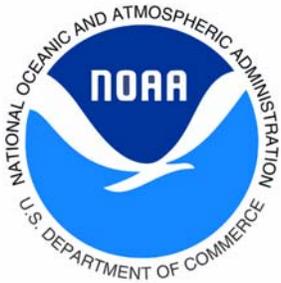


**DRAFT RESTORATION PLAN / ENVIRONMENTAL ASSESSMENT
FOR
MORRIS J. BERMAN OIL SPILL
SAN JUAN, PUERTO RICO**



Prepared for:
Trustees
National Oceanic and Atmospheric Administration
Puerto Rico Department of Natural and Environmental Resources
National Park Service
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ACRONYMS AND ABBREVIATIONS

ADA	Americans with Disabilities Act
Army Corps	United States Army Corps of Engineers
CWA	Clean Water Act (also known as Federal Water Pollution Control Act)
Coast Guard	U.S. Coast Guard
CZMA	Coastal Zone Management Act
DNER	Puerto Rico Department of Natural and Environmental Resources
Draft RP/EA	Draft Restoration Plan and Environmental Assessment
DOI	United States Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
Final RP/EA	Final Restoration Plan/Environmental Assessment
FONSI	Finding of No Significant Impact
MRI	Marine Resources, Inc.
MPRSA	Marine Protection, Research and Sanctuaries Act
NEPA	National Environmental Policy Act
NOAA Fisheries	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
NPS	National Park Service
OPA	Oil Pollution Act
SHPO	State Historic Preservation Office
T/B	Tank Barge
USFWS	U.S. Fish and Wildlife Service

EXECUTIVE SUMMARY

This Draft Restoration Plan and Environmental Assessment (Draft RP/EA) was prepared in compliance with the Oil Pollution Act (OPA) (33 U.S.C. § 2701, *et seq.*) and National Environmental Policy Act (NEPA) (42 U.S.C. 4321, *et seq.*) to address restoration of injured natural resources and lost ecological and recreational services resulting from the *T/B Morris J. Berman* grounding and oil spill off the coast of San Juan, Puerto Rico, on January 7, 1994. The Draft RP/EA was drafted by the Federal and Commonwealth trustee agencies affected by the oil spill, which include the Commonwealth of Puerto Rico's Department of Natural and Environmental Resources (DNER); the National Park Service (NPS), on behalf of the United States Department of the Interior (DOI); and the National Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce (collectively, the Trustees).

The purpose of restoration, as outlined in this Draft RP/EA, is to make the environment and public whole for injuries to natural resources and natural resource services by returning them (through primary restoration) to their baseline conditions (the level that would have existed if the grounding and spill had not occurred) and/or compensating for the interim loss of resources and services pending recovery to baseline (through compensatory restoration). Because primary restoration is infeasible for this spill, the Trustees have proposed a variety of compensatory restoration projects to compensate the public for injuries to and lost services from three injured resource types—reef resources, recreational beach use, and recreational use and enjoyment of historic sites.

The Draft RP/EA sets forth the Trustees' recommendations for a variety of restoration projects to compensate the public for injuries to and lost services from the three injured resource types.

The Draft RP/EA describes the proposed restoration projects, evaluates the environmental impacts of the restoration projects, and estimates the costs of completing the restoration projects. Proposed restoration projects are evaluated against relevant criteria, and preferred restoration projects are identified. Restoration alternatives selected as preferred for the lost reef services include Modular Reef Habitat Construction, Acquisition of Equivalent Lost Services, and Seagrass Restoration. The preferred restoration alternative selected for lost recreational beach use is Acquisition of Lands for Conservation. The three restoration alternatives selected as preferred for lost and diminished use of the San Juan National Historic Site include Improve and Extend the Coastal Promenade, Restore El Morro Water Battery, and Clean/Stabilize Exterior Walls of the Historic Site.

In addition to presenting the recommendations of the Trustees, the Draft RP/EA includes information on how the public can provide comments on the proposed restoration projects and offer suggestions for other restoration projects.

1.0 PURPOSE

This Draft Restoration Plan and Environmental Assessment (Draft RP/EA) has been prepared by the Commonwealth of Puerto Rico and Federal Trustees to address restoration of injured natural resources and lost ecological and recreational services resulting from the *Tanker Barge (T/B) Morris J. Berman* oil spill incident on January 7, 1994.

This document summarizes the Trustees' assessment of certain injuries to natural resources resulting from the 1994 *T/B Morris J. Berman* grounding and oil spill off the coast of San Juan, Puerto Rico (hereinafter, the "spill" or the "incident"). The Draft RP/EA sets forth the Trustees' recommendations for restoration projects and alternatives to restore resources to their baseline condition (the level that would have existed if the incident had not occurred) and to compensate for the interim loss of resources and services pending recovery to baseline. The Draft RP/EA also estimates associated costs of those projects. This document was prepared by the Commonwealth of Puerto Rico's Department of Natural and Environmental Resources (DNER), the National Park Service (NPS), a bureau within the United States Department of the Interior (DOI), and the National Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce (collectively, the Trustees).

1.1 OVERVIEW OF THE INCIDENT

Before dawn on January 7, 1994, the *T/B Morris J. Berman*—a 302-foot-long by 90-foot-wide barge loaded with 1.5 million gallons of # 6 fuel oil—drifted aground near San Juan, Puerto Rico, after its tow line from the tug *Emily S.* broke. The barge grounded on a reef near Punta Escambrón, at latitude 18° 28.3' N and longitude 66° 05.4' W. The grounding ruptured seven of the barge's nine holding tanks and resulted in the primary release and discharge of approximately 800,000 gallons of fuel oil into nearshore waters, including those adjacent to the San Juan National Historic Site. To remove the oil remaining on board the barge, lightering operations were initiated on the evening of January 8 and continued until January 12. However, bad weather conditions and rough seas at the site of the grounding and spill limited this operation. Figure 1-1 shows a map of the grounding site and surrounding area.

On January 15, 1994, after lightering most of the remaining oil from the barge, the U.S. Coast Guard (Coast Guard) refloated, transported, and then scuttled the barge in 6,123 feet of water at a former munitions disposal site located 20 nautical miles (23 miles) north-northeast of San Juan. The Coast

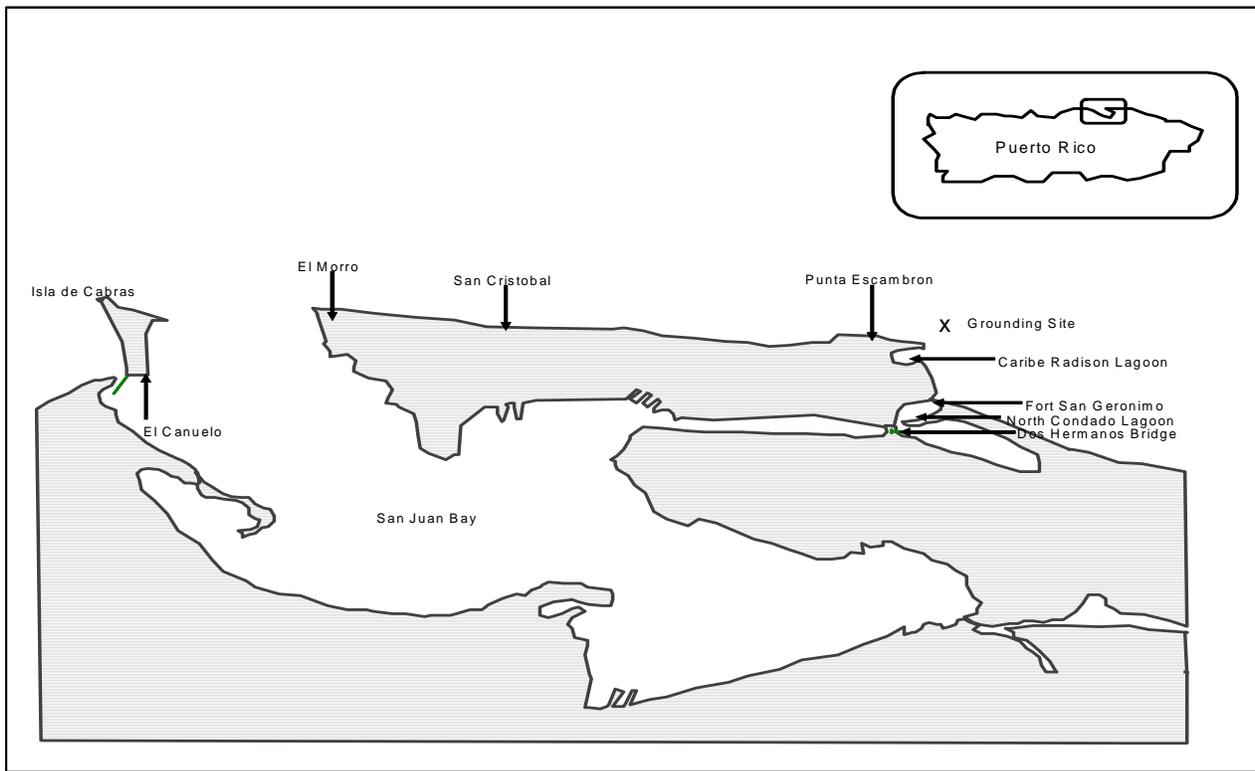


Figure 1-1 Grounding Site and Surrounding Area

Guard estimated that a secondary release of between 85,000 and 125,000 gallons of an oil-water mixture occurred during refloating and towing operations, resulting in patchy oil and sheens over a 20-mile stretch of offshore waters. An additional 160,000 to 200,000 gallons of oil sank with the barge. For several weeks after the scuttling, this secondary release of oil continued from the sunken barge and formed oily slicks and scattered tarballs. This oil eventually spread along much of the northern and northwestern coast of Puerto Rico. Figure 1-2 illustrates some of the areas along the coast that were impacted by the spill.

1.2 SUMMARY OF NATURAL RESOURCES INJURIES AND LOST SERVICES

The *T/B Morris J. Berman* grounding and oil spill adversely affected a number of natural resources, including surface waters, sediments, seagrasses, reefs, rocky shorelines, protected embayments, sand beaches, invertebrates, finfish, and birds. The Trustees recovered damages to compensate the public for injury, loss, and destruction of natural resources and reductions in the services provided by these resources. The Oil Pollution Act (OPA) natural resource damage assessment regulations define “injury” as “an observable or measurable adverse change in a natural resource or impairment of a natural resource

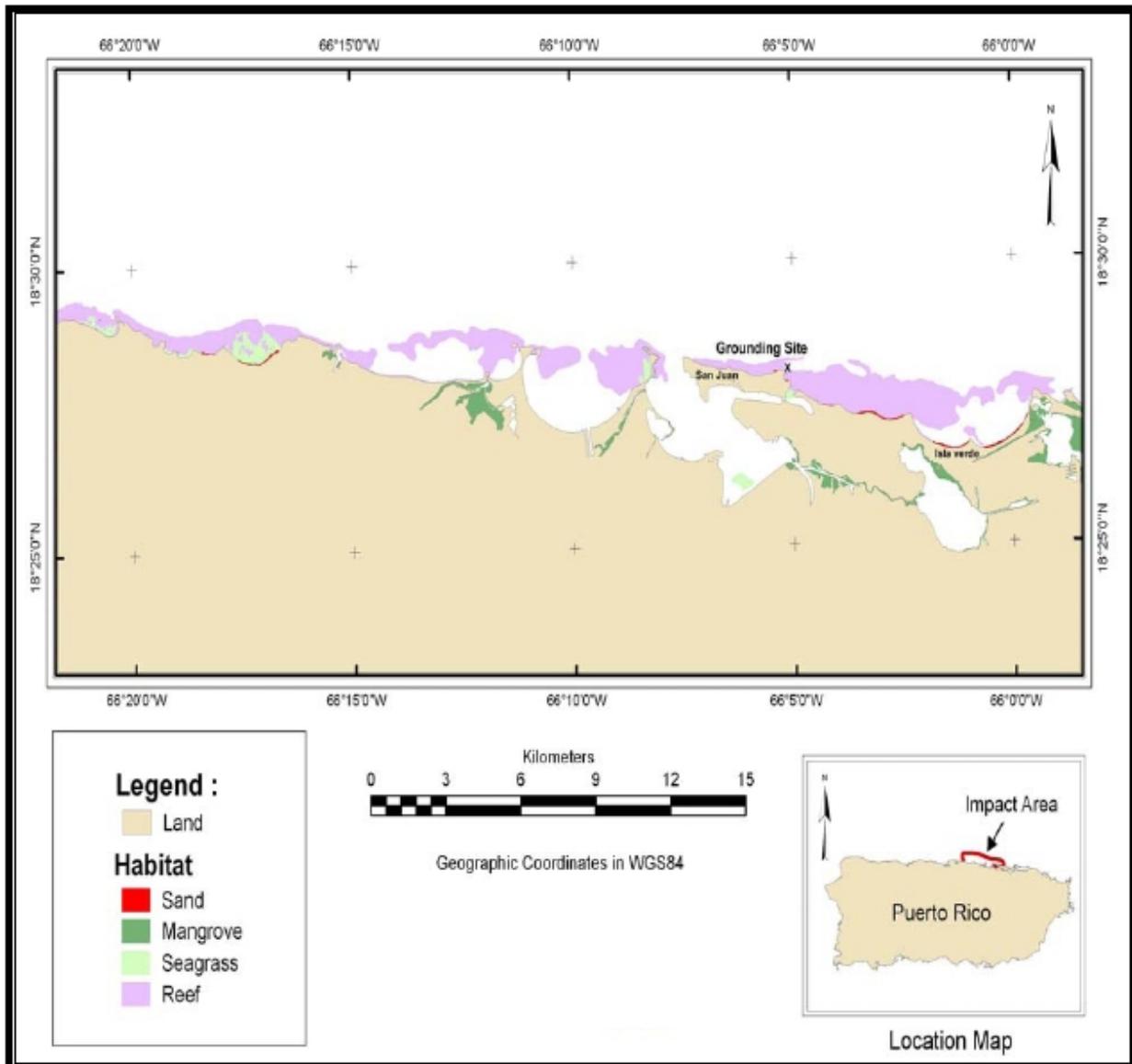


Figure 1-2 Overview of Morris J. Berman Oil Spill Impact Areas

service” (15 C.F.R. § 990.30). The regulations define “services” as “the functions performed by a natural resource for the benefit of another natural resource and/or the public” (15 C.F.R. § 990.30).

Table 1-1 summarizes the documented injuries.

**TABLE 1-1
DOCUMENTED INJURIES FROM THE MORRIS J. BERMAN OIL SPILL**

Natural Resource or Service	Injuries Observed
Natural Resource	
Surface Water	Oil affected an estimated 1,100 square miles of surface waters along the north coast of Puerto Rico, including 3.5 miles of shoreline owned and operated by the Federal Government as part of the San Juan National Historic Site. Oiled waters were a source of exposure to marine and terrestrial animals and plants.
Sand Beaches and Rocky Shorelines	Approximately 103 miles of ocean shorelines and 66 miles of bay shorelines were oiled. These natural shorelines contain a mix of rock, sand, and pocket gravel beaches, and anthropogenic features such as seawalls, rip-rap, bridges, and other structures. The shorelines are used for recreation and habitat.
Sediments	Much of the oil sank, contaminating seagrass beds and sediments with total petroleum hydrocarbons. Particularly high concentrations were found in the North Condado and Caribe Radisson (Escambrón) lagoons.
Seagrasses	Approximately 40,000 square meters of seagrass in the North Condado Lagoon suffered exposure to the sunken and entrained oil. Adverse impacts included sloughing and die-off of seagrass blades, as well as mortality or displacement of encrusting biota.
Reef Resources	Approximately 10,300 square meters of reef and associated biota were injured by the vessel grounding and required response actions. Nearshore soft coral communities were injured by the oil.
Invertebrates and Finfish	More than 5,600 finfish and invertebrates were recorded as killed or injured by the oil. Most of the 5,600 were invertebrates.
Birds and Wildlife	Twenty-eight oiled birds were collected during the spill; 18 of those died, including an endangered brown pelican. Two juvenile green sea turtles were oiled—one died and the other cleaned and released.
Service	
Recreational and Other Reef Services	The injured reef provided a three-dimensional habitat for fish, shellfish, corals, algae, sponges, echinoderms, and many other types of organisms. The reef and associated organisms afforded shelter, forage, and breeding and nursery grounds for marine organisms, as well as sport fishing and diving opportunities to human visitors. The physical presence of the reef offered some protection to the coastline during storms.
Recreational Beach Use	The area affected by the spill is an internationally recognized tourist destination. Miles of recreationally important beaches were oiled, affecting tourists and residents who use the beaches. The presence of oil and cleanup activities precluded swimming, sunbathing, and other beach recreation for up to three months in some heavily impacted areas. Other recreational activities, such as recreational boating and sport fishing, were also impaired as a result of the oiling.
Recreational Use and Enjoyment of Historic Sites	The spill area contains significant archeological and historic resources, and impacts to these resources extended from Dos Hermanos Bridge to Isla de Cabras, including Fort San Geronimo, El Escambrón Battery, San Cristóbal, El Morro, and El Cañuelo. The presence of oil on the shorelines and waters at historic sites, as well as impairment of the air quality by fumes, diminished the value of recreational visits.

Note:
Information on this table derives from Commonwealth of Puerto Rico, U.S. Department of Commerce/National Oceanic and Atmospheric Administration, and U.S. Department of the Interior 1995. *Preassessment Screen Document: Morris J. Berman Oil Spill, San Juan Puerto Rico.* February 24.

Following the spill and the cleanup efforts, the Trustees evaluated the injuries caused by the grounding and spill (Table 1-1). After careful consideration of all observed injuries, the Trustees described injuries to and lost services from three resource types in a natural resource damage assessment—reef resources, recreational beach use, and recreational use and enjoyment of historic sites. Other resources (surface waters, rocky shorelines, sediments, seagrasses, invertebrates, finfish, birds, and other wildlife) were all exposed to oil and injured as a result of the incident. These other resource categories recovered quickly to pre-incident conditions, and the period of interim lost services was short. The Trustees predicted that the monetary damages likely to be awarded for the limited duration injuries of these other resource categories would be less than the cost of assessment; therefore, the injuries to these resources were not evaluated further.

The Trustees continued with the natural resource damage assessment process for lost use of services related to reef resources, recreational beach use, and recreational use and enjoyment of historic sites. Summaries of the injuries for these three resource types are below.

1.2.1 Reef Injuries and Lost Services

The physical disruption of the reef injured by the incident is expected to have significant, and in some cases irreversible, long-term impacts on the reef ecosystem. Prior to the grounding, the reef provided a stable, three-dimensional habitat for fish, shellfish, corals, algae, sponges, echinoderms, and many other types of organisms. The reef provided food, shelter, and breeding and nursery grounds for many organisms, and supported many recreational activities including sport fishing and diving. The reef also served as a natural breakwater, protecting the coastline during storms. All of these services have been impaired by the grounding and subsequent response actions. While biota will recolonize the injured area once rubble is stabilized or removed, the loss of vertical rock outcrops and the specific services associated with them is permanent. This is described in more detail in the Habitat Suitability Analysis report (Marine Resources, Inc. [MRI] 2005).

1.2.2 Lost Recreational Beach Use

Tourists and resident beach users were advised to avoid beaches in the spill zone, and cleanup activities essentially closed many popular beaches for an extended period following the spill. Prospective users of affected beaches may have canceled trips to Puerto Rico and/or the beach altogether or may have substituted with second-best alternative sites outside the spill zone. Other beach users continued to visit

oiled beaches and suffered a loss of enjoyment, especially swimming, due to the oil. In addition, bathing suits and beach gear were damaged, and oil fumes caused headaches and nausea to some beach users.

Spill zones, identified by the Coast Guard and NOAA for response and assessment purposes, ranged from Punta Borinquen in the west to Loiza in the east. Due to the presence of oil cleanup crews and equipment, “de facto” closings occurred at many beaches. In many cases, exclusion tape closed off access to beach sites, and security personnel only allowed cleanup crews onto the beaches. In the immediate vicinity of the spill, the de facto beach closings lasted three months. At many of the more distant beaches, field operations were reduced or halted 5 or 6 weeks after the spill.

1.2.3 Lost Visitor Use of National Historic Site

The San Juan National Historic Site includes Forts San Felipe del Morro (El Morro), San Cristóbal, and San Juan de la Cruz (also known as El Cañuelo), the walls of San Juan, bastions, and powder houses. Interviews with National Park Service personnel indicated that oil vapors at the forts were intense for 3 weeks following the oil spill, to the point of causing headaches. The oil vapors were less intense, but noticeable, for an additional 3 weeks following the initial 3-week period. Therefore, the Trustees have calculated a reduction in historic appreciation services for a total of 6 weeks following the oil spill. To determine the number of visitors affected during this period, the National Park Service records of actual visitation at the Historic Site were used. Over 123,000 people visited El Morro and San Cristóbal during this six-week period. Because visitation records are maintained only for El Morro and San Cristóbal, the loss of services at El Cañuelo has not been quantified.

It is reasonable to expect that some individuals canceled their visits to the Historic Sites as a result of the oil spill. However, the Trustees have not quantified any reduction in visits to the site as a result of the oil spill. In addition, the Trustees have not quantified any reduction in use associated with canceled activities within El Morro and San Cristóbal. Due to these various data limitations, the estimate of lost services used for calculating damages is conservative.

2.0 PURPOSE AND NEED FOR RESTORATION

2.1 NATURAL RESOURCE TRUSTEES AND AUTHORITIES

The Oil Pollution Act, 33 U.S.C. § 2701, *et seq.* (OPA or OPA 90), establishes a liability regime for oil spills that injure or are likely to injure natural resources or the services that those resources provide to the ecosystem or humans. OPA defines "natural resources" to include land, fish, wildlife, water sources and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State, including the Commonwealth of Puerto Rico, or local government or Indian tribe, or any foreign government. Pursuant to OPA, Federal and state agencies, the Commonwealth of Puerto Rico, 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. Assessments are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services. OPA authorizes the Trustees to assess damages for natural resources injured under their trusteeship. OPA further instructs the designated Trustees to develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship. The process emphasizes both public involvement and participation by the responsible parties. For this incident, NOAA, the NPS, and the DNER share the responsibility as natural resource trustees. This Draft RP/EA has been prepared jointly by NOAA, NPS, and DNER.

2.2 SUMMARY OF THE DAMAGE CLAIM SETTLEMENT

OPA allows the Trustees to settle claims for natural resource damages at any time. The settlement must be fair, reasonable, and in the public interest, with particular consideration given to the adequacy of the settlement to restore, replace, rehabilitate, or acquire the equivalent of the injured natural resources and services. Sums recovered in settlements, other than reimbursement of Trustee assessment costs, may only be expended in accordance with a restoration plan, which is made available for public review and comment.

A settlement agreement reached on December 28, 2000, among the Federal government, the Commonwealth of Puerto Rico, and the parties responsible for the spill, resolved the Trustees' claims for natural resource damages against the responsible parties. Attached to this settlement agreement was a preliminary damage assessment restoration plan, which documented the injury assessment and preliminary restoration planning that occurred prior to the settlement agreement. The settlement

agreement provided the Trustees with funding for primary and compensatory restoration projects of \$9,479,003, including an additional \$286,614 for use to plan and oversee the implementation of the restoration projects identified therein. A Memorandum of Agreement among the NPS, NOAA, and the DNER allocates the natural resource damages for restoration among the three categories of natural resource injury described in Section 1.2:

- Reef injury associated with the barge grounding
- Loss of beach recreational use
- Loss of enjoyment of national historic site resources.

Interest accrued on the settlement funds is to be used for the selected restoration projects, including the costs to plan, implement, oversee and monitor restoration projects, as appropriate.

After the date of settlement, many restoration project-related changes have caused the Trustees to revise the preliminary restoration project alternatives that originally served as the basis of the settlement. Some changes occurred between the development of the preliminary damage assessment and restoration plan and the settlement, and other changes occurred between the settlement and the present. For instance, a breakwater project designed to protect historic resources was implemented by the U. S. Army Corps of Engineers (Army Corps) shortly after the settlement, thereby eliminating this project as a potential compensatory restoration project for this spill. Additionally, the preliminary damage assessment restoration plan was not formally submitted to the public for review and comment. This Draft RP/EA incorporates the post-settlement changes and proposes restoration projects using the settlement funds. In the Trustees' judgment, the settlement is still adequate to meet OPA requirements and restores the injuries resulting from the spill. The manner and the projects on which the settlement sums will be expended will be subject to the public participation process during the public notice and comment period for this Draft RP/EA.

**TABLE 1-2
SETTLEMENT FUNDS**

RESOURCE CATEGORY	FUNDS
Reef Injury	\$5,712,336
Recreational Beach Use and Injury	\$2,273,063
Lost and Diminished Human Use of the San Juan National Historic Site	\$1,493,604
Environmental Planning, Oversight and Administration	\$286,614
Total Funds	\$9,765,617^a

Note:

a The original settlement included an additional \$2,811,437 awarded to cover assessment costs. Those monies were disbursed to the respective agencies as reimbursement for past expenditures due to the incident.

2.3 PUBLIC PARTICIPATION

The Trustees intend to accomplish their restoration planning goals by communicating with the public at each major step of the restoration planning process, and to adapt their restoration approach, as necessary, based on public comment. The Trustees have developed a public participation plan that will serve as the guidance document for meeting their public participation responsibilities.

The Oil Pollution Act (OPA) at 33 U.S.C. § 2706 (c)(5) (the statute under which the response to the 1994 *T/B Morris J. Berman* oil spill was carried out and damages obtained) requires that the Trustees involve the public in the restoration planning process. The Trustees are required to provide the public with the opportunity to comment on a draft restoration plan, and to consider public comments when producing the final restoration plan (15 C.F.R. § 990.55(c)). The public participation plan describes the method to inform the public about the incident and the Trustees' plans and activities, and to solicit comments from the public on the proposed restoration projects that will address natural resource injuries. The scale and design of recommended restoration alternatives may be adjusted based on public input and/or additional scientific findings.

The Trustees strive to effectively involve citizens, public officials, and stakeholder groups in developing the Final RP/EA. The Trustees seek public input on the merits of individual restoration projects, as well as the effectiveness of those projects in addressing the resource injuries and service losses arising from the spill. In addition, the Trustees are interested in other possible projects that members of the public believe would be more cost effective or that would better restore the resources injured by the spill or the services lost while resources were injured or recovering. After evaluating public input, including any

alternative projects that the public may propose, the Trustees will prepare a Final RP/EA. Key features of the public participation process include the following:

- Public Awareness—To share information
- Public Education—To educate citizens and help them make more informed choices
- Public Input—To provide citizens and stakeholder groups with opportunities to contribute ideas to the planning process
- Public Interaction—To exchange views and ideas as a means of reaching consensus
- Public Partnership—To involve citizens in the decision making process

The Trustees will engage the public through public meetings and hearings, issuing written materials and information in a variety of formats and outlets, and providing opportunities for comments in the following ways:

- The Draft RP/EA document will be available for review at the Jane Stern Dorado Community Library and the SAJU Headquarters in Fort San Cristóbal.
- Notification in both English and Spanish of the availability of the Draft RP/EA and the time/location of public meetings will be made in various media outlets, on websites, and through direct mail.
- Presentations, fact sheets, exhibits, translation services, and opportunities to submit comments will be provided at two public meetings (in San Juan and Dorado).
- Comments will be compiled and responses prepared and incorporated into the Final RP/EA.

The Trustees have established a 60-calendar-day comment period for the Draft RP/EA. The Trustees will consider public comments before preparing the Final RP/EA. The deadline for comments is given in the public notices issued by the Trustees to announce the availability of this document and associated public meetings with opportunity for public comment. An additional opportunity for public review will be provided if there are significant changes in the evaluation or in the selection of restoration projects.

Please direct your written comments on the Draft RP/EA to:

**National Oceanic and Atmospheric Administration
Restoration Center
Attn: John Iliff
263 13th Avenue South
St. Petersburg, FL 33701**

or by email to

Berman.Comments@noaa.gov

2.4 ADMINISTRATIVE RECORD

The Trustees have maintained records to document the information considered by the Trustees as they have conducted restoration planning. These records are compiled in an administrative record available for public review at the address listed below. The administrative record facilitates public participation in the restoration planning process and will be available for use in future administrative or judicial review of Trustee actions to the extent provided by Federal or Commonwealth law. Additional information and documents, including public comments received on the Draft RP/EA, the Final RP/EA, and restoration planning documents, will be included in the administrative record as they are developed.

Documents in the administrative record can be viewed at the location listed below. Arrangements for reviewing the record or to request copies of documents should be made in advance with the official listed.

**Attn: Madeline Yordan
Fort San Cristóbal
Norzagaray Street
San Juan, PR 00901
Madeline_Yordan@nps.gov
(787) 729-6777**

3.0 AFFECTED ENVIRONMENT

This section summarizes the environmental setting of the area potentially affected by the proposed restoration projects.

The natural and cultural environments of the north coast of Puerto Rico are closely intertwined. In general, the north coast of Puerto Rico is a relatively high-energy, rocky coastline interspersed with sand beaches. The coastline is backed by small embayments including San Juan Harbor and Condado Lagoon, which form a productive natural ecosystem with many commercial and recreational uses. The embayments, nearshore waters, and shoreline host many marine and avian species, including Federally-listed endangered or threatened species. The marine and shoreline areas surrounding the restoration project areas are an internationally recognized tourist destination. Puerto Rico's north coast is popular for its variety of recreational and commercial activities, and has abundant archaeological and historic resources.

More detailed descriptions of the physical and biological resources of the area may be found in the Habitat Suitability Analysis report prepared by Marine Resources, Inc. (MRI) on behalf of the Trustees in August 2005.

3.1 PHYSICAL ENVIRONMENT

Puerto Rico, situated on the leading edge of the Caribbean plate, has a complex northern coastline formed predominantly of limestone formations and alluvial plains that supported development of beaches and dunes (Krushensky and Schellekens 2001). The insular shelf along the north coast of Puerto Rico is less than 1 mile wide and undergoes intense wave action and longshore currents (Glaucio A. Rivera & Associates 2003). Wave heights along the Puerto Rican north coast predominantly generated by the east trade winds range from 1 to 3 meters (Morelock 1978). These physical conditions, in conjunction with disproportional erosion of the limestone substrate, create topographically variable localized reef formations. Lithified beachrock and fossil sand dunes (i.e., eolianites) are nearshore features characteristic of the San Juan area. Eolianite reefs are submerged, hard-bottom structures composed of sand deposits cemented together with calcium carbonate; they lie along the northern coastline of Puerto Rico, oriented west to northwest following a slightly sinuous course (Kaye 1959).

Compensatory restoration projects are proposed for the offshore area, for beaches and other coastal habitats, and for the San Juan National Historic Site, as described in subsequent sections. Reef projects would be constructed in the general area of the impact site, but not in the precise location of the

grounding. Projects may be located farther offshore to avoid the high wave energy that characterizes the nearshore area. Beach acquisition and restoration projects are proposed for several areas of the Vicia Talega, Piñones, and Toricilla Alta ecosystem that were affected by the incident. Restoration projects focused on lost use of the San Juan National Historic Site will be located at that site.

3.2 BIOLOGICAL ENVIRONMENT

The bays and nearshore waters serve as a nursery for young fish, shrimp, and crabs. Bird species, including pelicans, herons, egrets, terns, and gulls, feed and nest along these shorelines and embayments. Bird colonies or rookeries are found on islands within coastal embayments and in coastal environs in the spill area. Intertidal areas, seagrass beds, and mangroves provide high-quality habitat and productive ecological services to marine fisheries resources, and feeding areas for resident and migrant shorebirds. Open oceanic waters are used for feeding by pelagic seabirds such as tropic birds and brown boobies. Complete listing of species reported to occur off the north coast of Puerto Rico with associated service category, biological descriptor, and presence/absence by habitat is presented as Appendix B of the Habitat Suitability Analysis (MRI 2005). A brief summary is included here.

The habitat impacted by the *T/B Morris J. Berman* grounding event is part of a continuous nearshore reef feature that extends the length of the San Juan coastline. Mignucci-Giannoni (1999) listed over 152 species of marine organisms affected by the *T/B Morris J. Berman* grounding event documented by the Caribbean Stranding Network (1994). Most commonly affected biota groups were echinoderms, mollusks, and crustaceans respectively comprising 58, 25, and 10 percent of the 152 species. Vertebrates, primarily fish, accounted for approximately 6% of the marine organisms affected by the incident (Mignucci-Giannoni 1999). Visual observation indicated that the reef injured by the grounding and spill was dominated by soft corals, sponges, and macroalgae.

A summary table indicating the presence/absence of species in the injured habitat and the four possible compensatory restoration habitats (i.e., shallow hard-bottom, deep hard-bottom, mangrove, and seagrass) is presented as Appendix B of the Habitat Suitability Analysis (MRI 2005). Life-history stage (juvenile, adult, or spawning) is presented for some of the listed species; life history data were unavailable for most species. On a broader scale than that reviewed by Mignucci-Giannoni (1999), a total of 478 marine species are known to occur along the north coast of Puerto Rico, as reported in the literature. Of the species found along the north coast, 165 were documented as likely injured by the grounding event. Faunal groups with the most species likely injured by the grounding event were fish (104 species), sponges (21 species), and hard and soft corals (17 species) (MRI 2005).

3.2.1 Threatened and Endangered Species

The north coast hard-bottom habitat is considered a habitat of concern for the threatened green sea turtle (*Chelonia mydas*) and the endangered hawksbill sea turtle (*Eretmochelys imbricata*) and leatherback turtle (*Dermochelys coriacea*). The green sea turtle, with a smooth grey, green, brown, and black carapace, can be up to 4 feet long and weigh up to 500 pounds. Adult green sea turtles are herbivorous and eat primarily seagrass and algae. Juvenile green sea turtles are carnivores that consume jellyfish and other invertebrates. The hawksbill is a small to medium turtle approximately 2-3 ft long and weighs up to 180 pounds (lbs). Adult hawksbills forage on invertebrates, primarily sponges, which are found primarily on hard-bottom habitats. Juveniles are known to forage and consume algae in coastal areas of northern Puerto Rico. The north coast of Puerto Rico provides one of the three major nesting sites in the world for the leatherback turtle, which is the largest living turtle. In 2005, DNER documented 473 leatherback nests in this area.

The general oceanic locale where the grounding occurred is not critical habitat for any listed species. The Trustees will complete the consultations required under the Endangered Species Act.

3.2.2 Species of Special Concern

The following species are afforded special protection under Commonwealth law and are likely to occur in the affected areas: *Epinephelus striatus* (Nassau grouper) (Endangered), *E. Itajara* (Goliath Grouper) (Critically endangered), and *Hippocampus* sp. (seahorses) (Vulnerable). Additionally, *Strombus gigas* (queen conch) are also found in the area and are listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna or CITES.

3.3 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act, 1966, as amended, requires Federal agencies to take into consideration the effects of their actions on cultural resources that meet the criteria for eligibility to the National Register of Historic Places (NRHP). Cultural resources include architectural and archeological resources that may relate to both the prehistoric and historic time periods.

The proposed projects are located at the San Juan National Historic Site and in nearby areas along the north coast of Puerto Rico that were affected by the *T/B Morris J. Berman* grounding and oil spill. The San Juan National Historic Site, nominated in February 14, 1949, for the NRHP, includes forts San Felipe del Morro, San Cristóbal, and San Juan de la Cruz (also known as El Cañuelo), the walls of San Juan,

bastions, and powder houses. In 1983, the resources were declared a UNESCO World Heritage Site. These structures represent the largest and oldest fortifications constructed by the Spanish in the New World still existing.

Potential cultural resources associated with native Taino occupations, Spanish colonization, and submerged shipwrecks related to Spain or other entities are possibly located within the project area of potential effect. In 1493, when Admiral Christopher Columbus arrived in the waters of the island that became known as Puerto Rico during his second voyage to the New World, the island was inhabited by native Tainos, descendants of the Arahucos. Columbus claimed the island as property of Spain. Subsequently, in 1508, Juan Ponce de Leon arrived on the island with 50 men who began colonization. Initially, the Tainos were hospitable towards the Spanish colonists. However, relations deteriorated as the Spaniards treated the native populations as slaves. In reaction to the technological superiority and assertive treatment by the Spaniards, some of the surviving natives dispersed to other Caribbean Islands.

The Caribbean Sea took on an important role in support of the Spanish expansion of power and prestige as Spain proceeded with its conquest of Mexico and Peru. Spanish galleons were assisted by Caribbean trade winds that blew from Africa towards the Caribbean islands. Treasure-laden galleons were targets of attack by pirates and by traditional enemies of Spain. In light of threats presented by enemies as well as tropical storms, the harbors of Puerto Rico presented a safe haven of national importance to Spain. The Spanish Crown recognized the strategic advantage of the island in controlling sea lanes and access to the Indies and proceeded to fortify the city of San Juan and its harbor, creating a strong and critically placed naval base. Philip II, King of Spain, declared the fortified city the “Key to the Indies” (<http://www.nps.gov/saju/saw4.html>, 3/13/06).

4.0 RESTORATION PLANNING

The goal of restoration is, to the extent feasible, to restore to baseline the reef resources and the biota using the reef as habitat. In addition, restoration should provide compensation for services lost prior to recovery of the injured resources.

4.1 RESTORATION STRATEGY

In selecting preferred restoration projects for each category of natural resource injury or loss, the Trustees identified feasible restoration actions to promote recovery of the resources to baseline (primary restoration) and to compensate for interim losses of resources or services prior to recovery (compensatory restoration). Primary restoration actions evaluated include natural recovery and one or more active restoration actions designed to directly restore natural resources or services to baseline on an accelerated time frame. The scale of the compensatory restoration actions was chosen to ensure that the public was compensated for the interim lost use of ecological and recreational services.

Proposed projects were evaluated by the Trustees based on threshold and additional criteria, as described below.

4.2 THRESHOLD AND ADDITIONAL CRITERIA

In accordance with OPA's natural resource damage assessment regulations, only restoration alternatives considered technically feasible and amenable to implementation in accordance with applicable laws, regulations, and/or permits may be considered for inclusion in a restoration plan (15 C.F.R. § 990.53 (a)(2)). The Trustees evaluated the feasible restoration alternatives for each category of injury or loss according to the following threshold criteria, which are in 15 C.F.R. § 990.54:

- The cost to carry out the alternative.
- The extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses.
- The likelihood of success of each alternative.
- The extent to which each alternative will prevent future injury as a result of the incident, and avoid collateral injury.
- The extent to which each alternative benefits more than one natural resource and/or service.

- The effect of each alternative on public health and safety.

A restoration alternative must meet all threshold criteria to be considered further. Once a restoration project has been determined to meet or exceed all threshold criteria, these six additional criteria are considered:

- Relationship to injured resources and services: A project that restores, rehabilitates, replaces, enhances, or acquires the equivalent of the resources and services injured by the spill is preferred over 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.
- Time to provide benefits: The Trustees consider the time required 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 considerations.
- 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 for each alternative. Projects with the least costly (i.e., most cost-effective) approach to deliver an equivalent type and amount of benefits are favorable.

In addition to these specific criteria, OPA and the National Environmental Policy Act (NEPA) require identifying and discussing the environmental consequences of implementing alternative projects with the aim of minimizing significant environmental impacts and/or justifying unavoidable impacts posed by the preferred restoration alternative. The environmental consequences for each of the proposed restoration project alternatives are covered in section 5.

4.3 EVALUATION OF RESTORATION ALTERNATIVES

The Trustees evaluated each of the proposed restoration alternative projects against the threshold criteria using a “Yes” or “No” rating to indicate whether they believed the project would meet each criterion. As

shown on Table 4-1, all of the proposed restoration projects were rated “Yes” for every threshold criterion. Therefore, all proposed restoration projects advanced for further Trustee evaluation.

The Trustees next developed a relative ranking of restoration projects based on the additional criteria using a 3- point scale. In the Trustees’ judgment, restoration projects receiving a score of 3 have a high likelihood of meeting a criterion; projects receiving a 2 have a moderate likelihood of meeting a criterion; and, projects receiving a score of 1 have a low likelihood of meeting a criterion. The averages of the individual scores assigned by the Trustees are shown on Table 4-2. Restoration alternatives that received an average score of 1 for any criterion were not selected as a preferred restoration alternative.

As a result of this evaluation the Trustees identified three preferred restoration alternatives for lost reef services, one preferred restoration alternative for lost recreational beach use, and three preferred restoration alternatives for lost and diminished use of the San Juan National Historic Site.

Restoration alternatives selected as preferred for the lost reef services included 1) Modular Reef Habitat Construction, 2) Acquisition of Equivalent Lost Services, and 3) Seagrass Restoration. The preferred restoration alternative selected for lost recreational beach use was Acquisition of Lands for Conservation. The three restoration alternatives selected as preferred for lost and diminished use of the National Historic Site include 1) Improve and Extend the Coastal Promenade, 2) Restore El Morro Water Battery, and 3) Clean/Stabilize Exterior Walls of Historic Site.

Three restoration alternatives, one from the lost reef service category and two from the lost recreational beach use category, received an average score of 1 for at least one criterion and were not identified as preferred. Reef Sedimentation Mitigation was not preferred because the Trustees felt the project could not be sustained long term without addressing the root cause of the sedimentation. Any likely short-term benefits gained from uncovering the buried reef would be lost as the reef was again covered and eventually buried with sediment. Improved Access to Public Beaches was not preferred because the relationship to the injured resources and services, specifically the distance to viable projects, was too great. The Improved Quality of Use of Public Beaches alternative was not chosen as a preferred restoration alternative because the relationship to the injured resources was considered weak and the long-term benefits were considered questionable given the type of maintenance required for beach infrastructure. Finally, all three of the restoration alternatives considered not preferred were evaluated as having low benefits relative to the potential costs. The Beach Erosion Mitigation project (construction of

**TABLE 4-1
THRESHOLD CRITERIA**

	THRESHOLD CRITERIA (Scoring: “YES” or “NO”)					
	Costs	Consistent with Trustees Restoration Goals	Likelihood of Success	Prevention of Future Injury	Benefits Multiple Resources or Services	Public Health and Safety
Proposed Projects for Reef Restoration						
Modular Reef Habitat Construction (Shallow Hard Bottom Project)	YES	YES	YES	YES	YES	YES
Reef Sedimentation Mitigation	YES	YES	YES	YES	YES	YES
Acquisition of Equivalent Lost Services	YES	YES	YES	YES	YES	YES
Seagrass Restoration	YES	YES	YES	YES	YES	YES
Propose Projects for Recreational Beach Use						
Acquisition of Lands for Conservation	YES	YES	YES	YES	YES	YES
Improved Access to Public Beaches	YES	YES	YES	YES	YES	YES
Improved Quality of Use of Public Beaches	YES	YES	YES	YES	YES	YES
Proposed Projects for San Juan National Historic Site Resources						
Improve and Extend Coastal Promenade	YES	YES	YES	YES	YES	YES
Restoration of El Morro Water Battery	YES	YES	YES	YES	YES	YES
Clean and Stabilize Exterior Walls	YES	YES	YES	YES	YES	YES

**TABLE 4-2
PROJECTS RATED AGAINST ADDITIONAL CRITERIA**

	ADDITIONAL CRITERIA (Scoring: 3=High, 2=Moderate, 1=Low)					
	Relationship to Injured Resources and Services	Provides Benefits Rapidly	Provides Long-term Benefits	Alternative and its Benefits can be Protected Long-term	Provides Opportunities for Collaboration	Cost-Effectiveness (benefits relative to costs)
Proposed Projects for Reef Restoration						
Modular Reef Habitat Construction (Shallow Hard Bottom Project) (5.1.2.1)	2.3	2	3	2.3	3	2
Reef Sedimentation Mitigation (5.1.2.2)	2	2	1.7	1	1.7	1
Acquisition of Equivalent Lost Services (5.1.2.3)	2.7	3	3	3	3	2
Seagrass Restoration (5.1.2.4)	2	2.3	3	2.3	2	2.3
Proposed Projects for Recreational Beach Use Restoration						
Acquisition of Lands for Conservation (5.2.1)	3	3	3	3	3	2
Improved Access to Public Beaches (5.2.2)	1.7	3	2.7	1.7	1.7	1
Improved Quality of Use of Public Beaches (5.2.3)	1	2	2.3	1	1.7	1
Proposed Projects for San Juan National Historic Site Resources						
Improve and Extend Coastal Promenade (5.3.1)	3	3	3	2	2.7	3
Restoration of El Morro Water Battery (5.3.2)	2.3	3	3	2	1.3	2.7
Clean/Stabilize Exterior Walls of Historic Site (5.3.3)	2.3	3	3	2	1.3	2

breakwaters to protect Fort El Cañuelo)—a fourth compensatory restoration project for injured historic resources and lost visitor use—is now considered unnecessary (based on an Army Corps analysis) because shoreline erosion has slowed and is no longer a serious threat.

5.0 RESTORATION ALTERNATIVES

Each of the restoration project alternatives is presented below under the following headings to facilitate evaluation and comparison:

- Project Description and Background
- Restoration Objectives
- Scaling Approach (if applicable)
- Success Criteria and Monitoring
- Cost and Timeframe
- Environmental Consequences

NEPA requires that proposed projects be compared not only with one another but also with the effects of taking no action whatsoever. For the reef injury, the no-action alternative is described in Section 5.1.1, following the format described above. For the lost recreational beach use and lost visitor use of the San Juan National Historic Site, the no-action alternative was categorically rejected. The injury to the public in both of these cases was lost use, and no primary restoration is possible. Because compensatory restoration is needed, the no-action alternative was not evaluated further. Compensatory restoration alternatives for lost beach access and lost visitor use are discussed in Sections 5.2 and 5.3, respectively.

5.1 REEF RESTORATION ALTERNATIVES

The physical disruption of the reef had long-term impacts on its ecosystem. Prior to the grounding, the reef provided a stable, three-dimensional habitat for fish, shellfish, corals, algae, sponges, echinoderms, and many other types of organisms. The reef provided food, shelter, and breeding and nursery grounds for many organisms, and supported many recreational activities, including sport fishing and diving. The reef also served as a natural breakwater, protecting the coastline during storms. All of these services were impaired by the grounding and subsequent response actions. The loss of vertical rock outcrops and other rocky substrates crushed by the grounding and the specific services associated with them are permanent losses. The encrusting coral, sponge, and algal communities were destroyed or were dislodged from the impacted substrates at the grounding site; these communities will never regain their pre-grounding level of complexity.

5.1.1 Proposed Reef Restoration Alternatives

The Trustees evaluated four potential reef restoration projects for restoring or replacing comparable ecological services at other nearby sites that would compensate (that is, compensatory restoration projects) for the lost use of the reef structure following the grounding-induced injuries. In addition, natural recovery was being considered as a primary restoration alternative at the grounding site itself. The goal of both restoration types is to restore reef resources as well as the biological services that the reef provides to associated species. Natural recovery and the four compensatory restoration projects are described in the following subsections.

Three of the proposed projects for restoring reef services were preferred by the Trustees: (1) modular reef construction, (2) acquisition of lost services, and (3) seagrass restoration. Any one or a combination of these projects would be considered to meet the restoration objections identified for the lost reef services. The Habitat Suitability Analysis is clear that a project that allows replacement of shallow water hard-bottom habitat combined with a seagrass or mangrove habitat project (or both) represents the best compensatory habitat choice to replace the lost ecological services provided by the injured eolianite reef. By choosing a restoration alternative that combines two or more key aspects of the Habitat Suitability Analysis technical recommendation, the Trustees have relied upon the best available information to meet both the restoration goals and objectives for injured reef resources.

5.1.2 Proposed Primary Reef Restoration Alternative (Natural Recovery) (Proposed Preferred)

The only primary restoration activity proposed for the Berman site is the no-action alternative, known as natural recovery.

5.1.2.1 Project Description and Background

The no-action alternative would not involve any direct human intervention to restore, or cause accelerated recovery of the injured resources.

5.1.2.2 Restoration Objectives

The restoration objectives would be partially met by the no-action alternative, in that lost resources would be allowed to recolonize the area, and lost services would be provided by the organisms that become reestablished there. Natural recovery would not meet the objective of returning the resource to its baseline condition because the loss of the vertical rock outcrops and other rocky substrates crushed by the grounding are permanent losses. However, the no-action alternative would cause the least amount of

intentional disturbance to recolonization of the grounding site that has occurred in the years since the incident. This alternative is already 12 years underway.

The no-action primary alternative would be augmented by some compensatory restoration action in nearby areas. Compensatory actions are discussed in Section 5.1.2.

5.1.2.3 Scaling Approach

No direct scaling of the no-action alternative is necessary, as the grounding and spill site is left alone. Recovery of resources and services in the area is not expected to be complete, but can occur partially in areas where rubble is stable enough to sustain recolonization of encrusting biota.

5.1.2.4 Success Criteria and Monitoring

Recolonization of the grounding and spill site by species assemblages typical of pre-incident communities is expected, but the exact process by which this natural recovery would occur is unknown. The no-action alternative to primary restoration would include a monitoring plan, likely with a “before-after” design that focuses on documenting changes in resources and services at the grounding site since the spill occurred.

5.1.2.5 Cost and Timeframe

The no-action primary restoration alternative would cost nothing to implement. If monitoring is included in the alternative, the costs would include intermittent labor of a small team of scientists who would collect data and prepare monitoring reports (likely less than \$100,000). Natural recovery is expected to take essentially forever, because attainment of pre-incident conditions is not expected at the grounding site. However, a more reasonable approximation is that maximum recovery will occur within 60 to 100 years if no other environmental manipulation of the site occurs (Hudson and Goodwin 1995).

5.1.2.6 Environmental Consequences

Direct Impacts: The encrusting coral, sponge, and algal communities destroyed or dislodged from the impacted substrates are expected to recover, but not to their full pre-incident complexity and diversity because of the likely instability of any rubble remaining on site for a foreseeable period of time.

Indirect Impacts: Natural recovery is not expected to adversely affect any other resource. As the reef recovers, positive effects of a re-established marine community are expected.

Cumulative Impacts: The natural recovery alternative is not expected to directly or indirectly benefit any other species. The no-action alternative does not expose divers to any potential danger.

5.1.3 Proposed Compensatory Reef Restoration Alternatives

Selection of the primary restoration action described in Section 5.1.2.1 would result in an extended period of loss of services during a long recovery period. Compensatory restoration alternatives are designed to compensate for the loss of services during the recovery period. Compensatory restoration alternatives identified by the Trustees would provide replacement services of the same type and quality as those lost. According to the OPA natural resource damage assessment regulations, Trustees may evaluate alternatives that provide services of comparable type and quality as those lost, if necessary, to provide a range of restoration options for consideration (15 C.F.R. § 990.53(c)(2)).

A Habitat Suitability Analysis was conducted to identify marine habitats that could be used for compensatory restoration in response to the *T/B Morris J. Berman* grounding incident. The objective of the Habitat Suitability Analysis was to evaluate and rank various marine habitats on a service-to-service basis, as described under Restoration Strategy in Section 4.1, to determine their suitability for providing ecological compensation for lost resources associated with the injured eolianite reef habitat. Habitats considered during the Habitat Suitability Analysis and identified in the Habitat Suitability Analysis report (MRI 2005) included the eolianite reef characteristic of the nearshore coastline and four potential compensatory habitats:

- Shallow hard-bottom (5- to 10-meter water depth)
- Deep hard-bottom (> 10 meters water depth)
- Mangroves
- Seagrass beds

The four categories of ecological services evaluated by the Habitat Suitability Analysis were primary producers, structural animals, invertebrate and vertebrate herbivores, and invertebrate and vertebrate predators.

Potential compensatory habitats were evaluated and ranked based on the eolianite reef species present in each habitat and the primary services provided by these species. A listing of the species documented on eolianite reef habitat along the north coast of Puerto Rico was compiled from the primary and unpublished literature. A data matrix of the species documented on the eolianite reef and their presence/absence within the potential compensatory habitats was the basis for the Habitat Suitability Analysis. Ordination of the resemblance data among the habitats was performed using nonmetric multidimensional scaling. Bray-Curtis similarity distances were used to calculate similarity between the potential compensatory habitats within each service category. Ordinations or diagrams depicting the

similarity of the habitats by the distances between them were then created from the Bray-Curtis ranks. Habitats close to one another had more species in common than those farther apart.

A total of 183 species were documented to occur on the eolianite reef habitat; 18 species were unique to the eolianite reef. When similarity to the eolianite reef in overall services provided was calculated, shallow hard-bottom had the highest degree of similarity to the reef. Mangrove habitat ranked second, seagrass ranked third, and deep hard-bottom was the least similar. Four compensatory habitat configurations are recommended, based on the Habitat Suitability Analysis: (1) shallow hard-bottom, (2) two-habitat mosaic, (3) three-habitat mosaic, and (4) four-habitat mosaic. The shallow hard-bottom alternative would consist of placing artificial reefs to mimic the eolianite reef habitat in shallow-water areas in proximity to the injured habitat. Because the Habitat Suitability Analysis showed that no single habitat was identical to the injured habitat for all four evaluated services, a mosaic approach (more than one habitat) may be the best restoration alternative. A two-habitat mosaic of shallow hard-bottom with seagrass would provide compensatory restoration for 150 eolianite reef species. A three-habitat mosaic of shallow hard-bottom, seagrass, and mangrove would provide compensatory restoration for 158 eolianite reef species. All four compensatory habitat types together would provide compensatory restoration for 165 of the 183 identified eolianite reef species.

5.1.3.1 Modular Reef Habitat Construction (Shallow Hard Bottom Project) (Proposed Preferred)

Modular Reef Habitat Construction (Shallow Hard Bottom Project) as a preferred restoration alternative would consist of using established technology to construct and place cement reef-replication modules in a manner to provide a range of desirable ecological services. For example, a modular reef can be designed to maximize vertical profile, surface area for settling organisms, crevices for shelter, foraging habitat for pelagic organisms, or some combination of services such as these. The reef modules would be installed at favorable locations some distance from the grounding site.

5.1.3.1.1 Project Description and Background

Trustees evaluated reef-replication modules consisting of prefabricated cement reef-replication modules to reconstruct the destroyed rock reef. Prefabricated reef modules have been used in the United States to restore coral reefs impacted by vessel groundings (Bodge 1995, Sheehy and Vik 1992). The creation of an artificial reef that mimics low relief hard-bottom coral reef is a compensatory habitat identified in the Habitat Suitability Analysis. Figure 5-1 illustrates an artificial reef module that mimics a natural reef.

This module, provided for illustrative purposes only, was constructed to repair a reef injury in the Florida Keys. The reef module was designed for both aesthetics and habitat function.

The project to construct and place cement reef-replication modules in a shallow or deep hard-bottom environment could be located in one or more favorable settings off the northern coast of Puerto Rico, where conditions for module placement and long-term stability are not as harsh as at the grounding site. To compensate for the loss of reef services, the Trustees propose construction of an appropriately scaled reef in a shallow or deep hard-bottom environment. To compensate for this permanent loss as well as the loss of reef services pending recovery of the remaining reef, the Trustees propose construction of an appropriately scaled reef offshore of the grounding site. In the Trustees' judgment, the high wave energy and shallow water at the grounding site would make construction there infeasible.

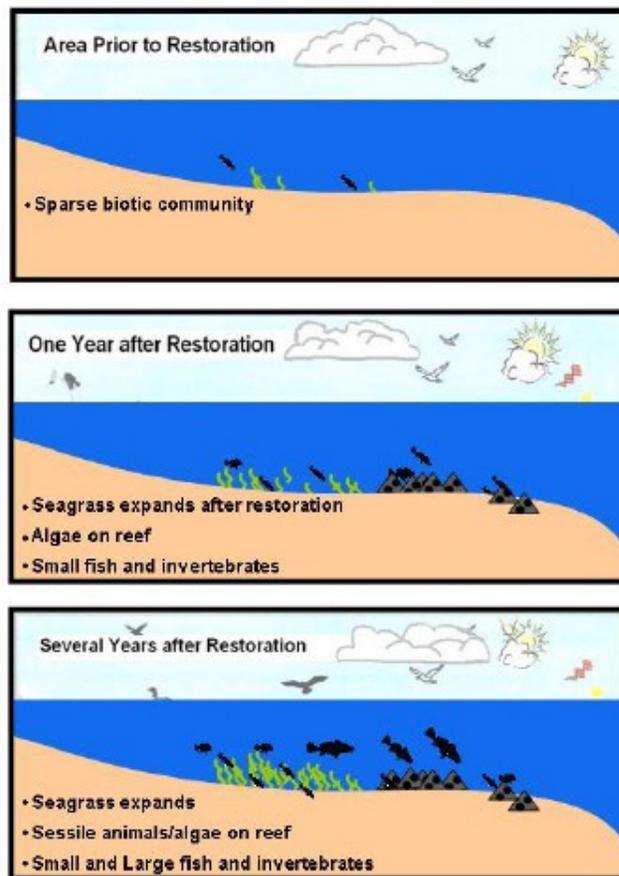


Figure 5-1 Side View of Low-Profile Reef Module from Florida Keys National Marine Sanctuary

5.1.3.1.2 Restoration Objectives

The Habitat Suitability Analysis specifically identifies artificial reefs constructed to mimic natural hard-bottom habitats located in a shallow hard-bottom environment as potentially meeting the ecological service replacement objectives. The constructed reef is a replacement project that will provide similar types of reef services as those lost, including suitable substrate for settlement and colonization by corals and other sessile reef biota, and suitable habitat for other reef dwelling and feeding organisms. A habitat creation project such as this would have multiple benefits over and above replacement of habitat services if located in a widely accessible nearshore area. According to the Habitat Suitability Analysis report (MRI 2005), artificial reefs created in the shallow water areas would be expected to function similarly to the injured habitat, if the design of such reefs could reasonably mimic the eolianite reef that was damaged. An artificial reef would provide residents and visitors a unique opportunity to view and gain an understanding of some of the sensitive and valuable shallow water marine habitats.

The Trustees recognize that a shallow hard-bottom replacement project could take any number of forms. Furthermore, the Habitat Suitability Analysis report recommended that desirable coupling could result from placement of a reef structure(s) in shallow hard-bottom located proximate to one or more other habitats (i.e., mangrove, seagrass), where additional restoration could take place (Figure 5-2). This mosaic approach to siting and placing reef structures near other habitats offers the opportunity to benefit juvenile and adult stages of species associated with the injured eolianite reef.



Schematic representation of a mosaic compensatory restoration area prior to and following coupling of seagrass and artificial reef habitat creation/restoration.

Figure 5-2 Mosaic Restoration Area: Seagrass Restoration and Artificial Reef

5.1.3.1.3 Scaling

The public can be compensated for past losses of natural habitats through replacement projects providing additional resources of the same type and quality, and of comparable value. To accomplish this, the method takes into account the amount of services lost over time from the injured habitat and the amount of replacement services to be provided per unit of the replacement habitat. The size of the replacement project is selected so that the quantity of services provided by the replacement project is equivalent to the quantity of services lost due to the injury.

Similarly, the assumption is that the partially impacted area lost 40 percent of its services and will require 30 years to recover. These parameter assumptions are based on the best professional judgment and experience of the Trustees with reef systems and impacts, and are judged as conservative estimates of reef recovery times.

The constructed reef is estimated to generate services in perpetuity. While artificial reef structures have been in use for only 50-60 years, the types of structure proposed by the Trustees is expected to become more stable with time as the coral community becomes established on the reef. After consulting with engineers and reef experts, the Trustees have concluded that a properly sited and engineered artificial reef should last essentially forever.

The constructed reef is expected to require 50 years to achieve complete biological productivity. At that time, the Trustees assume that the created reef will be 75 percent as productive as the natural reef because the created reef will be placed in a deeper site. The deeper site would be exposed to less light energy, and therefore have a lower productivity. In addition, the Trustees' experience is that created reef habitat is less productive than natural habitat. A prefabricated reef with some 10,200 square meters in surface area is required to accomplish full compensation for the loss in services from the injured rock reef. Note that this is a measure of the required surface area of the constructed reef—the footprint of the reef may be much smaller.

5.1.3.1.4 Success Criteria and Monitoring

Monitoring the constructed reef would provide information to the Trustees as to whether the project is functioning and providing services in a manner consistent with restoration goals. Trustees use monitoring data to determine if mid-course corrections of the restoration project are necessary. The design of the monitoring program would permit determination of need, nature, and location of any physical maintenance of the reef. During the monitoring period, scientists would also evaluate the productivity of

the benthic community to determine if the constructed reef is providing the expected level of natural resource services.

Factors considered in developing the monitoring plan include the strong physical dynamics of the project location (north coast of Puerto Rico) and the size of the constructed reef. These factors necessitate a 45 to 55-foot vessel with appropriate equipment for diving and moderate reef maintenance, and allowance of enough field days to accomplish monitoring objectives considering expected occurrences of poor weather conditions that prevent diving at the site.

The five-year monitoring schedule developed by the Trustees for this site assumes that a principal investigator and assistant biologist from the Commonwealth of Puerto Rico, along with a NOAA ecologist, would make semi-annual trips starting 6 months after construction of the reef. Few, if any, natural recruits other than algae would be large enough to observe before 6 months following reef construction. Conducting the initial monitoring survey in a timely manner would be important to allow documentation of the benthic community's initial development.

Subsequent surveys would dedicate considerable effort to finding, identifying, and recording natural recruitment of invertebrate benthos on the constructed reef. Because of the large reef area, a random sample approach likely would be needed to assess recruitment and growth of the benthic community. A written report describing species composition and distribution on the constructed reef would be completed within one month after the survey.

The exact location and final design of the artificial reef would have to be determined before a more detailed monitoring plan is developed. The detailed plan would include specific sample designs and survey methods necessary to evaluate the success of the project. The Trustees estimate that \$152,474 (adjusted for inflation) would be needed for the five years of monitoring. This figure includes labor costs, vessel costs, and equipment costs. Table 5-1 presents a summary of the reef monitoring costs, including a cost estimate adjusted for projected future inflation.

**TABLE 5-1
REEF MONITORING COST ESTIMATE**

CATEGORY	COST
Monitoring Design Protocol	\$5,102
Information Exchange and Mid-Course Recommendations	\$4,863
On-Site Monitoring	
Labor Costs	\$77,197
Vessel Use	\$7,462
Travel Costs	\$14,979
Field Equipment and Diving Fees	\$14,369
Sub-Total	\$114,007
Contingencies @ 25%	\$28,502
Total On-Site Monitoring Costs	\$142,509
Total Monitoring Costs (Adjusted for Inflation)	\$152,474

5.1.3.1.5 Cost and Timeframe

The Trustees used experience and cost factors from comparable restoration and mitigation projects employing similar prefabricated reef modules elsewhere in the United States as a basis for estimating the costs outlined in Table 5-2. As noted above, an additional \$152,474 would be needed for monitoring. The personnel and most of the equipment needed to install the commercially available modules are obtainable in Puerto Rico. A project implementation timeline has not been determined at this time, but would be developed during the planning and engineering design phase of the project.

**TABLE 5-2
CONSTRUCTED MODULAR REEF COST ESTIMATE**

CATEGORY	COST
Site Survey, Engineering Design, Construction Management	\$ 60,981
Fabrication and Installation of Reef	\$4,401,140
Total (2002 dollars)	\$5,062,121

5.1.3.1.6 Environmental Consequences

Nature of likely impacts

The proposed construction of an artificial reef offshore from the impact area to replace the reef functions lost as a result of the incident would produce largely beneficial impacts by adding three-dimensional hard substrate habitat features to the generally flat, sandy ocean bottom. These habitat features should increase productivity of various species by providing increased settling surface area, as well as additional areas for

cover, foraging, and spawning. Construction of the replacement reef would cause incidental loss of some sand bottom habitat and associated infaunal biota that will be covered by the footprint of the reef structure. However, sand bottom resources are extremely common in the area.

Marine species that use reef habitats as essential fish habitat would benefit from the proposed restoration action. Several managed species feed in non-reef sand bottoms, including the white grunt (juveniles and adults) and gray snapper (juveniles and adults); however, placement of the artificial reef would displace the feeding zones to a nearby equivalent area. No permanent adverse impact on feeding abilities of the managed species or significant loss of prey is expected. Placement of the artificial reef materials on a sand plain substrate will result in potential loss of habitat for juveniles, adults, and spawning sand tilefish. However, the essential fish habitat analysis indicates that sand habitat available for all the activities of the sand tilefish is not a limited resource, and thus the loss of less than 2.5 acres of sand substrate will have no measurable impact upon this species' typical life habits.

The construction period for all aspects of reef restoration would be fairly short—a matter of several weeks—so little if any disruption of oceanic biota would occur. The approximate area projected for siting the reef was selected by Puerto Rican fisheries biologists, and does not encompass any important fishing or recreational sites. All construction materials would be stable and nontoxic.

Direct Impacts: The shallow hard-bottom area where the newly constructed reef is placed will be permanently altered by the heavy concrete blocks that comprise the reef modules. The existing substrate will be covered, and the new vertical structure will promote establishment of a different species assemblage. The new reef will not be productive immediately. Recruitment of encrusting organisms would occur over time, as planktonic larval forms settle on the structure and build the complex base of the reef community.

Indirect Impacts: Reef reconstruction could benefit numerous other resources, including fish. Once the encrusting organisms become established, other species that feed on them could be supported by the new community. Transient species would be expected to use the reef for foraging and shelter, as well. This alternative would have no impact on public health and safety, although significant safety considerations for Trustees or their agents implementing this alternative would be required in the planning process.

Effects on public health and safety: The Trustees do not expect implementation of the reef restoration projects to have any impacts on public health or safety. If the reef is sited greater than 0.5 mile from shore, in about 80 feet of water, it will not be accessible to swimmers. Recreational divers are known to

visit the reef system in the area of the injury site, although not in great numbers. As a diving reef, the replacement reef would not present any unique physical hazards to humans, and the deeper waters with reduced surge might make diving somewhat less dangerous, relative to the injury site. The replacement reef would not affect shipping or marine navigation. No pollution discharges would be associated with reef construction, and the reef materials are nontoxic.

Unique characteristics of the geographic area

There are no truly unique characteristics of the area being considered for construction of the replacement reef. The area, offshore from the injury site, consists of relatively uniform, soft-bottom, open ocean habitat.

Controversial aspects of the project or its effects

The Trustees do not expect any controversy to arise in connection with the reef restoration projects. Replacement reef creation has been implemented by these and other Trustees in connection with other grounding incidents, particularly in Florida, with no adverse reaction from the public. Puerto Rico has a long standing artificial reef program. The proposed reef would be an engineered reef designed to mimic a natural reef, and would not involve use of tires, vessels, chunks of highway, or other similar materials that have raised objections from the public in other situations. The Trustees expect that the citizens of Puerto Rico will welcome the reef restoration project. The only notable difference between this project and past reef creation projects in Puerto Rico is the large size of the reef proposed in this Draft RP/EA.

Uncertain effects or unknown risks

Given their experience with constructing replacement reefs, the Trustees do not believe uncertain effects or unknown risks to the environment are associated with implementing this project. It is true that exact conditions at the project site are not known (wave action, current, surge, bottom sediment composition, etc.), because the exact position of the new reef has not been determined. Thus, the stability of the constructed reef and such parameters as biotic colonization rates may vary from those estimated in the assessment. However, as indicated in this Draft RP/EA, the Trustees would conduct a thorough site survey and engineering analysis prior to initiating construction to address any significant uncertainties.

Precedential effects of implementing the project

The Federal Trustees have sought damages for construction of replacement reefs to compensate for other grounding incidents in Puerto Rico and elsewhere. Artificial reefs have been constructed in Puerto Rican coastal waters in the past, although the proposed reef will be larger than previously constructed projects.

The Trustees therefore do not foresee that this project sets any precedent for future actions of the type that would significantly affect the quality of the human environment.

Possible significant, cumulative impacts

The Trustees know of no impacts on the environment to which the proposed reef would contribute that, cumulatively, would constitute a significant impact on the quality of the human environment. The reef site is fairly inaccessible to humans, and thus no additional projects affecting the area are anticipated.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources

The Trustees anticipate that the reef restoration areas will be sited greater than 0.5 miles offshore. A review of NPS and State Historic Preservation Office (SHPO) site files and other relevant sources on submerged cultural resources will be performed to assure that the proposed reef restoration projects will not affect any previously identified historic properties (that is, cultural resources that are listed in, determined eligible to, or potentially eligible to the NRHP). Prior to implementation of the restoration project, a cultural resources survey will be performed to assure that no sites that meet the criteria for eligibility to the NRHP will be affected by the proposed activities. Surveys may involve performance of a combination of complementary survey techniques including side-scan sonar, magnetometer, and sub-bottom profiler to provide a picture of potential anomalies that may prove to represent potentially NRHP-eligible cultural resources. Identified anomalies may require further follow-up investigation such as underwater surveys in order to confirm identification of anomalies. If significant resources are identified within a modular reef reconstruction area, NPS will attempt to redesign the proposed plan so as to avoid the resource. If avoidance is not possible, NPS will consult with SHPO and develop a Memorandum of Agreement that will outline appropriate mitigation of adverse effects.

Effects on endangered or threatened species

The Trustees know of no direct or indirect impacts of the proposed reef restoration project on threatened or endangered species, or their designated critical habitats. The general oceanic locale where the reef will be sited is not critical habitat for any listed species. The reef may indirectly benefit transient listed species that use the coastal waters of Puerto Rico (e.g., sea turtles) by adding habitat for prey species to the ecosystem. The Trustees will complete the consultations required under the Endangered Species Act and no further actions are deemed necessary.

Violation of environmental protection laws

The project does not require, nor do the Trustees anticipate, incidental violation of Federal, Commonwealth, or local laws designed to protect the environment. The project can be implemented in compliance with all applicable environmental laws and regulations.

Preliminary conclusion

The Trustees conclude that the reef construction project will have no significant impacts on the quality of the human environment. Few alternative projects are available to meet the Trustees' restoration objectives of replacing rocky reef services, and these do not necessarily minimize adverse environmental impacts. For instance, creation of seagrass beds also involves transformation of soft-bottom habitat.

5.1.3.2 Reef Sedimentation Mitigation

Reef Sedimentation Mitigations as a restoration alternative would consist of rehabilitating an existing natural reef, Submarine Gardens, located close to shore off Torrecillos Lagoon. The reef has been almost completely buried by sediments as a result of a human-made marina and associated channels.

Assumptions underlying success of this alternative are that uncovering the rocky reef substrate would eventually lead to re-colonization by typical reef organisms, and that future re-sedimentation could be prevented. This restoration alternative was determined to be non-preferred.

5.1.3.2.1 Project Description and Background

The Trustees evaluated rehabilitating the Submarine Gardens natural reef offshore from Torrecillos Lagoon, which has been smothered by sediments produced by construction of a marina beginning in the 1940s, by dredging and disposing of the sediment cover. The Submarine Gardens, located approximately 7-10 miles east of the barge grounding site, was a popular recreational diving spot for Puerto Ricans before the demise of the reef. This restoration alternative would require dredging to uncover the rocky reef substrate, which would eventually lead to re-colonization by typical reef organisms. The restoration project would include a long-term maintenance task designed to contain and manage sediment loads to prevent subsequent reburial of the reef.

5.1.3.2.2 Restoration Objectives

Restoration of this impaired reef structure would potentially produce similar ecological services as the lost reef structure at the grounding site. This alternative could benefit numerous natural resources in the same way as construction and deployment of a modular reef as described in Section 5.1.2.1.

5.1.3.2.3 Scaling Approach

No scaling was necessary for this proposed project.

5.1.3.2.4 Success Criteria and Monitoring

For a discussion of success criteria and monitoring, see Section 5.1.2.1.4.

5.1.3.2.5 Cost and Timeframe

No costs or timeframe have been determined yet for this project. Consequently, for this synopsis, the available funding for the reef restoration category is used as a maximum allowable amount for this action. The Trustees could choose to use some portion of the available funding to mitigate sediment in a part of Submarine Gardens while at the same time spending the remainder of the reef restoration funds on other projects. The categories of cost typically associated with sediment dredging projects are shown in Table 5-3 to illustrate the cost breakdown.

**TABLE 5-3
REEF SEDIMENTATION MITIGATION COST ESTIMATE**

CATEGORY	COST
Site Surveys, Engineering Designs, Construction Management	TBD
Dredging and disposal of the sediment cover	TBD
Measures to mitigate or prevent resedimentation	TBD
Total (using total available reef restoration funds)	\$5,712,336

TBD To be determined

5.1.3.2.6 Environmental Consequences

Direct Impacts: Uncovering the buried reef of the Submarine Gardens would result in immediate but temporary resuspension of sediments in the area. Soft-bottom benthic communities that have become established in the areas since the reef was buried would be displaced, but other similar habitat is common nearby. Minimal lost services would result from this community displacement. Colonization of the newly exposed reef structure by encrusting and reef building organisms would occur gradually, as larval recruits move into the area. Dredging is an imprecise and physically disruptive operation that would disturb the natural beauty of the area and interfere with the recreational pursuits of visitors during implementation.

Indirect Impacts: Dredged material from the area would have to be disposed of somewhere else, causing a cascade of indirect effects in the disposal area unless a beneficial use could be found for the fill material, such as replacement sediment for seagrass restoration. The significance of dredging impacts would be determined during the dredging design step when mitigation measures, if any, can be included. Future impacts from maintenance dredging would be proportional to the frequency of its occurrence, which cannot be predicted at this time.

Cumulative Impacts: Rehabilitation of the Submarine Gardens natural reef poses many short-term technical challenges along with several long-term uncertainties. Long-term maintenance dredging may be required to protect the Submarine Gardens from ongoing sedimentation. The significance of future maintenance dredging impacts would be determined in part by the frequency of its occurrence, which cannot be predicted at this time. Resource managers for Puerto Rico judge that containment of the sediment load would be an ongoing, labor-intensive project, with associated high but unpredictable costs. The potential success of this project was also judged questionable because of difficulties in containing sediments and unpredictability of recovery of the long-buried reef. Collateral resource injury could be expected from dredging and disposal of sediments. This alternative could benefit numerous natural resources in the same way as construction of a modular reef, and it would pose the same public safety issues as a new reef.

5.1.3.3 Acquisition of Equivalent Lost Services (Proposed Preferred)

One means of compensating the public for the reef injury is through acquisition of equivalent resources or services. The primary means of acquiring equivalent resource services, in this case habitat services, is through property acquisition. For property acquisition to be considered a viable restoration alternative, the property should, at a minimum, contain one or more of the habitats demonstrated in the Habitat Suitability Analysis as capable of providing habitat services to those natural resources that utilize eolianite reefs. Types of habitats would include, but are not limited to, eolianite reefs, coral reefs (patch or fringing), sea grass beds, hard-bottom/soft coral communities, and mangroves and mangrove lagoons.

In addition to habitat services, the Trustees identified other characteristics and features that would support the selection of a property acquisition alternative. Properties containing scarce habitat, such as *Pterocarpus officinalis* forests, or that support rare, threatened, or endangered species would be strongly favored. Similarly, properties containing important ecological values, whether because of size, habitat composition (e.g., multiple habitats), or geographic location, would be ranked highly.

5.1.3.3.1 Project Description and Background

This compensatory project entails acquisition, preservation, and enhancement of other coastal habitats that provide comparable and similar services to the lost reef resources. At this time, the Trustees are only able to discuss an acquisition strategy and the relative types of project benefits and features without revealing project locations or describing details because of the sensitivity of the potential land transaction process and due diligence activities; however, the nature of the habitats types and the objectives of the acquisition process can be summarized.

The project could involve single habitat categories or a mosaic of habitat types, characterized by the availability and timing of habitats for acquisition. Habitat types for consideration could include shoreline habitats, with adjoining submerged lands such as mangrove, seagrass, or some combination of desirable habitats. The potential to preserve other productive habitats, in addition to mangrove and seagrass habitat, will be considered when evaluating potential acquisitions. For example, beach and dune habitat, important to sea turtle nesting, may play a role in determining which properties are considered for acquisition. Beach and dune habitat acquisition would also partially compensate for the lost recreational beach use injury addressed in Section 5.2.

5.1.3.3.2 Restoration Objectives

Land acquisition has the potential to meet multiple restoration objectives, such as increasing public access to beach and dune habitats for recreation (see Section 5.2) as well as protecting habitat. Restoration objectives can also be met indirectly by acquiring property likely to be altered by development in the near future. If purchasing the property prevents loss of natural resources and services currently associated with that property, restoration goals are met.

For property acquisition to be considered a viable restoration alternative, the property should, at a minimum, contain one or more of the habitats demonstrated in the Habitat Suitability Analysis as capable of providing habitat services to those natural resources that utilize eolianite reefs. Types of habitats would include, but are not limited to, eolianite reefs, coral reefs (patch or fringing), seagrass beds, hard-bottom/soft coral communities, and mangroves and mangrove lagoons.

5.1.3.3.3 Scaling Approach

In addition to habitat services, the Trustees identified other characteristics and features that would support selection of a property acquisition alternative. Properties containing scarce habitat, such as *Pterocarpus*

officinalis coral forests, or that support rare, threatened, or endangered species would be strongly favored. Similarly, properties containing important ecological values, whether because of size, habitat composition, or geographic location, would be considered favorable.

5.1.3.3.4 Success Criteria and Monitoring

No monitoring of acquired property is included in the project plan.

5.1.3.3.5 Cost and Timeframe

No costs or timeframe have been determined yet. Consequently, for this synopsis, the available funding for the reef restoration category is used as a maximum allowable amount for a coastal habitat acquisition, preservation, and/or enhancement project or series of projects (\$5,712,336). However, the Trustees could choose to utilize some smaller proportion of the available funding for habitat acquisition while at the same time spending the remainder of the reef restoration fund allocation on other compensatory restoration projects. Furthermore, because the natural resource damage assessment process includes incentives for the Trustees to seek out other sources of funding or in-kind contributions from partnering organizations, the funds that the Trustees could allocate for this project may only reflect a portion of the total acquisition costs of any particular parcel or parcels of land, with the balance of funding coming from outside sources or allied natural resource partners. The categories of cost typically associated with land acquisitions are shown in Table 5-4 (a hypothetical acquisition) to illustrate the cost breakdown.

**TABLE 5-4
COSTS OF LAND ACQUISITION FOR CONSERVATION**

CATEGORY	COST
Land Purchases (2,660 acres)	\$3,782,500
Title Searches (\$1,000/parcel)	\$8,000
Appraisal Costs (\$3,000/parcel)	\$24,000
Survey Costs (approximately \$57/acre)	\$151,000
Administration Costs (\$3,000/year, 3 years)	\$9,000
Subtotal	\$3,974,500

5.1.3.3.6 Environmental Consequences

Nature of likely impacts

A compensatory restoration project consisting of purchasing property currently in a natural state entail no

additional habitat creation or rehabilitation work. Acquisition of natural habitat as a restoration project does not entail any destruction or loss of any structures, facilities, roads, or other amenities in use by the public. Thus, the immediate, direct impacts of the project consist of transferring ownership to a public entity and increasing the amount of natural habitat available to the public for use and enjoyment. The increased public use will be controlled and managed (by use of boardwalks or trails), and is not expected to degrade the ecological value of the purchased property. Indirect impacts that would follow from purchase of the property include protecting the property from almost certain development and consequent loss of ecological value and services.

Effects on public health and safety

The property acquisition restoration project is not expected to have any direct effects on public health or safety.

Unique characteristics of the geographic area

No particular parcel of land has been selected for acquisition. However, the nature of the habitat needs described in the Habitat Suitability Analysis report suggests that the land identified for acquisition will likely have unique ecological qualities.

Controversial aspects of the project or its effects

Because no particular parcel has been identified for acquisition, the Trustees cannot predict controversial aspects of the proposed property acquisition.

Uncertain effects or unknown risks

The Trustees know of no uncertain effects or unknown risks to the environment that may result from implementing the preferred restoration alternative. Purchase and protection of existing natural habitat are well-established activities.

Precedential effects of implementing the project

The Trustees know of no precedent that the acquisition of natural habitat as a restoration project may set for future actions that may significantly impact the quality of the human environment. Purchase and protection of habitat for conservation are well-established functions of the Trustee agencies.

Possible significant, cumulative impacts

The Trustees do not foresee any cumulative impacts from implementation of this restoration project, and similar projects in the future that would constitute significant impacts on the quality of the human environment. Acquired land will not change in character, as it is currently in a natural state. As discussed

above, the acquisition project will not entail destruction, loss, or conversion of any existing structure, facility, road, or other publicly-used amenity.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources

An acquisition project would have no known direct or indirect impacts on historic properties. When a specific acquisition area is identified, a review of NPS and SHPO site files and other relevant sources will be performed to determine whether the proposed acquisition area contains any previously identified historic properties (such as cultural resources that are listed in, determined eligible to, or potentially eligible to the NRHP). Prior to acquisition of any property, a cultural resources survey will be performed to determine the presence of sites that meet the criteria for eligibility to the NRHP. Identified cultural resources may require further follow-up investigation to determine if the resources potentially meet the criteria of eligibility to the NRHP. If significant resources are identified within an acquisition property, NPS would develop a management plan that would protect the resource from any activities associated with the acquisition. If avoidance of effects to the resource is not possible, NPS will consult with SHPO and develop a Memorandum of Agreement that will outline appropriate mitigation of adverse effects.

Effects on endangered or threatened species

Because the land to be acquired has not been identified, direct impacts on specific endangered or threatened species cannot be anticipated. Generally, the acquisition project is expected to benefit any endangered species that uses the acquired parcel, as the land would be protected from development activities that could be adverse. The Trustees will complete the consultations required under the Endangered Species Act, and take action as necessary, once a parcel has been proposed for acquisition.

Violation of environmental protection laws

The project does not require, nor do the Trustees anticipate, incidental violation of Federal, Commonwealth, or local laws designed to protect the environment. The restoration project can be implemented in compliance with all applicable environmental laws and regulations.

Preliminary conclusion

The Trustees conclude that implementation of the conservation lands acquisition restoration project would not have any significant impacts on the quality of the human environment. Further, other feasible restoration alternatives that could achieve the Trustees' restoration objectives would not necessarily have fewer adverse environmental impacts.

Cumulative Impacts

While an acquisition strategy does not yield a net increase in habitat services, it does preserve and protect existing habitat services from development losses. As future restoration funding opportunities emerge, additional enhancement may be made on any acquired parcels.

5.1.3.4 Seagrass Restoration Alternative (Proposed Preferred)

The Seagrass Restoration Alternative would consist of substituting wetland habitat services, such as seagrass habitats, for the services lost from the injured reef.

5.1.3.4.1 Project Description and Background

The Seagrass Restoration Alternative entails the beneficial use of dredged marine sediments from San Juan Harbor's maintenance dredging activities to fill dredge holes within the Condado Lagoon, approximately 1 mile southeast of the grounding site. According to a Preliminary Restoration Plan prepared by Army Corps in March 2003, an area totaling approximately 32 acres would be filled from a maximum depth of 35 feet to a maximum depth of 15 feet. Figure 5-3 illustrates one technique for managing the sediment filling process on similar depressions that resulted from vessel groundings called "blowholes." Once these dredge holes or blowholes are filled to grade and leveled, natural seagrass recovery and plant succession can proceed unassisted. Alternatively, planting bundled units of fast growing seagrass species (such as *Halodule wrightii* or *Syringodium filiforme*) within the filled area would likely speed the natural recovery of the seagrass beds.

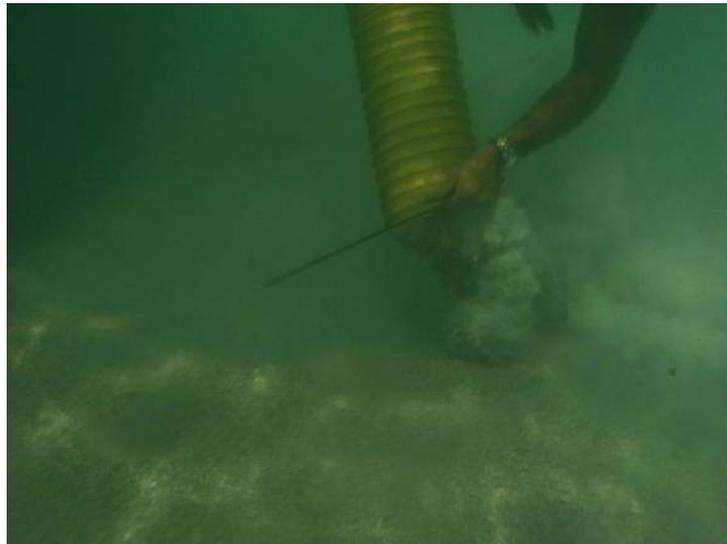


Figure 5-3 Fill Being Deposited in a Blowhole using a Large-Diameter Flexible Hose

Figure 5-4 provides an example of a blowhole's appearance after placement of sediment fill.

5.1.3.4.2 Restoration Objectives

In this case, Trustees considered creation of seagrass habitat that could provide ecological services comparable to those lost, such as habitat for adult fish and invertebrates, and nursery areas for juvenile marine organisms. However, the species composition of organisms using these habitats would be different, perhaps considerably different, than the species composition using offshore rock reefs.

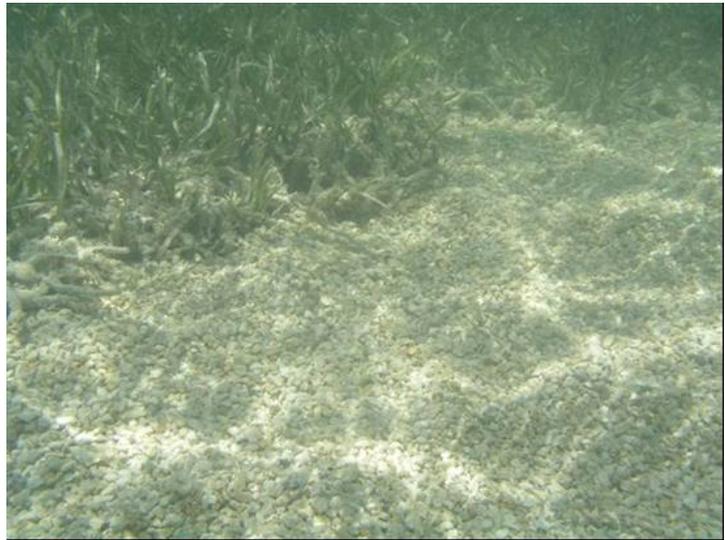


Figure 5-4 Example of Fill in a Blowhole that is Level and Up to the Surrounding Grade

Filling holes with native sediments similar to surrounding types can speed the natural recovery of seagrasses, thus restoring lost resources and services to the area. The Trustees undertook the Habitat Suitability Analysis in 2005 to determine viable habitats that can be considered to expand the available restoration options. The Habitat Suitability Analysis (MRI 2005) determined that seagrass habitat was one of the habitat replacements that would meet Trustee restoration objectives. In fact, seagrasses were identified as an important recruitment habitat, an added benefit.

5.1.3.4.3 Scaling Approach

Benefits of seagrass restoration can be coupled with restoration gains from other projects such as shallow hard-bottom modular reef construction if modules are placed carefully and locations of both restoration alternatives are proximate. The mosaic of habitats recommended in the Habitat Suitability Analysis included seagrass beds. The Habitat Suitability Analysis ranked seagrass habitat as the third most similar habitat to the injured eolianite reef—third only to shallow hard-bottom and mangrove habitats—based upon the similarity in herbivore species in these habitats. The differences between second-ranked mangrove and third-ranked seagrass were relatively minor, and the Habitat Suitability Analysis concluded that both were similar in terms of habitat replacement potential (MRI 2005).

5.1.3.4.4 Success Criteria and Monitoring

A before-after monitoring design would be recommended for this project as a means of documenting the actual increase in resources and services. The design could be as simple as measuring the acreage of seagrasses in the area prior to filling the hole and at several time intervals after the hole is filled.

Alternatively, a more complex investigation of primary production and community enhancement could be undertaken.

5.1.3.4.5 Cost and Timeframe

The Army Corps would implement the project as part of the San Juan Harbor Maintenance Dredging using its authority under Section 204 of the Water Resources Development Act of 1992. The Trustees would use settlement funds to pay the sponsor cost of the project, a 25 percent non-federal cost share. The sponsor cost is \$565,000.00 of the total project cost of \$2,260,000.00.

5.1.3.4.6 Environmental Consequences

In implementation of the Seagrass Restoration Alternative, the Trustees would rely upon the protocols followed by the Army Corps to comply with Section 106 of the NHPA. The Trustees would meet their obligations through collaboration with the Army Corps by providing the sponsor's cost share to the San Juan Harbor Maintenance Dredging Project. Anticipated effects are summarized below.

Direct Impacts: In the immediate project area, placing dredged material in the hole would result in a temporary increase in suspended sediment. However, longer term benefits would be realized. Reducing the depth of water would result in increased water flow and flushing, more light reaching the seafloor, and higher levels of dissolved oxygen. Filling the hole and establishing seagrass in a new area would cause collateral resource injury similar to that caused by reef creation—by converting existing sand or mud bottoms to a different habitat type. Use of the San Juan Harbor dredge spoils for this fill would eliminate the need to find and locate or even construct a confined disposal facility, thus reducing dredge disposal costs and lowering the cost of acquiring fill from another source to supply the replacement sediment.

Indirect Impacts: Growth of seagrasses, whether planted or naturally established, would subsequently provide structural habitat for other species. This alternative would not likely have any impacts on public health or safety.

Cumulative Impacts: The overall effect of using dredged material to fill the Condado Lagoon dredge holes or vessel grounding blowholes is expected to be positive. The actual contribution of this project to the goals of the restoration plan would depend on the location of other habitat areas being restored, created, or purchased. The mosaic of habitats described in the Habitat Suitability Analysis provides variable benefits, depending on the relative locations of each. Use of the San Juan Harbor dredge spoils for this fill would eliminate the need to place the fill in a confined disposal facility, which would cause the loss of habitat at the confined disposal facility location somewhere along the northern coast of Puerto Rico.

5.2 PROPOSED RECREATIONAL BEACH USE INJURY RESTORATION ALTERNATIVES

Approximately 169 miles of coastal shoreline and embayments along the northern coast of Puerto Rico was affected by the *T/B Morris J. Berman* oil spill. Oil from the spill contaminated many recreational beaches in this area during the height of the 1994 winter tourist season. Shoreline cleaning operations were extensive and lasted until April 8, 1994, on beaches close to the grounding site. In the immediate vicinity of the spill, the de facto beach closings lasted three months, while at many of the more distant beaches, field operations were reduced or halted five or six weeks after the spill. Tourists and resident beach users were advised to avoid beaches in the spill zone, and cleanup activities essentially closed many popular beaches for an extended period following the spill. The restoration goal for this injury category is to make the public whole for the lost services of recreational beach use resulting from the incident.

No primary restoration of lost visitor use of recreational beach use is possible because the lost services involve time; time cannot be replaced or restored. The Trustees considered compensatory alternatives that would provide replacement services of comparable type, quality, and value to those lost. Three compensatory restoration alternatives to address the injury to recreational beach use are considered in this section: acquisition of lands (preferred), improvement of beach access, and improvement of beach quality. Each of these is discussed below.

5.2.1 Acquisition of Lands for Conservation (Proposed Preferred)

Acquisition of Lands for Conservation as a restoration alternative encompasses the acquisition of one or more parcels or interests in land which include or border recreational shorelines affected by the spill. Ownership and/or future use of such lands is placed in the public domain, thereby expanding and preserving public access to or opportunities for use of shorelines, for such activities as beach recreation,

fishing, and nature viewing, in the area where these resource services were lost due to the spill. Acquired lands would be managed by local, municipality or Commonwealth authorities, as appropriate.

5.2.1.1 Project Description and Background

The Acquisition of Lands for Conservation Alternative as compensatory restoration project would involve acquiring coastal habitats that provide comparable, similar services to the lost recreational beach use. At this time, the Trustees are only able to discuss an acquisition strategy and the relative types of project benefits and features without revealing project locations or describing details because of the sensitivity of the potential land transaction process and due diligence activities.

5.2.1.2 Restoration Objectives

For the Acquisition of Lands for Conservation Alternative, all potential parcels for acquisition would likely be privately owned, with little to no public access or use. Private development of potential parcels for acquisition could also result in construction or other property alterations which detract from public use of adjacent shorelines, including environmental quality, viewing enjoyment, and access. Some potential parcels for acquisition may be adjacent to existing public lands, with natural reserve or recreation areas.

Waterfront property acquisition would serve both resource conservation and access enhancement objectives. New opportunities for the public to access and use natural shorelines for recreation are provided where property is acquired in areas with limited or no current public access. Acquiring parcels adjacent to existing public shorelines expands public access while also allowing public recreation to be spread over a greater area. Spreading recreational use over a greater area decreases the environmental burden of recreational activities in any one place.

Not all properties for potential acquisition would necessarily provide opportunities for or support multiple recreational uses. Further, some sites may be more suitable than others for post-acquisition enhancements which would increase either their utility for public recreation or their benefits to natural resources in these areas (e.g., such as by creation of dunes or planting of native vegetation). Properties with the potential to serve multiple restoration objectives and with low potential to negatively affect the quality of natural resources will be given a higher preference in the selection process. Property acquisition and planned uses will be coordinated with appropriate local, municipality, Commonwealth or Federal agencies to ensure consistency with any regional resource management plans or other community planning documents.

5.2.1.3 Scaling Approach

In this case, the cost of the lands proposed for acquisition equates to the value of the lost beach use, and the replacement services of the acquired lands will be of comparable type and quality. Consequently, this restoration project alternative will have a multifaceted beneficial impact on an extremely important natural ecosystem and popular coastal recreational areas on the northern coast of Puerto Rico affected by the incident. The acquisition of conservation lands for recreation would address public coastal recreation in the area affected by the oil spill incident, help preserve existing natural resources, and contribute to making the public whole for losses suffered.

5.2.1.4 Success Criteria and Monitoring

No monitoring of this project is recommended.

5.2.1.5 Cost and Timeframe

No timeframe has been determined yet, and the costs shown in Table 5-4 (Section 5.1.2.3.5) are for a potential land acquisition evaluated during the natural resource damage claim preparation. The costs shown for this synopsis illustrate the cost breakdown and scale of typical cost categories for acquiring coastal land parcels. The estimated costs in this hypothetical scenario currently exceed the recreational beach use restoration category allowance. As a consideration of the funding limitations, the Trustees could choose to utilize some smaller proportion of the available funding for land acquisition and spend the remainder of the recreational beach use restoration fund allocation on other restoration projects. Furthermore, because the natural resource damage assessment process includes incentives for the Trustees to seek out other sources of funding or in-kind contributions from partnering organizations, the funds that the Trustees could allocate for this project may only reflect a portion of the total acquisition costs of any particular parcel or parcels of land, with the balance of funding coming from outside sources.

5.2.1.6 Environmental Consequences

Nature of likely impacts

The preferred restoration alternative for lost use of beaches is purchasing beach property currently in a natural state; no additional habitat creation or rehabilitation work is anticipated. The project does not entail any destruction or loss of any structures, facilities, roads, or other amenities in use by the public. Thus, the immediate, direct impacts of the project consist of transferring ownership to a public entity and increasing the amount of natural habitat available to the public for use and enjoyment. The increased public use will be controlled and managed (by use of boardwalks or trails), and is not expected to degrade

the ecological value of the purchased property. Indirect impacts that would result from purchase of a property include protecting the property from almost certain development and consequent loss of ecological value and services. Further indirect impacts of the restoration action include protection of the valued ecosystems by creating a buffer from encroaching development.

Effects on public health and safety

A property acquisition project is not expected to have any direct effects on public health or safety.

Unique characteristics of the geographic area

Potential acquired properties would likely be biologically unique and ecologically valuable. The ecosystem of property for acquisition should be identified as a priority area for conservation, protection, and enhancement.

Controversial aspects of the project or its effects

The Trustees know of no controversial aspects of the proposed property acquisition plan.

Uncertain effects or unknown risks

The Trustees know of no uncertain effects or unknown risks to the environment that may result from implementing the preferred restoration alternative. Purchase and protection of existing natural habitat are well-established activities. The Trustees are investigating several parcels to determine if they are available for purchase.

Precedential effects of implementing the project

The Trustees know of no precedent that the acquisition project may set for future actions that may significantly impact the quality of the human environment. Purchase and protection of habitat for conservation are well-established functions of the Trustee agencies, and the subject properties have been identified in public documents as priorities for acquisition by the Commonwealth.

Possible significant, cumulative impacts

The Trustees do not foresee any cumulative impacts from implementation of this restoration project that would constitute significant impacts on the quality of the human environment. As discussed above, the acquisition restoration project will not entail destruction, loss, or conversion of any existing structure, facility, road, or other publicly-used amenity.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources

The acquisition restoration project should have no known direct or indirect impacts on any National Historic Site.

Effects on endangered or threatened species

The acquisition restoration project would have no direct impacts on any endangered or threatened species and may actually protect and benefit endangered and threatened species. Thus, the acquisition project would indirectly protect existing uses of the habitat by this endangered species. The Trustees will complete all required the consultations under the Endangered Species Act.

Violation of environmental protection laws

The acquisition restoration project does not require, nor do the Trustees anticipate, incidental violation of Federal, Commonwealth, or local laws designed to protect the environment. The project can be implemented in compliance with all applicable environmental laws and regulations.

Preliminary conclusion

The Trustees conclude that implementation of the conservation lands acquisition restoration project would not have any significant impacts on the quality of the human environment. Further, other feasible alternatives that could achieve the Trustees' restoration objectives would not necessarily have fewer adverse environmental impacts.

5.2.2 Improved Access to Public Beaches

Improved Access to Public Beaches as a restoration alternative encompasses such projects as the construction of boardwalks, sidewalks, dune walkovers, and biking or hiking trails. The boardwalk, sidewalk, or public trail projects under consideration would generally run parallel to and behind public beaches, facilitating public use and access to the full length of adjacent recreational public shorelines. Dune walkovers are elevated pedestrian walkways traversing dune habitats, including stabilizing vegetation. The creation of such public trails or walkways addresses the lost access to recreation shorelines during the spill event by providing increased or improved opportunities to access recreational shorelines and beaches in the future. These projects also contribute to the preservation of the natural habitats associated with these shorelines. This restoration alternative was determined to be non-preferred.

5.2.2.1 Project Description and Background

Improved Access to Public Beaches as a compensatory project would improve the quantity, quality, and availability to the public of coastal areas in Puerto Rico by completing feasible actions that the government has identified to improve access to beaches currently ranked as non-accessible. The Commonwealth of Puerto Rico identified and ranked numerous non-accessible beaches that would be candidates for improving public access. None of the identified, priority beaches is located within the coastal region directly affected by the oil spill; therefore the Trustees determined that the available priority projects were too far removed from the area impacted by the spill on Puerto Rico's north coast.

5.2.2.2 Restoration Objectives

Access to numerous public beaches was impeded by the spill and the cleanup actions during the response to the spill. However, none of the identified, priority beaches identified by the Commonwealth of Puerto Rico with major access problems is located within the coastal region affected by the oil spill; the Trustees determined that the available priority projects were too far removed from the area impacted by the spill to be truly compensatory to the public.

5.2.2.3 Scaling Approach

The Commonwealth study identified major problems with access and use, suggested feasible actions the government could take to improve public use, and ranked non-accessible beaches in priority order for action. However, no direct benefit from these priority beaches identified by the Commonwealth to the areas actually affected by the spill could be realized.

5.2.2.4 Success Criteria and Monitoring

No monitoring of this alternative is recommended.

5.2.2.5 Cost and Timeframe

The costs and timeframe for improving beach access were not investigated, as the Trustees determined that the available priority projects were too far removed from the area impacted by the spill to be truly compensatory to the public.

5.2.2.6 Environmental Consequences

Environmental consequences were not evaluated because no actual project was proposed.

5.2.3 Improved Quality of Use of Public Beaches

5.2.3.1 Project Description and Background

Improved Quality of Use of Public Beaches as a compensatory restoration project identified by the Trustees includes implementing a series of improvements previously identified by other organizations that would address restoration of desirable beach features and natural resources as well as needed additions or enhancements to visitor amenities on existing public beaches. More specifically, this project involves planning and carrying out re-vegetation of 25 miles of beach uplands; design and construction of walks, decks and maintenance areas; and installation of garbage stations. The series of improvement types that comprise this project alternative could be carried out at many of the same beaches along Puerto Rico's north coast that were affected by the oil spill. This restoration alternative was determined to be non-preferred.

5.2.3.2 Restoration Objectives

Improvements to beach resources such as reforestation or revegetation, as well as additions or enhancements to visitor facilities such as walkways, decks, maintenance areas, and garbage stations on beaches, would compensate the public for lost use of beaches resulting from the incident. Many of these activities are proposed for the beaches affected by the oil spill. These projects would expectedly enhance the value of existing use of beaches, and not necessarily increase beach use. Consequently, Trustee restoration objectives were not met adequately by this project.

5.2.3.3 Scaling Approach

The improvements would be proposed for the beaches affected by the oil spill as a means of enhancing the value of existing beach use, rather than increasing beach use, which would compensate for the largest injury caused by the spill. While the location of the projects would be at the formerly impacted beaches, the relationship of these improvement projects as compensation for the impacts from the spill incident is less certain than natural resource protection.

5.2.3.4 Success Criteria and Monitoring

No monitoring of this alternative is recommended.

5.2.3.5 Cost and Timeframe

The costs of projects designed to improve the quality of use of the beaches affected by the incident vary according to the actions included in a proposed package. Administrative costs—planning and design, and

the costs of upkeep—would have to be added to these estimates. The estimated total costs for all quality improvement projects identified by the Puerto Rico Coastal Zone Management Program currently exceed the funding allocation for the recreational beach use restoration category. No timeframe was developed for this non-preferred restoration alternative.

**TABLE 5-5
ESTIMATED COSTS OF PROJECTS TO IMPROVE QUALITY OF BEACH USE**

CATEGORY	COST
Revegetation of 25 miles of beach uplands	\$2,331,250
Construction of walks, decks, and maintenance areas	\$1,500,000
Costs of constructing garbage stations	\$562,500
Planning and design; costs of upkeep	TBD
Subtotal Cost	\$4,393,750

5.2.3.6 Environmental Consequences

The restoration alternative to improve beach quality was not selected as a preferred alternative, so no detailed environmental analysis was performed. General impacts are described below.

Direct Impacts: Any action that increases public use of beaches results in increased in traffic, disturbance of vegetation, litter, and other typical corollaries of human recreation. During the construction period, short-term increases in equipment noise and traffic may occur. Following construction, these effects will decrease.

Indirect Impacts: The indirect impacts of this restoration alternative are difficult to predict, because specific actions and locations are not specified. Use of some beaches may increase while other beaches may be visited less often.

Cumulative Impacts: The cumulative impacts of this restoration alternative are difficult to predict, because specific actions and locations are not specified. Overall change in beach use would not be expected, but the restoration project would enhance the value of the recreational experience. If so, no cumulative impacts would be expected from the restoration project.

5.3 PROPOSED NATURAL RESOURCE INJURY AND LOST VISITOR USE OF SAN JUAN NATIONAL HISTORIC SITE RESTORATION ALTERNATIVES

The Trustees are proposing three projects for San Juan National Historic Site related to compensation for lost visitor use caused by the spill. The Trustees determined there was a reduction in historic appreciation

services for approximately 6 weeks after the oil spill. During that time more than 123,000 people who visited El Morro and San Cristóbal were impacted. The National Park Service also determined that some individuals may have canceled their visits to the Park because of the spill. In identifying compensatory restoration projects, the Trustees considered alternatives that would provide replacement services of comparable type, quality, and value to those lost. Four compensatory restoration alternatives to address the injury to the historic site and to lost visitor use were considered: (1) Improving and Extending the Coastal Promenade, (2) Restoring the El Morro Water Battery (also known as the Floating Battery), (3) Cleaning and Stabilizing Exterior Walls of El Morro, and (4) Mitigating Beach Erosion. The first three projects, which were designated as “preferred” based on their evaluation against criteria described in Section 4 of this RP/EA, are discussed below. The fourth, Beach Erosion Mitigation, was not further considered because shoreline erosion is no longer a serious threat (based on a Army Corps analysis), and that project it is now considered unnecessary.

5.3.1 Improvements to and Extension of Coastal Promenade (Proposed Preferred)

5.3.1.1 Project Description and Background

The Promenade, a National Recreational Trail, provides access to an area of the historic site adjacent to the coast. The Promenade enhances visitor appreciation of the forts, the city walls, and their historic settings as well as the natural resources along the shoreline. As a result of the Improvements to and Extension of Coastal Promenade restoration project, now inaccessible natural areas with natural shorelines, vegetation, tide pools with sea life, and birds would become accessible and some resource protection features would be installed. The restoration project would offer opportunities to view the geology of the area and experience the coastal and marine resources that gave the El Morro fortifications their strategic importance.

The Coastal Promenade Project, originally defined during the damage assessment, consists of two phases. Phase I, constructing the promenade from the San Juan Gate to the Water Battery (see Figure 5-5) has been completed. Phase II, which involves improvements to and extension of the existing Promenade is now being proposed as the first priority restoration project for the Berman restoration. This restoration project consists of the seven options described below (Figure 5-6):



Figure 5-5 Phase I Coastal Promenade, Water Battery, and Wall Area Proposed for Improvement

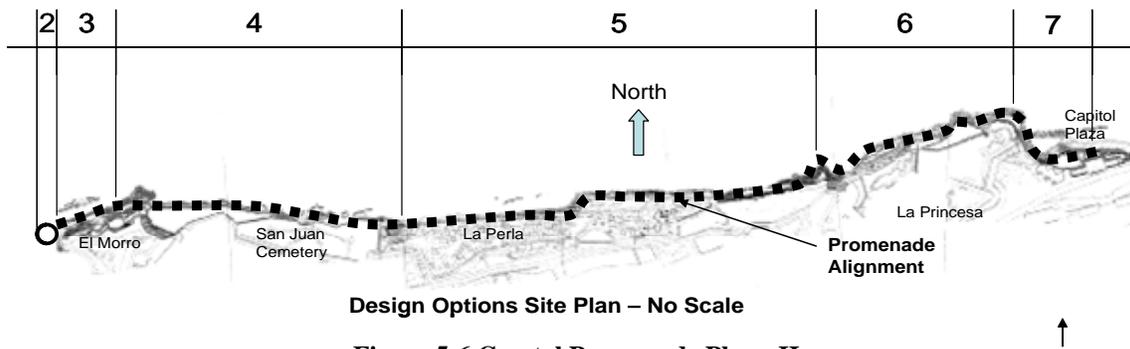


Figure 5-6 Coastal Promenade Phase II

5.3.1.1.1 Project Options

- Option 1: Application of Non-slip Surface Treatment on Existing Walkway
- Option 2: Construction of Water Battery Overlook
- Option 3: Promenade Extension from the Water Battery Overlook to El Morro
- Option 4: Promenade Extension from El Morro to San Juan Cemetery
- Option 5: Promenade Extension from La Perla to Devil’s Sentry
- Option 6: Promenade Extension from Devil’s Sentry to La Princesa
- Option 7: Promenade Extension from La Princesa to the Capitol Plaza

Options 1 and 2 may be implemented individually and separately. They are higher priorities than Options 3 – 7, which can only be implemented sequentially starting at Option 3. The current Promenade, to be improved in Option 1, is located on the west side of El Morro (Figures 5-7 and 5-8). The Water Battery Overlook and Promenade extensions would be located on the shoreline north of El Morro and Old San Juan in an area directly impacted by the spill (Figure 5-9). The total Phase II project would extend this coastal trail around the Old San Juan Historic Wall and San Juan Islet to



Figure 5-7 Close-up of Existing Stone Seat Wall and Bollards at the “Water Battery”



Figure 5-8 View to the East at the End of the Promenade

criteria for all portions of the walkway or features along the Promenade may not be possible; attaining an ADA design could exert considerable environmental impacts and involve excessive cost.

access the historic city walls and El Morro and its grounds.

The Promenade would take advantage of existing concrete walkways, rip-rap, roadways, stairways, and other features along the routes described in the treatment options. This Promenade should be accessible to persons with disabilities, as described in the Americans with Disabilities Act (ADA). However, given the rugged topography along the north coast of the island, to attain ADA design



Figure 5-9 View to the East across the Cemetery

5.3.1.1.2 Features Common to All Options

For consistency, the components of the proposed Phase II Promenade design alternatives would be similar to those of the existing Promenade, which runs from the San Juan Gate to the base of the Water Battery and was completed by the Army Corps of Engineers under Phase I approximately seven years ago.

Elements of the Phase II design include the following:

- The same material, width, coloration, and "wave" decorative pattern in the walkway as in the existing Promenade
- Use of rip-rap for shoreline protection
- Lighting of adjacent fort walls
- Lighting of the walkway surface
- Revegetation of the "land side" of the walkway
- Stone benches along the Promenade
- Wayside exhibits
- Stainless steel gates

Improvements to the Promenade design proposed for Phase II were chosen based on use and operational concerns from the Phase I work. Proposed improvements include the following:

- Incorporation of more stone benches to provide greater rest opportunities for visitors
- Incorporation of drinking fountains along the Promenade route to provide relief for visitors
- Incorporation of a non-corrosive pavement joint to create the two-tone "wave pattern" rather than the steel joint divider used in the existing walkway
- Use of water-resistant and vandal-resistant walkway lights in place of the bollard-type walkway lights installed along the existing walkway
- Use of geotextile engineering fabric to provide a more stable subgrade and minimize erosion and out-washing of walkway sub-base and base materials
- Construction of trench drains with gratings to preclude puddling and move water away from any low areas.

Option 1: Application of Non-slip Surface Treatment on Existing Walkway

The exposed aggregate surface of the existing Promenade was mechanically ground and sealed. The

resulting surface is too smooth for the sea-side setting, which is subject to salt spray and high tides, and is slippery and dangerous for pedestrians when wet. To alleviate this unsafe condition, Option 1 calls for a non-slip treatment on the entire existing walkway surface. The most cost-effective and long-lasting treatment is sandblasting. Additionally, several low areas along the existing walkway collect water, contributing to the slippery conditions. The work of Option 1 includes installation of trench drains across the width of the walkway, allowing water to drain from the walkway surface and run off into the sea.

Option 2: Construction of Water Battery Overlook

This option calls for extending the existing Promenade at the Water Battery (also called the “Floating Battery”) in a circular configuration as depicted in Figure 5-7. The center of the overlook would be a circular extension of the existing stone seat wall, which demarcates the edge of the existing paving. Concrete bollards (perhaps similar to those used in the portion of the Promenade constructed by the Ciudad de San Juan that runs from La Concepcion/Las Palomas to the Gate of San Juan) and low-level walkway lights would define the outside edge of the overlook.

Construction would require rearranging and adding to the existing rip-rap. Filling over the rip-rap with compacted sand and a well-graded aggregate would form the base course. Concrete would form the footings/edging and paving over the base. The overlook is a good location for a drinking fountain and signage to interpret the Water Battery, harbor development, and the Caribbean.

Option 3: Extension of the Promenade from the Water Battery to El Morro

This option calls for extending the Promenade following a route generally parallel with the shoreline from the Water Battery Overlook (Option 2) to the east along the base of the fort and connecting to an existing stairway built into the wall of El Morro. From the Water Battery Overlook, the Promenade would rise at a gradient of no more than 5 percent for approximately 300 feet, at which point a walkway would switch back towards the stairway to access the upper levels of El Morro. The switch-back section would make up the remaining approximately 25 feet of elevation difference between the Water Battery Overlook and the existing stairway to El Morro. The walkway would be lighted to provide safe night-time use.

Construction of this portion of the Promenade would involve, where possible, tying into the stone- and Gunite-reinforced wall of El Morro. The walkway would be built on a base of stone, a well-graded aggregate base course as well as a sand base. Clean fill would be required in places, as well as rip-rap to provide protection on the water side of the walkway.

Option 4: Extension of the Promenade from El Morro to San Juan Cemetery

This option calls for extending the Promenade from the switch-back point in Option 3 so that it runs easterly along the base of El Morro, past the San Juan Cemetery, at an elevation just above the beach and parallel with the northern shoreline. At the eastern edge of the cemetery (outside the cemetery wall), a stairway would connect the Promenade and San Juan Boulevard above in the community of La Perla. This area between the cemetery and the La Perla community has undergone considerable recent slope erosion. If no armoring or other protective treatment occurs in this area, continued erosion threatens to undercut the roadway and the cemetery. The stairway construction would incorporate retaining walls that protect against erosion as well as support the stairway. This location provides a good opportunity for introducing wayside exhibits with information on the history of the cemetery, interesting and famous people buried there, and points of interest within the cemetery. A wayside exhibit could also be devoted to information pertaining to La Perla.

Option 5: Extension of the Promenade from La Perla Community to Devil's Sentry

Option 5 calls for the Promenade to continue east from the stairway described in Option 4 and connect to Calle San Miguel. At this point, the Promenade would run on the sidewalk and street paving of Calle San Miguel through La Perla. Continuing east of La Perla, the walkway would parallel the shoreline, slowly gaining elevation and connecting to the existing path leading to the Devil's Sentry.

Signage or pavement markings would be required to delineate the Promenade as it runs along Calle San Miguel. Beyond this street, the walkway would be built on a sandy stretch of beach. Structural fill would be required to provide a firm foundation for the pavement. Rip-rap along the north side would protect the walkway from the erosive action of the ocean. Re-vegetation of the landside of walkway would help stabilize the shoreline topography and blend with the hillside vegetation. The Promenade east of the beach area would gain elevation en route to the Devil's Sentry. The alignment would follow along the existing earthen path that leads to the Devil's Sentry. A wayside exhibit near Devil's Sentry could include mapping, history, and significance of the structure.

Option 6: Extension of the Promenade from Devil's Sentry to La Princesa

The Promenade in Option 6 would continue from Devil's Sentry and extend to the base of La Princesa, a massive stone battery located at the eastern end of San Cristóbal. From the Option 5 Promenade alignment, the walkway would lead down to the base of Devil's Sentry, cutting across the existing rip-rap slope and connecting to the narrow existing concrete walkway along the water's edge at the base of Devil's Sentry. The connection to Option 5 alignment would occur approximately 150 feet west of

Devil's Sentry and begins to drop down toward the water. From Devil's Sentry, it would follow the shoreline, slowly gaining elevation up to the base of La Princesa.

The shoreline from the base of Devil's Sentry to the base of La Princesa is extremely rugged. It is composed of long sections of weather-beaten native stone and sections of narrow concrete walkway constructed at the base of the stone masonry fort walls. Construction of the Promenade in Option 6 would be more difficult and costly to build because of the rugged terrain and other technical challenges. In the areas of native rock outcrops and the existing concrete walkway, drilling holes, installing steel reinforcing bars, and grouting would be necessary to form part of the walkway's foundation. Additionally, the walkway would need to gain approximately 20 feet in elevation to reach the base level of La Princesa. As the Promenade begins to rise, adding a protective handrail on the ocean side may be necessary because the drop to the water is so severe.

Option 7: Extension of the Promenade from La Princesa to the Capitol Plaza

Option 7 calls for the Promenade extension to a termination point near the Puerto Rico Capitol. From La Princesa running easterly, the walkway alignment would drop to just above the shoreline elevation and continue along the shoreline to a point below the pedestrian plaza across the street from the Capitol. A lighted stairway would connect the Promenade to the plaza following the alignment of an existing, well-worn, dirt path. The shore in this area is a combination of sandy beach, native rock outcrops, and rip-rap. The termination of the Promenade would be an excellent location for a number of wayside exhibits describing the Promenade, the Capitol, the sea, natural forces along the coastline, or other pertinent themes.

5.3.1.2 Restoration Objectives

The choice of walkway configuration and connections to surrounding points of interest is based on providing visitor experiences that focus on interpreting the resources of San Juan National Historic Site (such as El Morro, San Sebastian, the Devil's Sentry, San Cristóbal, Santa Teresa, El Abanico, and La Princesa), points of interest of Old San Juan (such as the San Juan Cemetery and the Capitol building), and neighborhoods (such as La Perla) within the vicinity of the Promenade.

Completing any or all of the Promenade options would enhance visitor access to currently inaccessible natural areas where the historic structures and architectural features of the San Juan National Historic Site meet the adjacent coastal resources. Enhanced access here would promote greater visitor appreciation of the forts, the city walls, their historic settings, and the natural resources along the shoreline. The

improved access and enhanced visitor experiences provided by the projects would compensate for the lost and impaired use of these same resources during the spill incident and spill response period. The restoration alternatives would meet the restoration objectives of providing replacement services of comparable type, quality, and value to those lost, and address the injuries to the historic site and lost visitor use.

5.3.1.3 Scaling Approach

The Trustees determined that a reduction in historic appreciation services occurred for a period of approximately six weeks following the oil spill, during which more than 123,000 people who visited El Morro and San Cristóbal were impacted. NPS also ascertained that some individuals may have canceled their visits to the Park altogether. For this incident, the Trustees were unable to identify feasible restoration alternatives that would compensate for the partial lost value of visits to the San Juan National Historic Site resulting from diminished water and air quality, beyond what the oil spill response actions and natural recovery processes have done to remove significant sources of oil and oil vapors from the San Juan National Historic Site and adjacent natural resources. Therefore, in the Trustees' judgment, only the interim loss of visitors' use and enjoyment of the San Juan National Historic Site requires restoration. The Promenade Extension would provide replacement services of comparable type and quality, and of comparable value, to those lost during the time of the spill and the post-spill response actions. This compensatory restoration project would provide improved and safer access of comparable value for future visitors to this shoreline area of the San Juan National Historic Site, where significant cultural and natural resources are located that were directly impacted by the spill.

5.3.1.4 Success Criteria and Monitoring

No monitoring is included in this project alternative. Routine management activities carried out by NPS will be sufficient to document visitor use and appreciation, and functionality of the project elements.

5.3.1.5 Cost and Timeframe

Estimated costs proposed for the project options described above are shown in Table 5-6. The estimates include construction costs plus 17 percent for design, 8 percent for construction management, and 10 percent for construction contingency. Settlement funds in the amount of \$1,493,604 were received for NPS restoration projects at the San Juan National Historic Site. Available funds for the Resource Category of "Lost and Diminished Human Use of the San Juan National Historic site" are not sufficient to implement all options of this proposed alternative; therefore, the Trustees are proposing to use settlement funds to implement the first three options (Options 1–3). Any remaining settlement funds for this

Resource Category will be applied to the second and third priority proposed alternatives: Restoration of the El Morro Water Battery and Restoration of El Morro’s Exterior Walls, respectively. However, the National Park Service is actively seeking additional funding from other sources to eventually fully fund this alternative including Options 4-7.

Estimates of the time to complete each option are represented in Table 5-7. Schedules for implementing Options 1 through 3 are independent of each other, while those for Options 4 through 7 would be sequential. Thus, the completion times estimated for options 4 through 7 reflect the time to complete each option as well as the time to complete any prerequisite options. More detailed construction schedules for each option would be developed along with affiliated engineering and design packages. Options 4 through 7 would not be constructed using settlement funds from this spill.

**TABLE 5-6
TOTAL COST FOR INTERPRETIVE IMPROVEMENTS TO AND
EXTENSION OF COASTAL PROMENADE**

OPTION	COST
Option 1: Non-Slip Surface Treatment	\$196,594
Option 2: Water Battery Overlook	\$205,318
Option 3: Promenade Extension from the Water Battery Overlook to El Morro	\$974,142
Option 4: Promenade Extension from El Morro to San Juan Cemetery	\$2,274,800
Option 5: Promenade Extension from La Perla to Devil’s Sentry	\$3,567,957
Option 6: Promenade Extension from Devil’s Sentry to La Princesa	\$1,889,056
Option 7: Promenade Extension from La Princesa to the Capitol Plaza	\$1,363,666
Total Cost	\$10,471,533

**TABLE 5-7
PHASE II EL MORRO PROMENADE PROJECT COMPLETION TIME ESTIMATES**

PROJECT OPTION	ESTIMATED COMPLETION TIME (MONTHS)
Option 1: Non-slip Surface Treatment	2
Option 2: Floating Battery Overlook	3
Option 3: Floating Battery to El Morro	10
Option 4: El Morro to San Juan Cemetery	15 (includes Options 3 & 4) ^a
Option 5: La Perla to Devil’s Sentry	25 (includes Options 3, 4, 5) ^a
Option 6: Devil’s Sentry to La Princesa	36 (includes Options 3, 4, 5, 6) ^a
Option 7: La Princesa to Capitol Plaza	48 (includes Options 3, 4, 5, 6, 7) ^a

Note: ^a Time for completion of the associated option and all prerequisite options.

5.3.1.6 Environmental Consequences (Coastal Promenade Project Phase II Options 1, 2, and 3)

Nature of likely impacts from Coastal Promenade Project

Another project located along the same area as the coastal promenade restoration project has undergone a previous environmental assessment (Army Corps 1979). That information was reviewed and used in part to produce the following analysis. The Promenade project options would enhance and extend an existing trail around El Morro, the Old San Juan Historic Wall, and the San Juan Islet. Completion of this project would improve visitor safety and reduce impacts on surrounding natural and historic resources by directing visitor traffic into desired areas. Disturbance of wildlife and impacts on sensitive plants by construction and increased visitation are possible, but would be minimized by careful planning and design.

No significant impacts on natural resources are expected from construction and installation of the proposed trail enhancements. Minor, short-term impacts typically associated with construction activities (noise, dust, etc.) are expected during project implementation. However, these impacts would be minimized by adhering to standard construction practices for erosion and sediment control, waste disposal, and site cleanup. While this area would be inaccessible to visitors during construction, other visitor facilities would remain open. No adverse impacts on cultural or historic resources would result from implementation of the proposed enhancements. Likewise, no negative impacts on threatened or endangered species are anticipated.

Effects on public health and safety

The Trustees know of no likely adverse impacts of the coastal promenade restoration projects on public health or safety. These projects would improve visitor safety and enhance access.

Unique characteristics of the geographic area

The coastal promenade restoration project would traverse the Old San Juan Historic Wall and provide access to the Old San Juan National Historic Site's junction with the ocean and shoreline areas. The water battery and external fort walls are part of the fortifications of El Morro and are located at the interface between the fort architecture and shoreline natural resources. The shoreline, coastal, and oceanic resources themselves are not unique biologically. Visitor appreciation of the historic sites will increase as a result of the restoration projects.

Controversial aspects of the project or its effects

The Trustees know of no controversial aspects of the proposed restoration projects or their likely impacts on the environment.

Uncertain effects or unknown risks

The Trustees know of no highly uncertain effects or unknown risks to the environment from implementation of the proposed coastal promenade restoration projects. Walkway construction is a well-established, well-regulated activity, based on past experience from the Phase I project, which can guide implementation in this instance.

Precedential effects of implementing the project

The Trustees know of no precedent that would be set by implementing the proposed projects which would lead to future projects that significantly impact the quality of the human environment.

Possible significant, cumulative impacts

The Trustees know of no impacts on the environment to which the proposed restoration projects would collectively contribute that, cumulatively, would constitute a significant impact on the quality of the human environment.

Effects on National Historic Sites or nationally significant cultural, scientific or historic resources

The grounding and oil spill directly and indirectly affected shorelines in and adjacent to units of the San Juan National Historic Site, and decreased visitor enjoyment of those resources. The proposed projects are intended to compensate for interim lost human use and enjoyment of the San Juan National Historic Site, as well as the adjacent marine environment. Projects such as restoration of the floating battery and the cleaning and stabilization of exterior walls of El Morro would make visitor use and enjoyment of these structures more certain. Design for restoration and wall cleaning and stabilization should be in compliance with The Secretary of the Interior's Standards for the Treatment of Historic Properties 1995 (http://www.cr.nps.gov/local-law/arch_stnds_8_2.htm). The projects will be consistent with the Programmatic Agreement entered into by the NPS, SHPO, and the Advisory Council on Historic Preservation (ACHP), Puerto Rico Department of Transportation and Public Works and two local preservation organizations in July 2004. This agreement presented a plan for addressing the appropriate treatment of the defensive walls that was protective and resulted in minimal visual impacts. Areas where the project will result in new ground-disturbing effects will undergo a cultural resources survey in advance of project implementation to determine whether previously unidentified cultural resources that may qualify as historic properties are present within the project area. If historic properties are identified,

NPS will attempt to avoid these resources or develop, in consultation with SHPO, an appropriate treatment plan to address project impacts. The treatment plan would be incorporated into a Memorandum of Agreement for the project and provided to SHPO and other interested parties for their concurrence

Effects on endangered or threatened species

The restoration projects are not expected to adversely affect threatened or endangered botanical or zoological species, but this would be verified through consultations with the U.S. Fish and Wildlife Service and NOAA Fisheries concerning the Endangered Species Act.

Violation of environmental protection laws

The restoration project does not require, nor do the Trustees anticipate, incidental violation of Federal, Commonwealth, or local laws designed to protect the environment. The restoration project can be implemented in compliance with all applicable environmental laws and regulations.

Preliminary conclusion

The Trustees conclude that implementation of the coastal promenade projects, specifically Phase II Options 1, 2, and 3, will not have any significant impacts on the quality of the human environment.

5.3.2 Restoration of El Morro Water (or Floating) Battery (Proposed Preferred)

5.3.2.1 Project Description and Background

The Restoration of Fort El Morro Water (or Floating) Battery restoration project, which was identified by the Trustees as the second priority at the historic site, would stabilize and preserve the historic interior and exterior surfaces of the Water Battery area and the adjacent exterior walls that face the shoreline ecosystem and recreational trails. The Water Battery, sometimes called the Floating Battery, is located along the natural shoreline of San Juan Bay at the northwest corner of El Morro (Figure 5-5).

The project would correct existing unsafe conditions resulting from deterioration of structures over hundreds of years because of the tropical climate and wind and wave erosion. To perform the restoration, preservation teams on scaffolds would use low-pressure washing systems to clean the walls of vegetation and soil. Patches of inappropriate materials would be removed, cracks filled, and stucco replaced in-kind. The stairways would be repaired to allow access to portions of the battery now inaccessible to visitors. All restoration would follow recommendations of the historic site's General Management Plan and Historic Structures Report.

5.3.2.2 Restoration Objectives

At the Floating Battery, NPS can interpret cultural and historic resources, and provide visitor access to the natural shorelines and recreational trails of the site. Although access to this area is now limited, the Water Battery still attracts thousands of visitors a year. Restoring the battery would repair historic resources that have been deteriorating for decades and allow safe visitor access to areas currently closed. Access to the Water Battery area would not only help visitors understand the strategic relationship between the historic site's defensive systems and the natural environment, but also provide an area to interpret the shoreline ecosystem.

5.3.2.3 Scaling Approach

The Trustees determined that historic appreciation services were reduced for a period of approximately six weeks following the oil spill, during which more than 123,000 people who visited El Morro and San Cristóbal were impacted. NPS also ascertained that some individuals may have canceled their visits to the Park altogether. For this incident, the Trustees were unable to identify feasible restoration alternatives that would compensate for the partial lost value of visits to the San Juan National Historic Site resulting from diminished water and air quality, beyond what the oil spill response actions and natural recovery processes have done to remove significant sources of oil and oil vapors from the San Juan National Historic Site and adjacent natural resources. In the Trustees' judgment, only the interim loss of visitors' use and enjoyment of the San Juan National Historic Site requires restoration. Restoring portions of the walls of the Water Battery would provide replacement services of comparable type and quality, and of comparable value, to those lost during the time of the spill and the post-spill response actions. This compensatory restoration project would improve access to a portion of the historic fort directly impacted by the spill, where now access to significant cultural and natural resources is limited.

5.3.2.4 Success Criteria and Monitoring

No monitoring is included in this project alternative. Routine management activities carried out by NPS will be sufficient to document visitor use and appreciation, and effectiveness of stabilization and preservation actions.

5.3.2.5 Cost and Timeframe

San Juan National Historic Site in-house staff would restore approximately 5,000 square feet of the exterior wall of the Water Battery at an estimated cost of \$140,000. Project costs are shown in Table 5-8.

**TABLE 5-8
TOTAL COST TO RESTORE FORT MORRO WATER BATTERY**

CATEGORY	COST
Restoration of El Morro Water Battery	\$140,000
Total Cost	\$140,000

The time estimated to complete restoration of the El Morro Water Battery is four months. Lead time for commencing implementation would be minimal because extensive designs or plans are not required.

5.3.2.6 Environmental Consequences

The general environmental consequences described in Section 5.3.1.6 are applicable to the Water Battery project as well. Likely impacts are described briefly below.

Nature of Likely Impacts from the Floating Battery Project

Completion of this restoration project would improve visitor safety and increase visitor access to currently inaccessible areas. After construction, disturbance of natural areas by additional visitors would be minimal. No significant impacts on either natural resources or cultural resources from the restoration work are expected, although minor, short-term impacts associated with cleaning and repair (e.g., noise) are expected during project implementation. Impacts would be limited by adhering to best management practices. While the area of the project may be less accessible to visitors during implementation, other areas would be available for visitation, and the duration of the project would be limited. The project would, in fact, enhance and preserve important historic resources, while resulting in greater visitor access to shoreline resources. Moreover, while the waters near El Morro provide habitat for some threatened and endangered species, this project would not significantly affect that habitat; therefore, no negative impacts on threatened or endangered species are anticipated. Nonetheless, Endangered Species Act consultations with the U.S. Fish and Wildlife Service and NOAA Fisheries would address possible impacts.

Reconstruction activities of this historic property will be designed to be consistent with in-place Programmatic Agreements that specify restoration techniques that are protective, visually unobtrusive, and in harmony with the style and structural characteristics of Fort El Morro. The design for restoration and stabilization will comply with The Secretary of the Interior's Standards for the Treatment of Historic Properties 1995 (http://www.cr.nps.gov/local-law/arch_stnds_8_2.htm) and be consistent with the Programmatic Agreement mentioned in Section 5.3.1.6. Public interpretive signs will indicate those sections of the resource that are original construction and those that have been restored. Increased access

to Fort El Morro by the public as afforded by the compensatory restoration project could, in the long-term, result in greater deterioration of the resource. NPS may implement a monitoring plan designed to measure possible future deterioration or the results of over-use by the public so that a redirection of public traffic may take place periodically if necessary to prevent impacts to the resource. Areas where the project will result in new ground-disturbing effects will undergo cultural resources surveys as described in Section 5.3.1.

5.3.3 Clean and Stabilize Exterior Walls of Historic Sites (Proposed Preferred)

5.3.3.1 Project Description and Background

Clean and Stabilize Exterior Walls of Historic Sites restoration project, identified by the Trustees as the third priority, includes cleaning, stabilizing, and restoring approximately 25,000 square feet of the exterior wall of El Morro adjacent to the Water Battery. The exterior walls of El Morro proposed for restoration are the west-facing walls located at the northwest corner of El Morro, adjacent to and just south of the Water Battery, sometimes called the “Floating Battery” (Figure 5-5).

Cleaning would proceed using a mild, water-soluble solution applied with a low-pressure sprayer to remove environmental staining, vegetation, and biological growth such as fungi and seagrapes. Inappropriate patching material would be removed, cracks repaired, and deteriorated brickwork replaced. Deteriorated historic brickwork and masonry mortar would be replaced in-kind using a historic lime-based mortar.

5.3.3.2 Restoration Objectives

Biological growth and saltwater intrusion through exposed masonry threaten the long-term stability of the historic sites. By removing these threats, this restoration project would restore the historic walls and provide the public continued use and enjoyment of the structures into the future.

5.3.3.3 Scaling Approach

The Trustees determined that a reduction in historic appreciation services occurred for a period of approximately six weeks following the oil spill, during which more than 123,000 people who visited El Morro and San Cristóbal were impacted. NPS also ascertained that some individuals may have canceled their visits to the Park altogether. For this incident, the Trustees were unable to identify feasible restoration alternatives that would compensate for the partial lost value of visits to the San Juan National Historic Site resulting from diminished water and air quality, beyond what the oil spill response actions

and natural recovery processes have done to remove significant sources of oil and oil vapors from the San Juan National Historic Site and adjacent natural resources. In the Trustees' judgment, only the interim loss of visitors' use and enjoyment of the San Juan National Historic Site requires restoration. Restoring portions of the walls of El Morro would provide replacement services of comparable type and quality, and of comparable value, to those lost during the time of the spill and the post-spill response actions. This compensatory restoration project would improve the long-term visitor appreciation for a portion of the historic fort directly impacted by the effects of the spill, thereby assuring future visitors are afforded a view of walls more representative of historic conditions.

5.3.3.4 Success Criteria and Monitoring

No monitoring is included in this restoration project. Routine management activities carried out by NPS will be sufficient to document visitor use and appreciation, and effectiveness of the cleaning and stabilization.

5.3.3.5 Cost and Timeframe

San Juan National Historic Site in-house staff would repair approximately 25,000 square feet of exterior wall at a cost estimated at \$350,000. Project costs are shown in Table 5-9.

**TABLE 5-9
TOTAL COST TO CLEAN AND STABILIZE EXTERIOR WALLS OF HISTORIC SITES**

CATEGORY	COST
Clean and Stabilize Exterior Walls of Historic Sites	\$350,000
Total Cost	\$350,000

The estimated time to complete the restoration project to clean and stabilize the exterior walls of the historic sites is six months. Lead time for commencing implementation would be minimal because extensive designs or plans are not required.

5.3.3.6 Environmental Consequences

The general environmental consequences described in Section 5.3.1.6 are applicable to the El Morro Wall Cleaning project as well. Likely impacts are described briefly below.

Nature of Likely Impacts from the El Morro Wall Cleaning and Stabilization Project

Completion of this restoration project would improve visitor appreciation of the external walls of El

Morro. No significant impacts on either natural resources or cultural resources from the restoration work are expected, although minor, short-term impacts associated with cleaning and repair (e.g., noise) are expected during project implementation. Impacts would be limited by adhering to best management practices. While the area of the project may be less accessible to visitors during implementation, other areas would be available for visitation and the duration of the project would be limited. The project would, in fact, enhance and preserve important historic resources, while resulting in greater visitor appreciation of the part of El Morro closest to shoreline resources. Moreover, while the waters near El Morro provide habitat for some threatened and endangered species, this project would not significantly affect that habitat; therefore, no negative impacts on threatened or endangered species are anticipated. Nonetheless, Endangered Species Act consultations with the U.S. Fish and Wildlife Service and NOAA Fisheries would address possible impacts.

Effects on Historic Properties

Design for restoration, wall cleaning and stabilization will comply with The Secretary of the Interior's Standards for the Treatment of Historic Properties 1995 (http://www.cr.nps.gov/local-law/arch_stnds_8_2.htm) and be consistent with the Programmatic Agreement described in Section 5.3.1. Concerns described in Sections 5.3.1.6 and 5.3.2.6 apply equally to the cleaning and stabilizing project.

5.4 SUMMARY OF PROPOSED PREFERRED ALTERNATIVES

5.4.1 Preferred Reef Restoration Alternatives

Alternatives selected as preferred for the lost reef services included Modular Reef Habitat Construction, Acquisition of Equivalent Lost Services, and Seagrass Restoration. Decision-making for selection of the preferred restoration alternatives for lost reef services was based on the results of the final Habitat Suitability Analysis report prepared by Marine Resources, Inc. (MRI) on behalf of the Trustees in August 2005.

The Habitat Suitability Analysis report indicates that a project allowing replacement of shallow water hard-bottom habitat, especially if combined with a seagrass or mangrove habitat project (or both), represents the best compensatory habitat choice to replace the lost ecological services provided by the injured eolianite reef.

5.4.1.1 Funding Allocation

The Trustees did not identify a specific percentage of settlement funds to dedicate to the preferred Modular Reef Habitat Construction or Acquisition of Equivalent Lost Services; however, recognizing the

premium costs of acquiring coastal mangrove habitat, the Trustees anticipate using most reef restoration settlement funds for habitat acquisition. The remaining balance of settlement funds would be used for one or more shallow hard-bottom restoration and the seagrass project. The Trustees are particularly interested to receive public input on how much of the settlement funds should be directed to each aspect of the preferred restoration alternatives (shallow hard-bottom project, mangrove acquisition, and seagrass restoration).

5.4.1.2 Modular Reef Habitat Construction (Shallow Hard Bottom Project)

The Trustees recognize that a shallow hard-bottom replacement project could take any number of forms. The Habitat Suitability Analysis report specifically identifies artificial reefs constructed to mimic natural hard-bottom habitats as the intended recommended project to meet the ecological service replacement objectives. The Trustees will consider this Habitat Suitability Analysis recommendation as well as others, such as evaluating the proximity of reef placement sites to seagrass habitat in order to maximize the habitat service potential of the project.

While the Habitat Suitability Analysis recommendations are well-founded in published literature and a detailed analysis, the Trustees will remain open to alternative project concepts that meet the shallow hard-bottom project objectives. For instance, the Trustees are aware of a stand of elkhorn coral (*Acropora palmata*) near the grounding site at Punta Escambron that might benefit from a restoration project. Though not contemplated in the Habitat Suitability Analysis, restoring a stand of elkhorn coral might build upon recent restoration research not previously considered by the Trustees, and this might still meet restoration objectives. So while the Trustees have specific recommendations upon which they have based their preferred restoration alternatives, other shallow hard-bottom project ideas are welcomed as part of the public participation process.

The scale of a shallow hard-bottom project would be directly related to the cost of the restoration technique, because a more costly technique would correspondingly decrease the area treated by the restoration project.

5.4.1.3 Acquisition of Equivalent Lost Services

Mangrove habitat acquisition was identified as the major component of the preferred restoration alternative for reef injuries for many reasons. Coastal mangrove habitat is becoming scarcer due to development. Lands under government management or lands protected from development through conservation easements may be currently available for restoration, but private lands not under such

protections are likely to be forever unavailable for acquisition or restoration once developed. The opportunity to restore mangrove habitat assumes land is available for conservation. The Trustees would prefer to protect a parcel of land under threat of development and preserve the ecological services currently provided by that habitat than to undertake a smaller, but just as expensive, restoration project to replace the lost habitat services.

Careful selection of an acquisition parcel also may result in preserving habitat services of other sensitive habitats such as seagrass. For instance, if seagrass habitat is close to mangroves, some of the acquisition protection will extend to the adjacent seagrass habitats. In this manner, the existing seagrass habitat services would be protected from development as would be the mangroves. Likewise, the secondary effects of development, such as increased motor vessel traffic, demand for docks and boat slips, and dredging for vessel access, would be eliminated as threats. While an acquisition strategy does not yield a net increase in habitat services, it does preserve and protect the existing habitat services from loss due to development. As future restoration funding opportunities emerge, additional enhancements may be made on any acquired parcels.

Other habitats in addition to mangrove habitat will be considered when evaluating potential acquisitions. For example, beach and dune habitat, important to sea turtle nesting, may be considered in identifying properties for acquisition.

5.4.1.4 Seagrass Restoration

Seagrass restoration is selected as a preferred alternative for compensating the public for the loss of reef resources and services. Seagrass restoration, like mangrove restoration, was identified through the Habitat Suitability Analysis as a complementary restoration alternative to a shallow water reef project. While opportunities to restore discrete areas of seagrass habitat, particularly large-scale areas, are rare and can be extremely costly without funding partnerships, the Trustees did identify a single feasible seagrass project that is both large-scale and cost-effective. In this restoration project, dredged material from the San Juan Bay shipping channel would be used to fill in a large dredge hole in the Condado Lagoon. The Condado Lagoon was impacted by the *T/B Morris J. Berman* oil spill. In the judgment of the Trustees, the opportunity to leverage a large amount of Federal funds with a relatively small contribution of settlement dollars would be a sound investment in the restoration of 32 acres of seagrass habitat within the Condado Lagoon. Additionally, filling a large dredge hole, regardless of its location, will likely have other benefits such as eliminating poor water quality conditions, such as low dissolved oxygen, associated with the dredge hole.

5.4.2 Preferred Recreational Beach Use Restoration Alternatives

The beach use compensatory restoration project consists of purchasing property currently in a natural state, with no additional habitat creation or rehabilitation work planned.

5.4.3 Preferred San Juan Historic Site Resources Restoration Alternatives

The grounding and oil spill directly and indirectly affected shorelines in and adjacent to units of the San Juan National Historic Site, and the incident decreased visitor enjoyment of those resources. The proposed restoration projects are intended to compensate for interim lost human use and enjoyment of the San Juan National Historic Site and the adjacent marine environment during and following the incident. The Coastal Promenade Project, specifically Phase II Options 1, 2, and 3, will provide new and unique exterior views of the historic area, affording an appreciation of how the structures as a whole appear on the coastal horizon, thus providing a sense of the military significance of the San Juan National Historic Site. Restoration of the El Morro Water Battery will also make visitor use and enjoyment more certain and correct decades of deterioration. Cleaning and Stabilizing Exterior Walls of the Historic Sites will improve long-term visitor appreciation and ensure that visitors are afforded a view of walls that are more representative of historical conditions.

6.0 COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

In addition to OPA, implementation of the Trustees' preferred restoration alternatives is subject to the requirements of laws and regulations relating to environmental protection and the safe use of waterways, among other restrictions. This section discusses specific requirements and prohibitions of several laws likely applicable to the proposed projects, as well as procedures that Trustees are required to follow in complying with these laws.

Some laws, such as the NEPA and the Coastal Zone Management Act (CZMA), require that the Trustees certify to appropriate regulatory agencies, prior to reaching a final decision to implement the projects, that the projects will not violate the law in question. For these laws, the Trustees will forward this Draft RP/EA to the relevant oversight agency for evaluation. Any comments, questions, or requirements for project implementation identified by these agencies will be incorporated into the Final RP/EA.

Requirements for compliance with other laws, such as the Clean Water Act, can only be determined at the time that the Trustees apply for a restoration construction permit with the applicable regulatory agency. However, the general policies and prohibitions of these laws are described in following sections.

6.1 NATIONAL ENVIRONMENTAL POLICY ACT AND PRELIMINARY FINDING OF NO SIGNIFICANT IMPACT

6.1.1 Requirements of NEPA

Pursuant to the National Environmental Policy Act (NEPA), 42 U.S.C. § 4371, *et seq.*, and the implementing regulations at 40 C.F.R. Part 1500, Federal agencies contemplating implementation of a major Federal action must produce an environmental impact statement (EIS) if the action is expected to have significant impacts on the quality of the human environment. Federal agencies may conduct an environmental assessment (EA) to evaluate the need for an EIS. If the EA determines that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), and thus satisfies the requirements of NEPA.

NEPA defines the human environment comprehensively to include the “natural and physical environment and the relationship of people with that environment” (40 C.F.R. § 1508.14). All reasonably foreseeable direct and indirect effects of implementing the project, including beneficial effects, must be evaluated by the Federal agency (40 C.F.R. § 1508.8).

Section 1508.27 of the NEPA regulations describes the minimum factors that federal agencies should consider in evaluating the potential significance of proposed actions. The regulations explain that significance embodies considerations of both context and intensity. In the case of site-specific actions such as those proposed in this Draft RP/EA, the appropriate context for considering potential significance of the action is local, as opposed to national or worldwide. However, the national significance of the historic structures affected by the spill also warrants consideration in evaluating those restoration alternatives and their potential consequences.

With respect to intensity of the impacts of the proposed action, the NEPA regulations suggest consideration of 10 factors:

- Likely impacts of the proposed projects.
- Likely effects of the projects on public health and safety.
- Unique characteristics of the geographic area in which the projects are to be implemented.
- Controversial aspects of the project or its likely effects.
- Degree to which possible effects of implementing the project are highly uncertain or involve unknown risks.

- Precedential effect of the project on future actions that may significantly affect the human environment.
- Possible significance of cumulative impacts from implementing this and other similar projects.
- Effects of the project on National Historic Places, or likely impacts on significant cultural, scientific, or historic resources.
- Degree to which the project may adversely affect endangered or threatened species or their critical habitat.
- Likely violations of environmental protection laws.

These factors, and the Federal Trustees' preliminary conclusions concerning the likely significance of impacts of the proposed projects, are discussed in Section 5.0 with respect to each proposed project identified as "preferred."

6.1.2 Preliminary Finding of No Significant Impact on the Quality of the Human Environment

Based upon the information and analysis in this Draft RP/EA, the Trustees have reached a preliminary determination that implementing the preferred restoration projects (with the exception of Options 4 through 7 of the Coastal Promenade Project at San Juan National Historic Site) would not have any significant adverse impacts on the environment. Funding needed to implement Options 4-7 is currently not available; however, if funding should become available, a separate NEPA analysis by NPS would be required.

6.2 COASTAL ZONE MANAGEMENT ACT

The broad purpose of the CZMA (16 U.S.C. § 1451, *et seq.*), administered by NOAA, is to preserve, protect, develop, and, where possible, restore or enhance the resources of the Nation's coastal zone for this and succeeding generations. Puerto Rico's Final Coastal Management Program Plan was approved by NOAA in 1978. The Plan identifies permissible land and water uses, and their associated impacts on the regulated coastal zone.

Activities implemented by Federal agencies must comply with the Commonwealth's Coastal Zone Management Program and in particular with "enforceable policies" identified in the Commonwealth's plan. Generally, final Federal approval cannot come sooner than 90 days following certification by the Commonwealth of compliance with its plan.

The Puerto Rico Planning Board of the DNER is the agency designated to monitor compliance of activities in the coastal zone with requirements of Puerto Rico's Final Coastal Management Program Plan. DNER has advised the Federal Trustees that consistency determinations are not considered for review by the Planning Board prior to the permit application stage. At that time, in making the consistency determination required for the proposed restoration projects, NOAA and DOI will first analyze whether the projects qualify for any specific exclusions from requirements of Puerto Rico's Program.

If any of the proposed projects are not specifically excluded from the requirements of Puerto Rico's Program, NOAA and DOI must determine whether the projects may affect the coastal zone by analyzing which, if any, of the projects are subject to the Program's enforceable policies. The general enforceable policies of Puerto Rico's Coastal Zone Program include the following:

- The policies of the Islandwide Land Use Plan.
- The policy on special protection for mangrove wetlands.
- The policy on appropriate access to federal beaches.
- The policy on public access to beaches.
- Criteria for diking, filling, dredging, and depositing dredged sediments.
- The policy on sites for coastal-dependent development.
- The water quality standards adopted by the Puerto Rico Environmental Quality Board.
- Any additional policies, regulations, and plans—including plans for Special Planning Areas and Natural Reserves that have been incorporated into the Program.

6.3 ENDANGERED SPECIES ACT

The purpose of the Endangered Species Act (ESA) (16 U.S.C. § 1531, *et seq.*) is to provide the means to conserve endangered and threatened species, and the ecosystems upon which such species depend. All Federal agencies are required to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of habitat designated as critical for such species, unless the agency is granted an exemption for the proposed action.

The United States Fish and Wildlife Service (USFWS) and NOAA Fisheries have been delegated primary authority to oversee federal compliance with the ESA. The Trustees will consult with endangered species specialists of the USFWS and NOAA Fisheries to determine whether the proposed restoration projects can be implemented in furtherance of the purposes of the ESA. Further assessment of the NPS projects under the ESA may be required. NPS and the USFWS have already been in contact regarding consultations.

6.4 FEDERAL WATER POLLUTION CONTROL ACT (CLEAN WATER ACT)

The Federal Water Pollution Control Act, which is also known as the Clean Water Act (CWA) (33 U.S.C. § 1251, *et seq.*) was established to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The Act set a goal of eliminating the discharge of pollutants into navigable waters, and in the interim of attaining water quality that provides for protection and propagation of fish, shellfish, and wildlife, as well as opportunities for water recreation. The CWA and its amendments comprise a complex set of programs and regulations for effecting the purpose of the Act, including, among other things, permitting programs for discharges from facilities and other "point sources," specific discharge limitations for certain identified pollutants or categories of pollutants, provision for qualitative and quantitative water quality standards to be set by the states for their water bodies, and regulation of dredge and fill operations.

The Act's definitions of "pollutant," "discharge," and "fill" are so broad as to make the Act applicable to placement of artificial reefs on the ocean bottom and to construction of breakwaters, and thus applicable to two of the Trustees' preferred restoration alternatives. The Army Corps' Nationwide Permit #32 allows the Trustees to implement restoration actions consistent with a final Restoration plan that would otherwise require an individual dredge and fill permit. The Trustees will coordinate with the local Army Corps of Engineers office to ensure that Nationwide Permit #32 is issued for applicable restoration projects.

6.5 OCEAN DUMPING—MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

Like Section 404 of the Clean Water Act, applicable sections of the Marine Protection, Research, and Sanctuaries Act (MPRSA) (33 U.S.C. § 1401, *et seq.*) prohibiting "unregulated dumping of material" into the ocean have been interpreted and applied broadly so as to apply to the Trustees' proposed reef creation project as well as the seagrass restoration alternative. Compliance with the provisions of this Act requires a permit from the U.S. Environmental Protection Agency; this permit may be issued upon determination

that the “dumping” will not unreasonably degrade or endanger human health or welfare, the marine environment, or economic potentialities. Criteria considered in issuing a permit include the need for the dumping, the effects on human health and welfare (per economic, aesthetic, and recreational values,); effects on fisheries resources, shorelines, and beaches, and persistence and permanence of effects of the dumping.

6.6 PORTS AND WATERWAYS SAFETY ACT

Provisions of the Ports and Waterways Safety Act (33 U.S.C. § 1221, *et seq.*), governing vessel operations and navigational requirements, will apply to certain aspects of the artificial reef creation project, given the need to deploy and anchor construction barges and other vessels to implement the project. The Trustees will consult with the Coast Guard concerning applicable requirements, such as notices to mariners and the need for any permits.

6.7 NATIONAL HISTORIC PRESERVATION ACT AND ARCHAEOLOGICAL RESOURCES PROTECTION ACT

The San Juan National Historic Site was created under the provisions of the National Historic Preservation Act (16 U.S.C. § 470, *et seq.*), and implementations of the proposed shoreline stabilization, coastal promenade, and water battery projects comply with the broad purposes of the Act to preserve and promote public use and appreciation of National Historic Places. The National Historic Preservation Act of 1966, as amended, establishes a program for the preservation of historic properties throughout the nation. Section 106 of the National Historic Preservation Act, 1966, as amended, requires Federal agencies to take into consideration the effects of their actions on historic properties, including archeological, architectural, and Traditional Cultural Properties. It also requires Federal agencies to consult with respective State Historic Preservation Officers (SHPO) and interested Native American Tribal Historic Preservation Officers about their proposed projects. When consensus cannot be reached, the Federal agency is directed to bring the Advisory Council on Historic Preservation into the consultation process. This Act established the National Register of Historic Places and defines the criteria for eligibility. The Trustees will comply with the Section 106 requirements and consult with the Advisory Council on Historic Preservation and the State Historic Preservation Officer.

The Archaeological Resources Protection Act of 1979 (16 U.S.C. § 470aa-mm) protects archaeological resources on public lands and Indian lands. The Act fosters increased cooperation and exchange of information among governmental authorities, the professional archaeological community, and private individuals having collections of archaeological resources and data which were obtained before the date

of the enactment of the Act. Individuals who seek to excavate or remove any archaeological resource located on public lands or Indian lands and to carry out activities associated with the excavation or removal must apply to the respective federal land manager for a permit for this activity. Civil penalties may be assessed against persons who violate prohibitions of a permit or the Act.

6.8 ABANDONED SHIPWRECK ACT OF 1987

The Abandoned Shipwreck Act of 1987 (43 U.S.C. § 2101-2106) establishes the title of States, the District of Columbia, Puerto Rico, Guam, the Virgin Islands, American Samoa, and the Northern Mariana Islands in certain abandoned shipwrecks. States and other territorial governments have management responsibilities for shipwrecks covered under the Act and are encouraged by the Federal government to create cultural programs focused on historic preservation and environmental protection. Shipwrecks located on Indian lands are the property of the Indian tribe owning such lands.

6.9 ACT FOR THE PROTECTION, CONSERVATION AND STUDY OF THE UNDERWATER ARCHAEOLOGICAL SITES AND RESOURCES

The Act for the Protection, Conservation and Study of the Underwater Archaeological sites and Resources (1987) gives Puerto Rico the responsibility of managing all underwater archaeological sites and resources in the inland and coastal waters under its jurisdiction as sites of public interest. The law creates the Council for the Conservation and Study of Underwater Archaeological Sites and Resources (Council), attached to the Institute of Puerto Rican Culture and is responsible for the protection and custody of underwater archaeological resources. The Council is also charged with promoting the search to locate, protect, guard and recommend the acquisition of underwater archaeological sites and resources of a scientific, educational and cultural value. The Council establishes, updates, and conserves a Register of Underwater Archaeological Sites and Resources declared to be of public interest and has the power to grant permits to conduct studies, explore, excavate, recover or salvage underwater archaeological sites. The Council is granted power to impose administrative fines for acts determined to be in contempt of this law. (The Department of State for The Commonwealth of Puerto Rico and LEXIS-NEXIS of Puerto Rico, Inc. (Puerto Rico/Lexis-Nexis). 2005). The Trustees will comply with this Act in implementing the proposed restoration projects.

6.10 MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT (MAGNUSON-STEVENSON ACT)

The Magnuson-Stevens Act (16 U.S.C. 1801 et seq.), as amended and reauthorized by the Sustainable Fisheries Act (Public Law 104-297), established a program to promote protection of essential fish habitat

(EFH) through review of projects conducted under Federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. The Magnuson-Stevens Act provides for the conservation and management of the Nation's fishery resources within the Exclusive Economic Zone (from the low-water line of every state and the Commonwealth seaward to 200 miles from that baseline). The resource management goal is to achieve and maintain the optimum yield from U.S. marine fisheries. The Act also established a program to promote the protection of essential fish habitat in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. The National Marine Fisheries Service (NOAA Fisheries) is consulted 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 essential fish habitat.

The areas in which the coral reef restoration is planned have been identified as essential fish habitat for species managed by the Caribbean Fishery Management Council and for highly migratory species managed by NOAA Fisheries under the Federally implemented Fishery Management Plan.

Species managed by the Caribbean Fishery Management Council, for which sand substrate is an element of essential fish habitat, include juvenile and adult stages of gray (*Lutjanus griseus*), schoolmaster (*L. apodus*), mutton (*L. analis*), and yellowtail (*Ocyurus chrysurus*) snappers; red hind (*Epinephelus guttatus*), coney (*E. fulvus*), and Nassau grouper (*E. striatus*); sand tilefish (*Malacanthus plumieri*); white grunt (*Haemulon plumieri*); spiny lobster (*Panulirus argus*); and queen conch (*Strombus gigas*).

Essential fish habitat has also been identified in the project area for highly migratory species of shark, such as nurse (*Ginglymostoma cirratum*), blacktip (*Carcharhinus limbatus*), Caribbean reef (*C. perez*), bull (*C. leucas*), sandbar (*C. plumbeus*), lemon (*Negaprion brevirostris*), and Caribbean sharpnose (*Rhizoprionodon porosus*) sharks.

These species utilize areas of hard-bottom reef, sand plain bottom, and open water column for feeding. The Trustees do not believe that the preferred restoration alternatives will have a net adverse impact on essential fish habitat as designated under the Act. Specifically, any of the reef restoration alternatives would be expected to have a positive effect in creating, restoring or conserving essential fish habitat. A determination of this finding will be made with NOAA Fisheries, and correspondence will be included in the administrative record.

6.11 OTHER COMMONWEALTH STATUTES AND REGULATIONS

The Trustees will ensure that the restoration planning and projects will comply with the following Commonwealth statutes and regulations:

- Law for the Protection, Conservation, and Management of Puerto Rico Coral Reefs (Law 147 of July 15, 1999)
- Wildlife Law of the Commonwealth of Puerto Rico (Law 241 of Aug. 15, 1999)
- Law for the Conservation and Study of Underwater Archaeological Sites and Resources (Law 10 of Aug. 7, 1987)
- Puerto Rico Environmental Public Policy Law (Law 416 of Sept. 22, 2004)
- Regulation for Threatened and Endangered Species in the Commonwealth of Puerto Rico (Reg. 6766 of Feb. 11, 2004)

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