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) Personnel cost (planting) Herbicide cost	5 years 5 years 5 years	$16,500/yr $5,500/yr $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 Construct rock walls	2 years 2 years	$56,250/yr $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	1staff	$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