fish and Wildlife Service, and preparation of other regulatory permits), construction and revegetation, and pre- and post-construction monitoring. The budget has increased since earlier estimates due to revisions in estimated cost of services and products based on inflation and other considerations. It should be noted that the scope of work has not changed. The NPS will reduce costs by conducting as much of the environmental compliance and long-term monitoring components of the Proposed Project as possible “in-house.” Table 1 presents the approximate project cost for a six-year program to design, permit, implement, and monitor the Giacomini Coastal Wetland Restoration Project.

Table 1. Approximate project cost and projected funding for Giacomini Coastal Wetland Restoration Project

Expenditure	Duration	Total Cost
Property Acquisition		4,600,000
Project Implementation		
Staff (GS-11 Restoration Project Coordinator) ¹	6 years	402,744 ²
Staff (GS-7 Natural Resource Management Specialist) ¹	6 years	215,088 ²
Administrative Support Costs (field and office equipment, vehicle costs, document printing costs, etc.)	6 years	63,920
Technical Support ³	6 years	374,000
Construction and Revegetation		1,566,000
Long-Term Monitoring		207,000
Project Implementation Subtotal		2,828,752
Project Total (Property Acquisition and Implementation)		7,428,752
Funding Sources		
Secured Funding		
California Department of Transportation		4,200,000
Federal Appropriations		1,600,000
Secured Funding Subtotal		5,800,000
Funding Required (Project Total minus Secured Funding Subtotal)		1,628,752
Funding to be Secured From Other Sources		1,193,404
Funding Requested For This Proposal		435,348

¹ Staff will be responsible for certain portions of the biological baseline surveys, the NEPA process (e.g., public scoping, EIS preparation), formal consultation process with the U.S. Fish and Wildlife Service (e.g., preparation of the Biological Assessment), regulatory permitting (e.g., Section 404, Section 401), and certain portions of the long-term monitoring program

² Salary based on step increases within grade scale.

³ Contracts awarded for baseline wildlife assessments, hydrological assessments, topographic surveys, cultural resource surveys, etc.

Environmental Consequences

The NPS is initiating a formal environmental compliance process as required by NEPA and NPS Director's Order 12 that will be used to identify environmental consequences associated with restoration of the diked pasture land to tidal and non-tidal wetlands. The environmental compliance process is expected to include preparation of an EIS and formal scoping, formal consultation with U.S. Fish and Wildlife Service, and preparation of regulatory permits related to CWA Section 404 and Section 401 compliance. Environmental baseline studies have already begun to identify existing vegetation communities, wetlands, and special status plant species, and surveys for use by both common and special status wildlife species are expected to start in summer 2001.

While the preliminary work needed to identify environmental consequences of implementing this restoration project has not been completed, the NPS can anticipate some of the consequences based on preliminary environmental studies conducted as part of the feasibility study. A shift in the vegetation communities present (e.g., from predominantly pastureland with some freshwater marsh to salt, brackish, and freshwater marsh) will undoubtedly cause a shift in the types of both common and special status species that use the Project Area. Permanent impacts will occur from elimination of existing freshwater habitat used by amphibian and reptile species such as red-legged frog and northwestern pond turtle and potential elimination of berms and spoil piles used for nesting by burrowing owls. In addition, populations of a federal Species of Concern, Humboldt Bay owl's-clover, that grows on the tidal side of the levee system may be impacted if levees are removed, although restoration alternatives may use partial breaching as an avenue to avoid impacts. The NPS will develop a mitigation plan to offset any permanent impacts. Short-term impacts to other wildlife species are expected during construction, but the construction period will be timed to ensure that construction does not occur during nesting season (e.g., July/August through October).

Alterations in the levee system and increased tidal flushing in the Project Area may cause public concern about potential hydrologic impacts, including potential for flooding private residences and saltwater intrusion into groundwater wells. The NPS plans to contract with a hydrologist to address potential hydrologic impacts of each restoration alternative. Alterations of the levee system can change public recreational opportunities, as well. The NPS intends to address public recreation opportunities during the environmental compliance phase of the Proposed Project, with the goal of balancing both land- and water-based recreational needs with the needs of wildlife (i.e., minimizing disturbance). At this time, the NPS is considering use of an abandoned railroad berm as one of the potential alternatives for a public access trail, but cultural resource surveys will need to be performed to ensure that any cultural resources present are not impacted.

Evaluation

Wetlands provide important habitat for several species of fish and wildlife, as well as serving an important purpose in maintaining the quality and productivity of estuarine and marine ecosystems as a whole. Approximately 99 acres of wetlands and mudflats were affected by the Cape Mohican oil spill, many of which served as vital habitat for the very species of fish and wildlife that would benefit from the Proposed Project. In Tomales Bay, agricultural operations, leaking septic systems, watershed development, and limited historic mining have adversely affected wetlands, mudflats, and subtidal areas by increasing sediment, nutrient, and contaminant levels in an estuary that was until recently considered relatively pristine. Tomales Bay's critical role in supporting both natural and cultural resources (e.g., oyster fisheries) depends on the health of the estuary. Restoration of wetlands and water quality functions associated with wetlands can assist ongoing community efforts to improve health of the estuary by targeting and eliminating sources of pollution. Although temporary and permanent impacts to certain special status species may occur, overall, the Proposed Project is expected to provide tremendous benefits to wildlife such as shorebirds, waterfowl, rails, coho salmon, steelhead, and Pacific herring, as well as the ecosystem as a whole. Because all of these resources were adversely affected by the oil spill, there is a direct nexus between this restoration project and the oil spill.

The Trustees evaluated the Proposed Project against all Threshold and Additional screening criteria developed to select restoration projects and concluded that this Proposed Project is consistent with these selection factors. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for wetland impacts that occurred as a result of the oil spill.

4.3.3.2 #12 - Restoration Alternative: Hamilton Wetlands Restoration

Project Description

The Cape Mohican oil spill impacted approximately 99 acres of intertidal wetlands and mudflats. Sampling data indicated that oil from the Cape Mohican was detected as far north into San Pablo Bay as the northern side of China Camp, and thus likely impacted San Pablo Bay fish and birds and their habitat.

The Hamilton Wetlands Restoration Project will restore a diverse mix of wetlands to over 900 acres of diked baylands at the former Hamilton Army Airfield in the City of Novato, Marin County, on the west side of San Pablo Bay. The site is a diked bayland that has subsided to elevations below those suitable for tidal marsh. The project will beneficially reuse over 10 million cubic yards of clean sediment from Bay navigation channel dredging projects to raise site elevations to support establishment of wetland vegetation. Establishment of the mix of wetland habitats will complete the reuse process for the closed military base.

The restoration site will be filled with clean material from Bay dredging projects to construct upland and seasonal wetland features and to speed the formation of tidal wetlands. Two channels to the Bay will restore tidal waters to the site. Dredged material will be placed low enough in tidal areas to allow the wetlands to form naturally on sediments carried in on the tides. Salt pannes, a feature of historic Bay wetlands that flood only on the highest spring tides, and areas of seasonal wetlands will be created at the upper margin of the tidal areas. The result will be one of the largest contiguous tidal wetlands in the Bay.

The California Coastal Conservancy and the San Francisco Bay Conservation and Development Commission (BCDC) are managing the Hamilton wetlands restoration project at the state level and have completed a conceptual plan for the project. While the site was historically owned by the Army, ownership will be transferred to public ownership once the Army has cleared the site of contaminants to a level suitable for wetland habitat. In late 1998, the U.S. Army Corps of Engineers finalized a feasibility analysis to provide for federal involvement in the project. The project environmental review process is complete, and a final Environmental Impact Review and Statement was issued in late 1998. Currently, the final design process is underway. Construction is scheduled to commence in 2001.

The conceptual design for the restoration project is based on the physical characteristics of the site. The design will create a landscape that gradually slopes from uplands to the Bay, similar to the historic shoreline at the site, and will support large expanses of tidal and seasonal wetlands.

Project Objectives

The project is intended to achieve three regional objectives:

- Create a diverse array of wetland and wildlife habitats that benefit a number of fish, bird, and wildlife species including shorebirds, herons, and other migratory birds, as well as special status species such as the California clapper rail, salt marsh harvest mouse, steelhead, and other flora and fauna;
- Reduce in-Bay disposal of dredged material and beneficially reuse dredged materials
- Facilitate the base-closure and reuse process.

The project helps implement the San Francisco Estuary Project's Comprehensive Conservation and Management Plan (CCMP) goals for Wildlife and Wetlands by restoring large, contiguous expanses of tidal wetlands and necessary adjacent uplands, providing habitat to help recover endangered species and increasing biodiversity. The project will implement a reuse plan for the base developed by local citizens

of Novato and advance the objectives of the San Francisco Bay Plan, CALFED, the Long Term Management Strategy for Dredged Material Disposal in San Francisco Bay, and the recently issued Regional Habitat Goals Project.

Scaling Approach

This wetland project will provide compensation for habitat and wildlife injuries by restoring approximately 900 acres of wetland habitat for bird species such as herons, egrets, shorebirds, waterfowl, and other migratory species impacted by the oil spill. Although the public will not be allowed into the sensitive habitat areas of the marsh, the San Francisco Bay Trail will provide access by traversing one edge of the site, thus providing partial compensation for lost human-use that occurred during the Cape Mohican spill.

Probability of Success

The probability of success of this project is high. This conclusion is based on the conceptual design for the project, which incorporates lessons learned from similar wetland restoration projects implemented in the San Francisco Bay Area, such as the nearby Sonoma Baylands Project, which also included the use of dredged material. In addition, a high level of effort is being extended to investigate the hydrology of the site and properly design the project to help ensure the project is successful.

Success Criteria

This project will be determined successful upon the creation of 900 acres of intertidal wetland and mudflat habitat. It is estimated that the wetlands will be recreated and achieve an ecological function similar to natural wetlands within 10 to 20 years of project completion.

Approximate Project Cost

To date, a variety of sources, including the CALFED Bay/Delta Program, U.S. Army Corps of Engineers, the State Coastal Conservancy, the National Marine Fisheries Service, Environmental Protection Agency, and the Marin Community Foundation, have funded the \$1.85 million cost of planning the Hamilton wetlands restoration project.

The total cost to construct and complete the project is approximately \$55 million (see Table 1), with 75 percent of this total (or approximately \$41 million) coming from the federal government. The local cost-share portion of the project, \$14 million, will come from a variety of sources, including CALFED, State appropriations, private foundations, and other sources. The BCDC requests \$500,000 from the Cape Mohican settlement for the Hamilton wetland restoration project.

Table 1. Cost summary for the Hamilton wetlands restoration project

Expenditure	Total Cost
Relocations	\$2,138,200
Levees and floodwalls	\$19,325,800
Dredged material placement	\$27,809,100
Post-construction monitoring	\$1,530,000
Pre-construction, engineering, and final design	\$1,210,000
Lands	\$241,600
Construction management	\$2,900,000
Total Cost	\$55,154,700
Federal cost-share (75%)	\$41,000,000
Local cost-share (25%)	\$14,154,700

Environmental Consequences

Insufficient details of the project are known at this time. Therefore, this section can not be completed.

Evaluation

Wetlands provide important habitat for several species of fish and wildlife and were impacted as a result of the oil spill. At the Hamilton site, wetlands have been lost due to subsidence of a diked bayland to levels no longer suitable for supporting intertidal marsh. Although short-term negative environmental impacts will occur during project construction, there will be substantial long-term benefits. The project will benefit several species of birds, special status fish and wildlife species, as well as help to improve overall water quality. As all of these resources were adversely affected by the oil spill, there is a direct nexus to the incident. Completion of the project will result in the reuse of closed military base property.

The Trustees evaluated this project against all Threshold and Additional screening criteria developed to select restoration projects and concluded that this project is consistent with these selection factors. The Trustees determined that this type and scale of restoration would effectively provide appropriate compensation for wetland impacts that occurred as a result of the oil spill. The Trustees placed this project in the “non-preferred” category because of concerns about the amount of time required to achieve benefits, the high cost of the overall project, potential liability issues delaying project implementation, and unresolved contaminant issues.

4.3.4 SANDY SHORELINE AND ROCKY INTERTIDAL HABITAT RESTORATION

4.3.4.1 #13 - Project Alternative: Sandy Beach Habitat Restoration at Point Reyes National Seashore

Project Description

Approximately 1,300 acres of sandy beach habitat were contaminated by the spill; most of these were in Golden Gate National Recreation Area (GGNRA) or Point Reyes National Seashore (PRNS). Numerous shorebirds, including the federally threatened western snowy plover, were observed to be oiled. Sandy beach habitat is very important for wintering, migratory and nesting shorebirds for foraging, resting and reproduction. A primary cause of declines in shorebirds is loss or degradation of sandy beach habitat (e.g., from invasive non-native plants such as European beachgrass (*Ammophila arenaria*) and iceplant). Restoration of sandy beach habitat is a very effective restoration alternative for impacts to sandy beach habitat.

The project site is at PRNS, which provides nesting habitat for snowy plovers as well as non-breeding and foraging habitat for plovers and a broad spectrum of other shorebirds. This restoration project consists of habitat restoration, which is described below.

Habitat restoration will involve restoration of 20 acres of coastal dune habitat at PRNS. This will be accomplished through removal of European beachgrass and iceplant, and the subsequent recovery of native vegetation. This effort will directly complement an existing 3-year (2001-2003) 30-acre NPS dune restoration project. During the current project, trials of eradication methods, such as manual removal or use of small equipment (e.g., Bobcat) are being conducted to determine the most effective methods to remove non-native vegetation. Non-native vegetation removal will be conducted by staff, contractors, school groups, and volunteers once effective methods are determined. A Project Coordinator and two support staff have been hired to develop protocols, supervise evaluation of eradication methods, prioritize work sites, conduct training, develop schedules, and direct field teams during eradication activities. Money from this alternative will be used to expand removal efforts to an additional 20 acres for a project total of 50 acres of restored habitat.

Restoration Objectives

This restoration project is intended to increase nesting and reproductive success of shorebirds, especially western snowy plover, at the PRNS. The objective will be accomplished by increasing habitat for shorebird foraging and nesting through the removal of non-native vegetation.

Scaling Approach

The Cape Mohican spill oiled an estimated 1,294 acres of sandy beach to varying degrees. Ecological Services of oiled beaches were estimated to be reduced for a three-month period prior to natural recovery. This project compensates for the interim loss of sandy beach habitat by restoring 20 acres of sand dunes.

Based on the results of similar projects and best professional judgement of the Trustees, this scale of habitat restoration undertaken to improve sandy beach habitat conditions, especially for nesting and foraging shorebirds, is expected to compensate for injuries to sandy beach habitat.

Probability of Success

The probability of success for this restoration project is high. The project will result in removal of non-native plants from 20 acres of dune habitat. Implementation of similar sandy beach habitat restoration programs has been successful in increasing shorebird productivity. The Trustees, therefore, expect that similar benefits will be accomplished through this project.

Success Criteria and Monitoring

The success criterion will be the removal of invasive non-native vegetation from 20 acres at PRNS, which will increase nesting habitat and may increase western snowy plover productivity. As part of this project, the Trustees will continue to remove any new growth of beachgrass and iceplant for two years.

Approximate Project Cost

Partnerships and In-Kind Funding Support

Source of Funds	Total Cost
National Fish and Wildlife Foundation grant	\$25,000
California Native Plant Society volunteers (150 hrs/year @ \$20.00/hr x 3 years = \$9,000)	\$9,000
Point Reyes National Seashore Association (\$35,000/yr x 3 yrs = \$105,000)	\$105,000
Habitat Restoration Program (HRP) volunteers (500 hrs/yr @ \$15.00/hr x 3 years = \$22,500)	\$22,500
NPS-PRNS Personnel and Support	\$110,500
NPS Natural Resource Preservation Program (NRPP)	\$333,134
Total Already Secured	\$605,134

Funding Requested

Expenditure	Year 1	Year 2	Year 3	Year 4	Year 5	Total Cost
GS-07 BioTech (9 months/yr)	\$32,000	\$33,600	\$35,280			\$100,880
GS-06 BioTech (4 months/yr)	\$10,630	\$11,160	\$11,719	\$12,305	\$12,920	\$58,734
Transportation	\$2,400	\$2,400	\$2,400	\$1,800	\$1,800	\$10,800
Work Crews	\$38,000	\$38,000	\$38,000	\$3,600	\$3,600	\$121,200
Equipment	\$2,000	\$2,000	\$2,000			\$6,000
Supplies/Tools	\$1,200	\$1,200	\$1,200	\$1,000	\$1,000	\$5,600
Total Requested	\$86,230	\$88,360	\$90,599	\$18,705	\$19,320	\$303,214

Environmental Consequences

This project will result in environmental benefits by removing non-native vegetation to restore native plant species in sandy beach habitat in a national park. The project will also increase available nesting habitat for the federally listed threatened western snowy plover. Nest protection activities will restrict public use of the beach in a small area for a short period of time, but any adverse social or economic impacts are expected to be negligible. This project is not expected to result in any significant adverse environmental impacts.

Evaluation

Sandy beach habitat is very important for wintering, migrating and nesting shorebirds. This habitat has been degraded by the invasion of non-native vegetation. Coastal dune restoration will also benefit numerous species, in addition to birds, including native dune invertebrates, and numerous rare dune plant species. Habitat restoration is a practical and effective method to improve shorebird productivity, and has been successfully implemented at nesting and foraging sites elsewhere in California. Prior experience with shorebird management in California has shown that reproductive success is reduced without proper habitat management similar to that proposed in this project. Although accurate quantification of the success and benefits of this project is difficult, this project is expected to be successful in conserving shorebirds at PRNS.

The Trustees evaluated this project against all Thresholds and Additional screening criteria developed to select restoration projects and determined that this project is consistent with these selection factors. The Trustees determined that this type and scale of restoration will effectively provide appropriate compensation for injuries to sandy beach habitat that occurred as a result of the oil spill.

4.3.4.2 #14 – Restoration Alternative: Protection of Duxbury Reef Through Education

Project Description

Oil from the Cape Mohican affected rocky intertidal habitat along the Pacific Ocean in Marin County and along the San Francisco Bay shoreline. Approximately 516 acres of rocky intertidal habitat were oiled, and the recreational use of these areas was adversely affected. The ocean area between San Francisco and Point Reyes includes much of the shoreline of the Gulf of the Farallones National Marine Sanctuary (GFNMS).

The project will be located at Duxbury Reef Marine Reserve (DRMR) in Marin County, California. This area, two and one half miles long and about one-third mile wide, is the largest exposed shale reef in California. The project will possibly affect about one third of this 520 acre area. This project includes habitat restoration and protection of the rocky intertidal habitat that will probably be injured and lost as a result of current public use. Protection of this habitat will be achieved through the design and use of better management practices, environmental education, and stewardship programs.

This program will be developed through the cooperative efforts of GFNMS and Marin County Open Space District. This project is within an area that is part of two long-term monitoring programs sponsored by the GFNMS and the Point Reyes National Seashore (PRNS). Accordingly, this local, community-based stewardship program will be developed and implemented in coordination with the Farallones Marine Sanctuary Association (FMSA), the Marin County Open Space District, PRNS, GFNMS and the Fitzgerald Marine Reserve (FMR). FMR contains a similar smaller reef in San Mateo County.

Restoration Objectives

The objective of this project is to avoid further injury to and facilitate the natural recovery of intertidal rocky habitat at Duxbury Reef. This will be achieved through environmental education and stewardship program aimed at increasing public awareness of this sensitive habitat and controlling the large number of visitors to the area. The onsite education and interpretation will be implemented for four years and will enhance the qualities of visitor use and the protection of the reef. Printed materials and exhibits are projected to last seven to ten years. Major benefits to the recovering intertidal area will occur during the four-year program. Total recovery may not occur unless the program lasts seven to fifteen years.

Scaling Approach

It is expected that this project will result in the restoration of some of the most injured areas of rocky intertidal habitat at Duxbury Reef. The Trustees believe this restoration, when combined with increased environmental education and awareness, will provide sufficient compensation for injuries to rocky intertidal habitat that occurred as a result of the oil spill.

Probability of Success

The probability of success for this project is high. Environmental education programs of this nature are commonly very beneficial because the public gains knowledge of and appreciation for the environment. Educational programs and associated materials and displays almost always attract public interest and usually result in a positive benefit to the natural resources. The Trustees believe that positive benefits will be realized as a result of this project and that methodologies and materials may be used at other locations.

Success Criteria and Monitoring

Much of the intertidal rocky habitat is expected to recover naturally over a period of approximately three years provided current human practices would cease or be significantly altered. The project will be considered successful when public use is altered and results allows for the reef to begin recovering. Monitoring the effectiveness of the environmental education program is essential, in order to prevent injury to the restored portion of this project, and other heavily used areas of the reef. The restoration and monitoring portion of this project will include:

- A census of visitors and assessment of where visitors concentrate during the approximate 100 daylight hours of low tides each year when most people visit the rocky intertidal zones.
- Mapping areas of high visitor use, impacted and non-impacted areas, reef contours, observation sites, and monitoring sites.
- Assessment of rocky intertidal habitat's percent of cover, density, productivity, species diversity, effects of human trampling, and recovery.

Approximate Project Cost

Expenditure	Year 1	Year 2	Year 3	Year 4	Total Cost
Environ. Educ. Specialist	\$43,000	\$44,300	\$45,600	\$47,000	\$179,900
Biologist/Naturalist	\$18,000	18,500	\$19,100	\$19,700	\$75,300
Biologist/Naturalist	\$9,000	\$9,300	\$9,600	\$9,900	\$37,800
Biologist/Naturalist	\$7,000	\$7,200	\$7,400	\$7,600	\$29,200
Materials	\$13,000	\$10,700	\$8,300	\$5,800	\$37,800
TOTAL for this Proposal	\$90,000	\$90,000	\$90,000	\$90,000	\$360,000
Other Contributors ¹	\$51,500	\$51,500	\$51,500	\$51,500	\$206,000
GRAND TOTAL					\$566,000

¹ Point Reyes National Seashore, College of Marin, Gulf of the Farallones National Marine Sanctuary, Farallones Marine Sanctuary Association, Marin County Open Space District, Fitzgerald Marine Reserve.

Environmental Consequences

Direct positive benefits will result from this project including the prevention of further injury and recovery of rocky intertidal habitat currently impacted by human use. In addition, the public will be better informed and future human-caused adverse impacts may be avoided or minimized at Duxbury Reef and other areas. No significant environmental or economic adverse impacts are expected to occur as a result of this project.

Evaluation

Environmental education is an effective and practical method to achieve the restoration of injured intertidal habitats. Similar project methods have resulted in the recovery and protection of sensitive

natural resources in other areas. The project is not expected to result in any significant adverse environmental or economic impacts. A monitoring program directed at documenting the expected recovery of the intertidal habitat will be implemented.

The Trustees evaluated this project against all Thresholds and Additional screening criteria developed to select preferred restoration projects and determined that this project is consistent with selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation for impacts to rocky intertidal habitat.

4.4 EVALUATION OF LOST HUMAN-USE RESTORATION ALTERNATIVES

The Trustees have identified two restoration project alternatives to provide compensation for lost human-use that occurred at public facilities and areas as a result of the Cape Mohican oil spill. These restoration projects involve public stewardship and improved beach access, and will be implemented at the GGNRA and Angel Island State Park. The details of these Restoration Project Alternatives are described below.

4.4.1 Human Use Restoration

4.4.1.1 #15 – Restoration Alternative: Angel Island Foot Trail Enhancement

Project Description

Angel Island was one of the areas most affected by the Cape Mohican oil spill, and all of the beaches on the island were closed from 10 to 43 days because of the oil deposited on them during the spill (Table 1). The public was denied access to these beaches until they were cleaned up and declared safe for use.

This project involves the construction of stairways and walkways and trail improvements to enhance public access to beaches on Angel Island that were closed to public use because of the oil spill. The following beach-access enhancement projects will be completed:

- The trail to Perle's Beach will be rebuilt and upgraded, and the wooden stair will be replaced.
- A walkway-stairway will be built at Quarry Beach to allow for safe and convenient access.
- A walkway-stairway will be built at China Cove beach to allow for safe and convenient access.
- The trail that connects the East Garrison dock to China Cove will be repaired.
- The feasibility of constructing a trail to allow direct and easy access between the East Garrison dock and Quarry Beach will be evaluated. If feasible, the trail will be constructed.

Restoration Objectives

The objectives of this project are to provide additional use opportunities and enhance the quality of use on Angel Island to compensate for lost and diminished human-use that occurred as a result of the Cape Mohican oil spill. These objectives will be accomplished by providing safe and convenient access to several beaches on Angel Island.

Scaling Approach

There are no known studies of the value which will be derived by the participants and volunteers in the Habitat Stewardship Program or of that which the general public will derive from the enhanced educational and esthetic experience of the restored marsh habitat and biota. Consequently, without conducting an economic study of any proposed site specific restoration project, it is not possible to reliably establish a value. The OPA regulations provide that if, in the judgment of the trustees, valuation of the replacement services cannot be performed within a reasonable timeframe or at a reasonable cost, trustees may estimate the value of the lost services and then select the scale of compensatory restoration that has a cost equivalent to the lost value. Relying on this authority, the Trustees propose to fund the Habitat Stewardship Program in an amount that is equivalent in cost to the lost use value derived from their use of the benefits transfer methodology.

Probability of Success

Considering the unimproved condition of current access points to public beaches on Angel Island, the probability of success for this project is very high. Similar projects on Angel Island have resulted in increased use and improved public safety. For example, steps were constructed in Ayala Cove to improve

beach access and to discourage visitors from scrambling down the sea wall to the beach. This allows for a much safer and convenient access. The existing staircase at Perle's Beach was constructed to provide access to a beach that was attractive to visitors, but whose only access was a drainage area on the hillside. The staircase provided easier and safer access over the drainage area route and increased the use of Perle's Beach. However, the staircase has been damaged by storms over the last decade, and the original construction design did not adequately address erosion concerns. Thus, completion of this project is expected to achieve the restoration objectives of increased public use of beaches and enhanced quality of use.

Success Criteria and Monitoring

Success criteria will be the completion of each of the project elements as described above. Monitoring is not practical or cost-effective for this project, and will not be conducted. Ongoing maintenance of the new facilities will be provided by California State Parks personnel.

Approximate Project Cost

The following project budget will address all five of the identified elements of this restoration project.

Expenditure	Total Cost
Planning and Environmental Compliance:	\$15,000
Construction	\$150,000
Oversight	\$15,000
Total	\$180,000

Environmental Consequences

This project will result in positive benefits by enhancing the quality and amount of public use at Angel Island, which was affected by the oil spill. No significant adverse economic impacts are expected to occur as a result of this project.

To minimize potential short-term impacts to public use that may occur during construction, the project will be implemented during periods of low public use. Potential environmental impacts from construction activities will be addressed through the permit process. Construction of the Quarry Beach and China Cove walkways will prevent or minimize future adverse impacts to vegetation, which currently is affected by soil erosion at the site caused by public use of an unimproved foot trail. Thus, additional project benefits should be realized since it is expected that the vegetation will recover and soil erosion will be minimized or prevented.

Implementation of the project is expected to improve visitation to the beaches and will likely result in a small increase in visitor use. The project will provide visitors with a safer and more accessible route to the beaches. The impact of increased visitation to the beaches will likely result in an increased need for trash collection and safety patrols by rangers. Both of these needs can be met within existing resources.

Evaluation

Trustee analysis indicates that improved access to public beaches is a feasible, practical, and cost-effective means to increase the quantity and quality of human-use at Angel Island, which was impacted by the oil spill. Access improvement projects at other parks in the San Francisco Bay have been successful and resulted in increased public use. The project is not expected to have adverse economic impacts. Potential short-term environmental impacts can be addressed through permit requirements and impacts to public use can be minimized through proper timing of construction activities. Because many factors affect public use and it is complex to accurately measure the quality of visitor use, precise quantification of increased quality and quantity of use resulting from foot trail enhancement will be very difficult to measure.

The Trustees have evaluated this project against all Threshold and Additional screening criteria developed to select preferred restoration projects and determined that this project is consistent with selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation for lost human-use that occurred as a result of the oil spill.

4.4.1.2 #16 – Restoration Alternative: Crissy Field Habitat Stewardship Program

Project Description

As a result of the oil spill, eleven facilities or areas within the GGNRA were closed between one and six days, and the total number of days of closure across all areas was 44 days (Table 4). Human-use damages resulted from both lost and diminished quality of visits at the GGNRA and the value of these damages were calculated to be approximately \$938,300.

Within the GGNRA, Crissy Field beach was the site most adversely impacted, and approximately 7,000 linear feet of beach and associated shorelines were heavily oiled. Crissy Field lies entirely within the GGNRA and stretches over 1.5 miles of shoreline at the convergence of the San Francisco Bay Area's urban center and the mouth of a biologically rich and vast natural expanse. The GGNRA is prominently located and is one of the area's most popular parks because of this singular setting and spectacular vistas of the Golden Gate, Marin Headlands, Alcatraz, Angel Island and San Francisco skyline offered from the accessible shoreline. It is a destination for walkers, joggers, and bicyclists and is one of the premier boardsailing venues in the world. Crissy Field is one of the preeminent shoreline access locations in the Bay Area with current visitation approaching 1 million visitors annually. As shoreline park improvements near completion at Crissy Field, a dramatic increase in visitation is occurring. Because of the location, biological richness, and high public use, the site provides an unparalleled educational opportunity.

A large and highly visible environmental and public use enhancement project is now underway at Crissy Field to restore tidal marsh, beach, and dune habitats and improve public access and visitor experiences at the park. Although funds were acquired for the project, insufficient funds are available for public outreach and education and for monitoring of the habitat being restored.

This project will consist of developing and operating a 4-year public stewardship program whereby participants will visually and quantitatively measure the biological and physical changes of the newly restored habitats and participate in a variety of habitat restoration activities. Specifically, the project will provide funds for a Restoration and Public Programs Coordinator and Field Assistant, Monitoring Program Coordinator, and career development internships. These staff will conduct or support volunteer recruitment and coordination, monitoring, and education. Funds may also address associated school group transportation costs, outreach materials, information management needs, and restoration supplies.

Restoration Objective

The project presents opportunities to encourage community participation in habitat restoration projects, thereby promoting an understanding of the process of restoration and the value of monitoring such projects. It is anticipated that future community-based ecological restoration and monitoring efforts will build from adaptive management principles in which the public will collect valuable monitoring data and subsequently learn how this information feeds into determining management needs. These activities will aid the health and viability of the newly recreated natural habitats.

This project provides a rare opportunity for large segments of the public to participate and learn in partnership with professionals throughout the evolution of the project. The Crissy Field habitat stewardship project promotes a unique mechanism to increase use of the park and site by actively engaging a broad spectrum of diverse universities, communities, interest groups, and visitors in helping the newly restored environments develop and thrive. Consequently, this community outreach program

will substantially enhance the participation and visitation of an increasingly broad spectrum of park visitors.

This comprehensive natural resources restoration, community stewardship, and monitoring program will engage the public's attention. It will provide a unique opportunity for visitors to tour the project's sensitive natural areas, which will complement the use and visitor experience opportunities being developed throughout the Crissy Field Plan.

Approximate Project Cost

Expenditure	Quantity	Unit Cost	Total Cost
Monitoring Program Coordinator, GS-9/11 Ecologist	4 years	\$72,066	\$288,260
Restoration & Public Programs Coordinator, GS-9 Natural Resource Management Specialist	4 years	\$59,560	\$238,240
Restoration & Public Programs Field Assistant, GS-5 Biological Sciences Technician	3 years	\$39,000	\$117,000
Volunteer Coordination & Outreach Career Intern	4 years	\$12,000	\$48,000
Restoration Career Intern	3 years	\$12,000	\$32,000
Monitoring Career Intern	4 years	\$12,000	\$48,000
Outreach Support/Transportation	4 years	\$9,625	\$38,500
Information Management Assistance	4 years	\$4,000	\$16,000
Materials/Printing/Media	4 years	\$4,000	\$16,000
Office Equipment & Supplies	4 years	\$2,000	\$ 8,000
Total Program Cost			\$850,000

* Salaries include 40 % benefits; estimated GS pay scale step increases and estimated cost-of-living increases.

Scaling Approach

There are no known studies of the value which will be derived by the participants and volunteers in the Habitat Stewardship Program or of that which the general public will derive from the enhanced educational and esthetic experience of the restored marsh habitat and biota. Consequently, without conducting an economic study of any proposed site specific restoration project, it is not possible to reliably establish a value. The OPA regulations provide that if, in the judgment of the trustees, valuation of the replacement services cannot be performed within a reasonable timeframe or at a reasonable cost, trustees may estimate the value of the lost services and then select the scale of compensatory restoration that has a cost equivalent to the lost value. Relying on this authority, the Trustees propose to fund the Habitat Stewardship Program in an amount that is equivalent in cost to the lost use value derived from their use of the benefits transfer methodology.

Probability of Success

The probability of success for this project is very high based on the experience with similar stewardship programs at GGNRA. The Presidio Park Stewards and Habitat Restoration Teams at GGNRA have contributed hundreds of thousands of volunteer hours to stewardship of the park's native habitats. Thus, completion of this project is expected to achieve the objectives of increased public use, participation in environmental restoration projects, enhanced public environmental awareness, and enhanced quality of use.

Success Criteria and Monitoring

Success criteria will be the development and implementation of a functioning stewardship program that involves diverse sectors of the public. Detailed records will be kept documenting the number of hours of public participation and work accomplished and will be reported annually. It is expected that the re-created wetland and dune habitats will have stabilized by the end of the four year project, allowing a reduction of the level of long-term stewardship and monitoring. At that point, the reduced level of stewardship and monitoring required will be integrated into GGNRA's existing Presidio Park Stewards and natural resource monitoring programs.

Environmental Consequences

This project will increase the total value of human-use of the area most heavily affected by the spill by increasing the number of participants and visitors and by enhancing the quality of each visit or activity. In addition, the stewardship program will provide valuable assistance in conducting the monitoring of the important habitat restoration project currently being implemented at the park.

Evaluation

Trustee analysis of this project concluded that it offers a rare opportunity to implement a stewardship program expected to enhance public environmental awareness and increase the amount and quality of public use at GGNRA. Similar stewardship programs at the GGNRA and other parks have achieved these types of objectives, and the Trustees expect this project to also be successful.

The Trustees evaluated this project against all Threshold and Additional Screening Criteria developed to select preferred restoration projects and determined that this project is consistent with selection factors. The Trustees determined that this type and scale of project will effectively provide appropriate compensation, along with other projects, for lost human-use that occurred as a result of the oil spill.

4.5 ADDITIONAL NON-PREFERRED RESTORATION ALTERNATIVES

A large number of proposed restoration projects have been identified during all phases of the Restoration Planning process, including the injury assessment, public scoping, and restoration selection phases. The proposed restoration projects originated from the Trustee Council, other government agencies, and public and the Trustee Council considered and evaluated all of the proposed projects.

Projects evaluated early in the Restoration Planning process were reviewed using an informal screening approach that included criteria such as: a connection to the natural resources impacted by the oil spill, feasibility of the project, location of the project, and cost of implementing the project. The Trustee Council also used their best professional judgement in regards to these criteria and decision to accept or withdraw projects from further consideration in the early stages of Restoration Planning. Later in the Restoration Planning process, formal screening criteria were established and used to determine whether to retain or withdraw projects from further consideration. Some proposed restoration projects were withdrawn because funding from other sources was identified. Following is a brief description of several of the restoration projects considered but withdrawn for these various reasons.

Project funding received from other sources:

- **Entry Triangle Marsh Wetland Restoration:** This project would restore 8 to 10 acres of tidal marsh and mudflat habitat on the Don Edwards San Francisco National Wildlife Refuge by re-establishing tidal circulation to the marsh. The project would involve the removal of culverts, replacement of a tidal gate and re-defining existing channels.

- **Bolinas Lagoon Wetland Restoration:** Bolinas Lagoon is a 1400 acre tidal estuary located near the villages of Bolinas and Stinson Beach in western Marin County. The project is part of a larger Bolinas Lagoon effort. Specifically, this project would have enhanced or replaced several culverts that pass underneath Highway 1. Modification of these structures would increase water flow from the watershed to the lagoon and decrease sedimentation.
- **Tubbs Island Levee Setback:** This project would restore 72 acres of tidal salt marsh at the north end of San Francisco Bay within the San Pablo Bay National Wildlife Refuge. The project entails constructing a protection levee and breaching an old levee to open a 72-acre fallow field to tidal waters.

Projects that did not pass Trustee Council screening criteria:

- **Herring Stock Assessment:** This project would have determined and catalogued the genetic identities of different spawning schools of Pacific herring collected from San Francisco, Tomales, and Bodega Bays using mtDNA and microsatellite DNA markers. This information would help fisheries managers and researchers identify the population structure and genetics of herring that utilize San Francisco Bay and nearby bays for reproduction. This project was viewed as a research project by the Trustee Council and not an appropriate use of oil spill settlement funds.
- **Eelgrass Restoration in San Francisco Bay:** Eelgrass beds are productive areas in the estuarine ecosystem, and provide nursery, forage and structural habitat for birds, invertebrates, and fish including herring, a very important fishery. This project involved planting 1-acre eelgrass beds at three locations; Candlestick Point Park, India Basin, and Central Basin-Mission Rock to increase herring spawning habitat in San Francisco Bay and possibly adult herring abundance. The project was determined as technically questionable and financially infeasible with settlement funds.
- **Creation of Artificial Herring Spawning Habitat:** This project involved creation of new herring spawning habitat using oyster shell dredged from San Francisco Bay by constructing three artificial shell beds approximately 50 feet by 50 feet by 1 foot deep in water 10 to 15 feet deep mean low lower water. The goal was to increase the herring population, while also benefiting other aquatic species such as mussels, anemones, sponges, barnacles, and fishes, by increasing their spawning habitat. The project was deemed as technically infeasible for permitting reasons and highly questionable as suitable habitat.
- **Treasure Island Wetland Restoration:** Treasure Island is a 400-acre island in central San Francisco Bay. The project involved the creation of a freshwater and a tidal salt marsh on the eastern side of the island. The project also included an interpretive center, viewing overlooks, trails, and boardwalks. This project did not pass screening criteria because it involved creation of freshwater wetlands for wastewater treatment, which was not considered to be consistent with the Trustees' goal of compensating for spill-related impacts to salt marsh and mudflats.
- **Waterbird Conservation Project:** Development and implementation of a coordinated seabird conservation and management plan for central San Francisco Bay. The project involved the establishment of a committee to coordinate the enhancement of seabird nesting habitat, especially for double-crested cormorants, by creating, enhancing, and protecting roosting sites. The Council determined that there were enough suitable bird restoration projects that could be implemented directly, rather than indirectly through a committee.

- **Big Lagoon Public Access Project:** Big Lagoon is a fresh water wetland system located at the mouth of Redwood Creek at Muir Beach in Marin County. The project would entail removing levees, realigning Redwood Creek to its natural alignment, improving public access, and removing fill material resulting from land use practices in the watershed and former wetland. This project was dropped from consideration because a feasible project to compensate for lost public use of GGNRA land was identified at Crissy Field where the worst impacts to National Park lands occurred.
- **Wetlands Walkway at Candlestick Point State Recreation Area:** The project involves the construction of an elevated walkway into the wetlands at Candlestick Point State Recreation Area. The goal of the project is to provide recreational and environmental education to the public through interpretive signs and guided walks conducted by park rangers. This project was dropped from consideration because a feasible project was identified at Angel Island State Park where the worst impacts to State Park lands occurred.
- **Tern Nesting Bair Island:** The project involves the creation of suitable nesting substrate for Caspian and least terns by removing vegetation and placing shell and sand nesting material at the site. Levees at the site would be breached and soil or dredged material may need to be deposited to ensure nesting substrate is at a higher elevation than the flooded salt marsh. This project was dropped from consideration because the Alameda tern restoration project had a closer nexus to the location of the spill and was considered more technically feasible.
- **Martin dunes Acquisition:** This project involved acquisition of dune habitat near the mouth of the Salinas River in Monterey County to benefit snowy plovers and other shorebirds. The project was dropped from consideration prior to settlement of the case because other potential shorebird and sandy beach restoration projects were identified that were geographically closer to the area affected by the spill.
- **Muir Beach Water Supply Project:** The Muir Beach Water Supply Project would provide an alternative water supply system for the community of Muir Beach which currently relies on withdrawal of water for domestic use from the Redwood Creek basin. These water withdrawals pose a major threat to aquatic resources, including coho salmon and steelhead. A pipeline would be installed to supply potable water from Marin Municipal Water District facilities in the Mill Valley area to the existing distribution system. The Trustees determined that this project financially infeasible with settlement funds and did not have a strong enough relationship to the resources injured by the spill.

5.0 APPLICABLE LAWS AND REGULATIONS

5.1 Overview

The three major environmental statutes that guide the restoration of the injured resources and lost services for the Cape Mohican oil spill are OPA, NEPA, and CEQA. These statutes set forth a specific process of environmental impact analysis and public review. In addition, the Trustees must comply with several additional federal, state and local applicable statutes, regulations and policies. Relevant, and potentially relevant, statutes, regulations and policies are discussed below.

In addition to compliance with these statutes and regulations, the Trustees should consider relevant environmental or economic programs or plans that are ongoing or planned in or near the affected environment. The Trustees should ensure that proposed restoration projects neither impede nor duplicate such programs or plans. By coordinating restoration projects identified in this document with other relevant restoration programs and plans, the Trustees can enhance the overall effort to restore and improve the environment and resources affected by the oil spill.

Several of the restoration actions proposed in this RP/EA involve activities conducted in wetlands and waters of the United States. Therefore, these activities are subject to review and approval by the appropriate regulatory agencies.

5.1.1 Federal Statutes

Oil Pollution Act of 1990 (OPA), 33 USC 2701, et seq.; 15 CFR Part 990

OPA establishes a liability regime for oil spills that injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Federal and State agencies and Indian tribes act as Trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries and implement restoration. Section 1006(e)(1) of OPA [33 USC 2706 (e)(1)] requires the President, acting through the Under Secretary of Commerce for Oceans and Atmosphere (NOAA), to promulgate regulations for the assessment of natural resource damages resulting from a discharge or substantial threat of a discharge of oil. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services.

This rule provides a framework for conducting sound natural resource damage assessments that achieve restoration. The process emphasizes both public involvement and participation by the Responsible Party(ies). The Trustees have followed the regulations in this assessment.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4321, et seq., 40 C.F.R. Parts 1500-1508

The National Environmental Policy Act requires an assessment of any federal action that may impact the environment. NEPA applies to restoration actions undertaken by federal trustees, except where a categorical exclusion or other exception to NEPA applies. Congress enacted NEPA in 1969 to establish a national policy for the protection of the environment. NEPA established the Council on Environmental Quality (CEQ) to advise the President and to carry out certain other responsibilities relating to implementation of NEPA by federal agencies. Pursuant to Presidential Executive Order, federal agencies are obligated to comply with the NEPA regulations adopted by the CEQ. These regulations outline the responsibilities of federal agencies under NEPA and provide specific procedures for preparing

environmental documentation to comply with NEPA. NEPA requires that an Environmental Assessment (EA) be prepared in order to determine whether the proposed restoration action would have a significant effect on the quality of the human environment.

Generally, when it is uncertain whether an action would have a significant effect, federal agencies would begin the NEPA planning process by preparing an EA. The EA may undergo a public review and comment period. Federal agencies may then review the comments and make a determination. Depending on whether an impact is considered significant, an environmental impact statement (EIS) or a Finding of No Significant Impact (FONSI) would be issued.

The Trustees have integrated this RP/EA with the NEPA and CEQA processes to comply, in part, with those requirements. This integrated process allows the Trustees to meet the public involvement requirements of OPA, NEPA and CEQA concurrently. The RP/EA is intended to accomplish partial NEPA and CEQA compliance by: (1) summarizing the current environmental setting, (2) describing the purpose and need for restoration action, (3) identifying alternative actions, (4) assessing participation in the decision process. Project-specific NEPA and CEQA documents may be needed for some of the proposed restoration projects. Other projects may fall within an existing EIS or EIR.

Clean Water Act (CWA) (Federal Water Pollution Control Act), 33 U.S.C. Section 1251, et seq.

The objective of the Clean Water Act (*Federal Water Pollution Control Act, 33 U.S.C. § 1251 et seq.*) is to restore and maintain the chemical, physical, and biological integrity of the nation's water. The CWA is the principal statute governing pollution control and water quality of the nation's waterways. To this end, Section 404 of the CWA requires a permit from the U.S. Army Corps of Engineers (COE) for the discharge of dredge or fill material into waters of the United States, including most wetlands. Section 401 of the CWA requires states to certify that any federally permitted or licensed activity that might result in a discharge to waters of the United States, including issuance of a Section 404 permit, would not violate applicable water quality standards established by the states. In California, Section 401 water quality certification program is administered by the **Regional Water Quality Control Boards**. Together, the statutory authority of NEPA and CWA regulate most types of work conducted in wetlands.

National Park System Resource Protection Act, 16 USC 19jj

Public Law 101-337, the Park System Resource Protection Act. (*16 USC 19jj*), requires the Secretary of the Interior to assess and monitor injuries to NPS resources. The Act specifically allows the Secretary of the Interior to recover response costs and damages from the Responsible Party causing the destruction, loss of, or injury to park system resources. This Act provides that any monies recovered by the NPS may be used to reimburse the costs of response and damage assessment and to restore, replace or acquire the equivalent of the injured resources.

Coastal Zone Management Act (CZMA), 16 U.S.C. 1451, et seq., 15 CFR Part 923

The goal of the federal CZMA is to preserve, develop and, where possible, restore and enhance the nation's coastal resources. The federal government provides grants to states with federally-approved coastal management programs. The State of California has a federally-approved program. Section 1456 of the CZMA requires that any federal action inside or outside of the coastal zone that affects any land or water use or natural resources of the coastal zone shall be consistent, to the maximum extent practicable, with the enforceable policies of approved state management programs. It states that no federal license or

permit may be granted without giving the State the opportunity to concur that the project is consistent with the state's coastal policies. The regulations outline the consistency procedures.

The Trustees do not believe that any of the proposed projects would adversely affect the state's coastal zone. However, to comply with the CZMA, the Trustees intend to seek the concurrence of the State of California that their preferred projects are consistent to the maximum extent practicable with the enforceable policies of the state coastal program.

**Endangered Species Act (ESA), 16 U.S.C. 1531, et seq.,
50 C.F.R. Parts 17, 222, 224**

The federal ESA directs all federal agencies to conserve endangered and threatened species and their habitats and encourages such agencies to utilize their authorities to further these purposes. Under the Act, the National Marine Fisheries Service (NMFS) and the USFWS publish lists of endangered and threatened species. Section 7 of the Act requires that federal agencies consult with these two agencies to minimize the effects of federal actions on endangered and threatened species. Prior to implementation of these projects, the Trustees would conduct Section 7 consultations in conjunction with Essential Fish Habitat (EFH) consultation.

As noted in the RP/EA, several federal and state-listed species frequent the areas impacted by the oil spill. They are also in areas where the Trustees are considering restoration projects. Some listed species, such as the California brown pelican and western snowy plover, would benefit from the proposed restoration projects. Should it be determined that any of the proposed projects would adversely affect a threatened or endangered species, the Trustees would either redesign the project or substitute another project.

National Marine Sanctuaries Act (16 U.S.C. 1431 et. seq.)

Under the National Marine Sanctuaries Act the Secretary of Commerce is authorized to designate discrete areas of the marine environment as National Marine Sanctuaries to protect distinctive natural and cultural resources whose protection and beneficial use requires comprehensive planning and management. The purpose of the Act is to identify, designate, and manage areas of the marine environment of special national significance due to their conservation, recreational, ecological, historical, research, educational, or aesthetic qualities. The goals of the Act are to provide enhanced resource protection through conservation and management of the Sanctuaries that complements existing regulatory authorities; to support, promote, and coordinate scientific research on, and monitoring of, the site-specific marine resources of the Sanctuaries; to enhance public awareness, understanding, appreciation, and wise use of the marine environment; and to facilitate, to the extent compatible with the primary objective of resource protection, multiple uses of the National Marine Sanctuaries. The Act provides authority for comprehensive and coordinated conservation.

**Magnuson-Stevens Fishery Conservation and Management Act,
16 U.S.C. 1801 et seq.**

The federal Magnuson-Stevens Fishery Conservation and Management Act as amended and reauthorized by the Sustainable Fisheries Act (Public Statute 104-297) establishes a program to promote the protection of essential fish habitat (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. After EFH has been described and identified in fishery management plans by the regional fishery management councils, federal agencies are obligated to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any EFH.

Fish and Wildlife Coordination Act (FWCA), 16 U.S.C. 661, et seq.

The federal FWCA requires that federal agencies consult with the USFWS, NMFS, and state wildlife agencies for activities that affect, control or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. This consultation is generally incorporated into the process of complying with Section 404 of the Clean Water Act, NEPA or other federal permit, license or review requirements.

Rivers and Harbors Act, 33 U.S.C. 401, et seq.

The federal Rivers and Harbors Act regulates development and use of the nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the Corps with authority to regulate discharges of fill and other materials into such waters. Restoration actions that require Section 404 Clean Water Act permits are likely also to require permits under Section 10 of the Rivers and Harbors Act. However, a single permit usually serves for both. Therefore, the Trustees can ensure compliance with the Rivers and Harbors Act through the same mechanism.

Executive Order (EO) 12898—Environmental Justice

On February 11, 1994, President Clinton issued EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. This EO requires each federal agency to identify and address as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low-income populations. The Environmental Protection Agency and the CEQ have emphasized the importance of incorporating environmental justice review in the analyses conducted by federal agencies under NEPA of developing mitigation measures that avoid disproportionate environmental effects on minority and low-income populations. The Trustees have concluded that no low income or ethnic minority communities would be adversely affected by the proposed restoration activities.

Executive Order (EO) 11988—Construction in Flood Plains

This 1977 Executive Order directs federal agencies to avoid to the extent possible the long-and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct or indirect support of development in flood plains wherever there is a practicable alternative. Each agency is responsible for evaluating the potential effects of any action it may take in a flood plain. Before taking an action, the federal agency should determine whether the proposed action would occur in a flood plain. For major federal action significantly affecting the quality of the human environment, the evaluation would be included in the agency's NEPA compliance document(s). The agency should consider alternatives to avoid adverse effects and incompatible development in flood plains. If the only practicable alternative requires sitting in a flood plain, the agency should: (1) design or modify the action to minimize potential harm, and (2) prepare and circulate a notice containing an explanation of why the action is proposed to be located in the flood plain.

5.1.2 State Statutes

California Environmental Quality Act (CEQA) (Pub. Res. Code sections 21000-21177.1)

The California Environmental Quality Act, commonly referred to as CEQA, was adopted in 1970 and applies to most public agency decisions to carry out, authorize or approve projects that may have adverse

environmental impacts. CEQA requires that agencies inform themselves about the environmental effects of their proposed actions, consider all relevant information, provide the public an opportunity to comment on the environmental issues, and avoid or reduce potential environmental harm whenever feasible.

The CEQA process begins with a preliminary review as to whether CEQA applies to the project in question. Generally, a project is subject to CEQA if it involves discretionary action by an agency that may cause a significant effect on the environment. Once the agency determines that the “project” is subject to CEQA, the lead agency should then determine whether the action is exempt under either a statutory or categorical exemption, *14 Cal. Code Regs. Section 15061*.

If the lead agency determines that the project is not exempt then an Initial Study should be prepared to determine whether the project may have a potentially significant effect on the environment, *14 Cal. Code Regs. Section 15063*. To meet the requirements of this section, the lead agency may use an environmental assessment prepared pursuant to NEPA. Based on the Initial Study, the lead agency determines the type of CEQA documentation that will be prepared. The test for determining whether an Environmental Impact Report (EIR) or Negative Declaration should be prepared is whether a fair argument can be made based on substantial evidence that the project may have a significant adverse effect on the environment, *Pub. Res. Code Section 21068, 14 Cal. Code Regs. Section 15063*.

The State lead agency (CDFG) considers a number of these proposed projects to be categorically exempt pursuant to: (1) *14 Cal. Code of Regs. Section 15304*, “Minor alterations to land, water, or vegetation” (2) *14 Cal. Code of Regs. Section 15307*, “Actions by regulatory agencies for protection of natural resources,” and (3) *14 Cal. Code Regs. Section 15308*, “Actions by regulatory agencies for the protection of the environment.” Nonetheless, the State lead agency, in coordination with the Federal Trustees, decided to proceed with further CEQA documentation. The Trustees have integrated this RP/EA with the NEPA and CEQA processes to comply, in part, with those requirements.

This RP/EA, is intended to address the initial study requirements under CEQA by: (1) summarizing the current environmental setting; (2) describing the purpose and need for restoration action; (3) identifying alternative actions; (4) assessing the preferred actions’ environmental consequences; and (5) summarizing opportunities for public participation in the decision process. Project-specific NEPA and CEQA documents may be needed for some of the proposed restoration projects. Other projects may fall within an existing EIS or EIR.

CEQA encourages the use of an EIS or finding of no significant impact or combined state/federal documents in place of a separate EIR or negative declaration. Pub. Res. Code §§ 21083.5, 21083.7, 14 Cal. Code Regs. §§ 15221-15222. The State lead agency intends to use an EIS or finding of no significant impact in place of a separate EIR or negative declaration.

California Endangered Species Act, Fish and Game Code Sections 2050 et seq.

It is the policy of the State of California that state agencies should not approve projects as proposed which would jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of those species if there are reasonable and prudent alternatives available. If reasonable alternatives are infeasible, individual projects may be approved if appropriate mitigation and enhancement measures are provided. Under this act, the Fish and Game Commission established a list of threatened and endangered species based on criteria recommended by the Department of Fish and Game.

California Harbor and Navigation Code section 294

Harbors and Navigation Code section 294 creates absolute liability for damages from the discharge or leaking of gas, oil, or drilling waste onto marine waters. Damages include cost of wildlife rehabilitation, and injury to natural resources or wildlife, and “loss of use and enjoyment of public beaches and other public resources or facilities.” Section 294(g)(1)

California Lempert -Keene-Seastrand Oil Spill Prevention and Response Act, Government Code Section 9574.1, et seq.

Lempert-Keene-Seastrand Oil Spill Prevention and Response Act, commencing with Section 8574.1, became effective on September 24, 1990. This legislation has become the key state compensatory mechanism for subsequent spills. It establishes a comprehensive liability scheme for damages resulting from marine oil spills. Recoverable damages include injury to natural resources, cost of wildlife rehabilitation, and loss of use and enjoyment of natural resources, public beaches, and other public resources.

Public Resources Code, Division 6, Sections 6001 et seq.

The Public Resources Code, Division 6, gives the California State Lands Commission trustee ownership over State sovereign tide and submerged lands. Permits or leases may be required from the State Lands Commission if a restoration project is located on such lands.

Other Potentially Applicable Statutes and Regulations

Additional statutes may be applicable to NRDA restoration planning activities. The statutes listed below, or their implementing regulations, may require permits from federal or state permitting authorities.

Marine Mammal Protection Act. 16 USC 1361, et seq.

Migratory Bird Treaty Act, 16 U.S.C. 703, et seq.

National Park Act of August 19, 1916 (Organic Act), 16 USC 1, et seq.

Archaeological Resources Protection Act, 16 U.S.C. 460, et seq.

National Historic Preservation Act of 1966 as amended (16 U.S.C. 470-470t, 110)

Clean Air Act, 42 U.S.C. 7401, et seq.

Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. 6

6.0 REFERENCES, PERSONS, AND AGENCIES CONSULTED

6.1 Documents Referenced

The reference section is incomplete. Citations whose reference information is not presented here are highlighted in the report text.

Accruso, L.M. 1992. *Distribution and abundance of wintering waterfowl on San Francisco Bay 1988 through 1990*. Unpublished master's thesis. Humboldt State University, Arcata, Calif. 252 pp.

Blake, T.A. and P. Steinhart. 1987. Tracks in the Sky: wildlife and wetlands of the Pacific flyway. Chronicle Books, San Francisco, California. 166 pp.

Bellrose, F.C. 1980. *Ducks, geese, and swans of North America*. Harrisburg, Pa.: Stackpole Books.

Caffrey, J.M., Cole, B.E., Cloern, J.E., Tyler, C., and Jasby, A., 1994. *Studies of the San Francisco Bay, California, Estuarine Ecosystem Pilot Regional Monitoring Results*.

California Department of Fish and Game (CDFG). 2001. *California natural diversity database: State and federally listed endangered and threatened animals of California*. State of California Resources Agency, Department of Fish and Game, Habitat Conservation Divisions, Wildlife and Habitat Data Analysis Branch.

Goals Project. 2000. *Baylands ecosystem species and community profiles: Life histories and environmental requirements of key plants, fish and wildlife*. Edited by P.R. Olofson. Prepared by the San Francisco Bay Area Wetlands Ecosystem Goals Project. San Francisco Bay Regional Water Quality Control Board, Oakland, Calif.

Hankins, D. 2001. U.S. Fish and Wildlife Service, Ecological Service. Email to Yvette O'Keefe, Harding ESE, Inc. March 20.

Kelly, J.P. and B. Fischer. 2000. *Heron and egret monitoring results at West Marin Island: 2000 nesting season*. Audubon Canyon Ranch Technical Report 90-3-11, Cypress Grove Research Center, Marshall, California.

Page, G. W., L. E. Stenzel, and J. E. Kjelmyr. 1999. Overview of shorebird abundance and distribution in wetlands of the Pacific coast of the contiguous United States. Condor 101:461-471.

Steere, J.T. and N. Schaefer. 2001. Restoring the Estuary: Implementation Strategy for the San Francisco Bay Joint Venture. San Francisco Bay Joint Venture. Oakland, California. 124 pp.

U.S. Fish and Wildlife Service (USFWS). 1987. *Birds of San Francisco Bay National Wildlife Refuges*.

U.S. Fish and Wildlife Service. 1987. Birds of San Francisco Bay and San Pablo Bay National Wildlife Refuges. U.S. Fish and Wildlife Refuge.

U.S. Fish and Wildlife Service, Jamestown, N. Dak.: Northern Prairie Wildlife Research Center.
<http://www.npwrc.usgs.gov/resource/othrdata/chekbird/r1/sfbay.htm> (Version 22May98).

_____, 1989. *Concept plan for wetland habitat protection*. North American Waterfowl Management Plan, Category 27. U.S. Department of the Interior, Fish and Wildlife Service. Rep. Portland, Oregon.

_____, 1995. *Coastal ecosystems program*. Branch of Coastal and Wetland Resources, Division of Habitat Conservation. Washington, D.C.

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APPENDIX A
ADMINISTRATIVE RECORD

SS Cape Mohican Oil Spill, October 28, 1996,
San Francisco Drydock Shipyard
Natural Resource Damage Assessment

APPENDIX A
ADMINISTRATIVE RECORD

SS Cape Mohican Oil Spill, October 28, 1996,
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 - 5.3 Potential Restoration Projects for Natural Resources Impacted by the Cape Mohican Oil Spill: A Public Scoping Document
 - 5.4 Project Evaluation Criteria and Potential Restoration Projects, Public Workshop 5/10/99
 - 5.5 Updated Descriptions of Potential Restoration Projects for Birds and Wetland/Mudflat Habitats Injured by the Cape Mohican Oil Spill
- 6.0 PUBLIC COMMENTS
 - 6.1 Memo dated July 6, 1999, Public Comments on Potential Restoration Projects for Natural Resources Impacted by the Cape Mohican Oil Spill
 - 6.2 Memo dated June 8, 1999, Public Comments on Potential Restoration Projects for Natural Resources Impacted by the Cape Mohican Oil Spill