FINAL

RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE 2002 M/V EVER REACH OIL SPILL CHARLESTON, SOUTH CAROLINA

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Prepared by:
South Carolina Department of Natural Resources
South Carolina Department of Health and Environmental Control
National Oceanic and Atmospheric Administration
and
United States Fish and Wildlife Service
acting on behalf of the
United States Department of the Interior

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APPENDICES:

A - Notice of Intent to Conduct Restoration Planning, *The Post and Courier, 11/25/03*.

B - *Final Modeling of Physical Fates and Biological Injuries Report*, Executive Summary, 2006.

C - *Final Report on Restoration Scaling for Bird Injuries*, November 13, 2006.

D- Copy of signed FONSI Determination and USFWS Concurrence Letter

1.0 INTRODUCTION

This Final Restoration Plan and Environmental Assessment (Final RP/EA) has been developed by the South Carolina Department of Natural Resources (SCDNR), the South Carolina Department of Health and Environmental Control (SCDHEC), the National Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce, and the United States Fish and Wildlife Service (USFWS), acting for the United States Department of the Interior (collectively, "the Trustees") to address the injury to, loss of, destruction of, and lost use of natural resources resulting from the accidental discharge of oil from the M/V EVERREACH in the vicinity of Charleston, South Carolina on or about September 30, 2002 (hereafter, the "oil spill" or the "Spill"). This document summarizes the Trustees' assessment of the natural resource injuries caused by the spill (both ecological and recreational services losses) and describes the restoration actions that the Trustees have selected for use to compensate for the assessed ecological injuries. The purpose of restoration under this plan is to make the public whole by providing for restoration or replacement of resources and services that will compensate for the interim ecological resource and service losses attributable to the Spill.

The monetary value of the recreational services has been assessed but restoration planning for those losses is more appropriately undertaken after recovery of those funds and is, therefore, being deferred to a later time.

This Final RP/EA:

- Describes the September 30, 2002, M/V EVERREACH oil spill and the Trustees' assessment of the natural resource injuries and losses from that spill,

- Identifies the restoration objectives for the natural resources or services that were injured or lost,

- Identifies and evaluates a reasonable number of restoration alternatives that are consistent with the restoration objectives for the ecological injuries,

- Identifies the restoration actions that the Trustees have selected for use to compensate for the ecological injuries that occurred,

- Identifies the scale of the restoration project needed to compensate for the injuries and losses that occurred,

- Describes the monitoring that will be used to determine the success of the project,

- Serves in part to document compliance with Trustee responsibilities under the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.*, applicable to restoration planning.

In developing this plan, the Trustees have acted in accordance with the natural resource damage assessment regulations applicable to oil spills issued under the Oil Pollution Act of 1990 (OPA).

These regulations are set forth at 15 C.F.R. Part 990 (hereafter, "NRDA regulations"). In accordance with these regulations, the methods selected by the Trustees to assess resource losses and scale restoration are technically reliable and valid, and have been judged to be cost-effective for this incident.

The restoration alternatives considered and the restoration action selected in this plan were identified and evaluated based on the technical expertise and restoration experience of the Trustees and other consulted scientists. The restoration action selected for implementation encompasses all the actions appropriate to the design, construction, monitoring, and evaluation of restoration performance.

1.1 Authority

This Final RP/EA was prepared jointly by the Trustees pursuant to their respective authority and responsibilities as designated Trustees for natural resources injured as a result of the spill under the Federal Water Pollution Control Act, 33 U.S.C. §1251 *et seq*., the Oil Pollution Act (OPA), 33 U.S.C. § 2701 *et seq.*, and other applicable federal laws, including Subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300.600 et seq. SCDNR and SCDHEC also have such authority under the South Carolina Pollution Control Act, S.C. Code Ann 48-1-10 et seq. (Supp. 2002), or other applicable state laws.

Section 1002(a) of OPA provides that each party responsible for a vessel or facility from which oil is discharged, or which poses a substantial threat of a discharge of oil, into or upon the navigable waters of the United States or adjoining shorelines, is liable for natural resource damages resulting from such actual or threatened discharges of oil (33 U.S.C. §2702(a)). OPA Section 1006(d)(1) defines the measure of natural resource damages as the cost of restoring, rehabilitating, replacing or acquiring the equivalent of the injured natural resources, compensation for the diminution in value of those natural resources pending restoration, and the reasonable costs of assessing such damages (33 U.S.C. §2706(d)(1)). Sums recovered for the first two components of damages are required to be spent to restore, rehabilitate, replace or acquire the equivalent of the injured resources, in accordance with a restoration plan developed by the Trustees (33 U.S.C. §2706(f)).

1.2 Trustee Determinations Supporting Development of this Restoration Plan, 15 C.F.R. 990.40-.45 (Subpart D)

The Trustees' decision to conduct a natural resource damage assessment for this oil spill is based on and supported by certain determinations made by the Trustees pursuant to the NRDA regulations, i.e., the Determination of Jurisdiction to Pursue Restoration pursuant to 15 C.F.R. 990.41 and the Determination to Conduct Restoration Planning pursuant to15 C.F.R. 990.42. These determinations and the bases of these determinations were set forth and described in a Notice of Intent to Conduct Restoration Planning published by the Trustees on November 25, 2003, in *The Post and Courier*, a newspaper of large general circulation in and around the spill area. A copy of that Notice is included in this Final RP/EA, in Appendix A.

1.3 Coordination with Responsible Party

Under OPA and state laws, the party responsible for a vessel or facility from which oil is discharged ("responsible party" or "RP") is liable for the injuries to natural resources that result from the discharge. The OPA regulations require the Trustees to invite RPs to participate in the damage assessment process. Although the RPs may contribute to the process in many ways, authority to make determinations regarding injury and restoration rests solely with the trustees.

Evergreen International, S.A., the owner and/or operator of the M/V EVERREACH, was officially designated as the RP for this oil spill. The Trustees officially invited the RP to cooperatively participate in the NRDA process in a letter dated December 11, 2002, and the RP officially confirmed its interest in doing so via a formal reply.

Input from the RP has been sought and considered by the Trustees in assessing the resource injuries and losses caused by this spill and in the development of this Final RP/EA. The RP has provided a substantial amount of data and other information that the Trustees considered in assessing the nature and extent of the spill's impacts on ecological resources and also provided technical comments on data, methodologies, draft analyses and draft estimates of injuries or losses as developed by the Trustees. The Trustees and the RP never reached technical agreement on many issues associated with the Trustees' injury analyses and estimates and the Trustees proceeded with plans to prepare and release the Draft RP/EA based on their positions on these issues. The Trustees shared a copy of the Draft RP/EA with the RP in advance of its completion and public release. The RP responded with formal technical comments on the injury assessment described therein. The RP has, however, since agreed to perform the restoration actions selected in this Final DARP/EA as part of a settlement of its natural resource damages liability for this Spill. In light of that pending settlement, the RP agreed the Trustees need not prepare formal responses to those comments. These comments are included in the Administrative Record relating to this Final RP/EA.

Overall, this coordination and cooperation between the Trustees and the RP helped avoid duplicate assessment studies, allowed increased information sharing and joint utilization of experts, has made the process more cost-effective, and led to the identification of appropriate, restoration-based compensation for the public natural resource damages claim arising from the Spill.

1.4 Public Participation

Section 1006(c)(5) of OPA requires the Trustees to involve the public in the restoration planning process (33 U.S.C. 2706(c)(5)). The NRDA regulations interpret this provision as requiring, at a minimum, that Trustees provide the public with the opportunity to comment on a draft restoration plan, and that any public comments received be considered prior to adopting a final plan (15 C.F.R. Section 990.55(c)). The Trustees believe that public involvement and input is essential to an effective restoration planning process. Affording opportunity for public comment is also consistent with all applicable state and federal laws and regulations, including NEPA and its implementing regulations at 40 C.F.R. Parts 1500-1508.

The Notice of Intent to Conduct Restoration Planning published in *The Post and Courier* on November 25, 2003, provided an early opportunity for the public to submit restoration ideas or alternatives for consideration by the Trustees in the development of a restoration plan for this spill

(see Appendix A). That Notice identified the spill event and the Trustees involved[1], provided general information on the natural resource injuries and losses for which compensation might be required, and invited input from the public on the restoration alternatives that should be considered in developing this restoration plan. The Trustees also investigated possible restoration options through direct discussions with representatives of various state, county and local governments and institutions, private organizations and RP representatives. The Trustees used information from these discussions in developing this Final RP/EA and in identifying the restoration action selected herein.

The Draft RP/EA was released for public review and comment for a period of 30 days on July 24, 2009. Notice of the availability of the Draft RP/EA and of the period for public review and comment was published in the *The Post and Courier* on July 24, 2009. Public review of the Draft DARP/EA was the means by which the Trustees sought direct public input on the restoration plan they were proposing be used to compensate for the ecological injuries and losses caused by the Spill. The Trustees received no comments on the Draft DARP/EA during the time it was available for public review.

1.5 NEPA Compliance

Actions undertaken by Trustees to restore natural resources or services under OPA and other federal laws are subject to the National Environmental Policy Act (NEPA), 42 U.S.C. § 4321 *et seq.*, and the regulations guiding its implementation at 40 C.F.R. Part 1500. NEPA and its implementing regulations outline the responsibilities of federal agencies under NEPA, including the preparation of environmental documentation. In general, 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. When it is uncertain whether a contemplated action is likely to have significant impacts, federal agencies prepare an environmental assessment (EA) to evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required. For a proposed restoration plan, if a FONSI determination is made, the Trustees may then issue a final restoration plan describing the selected restoration action(s).

In accordance with NEPA and its implementing regulations, this Final RP/EA summarizes the current environmental setting, describes the purpose and need for restoration, identifies alternative restoration actions considered for the ecological injuries, assesses their applicability and potential environmental consequences, and summarizes the opportunity afforded for public participation in the process of making the restoration plan decisions. This information was used to make the threshold determination as to whether preparation of an EIS was required prior to selecting the final ecological restoration action.

Based on the EA integrated into this document and the analyses described in Section 6.0, the federal

[1] This Notice identified the U.S. Navy as a Trustee participating in the assessment process for this spill. On December 16, 2003, after the publication of this Notice, the U.S. Navy notified the other Trustees it was ending its participation in that process after determining harm to its trust interests was limited and that compensation for those losses would be covered by the ongoing assessment actions of the other Trustees.

Trustees – NOAA and USFWS – concluded that the ecological restoration action identified herein does not meet the threshold requiring an EIS and, accordingly, issued a Finding of No Significant Impact.

1.6 Administrative Record

Acting in accordance with 15 C.F.R. 990.45, the Trustees established an Administrative Record (AR) documenting records relied upon by the Trustees in proceeding with the NRDA for the Spill. These records collectively comprise those supporting this Final RP/EA. The AR is available for public review at the address given below. It is also available for use in future administrative or judicial review of Trustee actions, to the extent such review is provided by Federal or State law.

Documents within the AR can be viewed at:

USFWS
Division of Ecological Services,
176 Croghan Spur Road,
Charleston, S.C.

Appointments to review the AR may be arranged by contacting that office , by phone at 843-727-4707, ext. 218. Access to and copying of these records is subject to all applicable laws and policies including, but not limited to, laws and policies relating to copying fees and the reproduction or use of any material that is copyrighted.

2.0 PURPOSE AND NEED FOR RESTORATION

The purpose and need for restoration derives from the natural resources injuries and losses that resulted from the discharge of oil from the M/V EVERREACH into the Charleston Harbor, South Carolina, including from activities associated with clean-up. The need to pursue restoration is based upon OPA, which establishes the RP's liability for the resource injuries and losses caused by the Spill. The purpose of restoration under OPA and its implementing regulations is to restore, replace, rehabilitate or acquire equivalent natural resources or services, including where necessary to compensate for interim resource losses. Such restoration is defined in accordance with a restoration plan developed by designated natural resource trustees.

This section generally describes the Spill, including the resources and resource uses affected by the incident, and provides information on the physical, biological and cultural/human use environments that were affected by the Spill and that may be affected by the restoration actions identified in this Final RP/EA.

2.1 Description of the Spill Incident

On or about September 30, 2002, #6 fuel oil was accidentally discharged into the waters of the Cooper River and Charleston Harbor, in South Carolina, from the containership M/V EVERREACH. The amount of oil discharged is not precisely known, but has been estimated at approximately 12,500 gallons. The principal distribution of oil was concentrated along the western shore of the Cooper River between the Interstate 526 Bridge and the Cooper River Bridge, in the vicinity of the North Charleston Terminal and the Old Navy Base piers and docks, however, other shoreline areas were also exposed to oil in varying degrees. These other areas included tidal creeks and backwater areas in the vicinity of James Island, Fort Johnson, Shutes Folly, Crab Bank, Morris Island, Folly Beach and Sullivan's Island. In all, released oil was found over approximately 30 linear miles of shoreline comprised of a variety of types, including tidal flats, fringing marshes, intertidal oyster reefs, sandy beaches and man-made structures (i.e., docks, piers, bulkheads), and their associated sediments. The distribution of oil is generally depicted in Figure 2.1. The oil spill also resulted in the oiling of a number of shorebirds, a shellfish bed closure, and a temporary disruption to recreational shrimp baiting in area waters. Response actions were coordinated and carried out by the RP, the United States Coast Guard, and SCDHEC, with participation and assistance from other agencies. The response effort included actions to minimize the spread of oil and its potential effects, to remove oil from the environment (particularly from shoreline structures and habitats) and to protect the public from possible risks associated with resource uses during the spill event. Response actions could not prevent natural resource injuries and losses from occurring and did not restore or compensate for the injuries and losses that occurred.



Figure 2.1 Shoreline Oiling as a Result of the Spill.

2.2 Affected Environment: The Cooper River, Charleston Harbor, and Surrounding Areas

This subsection presents information on the physical, biological and cultural/human use environments in the area affected by the spill and that may be affected by restoration actions considered in this Final RP/EA. It includes information on the overall environmental setting in which the spill occurred as well as on the specific environments affected or potentially affected by the spill and that have been targeted for restoration activities. The physical environment includes the surface waters of Charleston Harbor, the Cooper River, the Ashley River, and the Wando River. The biological environment includes a wide variety of fish, shellfish, wetland vegetation, birds and other organisms, including endangered or threatened species.

2.2.1 The Physical Environment[2]

The Charleston Harbor Estuary
The Charleston Harbor Estuary (Estuary) is located within the Charleston Harbor Watershed, in the central portion of South Carolina's coastline and is formed by the confluence of the Ashley, Cooper, and Wando rivers. It is a highly dynamic Estuary, influenced by the salinity gradient that extends from the seawater at its mouth to freshwater upriver, and the tidal energy that mixes the fresh and saltwater. These dynamics in the Estuary provide habitat for marine, estuarine, and freshwater organisms.

The Estuary lies entirely within the South Carolina Coastal Plain and consists of sedimentary deposits of sand, gravel, clay, marl, and limestone resting on metamorphic and igneous rocks. Overlying these deposits are marine and riverine sediments and a thin veneer of sand, clay, and shell comprising Pleistocene and Recent formations. The watershed is composed of 63% uplands, 19% open water, 11% freshwater wetlands, 6.5% estuarine marsh, and less than 0.5% estuarine tidal creeks. Upland land use patterns within the watershed are 61.6% forested, 11% urban, 9.3% forested wetlands, 7.7% non-forested wetlands, 6.3% scrub/shrub/disturbed, 3.8% agricultural and grasslands, and 0.3% barren. Federal, state, county, and municipal governments own 302,122 acres (122,267 hectares) of the forested watershed lands. Farmers, corporations, and private individuals own the remaining 638,820 acres (258,527 hectares) or 68% of the total forested lands within the watershed. The forests are composed of approximately 45% loblolly, slash, and short- and long-leaf pines, and 20% oak/hickory hardwoods. Annual precipitation is 49 inches per year (124.9 cm). The wide variety of habitats present in the Estuary support a diverse array of flora and fauna, including more than 80 species of plants, over 250 species of birds, 67 species of mammals, over 570 species of invertebrates and finfish, and at least 580 species of plankton.

The average depth of the Estuary basin is 12 feet (3.7 m) at mean low water (MLW), but navigation channels have been deepened to 40 feet (12.2 m) MLW. The mean tidal range is 5.2 feet (1.6 m), and spring tides average 6.2 feet (1.9 m). Water temperatures range from 38°F to 87°F (3.5^{o} to 30.7^{o} C), and average 67°F (19.4^{o} C). Salinities range from 0 to 35.6 parts per thousand. Similarly, dissolved oxygen levels range from 0 to 17.1 milligrams per liter, averaging 7.3 mg/l over the entire Estuary.

The physical environment of the Estuary also includes many amenities supporting the use of natural resources for recreation by humans, including facilities such as boat ramps, marinas and public beaches. Natural resources in the Estuary environment that are popular with the public include Folly Beach, shellfish beds in and adjacent to the Folly River, and areas of Charleston Harbor popular for shrimp baiting in the fall season.

The Cooper River
The Cooper River watershed is extremely complex due to the Santee-Cooper Hydroelectric Project and the subsequent re-diversion of the river in 1985. The lower component of the basin extends 50 miles (81 km) from the Pinopolis Dam to the mouth of the Cooper River on the north side of the Charleston City peninsula where it flows into Charleston Harbor. This section of the river drains almost 1400 square miles (3,625 km^2) of midlands and lowlands, including fresh and brackish

[2] The description in this section is adapted from the Charleston Harbor Project Report (SCDHEC 2000**).**

wetlands. The West Branch Cooper River is 17 miles (26.5 km) long and flows from the Tail Race Canal at Moncks Corner to its junction with the East Branch. This reach is a meandering natural channel bordered by extensive tidal marshes, old rice fields, and levees in varying states of disrepair. The area contains volumes of poorly defined overbank storage and immeasurable flows because of broken levees between the channel and old rice fields. The East Branch Cooper River is 7.6 miles (12.3 km) long and flows from its headwaters in Hell Hole Bay to its junction with the West Branch, commonly referred to as the "Tee". The East Branch is a tidal slough throughout its 7.5 miles (12 km) length. The river then flows 17.7 miles (28.5 km) to its junction with the Charleston Harbor basin on the north side of the Charleston peninsula.

The Ashley River

The Ashley River flows approximately 31 miles (50 km) from its headwaters in Cypress Swamp in Berkeley County to its junction with the Intracoastal Waterway on the south side of the Charleston City Peninsula, where it empties into Charleston Harbor's lower basin. The Ashley River basin drains a 216-square-mile (900 km^2) area of marsh and lowlands, spread out over Dorchester, Berkeley, and Charleston counties. Depths of the natural channel in the river range from 5.9 to 36 feet (1.8 to 11.0 m) and are influenced by tidal action throughout the river's entire length. Essentially a tidal slough, the tidal ranges of the Ashley River amplify progressively upstream. The extent of saltwater intrusion on the river varies greatly with the hydrologic condition of the basin. During extremely dry periods, with little freshwater draining from Cypress Swamp, saltwater extends throughout most of the Ashley River. During periods of heavy precipitation, saltwater can be limited to the lower part of the river below Drayton Hall. The banks of the river are dominated by *Spartina* marshes.

The Wando River

The Wando River is a tidal river that flows approximately 24 miles (38 km) from its headwaters in I'on Swamp in Charleston County to its junction with the Cooper River on the north side of the Charleston City Peninsula. The river drains 120 square miles (310 km^2) of marsh and lowlands, and its depth ranges from 5 feet to 42 feet (1.5 to 12.8 m). The Wando is influenced by tidal action throughout its entire length, and estuarine waters extend into the creeks that form its upper limits. Like the Ashley River, the tide ranges are amplified as they progress upstream. The Wando River has the best water quality of the three rivers. Above the Wando Terminal, the water quality is suitable for harvesting clams, mussels, and oysters for human consumption. The banks of the River are dominated by extensive *Spartina* and *Juncus* marshes.

2.2.2 Biological Environments[3]

Tidal currents provide a highly diverse habitat for the plants and animals common to the Charleston Harbor Estuary. Marsh vegetation is extensive in the Estuary due to the gently sloping coastal plain and the tidal range. The estimated acreage of the marshes in this area exceeds 52,000 acres (21,000 ha) of which 28,500 acres (11,500 ha) consist of brackish and salt marsh, 18,500 acres (7,500 ha) consist of freshwater marsh, and approximately 5,000 acres (2,000 ha) lie within impoundments. A diverse assemblage of plant species typically found throughout the Southeast United States is found

[3] The description in this section is also adapted from the Charleston Harbor Project Report (SCDHEC 2000**).**

within the Estuary, with the distribution determined by salinity and the duration of inundation. The tidal marshes of the Ashley and Wando rivers reflect a strong marine influence, with salt and brackish water marshes existing throughout almost all of their length. The Cooper River marshes exhibit a wide range of vegetation, changing markedly from salt to brackish to freshwater species. The flow rate and salinity of the Cooper has been significantly altered by the diversion of the Santee into the Cooper and the 1985 re-diversion project.

The shallow marsh habitats of the Charleston Harbor Estuary provide seasonal year-round habitats for a diverse assemblage of adult and juvenile finfish and crustaceans. The highly productive marshes provide abundant food resources for early life history stages of a variety of species. The shallow-water marsh also serves as a refuge for many creatures by providing a diversity of habitat and by excluding predators from the upper reaches of the Estuary. These advantages result in reduced competition, lower mortality, and faster growth rates for many species. Many of these species are commercially or recreationally valuable. The Estuary contributes approximately 20% and 8% of the state's shrimp and crab landings, respectively. Spot, Atlantic croaker, red drum, spotted seatrout, flounder, and catfish inhabit the estuary and are recreationally important. The Estuary also supports numerous ecologically important species such as bay anchovy and grass shrimps, which serve as food for economically and recreationally important species. The young of several species of finfish that are spawned in the lower estuary or ocean enter the shallows of the Estuary as juveniles and stay until they reach larger sizes or until lower winter temperatures drive them seaward.

The spatial distribution of the fishery species living in the bottom of the Charleston Harbor Estuary is similar to that of other estuaries along the mid-Atlantic, southeast and Gulf coasts of the United States. Numerically dominant species include mollusks, polychaetes, oligochaetes, nematodes, and amphipods. Among the three river systems, average diversity values are lower in the Cooper River than in the Ashley and Wando rivers. The lower diversity in the Cooper River may reflect adverse effects from the greater number of industrial and port facilities in this system as compared to the other two river systems.

Studies show that some of the physical and biological changes seen within the Charleston Harbor Estuary are not typical for an estuarine system with reduced freshwater inflow. In any estuary, the mixing zone is an important nursery area for new recruits. Many species utilize the shallows of these areas independent of salinity and also use tidal stream transport to initially colonize the upper estuary. Increased freshwater inflow rates displace the freshwater line seaward, compress the freshwater boundary horizontally and vertically, and prevent flood-tide displacement into the recruitment areas. Conversely, a decreased freshwater inflow rate, as occurs with rediversion, should enhance the recruitment process, There are suggestions, however, that reductions in freshwater flow rates from diversions result in reduction in the overall size of the estuarine nursery habitat and disrupt spawning and nursery cycles. Evidence suggests that a reduction of freshwater inflow by as little as 30-40% can destroy the dynamic equilibrium of an estuary within three to seven years and may increase the impacts of pollutants by four to twelve times.

Rather than the losses and destruction reported in other estuaries, the Charleston Harbor Estuary has seen an increase in use by many more species as a nursery area, especially in the main channels of the rivers but what this represents is uncertain. It is possible that coincidental environmental conditions (drought or cold winters) may have eliminated, masked or postponed negative effects from the rediversion, or that the continued regulation of the flow, as opposed to absolute elimination, has

contributed to an improved end result. It is also possible that changes are occurring on a larger time scale and that current results represent a transitional phase in this process, or that the Estuary is returning to its pre-1942 hydrographic/biologic character.

2.2.3 The Cultural/Human Use Environment[4]

The greater Charleston area is better known as the Trident Region and is comprised of portions of Berkeley, Charleston, and Dorchester counties. The area includes twenty-five incorporated communities ranging in size from Jamestown in Berkeley County, with a population of approximately 84, to the City of Charleston with about 104,000 residents. The total population of the three counties doubled between 1960 and 1990 and is expected to increase to 619,500 by the year 2015. Administratively, their respective county councils and the combined Berkeley-Charleston-Dorchester Council of Governments (COG) serve the counties. Charleston County is the state's most urban county with 88% of its residents living in an urban setting (as defined by the U. S. Census). Similarly, Berkeley and Dorchester counties are significantly more urban than rural, with respectively 65.1% and 67.4% of their populations classified as urban.

Tourism, the Port of Charleston, health care, and several large industrial employers heavily influence the economy. Charleston Harbor's port facilities, composed of an extensive network of modern shore side facilities, represent the largest economic resource associated with the Charleston Harbor Estuary. Most of the $10.7 billion in 1997 sales revenues attributed to South Carolina's ports came through Charleston. During the State Ports Authority's 1999 fiscal year, which ended in June, 13.3 million tons of cargo moved through the port aboard 2,457 ships and barges. The Port of Charleston is the number one container port on the southeast and gulf coasts and is second only to the combined ports of New York and New Jersey on the entire eastern seaboard. Until 1994, the U.S. Navy maintained its third largest homeport on the Cooper and Wando rivers. These facilities consisted of a naval shipyard and weapons station and served more than 70 surface vessels and submarines. Charleston International Airport provides commercial and military air service for the region and currently serves over 1.5 million passengers annually. Six private airports located throughout the region can accommodate both corporate and private aircraft. Approximately 100 motor carriers and three railroads serve the Trident Region and, along with Interstates I-26, I-95, and I-526, provide access to residential, private, government, and commercial concerns. Six colleges and universities are located within the region with a combined annual enrollment of almost 27,000 students.

Although there are no major industries located on the harbor, the basin is surrounded by urban development and receives secondarily treated effluent from two sewage treatment facilities on Plum Island and in Mount Pleasant. The number of permitted point sources of pollution in the Charleston Harbor estuary decreased from 115 in 1969 to 67 in 1996. The volume of these discharges decreased from 328 to 205 cubic feet per second (9.3 to 5.8 m^3/s) during the same time period. Other sources of pollution affecting the harbor include nonpoint source runoff from the city and other urban areas, marina facilities near the mouth of the Ashley River, and runoff and discharges from forested and agricultural lands. Several diked, dredged material disposal areas are located in the harbor area, with the largest being Drum Island. The water quality of the harbor's tidal saltwater is rated as suitable for fishing and boating, but not for swimming, and the harvesting of oysters, mussels and clams is prohibited. However, reviews of data collected by SCDHEC reveal that the water quality within the basin often meets higher standards for dissolved oxygen and fecal coliform than the ratings indicate.

[4] [4]The description in this section is also adapted from the Charleston Harbor Project Report (SCDHEC 2000).

Among the three river systems that form the Charleston Harbor Estuary, the Cooper River has the greatest number and density of industrial and port facilities. The majority is located on the western shore and includes the former U. S. Navy port facilities; commercial facilities associated with the State Ports Authority and numerous private companies. In all, there are 22 industrial and municipal permitted point dischargers into the Cooper River with a combined flow of 127 ft^3/s (3.6 m^3/s). To accommodate shipping traffic, a 40 feet (12.2 m) deep navigation channel is maintained in the lower Cooper River and extends 20 miles (32 km) upstream from the mouth of the river. The eastern shore of the Cooper River is relatively undeveloped, although there are several diked dredged material disposal sites along the length of the maintained channel. The water quality rating of the lower basin is rated as suitable for fishing and crabbing, but not for swimming or the harvesting of clams, oysters or mussels. Water quality often meets higher standards than the rating for oxygen and fecal coliform.

The Charleston Harbor area also contains some of the most significant historic and archeological sites in the United States. Cultural resources include historic buildings, structures and sites, unique commercial and residential areas, unique natural and scenic resources, archeological sites, and educational, religious, and entertainment areas or institutions. In some areas preservation programs are effective in maintaining these resources. In other areas these resources are being lost or neglected primarily because of our limited knowledge. There is a continuing need for surveys to identify the cultural resources, their locations and significance.

3.0 INJURY DETERMINATION AND QUANTIFICATION

3.1 Overview of Injury Assessment Process

The goal of the injury assessment process is to determine the nature, degree, and extent of any injuries to natural resources and services caused by a particular event, such as an oil spill.

Injury is defined in the NRDA regulations as "an observable or measurable adverse change in a natural resource or impairment of a natural resource service. Injury may occur directly or indirectly to a natural resource and/or service" (15 C.F.R. Section 990.30). "*Services*" are defined as "the functions performed by a natural resource for the benefit of another natural resource and/or the public" (15 C.F.R. Section 990.30).

The injury assessment process has two components: injury determination and injury quantification. *Injury determination* requires that trustees demonstrate that the discharged oil has caused an adverse effect on a resource or the services it provides. If trustees determine a resource has been injured or its services lost, the injury or losses are then quantified.

Injury quantification involves determining the severity, extent and duration of the adverse effects on a resource or its services caused by the spill. Resource injuries may be quantified directly and/or by the reduction in resource services caused by the oil. Adverse change in a natural resource or service is defined by the difference between its pre-spill 'baseline' and its post-spill conditions. 'Baseline' refers to the condition or level of services the resource would have maintained, in the absence of the effects caused by the oil spill. Once the magnitude of injury is defined, trustees then estimate the time required for the resource and/or its services to recover, i.e., to return to its baseline condition. While both the magnitude of injury and recovery time have to be considered when quantifying resources injuries and losses, the biological processes that determine recovery from an oil spill are complex. The knowledge and data needed to precisely estimate recovery times are rarely available.

Some resources or services may be affected to such a limited extent that they cannot be meaningfully quantified or quantified at a reasonable cost. Injuries/services losses of this nature, however, are usually related to other components of the ecosystem and, because of these interrelationships, these injuries/service losses are often implicitly captured in other analyses or benefit from the recovery or restoration of other resources. This allows development of more appropriate and cost-effective options for restoring injured resources or services in the affected ecosystem in the context of a restoration-based approach to defining compensation for resource injuries and losses. (15 C.F.R Section 990.54). The restoration-based approach is favored because it helps achieve restoration of resources and services, thereby compensating for injuries/losses of public resources, more directly and more quickly.

In choosing injury assessment procedures under the NRDA regulations, trustees consider the relevance and adequacy of the information a procedure will generate and its potential role in restoration-scaling (15 C.F.R. 990.27(c)). The NRDA regulations identify a variety of methods that may be used for scaling compensatory restoration actions, however, injury assessment and restoration scaling procedures are often interrelated; the assessment procedure used can influence the approach used in restoration-scaling (see Section 4.1 for further discussion of restoration-scaling approaches)

3.1.1 Injury Evaluation and Selection Criteria

Trustees consider a number of factors in deciding which potential injuries to include in an assessment. As described in the NRDA regulations at 15 C.F.R. Section 990.51(f), these include:

1. The natural resources and services of concern;
2. The procedures available to evaluate and quantify injury, and associated time and cost requirements;
3. The evidence indicating exposure;
4. The pathway from the incident to the natural resource and/or service of concern;
5. The adverse change or impairment that constitutes injury;
6. The evidence indicating injury
7. The mechanism by which injury occurred;
8. The potential degree, and spatial and temporal extent of the injury;
9. The potential natural recovery period; and
10. The kinds of primary and/or compensatory restoration actions that are feasible.

The resources and services investigated for potential injury or service losses for the EVERREACH oil spill are listed in Table 3.1. There were six categories of ecological resources and four categories of resource uses (recreational). These categories were identified using evidence or information obtained during the response or as part of the Trustees' pre-assessment activities, with input from local, state and federal officials, the RP's representatives, and academic or other persons with knowledge about the affected environment, as appropriate.

Ecological	**Recreational Uses**
Birds	Recreation Shrimp baiting
Aquatic Fauna	Recreational Shellfishing
Salt Marsh (Vegetated Shoreline)	Recreational Boating
Non-vegetated Shorelines	Beach Use
Oyster Reef	
Man-made Structures	

Table 3.1 EVERREACH Spill - Resources/Services Investigated for Potential Injury/Loss

3.2 Ecological Injuries - Determination and Quantification

The model system known as "SIMAP" (Spill Impact Model Analysis Package) was a primary tool used by the Trustees to evaluate and assess the ecological injuries for this spill. SIMAP is an oil spill modeling system comprised of two submodels: the Physical Fates model and the Biological Effects model. For the EVEREACH spill, the Trustees used the SIMAP model to assess the pathways and fate of the oil in the environment, to estimate oil exposure to the water surface, water column, sediments, shoreline and other habitats, and to estimate injuries to wildlife and aquatic organisms. The Physical Fates model is a three-dimensional model that estimates the distribution of oil (taking

into account mass and concentration) on the water surface, on shorelines, in the water column and in the sediments. It is based on the Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME, Version 2.4, April 1996). The model uses a variety of incident-specific data, such as on winds and currents, as well as transport and weathering algorithms, to calculate the mass balance of oil in the various components of the environment, surface oil distribution over time and concentrations of oil constituents in water and sediments.

Geographical data (habitat mapping and shoreline location) for this spill were obtained from existing Geographical Information System (GIS) databases based on Environmental Sensitivity Indices (ESI). Water depth inputs were based on NOAA's National Ocean Service (NOS) soundings databases. The trustees obtained hourly wind speed and direction data during and after the spill from a nearby meteorological station. Tidal and other currents were modeled from known water heights in the Charleston Harbor setting, using a hydrodynamic model based on the physical laws of hydrodynamics. Algorithms based on state-of-the-art published research are used to establish the spreading, evaporation, transport, dispersion, emulsification, entrainment, dissolution, volatilization, partitioning, sedimentation, and degradation of oil in the spill environment.

The Biological Effects model estimates short-term (acute) exposure of biota of various behavior types to floating oil and subsurface contamination (in water and subtidal sediments), resulting percent mortality, and sublethal effects on production (somatic growth). Acute mortality of water column and benthic resources is estimated as a function of temperature, concentration of dissolved aromatics and length of exposure. Acute mortality of other wildlife is estimated as a function of the area swept by oil, dosage and vulnerability. The model produces an estimate of the numbers of animals lost, based on the probability of direct mortality under the circumstances of exposure. Because the model estimates these numbers based on probabilities of mortality, the estimated numbers can include fractions of animals. Chronic effects of long-term oil concentration in sediments or via ingestion are not considered by this model.

The SIMAP modeling and results used in assessing resource injuries for the M/V EVERREACH oil spill are fully described in the Final Modeling of Physical Fates and Biological Injuries Report dated August 2006. The Executive Summary from this report is included in this Final RP/EA as Appendix B but the full report is included in the AR. The specific usage and results of this work for each of the six ecological resource categories evaluated by the Trustees are described below.

In undertaking this assessment, the interrelationships among natural resources in the Cooper River and Charleston Harbor ecosystems was also key. First, understanding these relationships helped ensure all potential resource injuries and service losses were accounted for in the assessment and that double-counting of injuries was avoided. Resources or services that may have been affected to such a limited extent that they could not be meaningfully quantified are still implicitly addressed through the quantification of service losses and determination of restoration requirements. Understanding these relationships also provided a foundation for restoration planning, as it permitted identification of appropriate and cost-effective options for restoring injured resources or services and the use of restoration options benefiting multiple natural resources and their ecological services.

3.2.1 Birds

A. Determination of Injury

During response and pre-assessment activities, a total of 18 to 23 brown pelicans were observed in the field as moderately or heavily oiled, with 30 other pelicans showing spots or oil stains. Tri-State Bird Rescue & Research, Inc., a bird rescue and rehabilitation contractor, treated and released 21 of the oiled pelicans (1 adult and 20 juveniles) as part of the response. Other oiled birds observed included: 1 great blue heron, several egrets, 1 double-crested cormorant, and 15 ruddy turnstones. All of these birds were captured or observed on Crab Bank in lower Charleston Harbor. This information was used to the extent possible as input to and to calibrate the SIMAP model.

Diving birds like pelicans and waterfowl are usually at greatest risk during oil spills, because they spend nearly all their time on the water surface. Waterfowl and wading birds may be directly oiled, and can become oiled on the upper body and feathers by coming in contact with oiled vegetation or prey while feeding. Shorebirds usually avoid oil, but may be impacted by loss of feeding areas or intertidal prey. Gulls, terns and raptors may be at risk because they are often attracted to and will prey on sick or injured prey. This behavior may result in oiling of feathers and the ingestion of oil.

Oiling of birds reduces the buoyancy, water repellency, and insulation provided by feathers, and may result in death by drowning or hypothermia. Preening of oiled feathers may also result in ingestion of oil resulting in irritation, sickness, or death. Determining the number of birds that actually die from oiling is difficult in aquatic environments because many oiled birds will retreat to marshy areas to die or they will lose buoyancy and sink. In breeding season oiled birds may take oil back to the nest and that oiling may impact the young and cause them to die.

B. Quantification of Injury

Aquatic bird injuries were estimated using the SIMAP model and data for areas swept by enough surface oil to oil a bird above a threshold dose level for effects. The modeling incorporates exposure estimates, information relating to the volatility and solubility of the released oil type, and assumed toxicity values based on laboratory bioassay data for particular species and life stages.

The SIMAP model estimated the total birds oiled at 175, including brown pelicans, black skimmers, terns, gulls, wading birds, and shorebirds (See Appendix B – *Final Modeling of Physical Fates and Biological Injuries Report, Executive Summary, 2006*). The number of oiled birds estimated by the model is higher than the number of birds actually observed as oiled in the field. This difference reflects several factors, including the fact that some oiled birds die and sink and that the model estimates injuries to birds throughout the harbor and in the rivers, not just to birds in the areas where the heaviest oiling was found.

The injury to birds was quantified in terms of the interim loss associated with the oiled birds. This was calculated based on the number of oiled birds estimated to be killed due to oiling, plus the loss of their first generation of progeny. Both the birds estimated to be directly killed and their lost future fledglings were quantified in terms of a number of bird-years lost[5].

[5] 'Bird years lost' refers to the number of birds lost and their lost future fledglings multiplied by their average life span.

The total of the bird-years lost was then divided by the bird-years that would be gained for each new fledgling. This yielded the number of fledglings that would need to be produced to effectively replace the bird-years lost. This approach permits a restoration action to be evaluated or scaled based on its ability to increase fledgling production, so that the amount of restoration required to replace the birds lost can be determined.

Thus, the interim loss is expressed in an equivalent number of age 0 animals (fledglings) lost. The loss is assumed to occur every year after 2002 until restoration in 2007. A discount rate of three percent is applied to the loss for every year between 2002 and 2007, to account for the difference in time between the initial kill and the later years when growth is foregone[6]. After discounting, the entire bird injury is expressed in terms of its value as of the date of the initial kill[7].

The estimated injuries to birds that results from this analysis is presented in Table 3.2 below. Because the model uses probabilities in estimating injuries, the resulting estimate may include a fraction of an animal.

Group Totals	**Birds Killed (#)**	**Observed (#)**	**Interim Loss (#-years)**	**# Fledgling Equivalents (in 2002)**	**# Fledgling Equivalents (in 2007)**
Waterfowl	0.06	-	0.1	0.1	0.1
Seabirds	89.2	49-54 (pelicans)	556	384	446
Wading birds	16.4	~ 4	31	36	41
Shorebirds	68.8	15	531	260	301
Raptors	0.14	-	1.0	0.5	0.6
Total birds	**174.6**		**1120**	**681**	**789**

Table 3.2: EVERREACH - Summary of estimated injuries to birds (French McCay et al., 2005a).

3.2.2 Aquatic Fauna

A. Determination of Injury

Though the Charleston Harbor area is heavily used by aquatic fauna, including blue crabs, shrimp, and other invertebrates, and numerous species of fish, no evidence of injury to aquatic fauna (i.e., fish kills, etc.) was observed or reported during the response. The Trustees, however, recognized that mortality could occur at levels that might not have been easily detected or documented over the large area affected by the spill. The Trustees used the SIMAP model to evaluate the potential for such

[6] A discount rate must be applied when comparing resources or services across different time periods so that the calculated losses are adjusted to reflect the greater value that people assign to goods and services in the present, as compared to the future. The discount rate approximates this rate of societal time preference.
[7] For additional discussion concerning discounting, please refer to the NOAA technical document on discounting (NOAA, 1999) which is available at the following website: http://www.darrp.noaa.gov

injuries based on potential exposure of these resources to likely concentrations of oil hydrocarbons and dissolved aromatics in the water column and subtidal habitats. The SIMAP model indicated subsurface concentrations of oil hydrocarbons and dissolved aromatics did not exceed 1 ppb in any water volume >140 m^3 (the resolution of the model grid for the subsurface plume) at any time after the spill. This level of exposure is not significantly toxic to organisms in the water column or to bottom-dwelling organisms in subtidal habitats, or known to result in sublethal injuries to these resources. The SIMAP estimate of total injury to subtidal fish and invertebrates was 0 kg (See Appendix B – *Final Modeling of Physical Fates and Biological Injuries Report, Executive Summary, 2006*). Accordingly, the Trustees did not determine an injury to aquatic fauna occurred due to the spill.

3.2.3 Shoreline Habitats

A. Determination of Injury

Approximately 31 miles of shorelines in the Charleston Harbor area were oiled to varied degrees as a result of the spill. Affected shoreline areas included the south shore of the Cooper River from Interstate 526 to the Cooper River Bridge, Shutes Folly, Crab Bank and the adjacent shoreline of Mt. Pleasant, the shoreline from Ft. Johnson to Ft. Sumter, Morris Island and Folly Beach.
The extent of shoreline oiling was determined using a combination of field observations, SCAT reports[8] and aerial photography. The degree of oiling was estimated by the Trustees using SCAT reports that described the extent and degree of observed shoreline oiling, by relating known oil locations to areas of shoreline using habitat maps, and by applying professional knowledge and judgment as needed. The process was undertaken cooperatively with the Responsible Party's technical representatives and consultants.

The shorelines affected by the Spill included a variety of different habitat types. Affected shorelines were grouped into four representative categories for injury assessment purposes: (1) Vegetated Shorelines (marsh), (2) Non-Vegetated Shorelines (mudflats, sandy beach, etc), (3) Oyster Reefs (large oyster beds) and (4) Man-made Structure (seawalls, piers, etc). This approach allowed the Trustees to calculate the acres of each habitat type exposed to heavy, moderate and light oiling, respectively. The determination of injury to these habitats takes into account the levels of exposure to oil, information relating to the volatility and solubility of the released oil type, and toxicity values for benthic and other organisms from published scientific data and studies. Table 3.3 shows the extent and degree of oiling by shoreline type.

[8] The Shoreline Clean-up Assessment Team (SCAT) process is used to evaluate oiled shorelines and their need and priority for clean-up as part of the spill response. The key element of the SCAT process is the use of trained observers to systematically document areas affected by an oil spill using standard terms and definitions of shoreline areas (the SCAT survey).

Shoreline Type	Degree of Oiling	Extent (Acres)
Marsh	Heavy	4.06
Marsh	Moderate	7.39
Marsh	Light	6.80
Hard Structure	Heavy	0.11
Hard Structure	Moderate	2.53
Hard Structure	Light	1.07
Non-Vegetated Shoreline (Sandy Beach/Shell Beach/Mudflat)	Heavy	0.00
Non-Vegetated Shoreline (Sandy Beach/Shell Beach/Mudflat)	Moderate	1.91
Non-Vegetated Shoreline (Sandy Beach/Shell Beach/Mudflat)	Light	14.31
Oyster Reef	Heavy	4.70
Oyster Reef	Moderate	7.70
Oyster Reef	Light	7.50

Table 3.3: Extent and Degree of Oiling by Shoreline Type

B. Quantification of Injury

Though the injury to shoreline habitats was apparent from pre-assessment observations and information, it was not immediately clear whether the extent of the injury, and more particularly its likely equivalent in available cost-effective restoration, was enough to justify the cost of pursuing additional studies of the injured habitats to further document and quantify the extent of the losses. The Trustees used an exercise to help inform their efforts to identify an appropriate, cost-reasonable injury assessment strategy. Specifically, the Trustees ran a preliminary Habitat Equivalency Analysis (HEA) using potential parameters[9]. This exercise yielded an early, albeit rough estimate of the amount of shoreline injury (i.e., total ecological service loss) that might have occurred and of the amount of restoration that might be needed to offset it. The results of this exercise indicated the size of the injury might not be sufficient to justify pursuing additional studies, considering its likely restoration equivalent.

As an alternative, the Trustees and the RP elected to seek consensus on a set of conservative assumptions[10] that could be used to estimate the potential losses and to identify the type and scale of an ecological restoration project sufficient to offset those losses, using the HEA framework. This alternative was viewed by the parties as a more cost-effective approach than undertaking additional

[9] HEA is a valid and reliable method that is frequently applied in NRDAs to quantify ecological losses associated with injuries to habitats and other resources. It is appropriate for use where service losses are primarily ecological and the creation of habitats or services like those injured or lost is technically feasible. It estimates the acres of habitat required to functionally replace ecological service losses, according to a technically-structured formula. Use of the HEA method facilitates assessments of restoration-based compensation for natural resource losses.

[10] This approach is a means of addressing technical uncertainties in an analysis. It involves the use of inputs or values that are protective of the natural resources and/or favor the public, and leads to higher estimates of injuries and losses.

focused studies in an attempt to reach agreement on the injury estimate for the shoreline habitats. Though technical agreement on the injury determination was never reached, the parties recognized that the restoration chosen can encompass differing injury estimates.

The Trustees took into account reductions in the entire flow of services provided by all affected habitats. In other words, for each affected habitat type, the reductions in likely service flows due to oiling included reductions in services the habitat provides to other resources. The results of this approach are, therefore, intended to capture the reduction in bird production that occurs when habitat services flows that support birds are disrupted or lost, the reduction in aquatic faunal production that occurs when habitat service flows supporting fish, shrimp, crabs, and other aquatic fauna are disrupted or lost, and the loss of other habitat services as appropriate. For each injured habitat type, this approach resulted in an estimate of the total number of lost 'acre-years' that likely resulted from the level or degree of observed oiling. An 'acre-year' is the total amount of ecological services that an acre of shoreline habitat will provide to all other natural resources in one year. Losses were evaluated for heavily oiled, moderately oiled and lightly oiled areas, respectively. Losses were assessed on an annual basis and discounted to reflect their present value as of October 2002 (the time of the spill) to produce the total estimated discounted service acre-years (DSAYs) lost. The DSAYs lost is the metric for determining the amount of habitat restoration, in acreage, required to restore or replace ecological services equivalent to the losses.

The HEA parameters and calculated service losses for each type of injured habitat are described below. Table 3.4 summarizes the key parameters and the results of the quantification of the DSAYs lost due to injury to shoreline habitats.

B.1 Vegetated Shorelines

Heavy oiling in marsh was estimated to cause an 80 percent service loss immediately following the spill. Losses were estimated to decline and then recover linearly, with return to baseline conditions after three years. In moderately oiled marsh, initial service losses were estimated to be 50 percent, with linear recovery and return to baseline after two years. In lightly oiled areas, the initial service loss was estimated to be 10 percent, with linear recovery and return to baseline after six months. The above service loss and recovery parameters are based on results of previous studies of injury to and recovery of marshes following oil spills, as presented in Michel et al. (2002) and Penn and Tomasi (2002). In these previous studies, service losses and recovery of marsh were determined for heavy, moderate, and light oiling based on biological metrics for vegetation services, including stem density and plant biomass, and measurements of soil services such as nutrient cycling. The parameters selected for use in this assessment fall within the range of these parameters found in these previous spill studies.

Total estimated ecological service losses for injury to vegetated shorelines: 8.51 DSAYs.

B.2 Man-made Structures

Man-made structures can serve as surrogates for other naturally occurring hard substrates, such as hard bottom or oyster reef, and become habitat for a variety of subtidal plants and animals. These epibiotic organisms are, in turn, sources of food and shelter for many types of other organisms. Though lacking the complexity of natural habitats, they can be an important component of subtidal

systems. Man-made structures are less vulnerable to the effects of oil and recovery to baseline occurs more quickly than in most natural habitats because they can be cleaned more easily, lack habitat complexity, and re-colonize rapidly. Evidence and information obtained during the pre-assessment phase was not sufficient to support a direct assessment of likely losses and of the recovery of resource services. Service losses associated with this type of shoreline habitat were evaluated and assessed based on the expertise and professional judgment of state and federal scientists involved in the assessment. Initial service losses in heavily, moderately and lightly oiled areas were estimated to be 15, 10 and 5 percent respectively, with a linear recovery and return to baseline after six months.

Total estimated ecological service losses for injury to man-made structures: 0.08 DSAYs.

B.3 Non-Vegetated Shoreline

Non-vegetated shorelines are areas found around the high or low watermarks in tidal and intertidal zones. They are characterized by loose, unconsolidated sediments that serve as habitat for mollusks, crabs, shrimp and worms. These organisms are the primary sources of food for many larger estuarine organisms such as fish. Evidence and information obtained during the pre-assessment phase was not sufficient to support a direct assessment of likely losses and of the recovery of resource services for non-vegetated shorelines. Service losses associated with this shoreline habitat were evaluated and assessed based on the expertise and professional judgment of state and federal scientists involved in the assessment. No heavy oiling was observed or documented in non-vegetated shoreline areas. In moderately oiled areas, initial service losses were estimated to be 50 percent, with linear recovery and return to baseline after three years. In lightly oiled areas, initial service losses were estimated to be 10 percent, with linear recovery and return to baseline after six months.

Total estimated ecological service losses for injury to non-vegetated shoreline: 1.74 DSAYs.

B.4 Oyster Reefs

Similarly, initial service losses in heavily, moderately and lightly oiled areas were estimated to be 75, 35 and 15 percent respectively, with a linear recovery and return to baseline after six months.

Total estimated ecological service losses for injury to oyster reefs: 1.82 DSAYs.

Table 3.4: Key HEA Parameters and Lost DSAY Calculations by Shoreline Habitat Category

HEA Injury Categories	Degree of Injury	Acres	Initial % Service Loss	Recovery Time (Years)	DSAYs[11] Lost
Marsh	Heavy	4.06	80%	3	4.72
Marsh	Moderate	7.39	50%	2	3.62

[11] The DSAYs Lost indicated on this table are converted to a common metric in order to evaluate the scale of restoration required to compensate for losses. This process is further discussed in section 5.1.4.

Marsh	Light	6.80	10%	0.5	0.17
Hard Structure	Heavy	0.11	15%	0.5	0.004
Hard Structure	Moderate	2.53	10%	0.5	0.063
Hard Structure	Light	1.07	5%	0.5	0.013
Non-Vegetated Shoreline	Heavy				
Non-Vegetated Shoreline	Moderate	1.91	50%	3	1.38
Non-Vegetated Shoreline	Light	14.31	10%	0.5	0.36
Oyster Reef	Heavy	4.70	75%	0.5	0.88
Oyster Reef	Moderate	7.70	35%	0.5	0.67
Oyster Reef	Light	7.50	15%	0.5	0.28

3.3 Lost Recreational Services – Determination & Quantification of Losses

Among the many services provided by a natural resource are those for public recreation. When a resource is injured or access to that resource disrupted by a spill, the public's recreational use of the resource can be lost or diminished. Such losses are part of the natural resources damages that are recoverable under OPA and addressed in the Natural Resource Damage Assessment (NRDA) process. This subsection summarizes the data and methods used to evaluate, identify and calculate lost-use damages for recreational losses due to the EVERREACH oil spill. The term "lost-use damages" refers to the decline in value of recreational uses associated with resources affected by the Spill

The EVERREACH spill affected recreational shrimp baiting and recreational shellfishing. The Trustees determined that the EVERREACH oil spill caused a reduction in the number of shrimp baiting and shellfishing trips taken in the Charleston Harbor area in the fall of 2002 and also that the value of shrimp baiting trips taken under spill conditions was reduced. The assessment undertaken to identify and quantify these losses (i.e., to determine the number of affected trips and the total value of those losses) is described below. This assessment was undertaken cooperatively with the RP. The Trustees also examined potential effects of the spill on beach use and recreational boating but determined that impacts to these activities, if any, were likely very small and did not warrant further assessment. Further details of the lost recreational use injury assessment are described in English et al. (2004).

3.3.1 Recreational Shrimp Baiting

Recreational shrimp baiting takes place throughout Charleston Harbor and in several other areas of coastal South Carolina within an annually noticed season (typically about 60 days) that normally begins in mid-September and extends into November**.** The fishery usually involves marking several spots with poles, setting bait in the water, and casting a net over the shrimp that are drawn to the bait. The activity typically takes place at night to improve catch and is almost always undertaken using a boat. Well over 10,000 permits for this recreational season are sold annually by SCDNR. Over 3000 Charleston County residents purchased a permit for the 2002 season.

The 2002 season began on September 13th and ended on November 12th. The EVERREACH spill into Charleston Harbor occurred on or about September 30th of that year. Recreational shrimp baiting activities were adversely affected by the presence of oil in these waters, the potential for shrimp to be contaminated, and response activities (including necessary public warnings and closures) over the remainder of the 2002 season. As part of the NRDA for this spill, the Trustees investigated and determined the extent to which shrimp baiting activities were lost or diminished in value during the last 43 days of the 2002 season.

Losses of recreational shrimp baiting due to the spill were determined from information obtained as part of the post-season survey of shrimp baiting license holders administered annually by the SCDNR. Questions designed to reveal the effect of the spill on shrimp baiting activities for the 2002 season were added to the November 2002 survey and the responses to these questions were used to assess the 2002 recreational shrimp baiting losses attributable to the spill.

The questions added to the survey focused on changes in the location of respondents' shrimp baiting trips. In particular, respondents were asked if they took fewer trips than planned to the Charleston area during the 2002 season, and if so, to state the reason. From those respondents reporting fewer trips to Charleston and giving the oil spill as the reason, the total number of trips affected by the spill was determined. The total estimated number of lost trips due to the spill was 4,232.

The total monetary value of all shrimp baiting losses was then estimated with a Random Utility Model (RUM) travel cost method. This is a standard econometric technique. It uses the number of lost trips in combination with other data (including the approximate location where shrimp baiters live, the sites they visit, the costs of reaching the available shrimp baiting sites ("transportation costs") and other data from publicly available sources to estimate the value of changes at a recreational site, such as may result from temporary reductions in the quality of a site due to an oil spill. The analytical methods applied involved econometric estimation of recreation demand and were drawn from sources in the peer-reviewed economics literature. Specific details of the RUM travel cost analysis performed for the EVERREACH spill are provided in English et al. (2004), a copy of which is included in the AR.

The RUM travel cost analysis produced estimates of the lost value associated with both lost and degraded trips. The term "lost trips" refers to the total decline in the number of shrimp baiting trips to the Charleston Harbor area. Some of the "lost trips" involved use of alternative shrimp baiting sites not affected by the spill and some involved trips that were foregone altogether. The term "degraded trips" refers to trips taken to the Charleston site under degraded conditions. Some lost or degraded trips may have resulted from perceptions about potential oiling in locations that were not directly impacted by the oil. All affected trips involve a loss in value and the total quantified losses are the assessed damages.

Total losses to recreational shrimp baiting resulting from the oil spill were estimated at a range of $74,476 to $114,452 in 2002 dollars. These losses must be adjusted over time to account for discounting and inflation. The value of the estimated losses would be $105,905 to $162,708 in November 2008 dollars[12].

[12] This figure is as it appeared in the Draft RP/EA released in 2009.

3.3.2 Recreational Shellfishing

The SCDHEC closed shellfish bed S200 on October 1, 2002, due to potential contamination from the spill. SCDHEC lifted the closure November 5, 2002. The designated area S200 is located near Folly Island, and is accessed primarily from the Folly River boat landing located on State Route 171. There are four other shellfish beds in or adjacent to Folly River which are open to recreational use and are accessed from the same boat landing. These other shellfish beds were not closed following the spill. There are additional shellfishing areas nearby in the Kiawah River and Clark Sound.

To determine recreational shellfishing losses, the number of lost trips was estimated for the 35-day closure of bed S200. Information on shellfishing trips in the Folly River area was taken from a 1990 report entitled "South Carolina Marine Recreational Fish and Shellfish Fishery Surveys, 1988" (Waltz, *et al*., 1990). This report was the most recent source of information on recreational shellfishing trips available for the relevant area. Based on intercept surveys administered during the 1988-1989 season, the report concluded that an average of 13.8 people accessed the Folly River each day and that for most of them (92.5 percent) shellfishing was the primary purpose of their visit. Therefore, 13.8 trips per day was used in calculating the shellfishing losses due to the spill. Multiplied by 35 days, the total number of lost trips was estimated at 497.[13]

The value of each shellfishing trip was estimated based on evidence from the shrimp baiting survey, because that survey captured the practices and preferences of South Carolina residents for a similar marine-based, recreational-fishing activity. However, there is other evidence to indicate that shellfishing trips may have slightly lower value than shrimp baiting trips. In particular, shrimp baiting draws a greater share of its participants from inland counties compared to shellfishing (Waltz, 1996). In the context of recreational demand, this implies that shellfishing is a less valuable recreational activity. The range in value for "person-trips" in the travel cost analysis for shrimp baiting is $17.60 to $27.04. For shellfishing, a slightly lower range of $15.00 to $20.00 was assumed, consistent with this evidence. Applying this range of values to 497 lost trips, total losses to shellfishing as a result of the spill are calculated to be $7,452 to $9,936 in 2002 dollars. Here again, losses must be adjusted over time to account for discounting and inflation. When these adjustments are made, the value of these losses would be $10,598 to 14,131 in November 2008 dollars[14].

[13] Several points relating to this estimate are worth noting. First, there is no information available to indicate whether the level of shellfishing activity in Folly River in 2002 may have been higher or lower than in 1989 or the trends in this activity over time. Second, the figures in the 1990 report reflect use at the three shellfish beds that were open in 1989 and accessible from the Folly River boat landing, including S200. Since only S200 was closed following the spill, the 13.8 trips per day figure could overestimate the trips lost due to the spill. Conversely, though several areas of the Folly River near S200 were not closed, public misunderstanding or misperception regarding the closure may have affected trips and led to losses in other recreational shellfishing areas as well. In 2002, there were five areas in or adjacent to Folly River designated for recreational shellfishing (S189, S196, S200, S206 and R201). Additionally, this list includes two additional recreational beds designated since 1989 when the original data were collected. These factors imply the 13.8 trips per day figure is an underestimate of the trips affected by the spill. The net effect of all the above factors is unknown. The Trustees determined further surveys to refine the estimate of trips per day for use in this analysis was not warranted, in light of the modest identified losses and the potential time and cost of such additional investigation.

[14] This figure is as it appeared in the Draft RP/EA released in 2009.

3.3.3 Beach Use

Following the spill, some oiling was observed at Folly Beach, a county-operated recreation site located directly on the Atlantic Ocean south of the entrance to Charleston Harbor. Because Charleston County beaches continue to have considerable levels of use during late September and early October, particularly on weekends, the Trustees initiated a preliminary investigation into potential spill-related losses at Folly Beach. Data on attendance at Folly Beach was obtained, along with data for two other Charleston County beaches: Beachwalker County Park, located south of Folly Beach on Kiawah Island, and Isle of Palms County Park, located north of Folly Beach. Neither the Kiawah Island nor Isle of Palms beaches were directly impacted by the oil spill. Using the attendance data for the two nearby beaches as controls indicative of the possible influence of weather, the Trustees analysis did not indicate any significant change in attendance at Folly Beach associated with the oil spill.

3.3.4 Recreational Boating

The Trustees also conducted a preliminary investigation of potential public recreational boating losses in Charleston Harbor due to the spill. This investigation focused on potential losses associated with the disruption of access to and use of the waters of the Harbor by recreational boaters using the Cooper River Marina. Considerable oiling occurred in the vicinity of this marina, and during the course of containment and cleanup activities, an oil boom was placed around the perimeter of the marina. As a consequence, boats moored at this marina had no access to the waters of the Harbor for a period of ten days. At the same time, however, the hulls of most of the boats at the marina were oiled to some degree and, independent of the containment booming, this condition prevented their use until they could be cleaned[15]. Any disruption in recreational boating that could be attributed solely to the containment booming was likely minimal since the booms were in place for only 10 days and the affected area of the river was small. Aside from boating access at this marina, the Trustees' are not aware of any other potentially notable interference with recreational boating access. Taking into account all circumstances, the Trustees found that assessing public recreational boating losses associated with boaters originating from this marina would be difficult and likely involve costs in excess of the amount of any potential public claim. For these reasons, the Trustees determined that further action to assess public recreational boating losses based on this temporary interruption in access to area waters was not warranted.

[15] The oiling of these boats gave rise to private loss claims that were separately responded to and addressed by the RP for this spill.

4.0 RESTORATION PLANNING PROCESS

4.1 Overview

The goal of restoration planning under OPA is to identify restoration actions that are appropriate to restore, rehabilitate, replace or acquire natural resources or services equivalent to those injured or lost due to unlawful discharges of oil. Restoration planning may involve two components: primary restoration and compensatory restoration. Primary restoration actions are actions designed to assist or accelerate the return of resources and services to their pre-injury or baseline levels. Compensatory restoration actions, on the other hand, are actions taken to compensate for interim losses of natural resources and services, pending return of these resources and services to their baseline levels. For this Spill, response actions taken following the incident were sufficient to protect natural resources from further or future harm and to allow natural resources to return to pre-injury or baseline conditions within a reasonable period of time. Under these circumstances, it is unnecessary for the Trustees to consider or plan for primary restoration actions. Accordingly, this Final RP/EA addresses only compensatory restoration.

The goal of a compensatory restoration action is to restore, replace or acquire natural resources or services of the same type and quality, and of comparable value as those lost. To meet this objective, the NRDA regulations identify a variety of methods that may be used to evaluate or scale such actions. Trustees must consider using a service-to-service approach first. Under this approach, trustees determine the scale or amount of restoration that will provide a flow of natural resource services over time that will be equivalent to the quantity of services lost as a result of the resource injuries, taking into account the different time periods in which the services are provided through the use of discounting. When the service-to-service approach is not appropriate, trustees may use "valuation scaling". This approach explicitly measures the value of the resources and/or services lost; the scale of restoration is then defined as that required to produce natural resources and/or services of an equivalent value to the public. If, in the judgment of the trustees, use of the valuation scaling approach is not practicable, or cannot be performed within a reasonable time frame or at a reasonable cost, restoration is scaled using a "value to cost" approach. Under this approach, the scale of restoration will be that which can be achieved at a cost that is equivalent to the value of the resources and/or services lost.

The Trustees used a service-to-service approach to identify restoration sufficient to compensate for the ecological losses described in subsection 3.2. With respect to the ecological injuries, the Trustees identified and evaluated a reasonable range of restoration alternatives that would be potentially appropriate compensation for these. Consistent with the NRDA regulations, only those alternatives considered technically feasible and capable of being implemented in accordance with applicable laws, regulations and/or permits were considered (15 C.F.R. 990.53). The ecological restoration alternatives identified by the Trustees were then evaluated based on the criteria outlined in subsection 4.2 below. The "No Action" alternative was also considered, as required by NEPA and the NRDA regulations. In evaluating the alternatives, the Trustees sought to ensure that the restoration actions proposed for use would be capable of providing multiple benefits or services, so that restoration actions undertaken will also provide the greatest overall benefit to the public.

Section 5.0 presents the Restoration Plan selected as compensation for the ecological losses caused by the Spill (i.e., those losses identified in subsection 3.2 above). This section identifies the alternatives considered, the results of the Trustees' evaluation of those alternatives in light of the restoration objectives for the ecological injuries and the basis for selecting the preferred action. Consistent with its role as an Environmental Assessment under NEPA, this Final RP/EA includes information relating to potential environmental, social, and economic consequences of restoration in this setting and that the Trustees have considered in identifying the proposed restoration action.

The Restoration Plan presented in Section 5.0 does NOT address the recreational losses caused by the Spill (i.e., those identified in subsection 3.3 above). A separate Restoration Plan will be developed at a later time for those losses. This is appropriate in part because the value-to-cost approach will determine the "restoration scale" for the recreational losses, meaning that the amount of compensatory restoration for these losses will be equivalent in cost to (or achievable with) the dollar value of the recreational losses identified in subsection 3.3. The value-to-cost approach is being used because the methods required to implement either the service-to-service and valuation scaling approaches for these losses could not be applied without incurring significant additional costs and, based on the evidence available for this Spill, would be unlikely to yield a difference in restoration scale sufficient to justify the additional costs. Deferred plan development is also appropriate because the restoration goals for these losses are different and uncertainties associated with this planning (i.e., amount of restoration funds; community planning considerations; availability of matching funds; timing; necessary partnerships; etc.) make it difficult for trustees to complete a viable plan before funds are recovered. However, the Trustees intend to seek one project to compensate for both Shrimp baiting and Shellfishing recreational losses. The Trustees will develop a restoration plan for these losses as soon as is possible following any damages recovery, including with public input, prior to selecting a project for this purpose.

The remainder of this Section provides additional information pertaining to the restoration planning process undertaken for this Spill.

4.2 Restoration Selection Criteria

Consistent with the NRDA regulations, the following criteria were used to evaluate restoration project alternatives and to identify the restoration actions that where preferred for implementation:

The extent to which each alternative is expected to meet the Trustees' restoration goals and objectives: The primary goal of any compensatory restoration plan is to provide resources and services comparable to those lost. In meeting that goal for this Spill, the Trustees propose to create and/or enhance estuarine habitats and to enhance recreational access in and around the Cooper River/Charleston Harbor to offset assessed ecological and recreational losses. In addressing ecological losses, the potential relative productivity of restored habitat and whether the habitat is being created or enhanced is considered. Future management of the restoration site is also considered because management issues can influence the extent to which a restoration action meets its objective.

The cost to carry out the alternative: The benefits of an action relative to its cost are a major factor in evaluating restoration alternatives. Factors that can affect and potentially increase the costs of implementing a restoration alternative can include project timing, access to the restoration site (e.g., with heavy equipment or for public use), acquisition of state or federal permits, acquisition of the

land needed to complete a project, measures needed to provide for long-term protection of the restoration site, and the potential liability from project construction. The cost of monitoring sufficient to document restoration performance is a necessary component. Total project costs, and the potential availability of matching funds, if any, can also be considered.

The likelihood of success of each restoration alternative: The Trustees consider technical factors that represent risk to successful project construction, project function, long-term viability and sustainability of a restoration action. Alternatives susceptible to future degradation or loss, such as due to subsidence or erosion, are considered less viable. The Trustees also consider whether difficulties in project implementation are likely and whether long-term maintenance of project features is likely to be necessary and feasible.

The extent to which each alternative will avoid collateral injury to natural resources as a result of implementing the alternative: Restoration actions should not result in significant additional losses of natural resources and should minimize the potential to affect surrounding resources during implementation. Restoration actions with less potential to adversely impact surrounding resources are generally viewed more favorably. Compatibility of a restoration action with the surrounding land use and potential conflicts with endangered species are also considered.

The extent to which each alternative benefits more than one natural resource or service: This criterion addresses the interrelationships among natural resources, and between natural resources and the services they provide. Projects that provide benefits to more than one resource and/or yield more beneficial services overall, are viewed more favorably.

The effect of each alternative on public health and safety: Restoration actions that would negatively affect public health or safety are not appropriate.

The NRDA regulations give the Trustees discretion to prioritize these criteria and to use additional criteria, as appropriate. In developing this Final RP/EA, the first criterion listed above has been a primary consideration, because it is critical to ensuring that restoration will compensate the public for the resource injuries and losses attributed to this Spill through the Trustees' assessment. The evaluation of restoration alternatives using these criteria involves a balancing of interests in order to determine the best way to meet the restoration objective.

The Trustees approached restoration planning with the view that the injured natural resources and recreational services lost are part of an integrated ecological and recreational system and that the Cooper River/Charleston Harbor area represents the relevant geographical area for siting restoration actions. Areas outside the Cooper River/Charleston Harbor area were considered less geographically relevant as compensation for this Spill. This helped to ensure the benefits of restoration actions were related, or had an appropriate nexus, to the natural resource injuries and losses attributed to this Spill. The Trustees also recognized restoration actions should be consistent with local community objectives. Alternatives were considered more favorably if complementary with other community development plans/goals.

NEPA and the NRDA regulations required the Trustees to evaluate the "No Action" alternative, which for compensatory restoration equates to "No Compensation." Under this alternative, the

Trustees would take no action to compensate for interim losses associated with the evaluated natural resources.

4.3 Identification of Appropriate Restoration Alternatives

4.3.1 First Tier Screening of Potential Alternatives

At the outset of the restoration planning process, the Trustees used a matrix (Table 4.1) to compare potential restoration actions in the Cooper River/Charleston Harbor area to each of the ecological injuries and recreational impacts caused by the Spill. This exercise allowed the Trustees to identify restoration alternatives suited to meeting the stated restoration goal for each injury or loss. In this exercise, the Trustees rated each potential restoration alternative based on its ability to meet the primary restoration criterion for each type of injury or loss. Each injury/restoration alternative pairing was evaluated and assigned one of the following four ratings:

> **First Order Nexus** – Project type provides same resource services as were lost due to the injury.
>
> **Second Order Nexus** – Project type provides some of the same resource services as were lost due to the injury, and others that are similar.
>
> **Third Order Nexus** – Project type only provides resource services that are comparable and/or similar to those lost due to the injury.
>
> **No Nexus** -- Project type does not provide any of the same resource services as were lost due to the injury, and does not provide any that are comparable or similar.

As a result of this comparative screening evaluation, the Trustees found that for the shoreline and bird injuries a Multi-Habitat Acquisition/Creation/Enhancement Project (Marsh, Upland, Oyster) was most closely aligned with the primary restoration selection criterion. This alternative was followed closely by implementation of Wetland or Oyster Reef-based actions.

For the Shrimp baiting and Shellfishing recreational losses, this screening evaluation indicated actions that would improve Boating Access would be likely to meet the primary selection alternative. This information will be carried over and help the Trustees develop a restoration plan for those losses in the future.

Potential Injury Types and Appropriate Potential Compensatory Restoration Alternatives		Creation of Wetlands	Creation of Wetland/Oyster Area	Restoration of Degraded or Impounded Wetlands	Restoration of Degraded Wetland/Oyster Area	Protection of existing wetlands (erosion...)	Protection of Wetland/Oyster Area	Oyster Reef Creation	Acquisition of multi-habitat area (upland, wetland, beach) (under threat of development)	Boating Access (ramps etc.)	Enhancement of Bird Rehabilitation Capabilities	Enhancement of Bird Rookeries (Dredge Material Placement, etc.)	Mulit-Habitat Creation/Enhancement Project (Marsh, Upland, Oyster)	Beach Protection Projects (dunes, etc.)
Shoreline														
Vegetated Shoreline														
Non-Vegetated Shoreline														
Hard Structure														
Oyster Reef														
Birds														
Shorebirds														
Marsh Birds														
Wading Birds														
Seabirds														
Recreational Lost Use														
Shrimp Baiting														
Oyster Harvesting														

Ranking: The potential restoration alternatives above should me ranked compared to the various injury categories along the left side based on the criteria below.

Symbol & Rank		Definition of Ranking
	First Order Nexus	A project that provide the same services compared to those that were lost as a result of the injury.
	Second Order Nexus	A project that provides some services that are the same and others which are similar to those lost as result of the injury.
	Third Order Nexus	A project that provides comparable and similar services to those that were lost as a result of the injury.
	No Nexus	A project that does not provide the same or comparable service to those that were lost as result of the injury.

Table 4.1: Restoration Alternatives Matrix

4.3.2 Second Tier Screening - Identification of Project Alternatives

Having identified the types of restoration actions most likely to meet the restoration goal for each injury or loss, the Trustees began reviewing the specific project opportunities in the Cooper River/Charleston Harbor area consistent with these types of actions.

In 2003, the Trustees developed a list of more than 50 potential restoration opportunities in the Charleston Harbor area (Ridolfi Inc. 2003). Working cooperatively with the RP, the Trustees narrowed that list based on the following factors:

- Preference for projects that could be implemented in the short term.
- Preference for projects with a strong nexus to the injured resources.
- Preference for projects with a high degree of habitat enhancement.
- Preference for projects that limit disruption to existing resources.

Through that process, the following projects emerged as potential restoration alternatives for addressing the Shoreline and Bird injuries caused by this Spill:

- Noisette Creek Golf Course Wetland Restoration – Wetland restoration by breaching of a berm, adding a network of tidal creeks and lowering elevation of portions of the site of an abandoned golf course.
- Saltmarsh Creation/Enhancement at Long Branch Creek (Installation of Water Structure in Diagonal Berm) - Saltmarsh enhancement/creation by installing water conduit structure in an existing berm that was built at a "diagonal" axis to the creek.
- Saltmarsh Enhancement at Long Branch Creek (Culvert, Flap-gate & Berm Removal) - Saltmarsh enhancement by removing a water control structure and associated berms that were used to prevent saltwater from inundating upstream areas.
- Saltmarsh Enhancement at Long Branch Creek (Highway 17 Box Culverts Upgrade) - Saltmarsh enhancement by upgrading existing box culverts where Long Branch Creek flows under State Highway 17.
- Saltmarsh Enhancement at Long Branch Creek (Greenway Culvert Replacement) – Saltmarsh enhancement by replacing currently undersized culverts with a pedestrian bridge and/or properly sized culverts.
- Saltmarsh Creation/Enhancement at Noisette Creek (Concrete Perimeter Road Removal) – Saltmarsh enhancement/creation by removing an existing concrete causeway, grading and then planting *Spartina*.
- No Action.

The Trustees evaluated these alternatives using the criteria listed in subsection 4.2. The Trustees' evaluation of these alternatives is summarized in Table 4.2 (reflected by scale of zero to plus three). The preferred restoration alternative - Noisette Creek Golf Course Wetland Creation – is highlighted in bold. The Restoration Plan for Ecological Injuries presented in

Section 5.0 provides further information regarding the basis for choosing this restoration alternative and the evaluation of the non-preferred alternatives.

Restoration Alternative	Implementable in short term	Strong nexus between injured & restored habitats	Amount of habitat function enhancement	Avoids injury to existing resources
Long Branch Creek Diagonal Berm	No	+++	+++	Yes
Long Branch Creek Tidegate and Berm Removal	No	+++	+++	Yes
Long Branch Creek Highway 17 Box Culverts Upgrade	No	+++	+	Yes
Long Branch Creek Greenway Culvert Replacement	No	+++	+	Yes
Noisette Creek Golf Course	Yes	+++	+++	Yes
Noisette Creek Concrete Perimeter Road Removal	Yes	+++	++	Yes
No action	Yes	0	0	0

Table 4.2 Summary of Trustees' Second Tier Screening of Restoration Alternatives

5.0 RESTORATION PLAN FOR ECOLOGICAL INJURIES AND ANALYSIS FOR NEPA REQUIREMENT

The restoration project selected to compensate for ecological injuries is identified in subsection 5.1. Subsection 5.2 describes the other project alternatives that were considered but not selected.

5.1 Selected Alternative: Noisette Creek Golf Course Wetland Restoration

The selected project will restore saltmarsh habitat at the site of the former Navy golf course along Noisette Creek in North Charleston. This land is owned by the city of North Charleston and the Noisette Company and is identified as a priority site for restoration in the Noisette Creek Restoration Plan. The project will entail breaching a berm in two areas along Noisette Creek and construction of a network of tidal creeks throughout the property. Roads, drainage tiles, rip-rap and other sources of debris will be also be removed. These actions will result in increased tidal exchange across the site that will restore and improve tidal marsh habitat for fish and invertebrates. A total of 11.7 acres of saltmarsh habitat will be restored. Additionally, five upland islands totaling .45 acres will remain within the marsh and perimeter uplands bordering the entire site will be restored to functional marsh buffer habitat for such species groups as passerine birds.



Figure 5.1 Aerial view of the Noisette Creek Project Site

5.1.1 Historic and Current Project Site Conditions

Land Use

The project site is located close to the confluence of Noisette Creek and the Cooper River. The area has a long history of habitation. In the late 17th century, plantations were established north and south of the creek and focused on the development of land for agriculture. In 1901, the City

of Charleston provided the land to the U.S. Navy for development of a naval base. To create more useable land within the base, the Navy placed dredge spoils and other fill in nearby marshes. As part of this effort, the Navy filled in the marsh on the south side of Noisette Creek to create an executive golf course. Use of the site as a golf course continued until the Navy closed the base in 1996. The land was subsequently transferred to the City of North Charleston. Today, the majority of the land encompassing the former golf course is owned by the City of North Charleston; a small part of the site's most upland reach is owned by the Noisette Company. In recent years, the site has been unmanaged and is now largely overgrown with vegetation.

In 2002, the City of North Charleston entered into a Purchase and Sale Agreement with the Noisette Company to redevelop the former naval base property. Under this agreement, the Noisette Company was to provide master planning services for an approximately 4 miles^2 area that encompassed the former naval base property as well as adjacent incorporated areas of the City of North Charleston. A central feature of this agreement was the delineation of a 135 acre "recreation and nature preserve at the heart of the redevelopment, located around Noisette Creek and its marshes, creeks and inlets" called the Noisette Preserve. The Preserve area consists of 72 acres of existing marshes and open water, 55.6 acres that the City has contributed, and 7.3 acres that the Noisette Company plans to contribute.

In 2005, the Noisette Preserve Plan was developed. This plan outlines specific ecological restoration needs and management plans for the Preserve. The Preserve Plan included plans to restore the former Navy golf course site back to a tidal marsh environment as well as other recommendations for the entire 1400 acre Noisette Creek watershed intended to protect and enhance the Preserve.

Hydrology

The hydrology at the project site reflects the matrix of complex hydrological modifications carried out during past filling of the marsh and construction of the golf course. These modifications blocked routine tidal inundation from Noisette Creek. With the exception of the course's greens, a central north-south berm, and several roadways, the filling of the golf course was inadequate to fully raise it above tidal elevations. The greens, berm and roadways appear to have been created using fill from excavation of a pond on site, but also may have required fill from offsite. The site also features approximately 5,000 linear feet of subsurface drainage tiles that are connected to surface grates.

Topographic studies[16] and field observations indicate that the current tidal range within the site is muted compared to the tidal range reported outside of the water control structures, and that drainage is impeded by the structures and clogged drainage tiles (Figure 5.2). In addition, the site's north-south berm (Figure 5.2) separates the east and central drainage basins and appears to prevent free exchange of tidal waters with Noisette Creek, slows freshwater drainage from

[16] Topographic survey results from December 4-7, 2006 show a range of present elevations across the site, from a minimum +0.9 ft NGVD in the unvegetated portions of the constructed pond to a maximum +5.2 NGVD at the top of the highest former green. The majority of the site, however, features elevations between +3.0 and +4.0 ft NGVD (Figure 5.2). Reports indicate the 2006 mean range of tides at the Customhouse Wharf in Charleston is 5.3 feet, with the Mean Higher High Water (MHHW) reported to be + 6.1 feet Mean Lower Low Water (MLLW), and Mean Tide (MT) reported as +2.8 ft MLLW.

rainfall and slows upland drainage across the site.

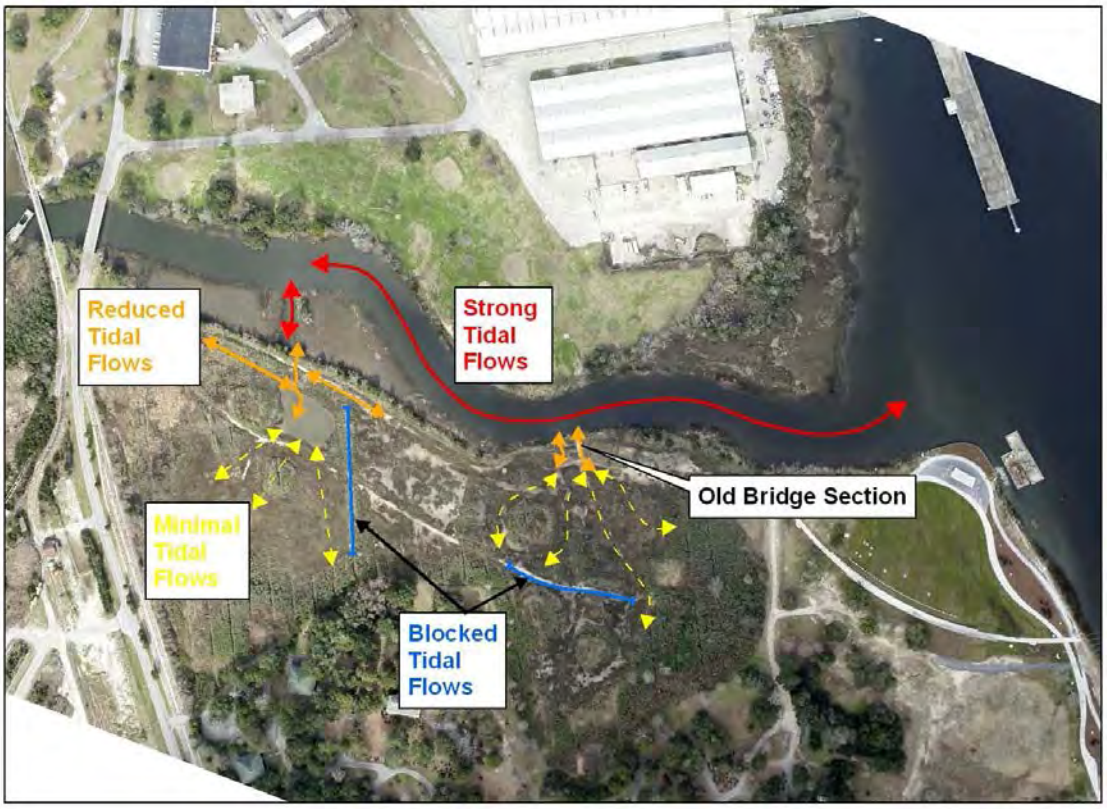


Figure 5.2 Current Hydrology of the Noisette Creek Site

Vegetation

Topographic maps included and data collected as part of the December 2006 survey indicate that most of the Noisette Creek landscape was saltmarsh prior to construction of the golf course. As saltmarsh, the site would have been dominated by smooth cordgrass (*Spartina alterniflora*). The site would have been characterized by taller and more vigorous growth of this species alongside Noisette Creek but these plants would have become shorter, sparser and intermixed with beach cordgrass and other salt-tolerant species further from the channel. Along the site's upland edge, the smooth cordgrass might have been replaced by zones of more salt-tolerant low-growing wetland plants. Where freshwater entered the marsh, there would likely have been stands of black rush (*Juncus roemerianus*).

Turf grasses were presumably planted on the greens and fairways when the golf course was constructed. Though the trustees have no records showing what species were planted in creating the course, Bermuda grass is present on the greens now and suggests some variety of *Cynodon dactylon* was used on parts of the course.

The status of vegetation communities at the site today indicates the golf course was abandoned at least 15 years ago. Natural ecosystem recovery processes have allowed coastal wetland plants to re-establish across most of the site but only to a limited degree as topographic and hydrological alterations, exotic plant invasion, and human disturbance (including periodic mowing) have interfered with normal succession and recovery patterns. Eighty-one (81) species of plants were

identified during the December 2006 survey. Most of the species on the site now can be generally grouped into one of the following four (4) categories of vegetation types: Salt Marsh, Brackish Marsh, Salt Flat and Salt Shrub Thicket. Although the site's elevated greens and berm along the creek are man-made landscape features (and not directly analogous to any of the site's original South Carolina habitats), these areas have been colonized by native plants and have begun to function like natural communities in the years since the course was abandoned. However, continuing human disturbance (including periodic past mowing) and invasion by exotic plant species are preventing these areas from progressing towards a higher level of ecological function.

Fauna
Observations of fauna at the site in recent years involve mainly passerine birds, a few wading birds, some small fish species and some invertebrates. No mammals were observed, but raccoon (*Procyon lotor*) and opossum (*Didelphis virginiana)* are likely residents. Small passerine birds observed using the site include a white-eyed vireo (*Vireo griseus*), blue jay (*Cyanocitta cristata*), cardinal and loggerhead shrike (*Lanius ludovicianus*). A northern harrier (*Circus cyaneus*) was spotted cruising over the marsh. The wading birds observed were six white ibis (*Eucocimus albus*) (overhead) and one snowy egret (*Egretta thula*). Calls of clapper rails (*Rallus longrostris*) were heard on occasion. Use of the site for feeding by herons and egrets appears largely non-existent. Likely this is due to the lack of shallow tidal creeks suitable to allow small fish to enter and exit the site.

Invertebrates observed included fiddler crabs (*Uca* spp.) and the marsh periwinkle (*Littorina littorea*). The total numbers of these species appeared to be very low, however, and they were observed only in a few specific locations suitable to survival under the wide range of flooding and drying conditions, and wide variability in salinities.

5.1.2 Description of Selected Restoration Actions

The hydrologic alterations, exotic plant invasion and human disturbances collectively continue to hinder recovery and to prevent full functioning of wetlands at the site. The vegetation communities struggle to progress through natural succession within disturbed areas and fauna diversity is limited due to the unavailability of suitable habitat. The site's value as wetland habitat can be increased through restoration actions. The Project involves activities needed to restore the site's hydrologic regime, increase the area of marsh, accelerate natural recovery of wetland vegetation, increase faunal diversity, and enhance wetland functioning.

The Project involves the removal of existing roads, the creation of tidal creeks, the removal of all the drainage tile systems, breaching of the north-south berm at two locations and removal of the creek side berm in the area where the major tidal connection and drainage pipes exist (Figure 5.3). These actions will increase the tidal range over the site and result in a more normal drainage pattern of freshwater flow from rainfall and uplands. This will allow for increased mixing of marine and freshwater and result in re-establishment of a salinity regime suitable for the growth of salt marsh vegetation and healthy functioning of tidal wetlands. Restoration of tidal flow and normalization of the salinity regime are necessary elements for restoring and improving habitat conditions at this site. The habitat improvements will encourage colonization and use of these wetlands by the small estuarine fish and invertebrates normally seen in these

habitats.

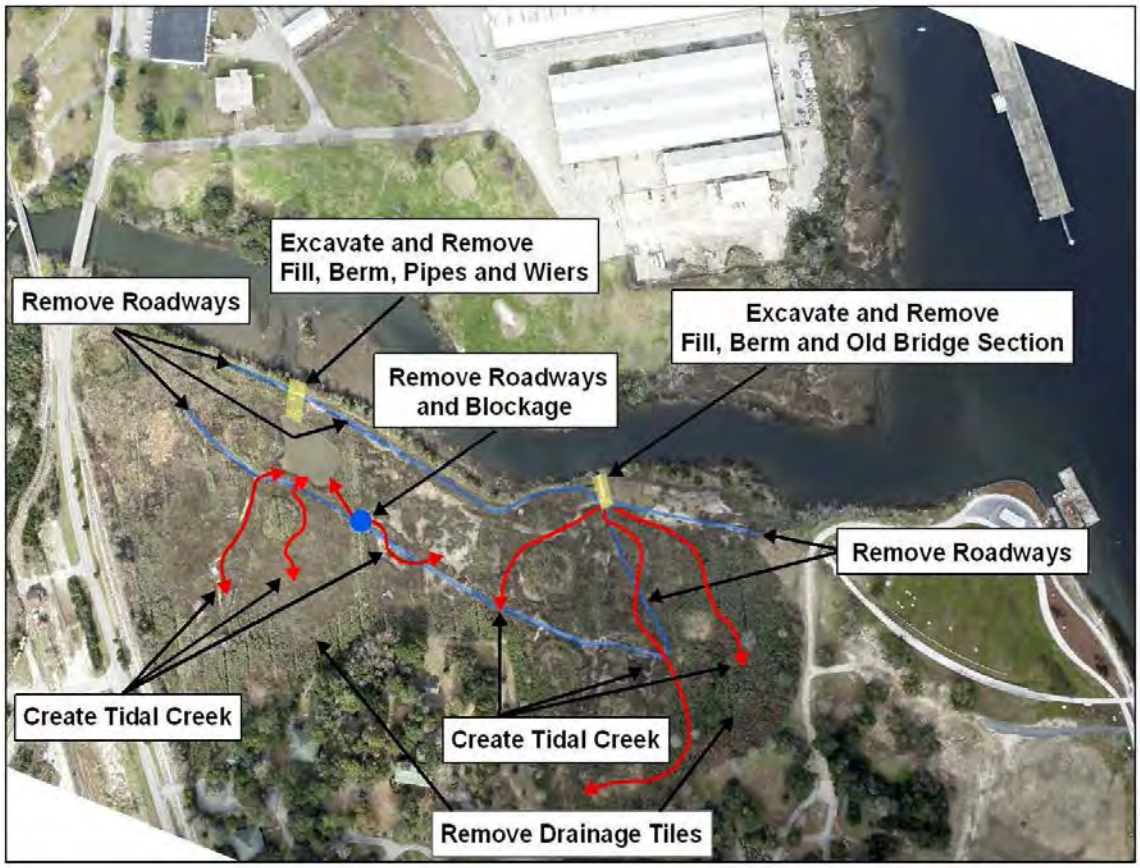


Figure 5.3 Overview of Selected Restoration Actions

Figure 5.3 provides an overview of the restoration activities associated with the Project. The Project is expected to result in enhanced functioning of tidal marsh habitat over 11.70 acres. Two tidal connections will be constructed (0.12 acres). Five upland islands within the marsh (0.45 acres) and the existing pond (0.36 acres) will remain. The 0.45 acre of island uplands and the perimeter uplands will be restored to functional marsh buffer habitat. This will be achieved by removing exotic plant species (primarily Chinese tallow) and planting of native upland species such as red cedar and southern red oak.

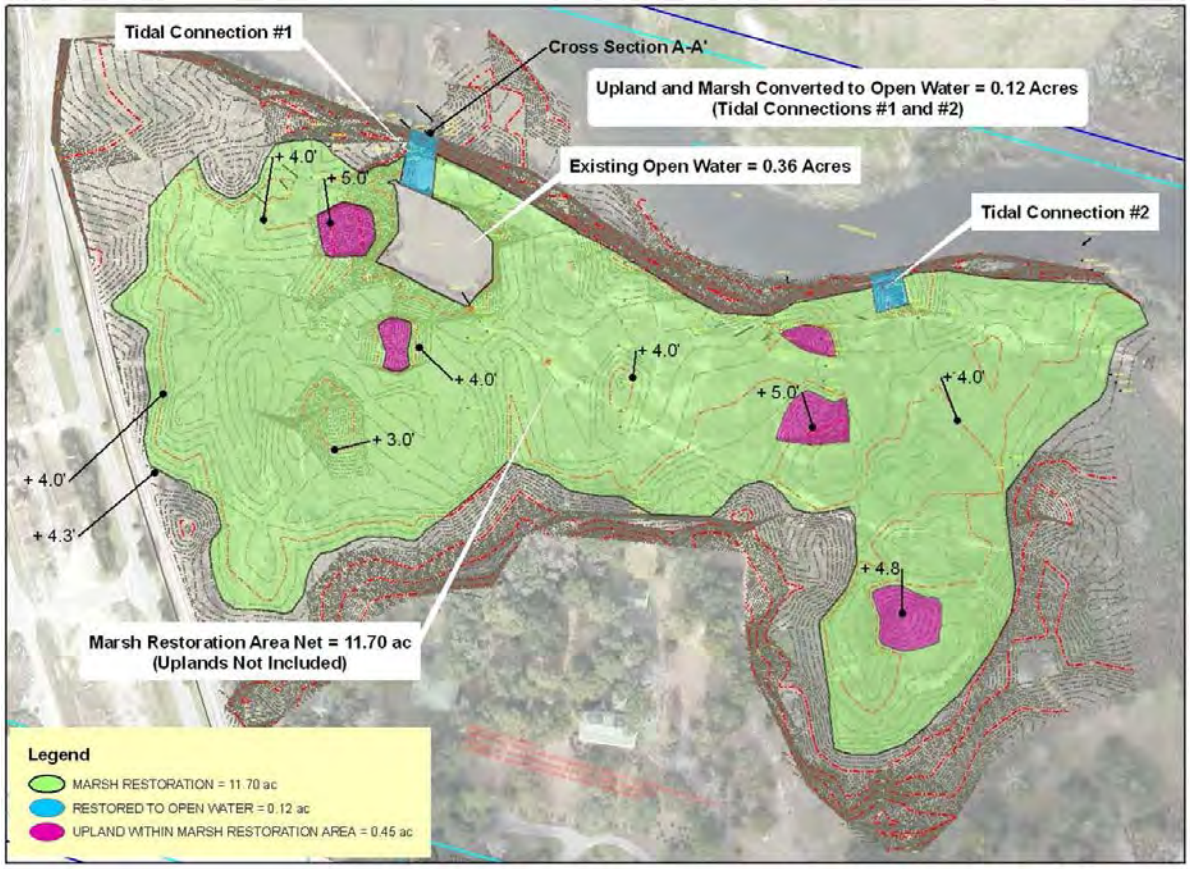


Figure 5.4 Expected Site Characteristics Post-Restoration

To ensure the restoration actions result in the establishment of the expected structural and functional site characteristics, detailed monitoring activities of the site will be conducted to ensure specified success criteria will be met at appropriate time horizons. Details of this process will be explained in a Restoration Implementation Monitoring Plan.

5.1.3 Evaluation of Alternative

The selected Project represents an opportunity for successful estuarine habitat restoration using a very cost-effective approach: the re-introduction of tidal flow. The Project site is within the Cooper River and Charleston Harbor environment affected by the spill and is central to the areas where injuries to birds and shoreline habitats occurred. The improved salt marsh habitat will provide shoreline habitat services comparable to those lost and habitat and food sources needed to locally enhance affected bird populations. The planned restoration activities, including the techniques to be used in implementation, have a high likelihood of success. The restored wetland is expected to require minimal intervention following implementation in order to achieve functional success, to be largely self-sustaining, and to provide an uninterrupted flow of services into the future. The Project is consistent with the public objectives and master plan for re-development of the approximately 4 square mile area encompassing the former naval base property as well as the Noisette Preserve Plan which describes both restoration needs and management plans for this site within the 135 acre Noisette Preserve. The public owners and partners involved in planning and restoration of lands within the Preserve approve of the proposed restoration actions at the site, will allow access to the site for implementation and

monitoring and will ensure long-term protection of the restored site through appropriate measures. The nature of the Project and the setting for implementation would present no human health or safety issues beyond those met by standard procedures for safe construction.

5.1.4 Evaluation of Restoration Scale

The scale, or size, of a restoration project should provide enough ecological service gains to offset assessed losses. This section describes the Trustees' evaluation of the scale of restoration required to compensate for the bird and shoreline losses described in subsection 3.2 and the ability of the proposed Project to provide offsetting ecological gains. The scale of restoration required is first presented in terms of the amount of salt marsh *creation* required to offset the assessed losses. The Project described in subsection 5.1, however, is focused on a site with areas currently providing some wetland functioning, albeit in a degraded state. The Project will result in "enhancement" of the functioning of these existing wetlands, not the "creation" of new wetlands. On a per-acre basis, "enhancement" will yield a percentage of the wetland services that would be gained via creation of a new wetland acre. The means by which the Trustees translated the marsh "creation" requirements derived for the bird and shoreline injuries for use in evaluating the "enhancement" gains expected from implementation of the Project is also described in this section. The comparison of losses and gains is expressed in terms of "discounted service-acre-years", or DSAYs, lost. To allow comparison, 'service-acre-years' have to be discounted to account for the difference in time between when losses occur and services gained through restoration are delivered.

A. Restoration Requirement for Bird Injuries

For bird losses, the amount of salt marsh restoration required to offset the assessed bird losses was estimated using food web modeling and HEA calculations. This was a two step process involving (1) the use of trophic transfer modeling to estimate the compensatory bird food production rate per unit of salt marsh created and (2) determining the amount of food required to produce additional fledglings. This information was then used to calculate the area of marsh required to offset the assessed loss, that is, to produce the same number of fledglings assessed as equivalent to the bird losses in subsection 3.2.1. This approach recognizes that the creation of saltmarsh increases invertebrate and fish production, the additional production represents appropriate bird food (i.e. added prey biomass) for the injured bird species, and increases in the prey biomass for birds can contribute directly to increasing fledgling production and survival.

Following this method, the Trustees estimate that 5.8 acres of salt marsh creation (75.95 DSAYs) would be required to produce sufficient food to feed a sufficient number of fledglings to compensate over time for the bird losses. Further details of this scaling analysis for birds may be found in the *Final Report on Restoration Scaling for Bird Injuries*, November 13, 2006, included in this RP/EA as Appendix C.

Injury Basis	Number of Birds	Created Wetland Acres Required (to feed the fledglings)
Observed heavily oiled birds	19-24	1.3
Observed lightly oiled birds	101-106	*2.3*
Based on SIMAP modeling	45-50	2.2
Total Birds	175	5.8

Table 5.1: Estimated Restoration Requirements for Birds[17]

The largest wetland creation requirement is associated with the bird losses.

B. Restoration Requirement for Shoreline Injuries

Subsection 3.2.3 describes in the shoreline losses estimated using the HEA method. This represents the 'debit side' of this model[18]. The HEA method can also be used to estimate the extent of restoration needed to compensate for these losses. The total ecological service losses for the four types of shoreline habitats affected by the Spill are estimated to be 12.22 DSAYs.

To determine the salt marsh *creation* needed to offset the shoreline losses, the Trustees assumed that a salt marsh creation project would begin in the year 2009, take 15 years to reach 80% of full function, and have a project lifespan of 50 years. Applying these assumptions, the Trustees estimated that one acre of salt marsh creation would yield 13.095 DSAYs over its lifespan. Offset of the assessed shoreline losses then would require .93 acres of salt marsh creation.

The Trustees' evaluation of the gains (DSAYs of new salt marsh services) estimated from the proposed Project over its lifespan are described below.

C. Selected Project - Restoration Credit Analysis

The Noisette Creek Golf Course Wetland Restoration Project will restore 11.7 acres of saltmarsh. As explained earlier, the site has already begun a slow natural transition towards re-establishing itself as a wetland. The Trustees estimate[19] that the site's present level of functioning provides approximately 25% of the services that a natural wetland would normally

[17] The values in this table have been adjusted to correspond to restoration implementation in 2009. The same table in the Final Report on Restoration Scaling for Bird Injuries (Appendix D) presented values assuming restoration implementation in 2007.

[18] HEA begins with the injury assessment and an identification of the habitat-specific resource services that were lost due to the incident. A "debit" is specified for the lost services for each type of resource habitat. The debit equals the loss in service-acre-years from the injury to the habitat, as a result of the incident, in present-value terms. For each debit, the scale of a compensatory restoration project is determined by calculating the credit, per acre, that a restoration project will generate over its lifespan. This credit is the present value of the ecological services provided by the project. The size of the compensating project needed to produce total service gains over time that equate to the total services lost is then determined.

[19] This estimate is based on the collective expertise and best professional judgment of the Trustees' technical staff.

provide. When estimated, restoration actions at the site were expected to occur in the year 2009, with the site expected to reach maximum wetland functioning (80% relative value compared to a natural marsh) in the year 2024. The Project is expected to have a 50 year lifespan. Using these as input parameters, the Trustee's calculated that the Project would yield a net increase in wetland services of 9.003 DSAYs per acre over the lifespan of the 11.7 restored acres. This results in an estimate that the Project would yield a total of 105.7 in additional DSAYs over its lifespan. These service gains would be sufficient to offset the losses assessed for the bird and shoreline injuries.

5.1.5 Environmental & Socio-Economic Impacts

The environmental and socio-economic impacts of the described restoration actions are largely beneficial. The actions to be implemented will increase tidal exchange over the site, improve and enhance a tidal marsh habitat, improve and enhance adjacent buffer and upland areas, and increase the site's overall diversity, value and usage as habitat for fish, invertebrates, birds and other wildlife. These effects, in turn, will contribute to improving the overall quality of the environment within Charleston Harbor, allowing for increased populations of birds, improved habitat for marine mammals**,** improved habitat for intertidal and subtidal biota, and other benefits for a variety of federally threatened and endangered species and State-listed sensitive species in this system. Certain restoration actions (e.g., berm breaching; excavation and removal of roads, drainage system and debris; creating tidal creek network, etc.) have associated adverse effects, including noise, added traffic, and turbidity in surface waters. These effects, however, will be localized and of very limited duration. Potential impacts from invasive species as a result of site modifications will be minimal, as the restoration action will create habitat conditions conducive to the re-establishment of native species. To eliminate the potential of invasive introduction to the project site, no invasive materials will be transported from off-site, and local contractors and equipment will be utilized for construction. Post-construction monitoring will include observations and actions as needed to prevent or control invasive species. The Project will have only positive impacts in the local community. The actions to be undertaken will restore an area adjacent to a city park and residential community that is currently run-down and overgrown. These improvements will contribute to and increase the value of the Noisette Preserve area as a public amenity within the community. Such improvements also help support or increase local property values and contribute to the overall quality of life in North Charleston. The Project's location directly adjacent to a city park may allow for increased educational opportunities. Both recreational and commercial fisheries in the Charleston Harbor area have the potential to indirectly benefit as the proposed Project will improve habitat in the system that many economically important species of finfish and invertebrates rely on during various life stages.

The project, as described in section 5.1.2 above, is not expected to have a significant cumulative effect on the human environment since it alone, or in combination with other wetland restoration projects in the vicinity, will not result in any change in the larger current pattern of hydrologic discharge, boat traffic, economic activity or land-use in the Charleston Harbor watershed.

Additional information on the likely ecological and socio-economic effects of the Project is found in subsection 6.1 (NEPA Significance Analyses).

5.2 Non-Selected Restoration Alternatives

5.2.1 Saltmarsh Creation/Enhancement at Long Branch Creek (Installation of Water Structure in Diagonal Berm) - This project involves the installation of a water conduit structure in an existing berm that was built at a "diagonal" axis to Long Branch Creek. This berm currently restricts tidal flow. The proposed structure would serve to increase tidal flow to the impounded area and result in an improvement in salt marsh habitat for fish and invertebrates.

Evaluation of Alternative
While this project could conceptually meet the Trustees' goals and objectives in this Final RP/EA and also presents a high likelihood of success, the project was not favored because of inherent complications, delays, and additional costs associated with relocating utility lines that are currently buried in the berm. The project also has foreseeable potential permitting problems since it involves exposing an area currently designated as "jurisdictional freshwater wetlands" to increased tidal flow and salinity intrusion. Indeed, these wetlands are already proposed to be protected in their current freshwater condition as part of a master plan for an adjacent residential development. Taking into account the complications and costs associated with gaining the support of stakeholders, relocating the utility lines and the obstacles to obtaining necessary permits, the Trustees concluded this was likely not a viable option for use to compensate for injuries and losses caused by this Spill.

Environmental and Socio-Economic Impacts
The environmental impacts of this project would be similar in nature to those of the preferred project and largely beneficial (i.e., would add ecological services comparable to those lost, including habitat and food sources needed to enhance fish, invertebrates, and affected bird populations, would be largely self-sustaining, and would provide an uninterrupted flow of services into the future). The effects would benefit a wide variety of fish and wildlife, including those of recreational and commercial importance. Construction may disturb or displace resources within the footprint and immediate vicinity of the project area, but these impacts would be minimal, largely temporary, and result in no long-term effects other than the positive effects associated with the future functioning of the enhanced marsh. Further, its implementation would present no human health or safety issues beyond those met by standard procedures for safe construction.

5.2.2 Saltmarsh Enhancement at Long Branch Creek (Culvert with Flap Gate & Berm Removal)- This project would entail the removal of a water control structure (culvert with one-way flap gate), together with its associated berms. Removal of these structures would increase tidal flow and circulation and restore salt marsh habitat to the relic impounded area.

Evaluation of Alternative
This project represents a cost-effective means of restoring salt marsh, has a high likelihood of success and is consistent with the goals and objectives of the restoration planning for this Spill. However, plans already approved for an adjacent residential development provide for incorporating this berm into a system of walking trails for

residents of the development and the owners/developers of this land have indicated they are not willing to modify that plan. The Trustees believe that the actions involved in this project could be designed to be compatible with use of this berm as part of the residential walking trail, however, until the current owners of the berm area will agree to these modifications, or until ownership is transferred to another entity (such as a homeowners association), project implementation will not be feasible.

Environmental and Socio-Economic Impacts
The environmental impacts of this project would be similar in nature to those of the proposed project and largely beneficial (i.e., would add ecological services comparable to those lost, including habitat and food sources needed to enhance fish, invertebrates, and affected bird populations, would be largely self-sustaining, and would provide an uninterrupted flow of services into the future). The effects would benefit a wide variety of fish and wildlife, including those of recreational and commercial importance. Construction may disturb or displace resources within the footprint and immediate vicinity of the project area, but these impacts would be minimal, largely temporary, and result in no long-term effects other than the positive effects associated with the future functioning of the enhanced marsh. Further, its implementation would present no human health or safety issues beyond those met by standard procedures for safe construction.

5.2.3 Saltmarsh Enhancement at Long Branch Creek (Highway 17 Box Culverts Upgrade) – This restoration alternative involves upgrading existing box culverts where Long Branch Creek flows under State Highway 17. This action would improve hydrologic conditions by increasing tidal flow that would result in enhanced functioning of an existing salt marsh.

Evaluation of Alternative
This project would have a high likelihood of success and is also consistent with the goals and objectives of the restoration planning for this Spill but several factors weighed against its selection. Though the existing culverts are slightly undersized (they are not visible at high tide), they appear to provide adequate tidal exchange. Costly engineering studies would be needed both to understand the extent of the hydrologic benefits that could be realized as well as to determine the risk to local properties and infrastructure from any hydrologic alteration. Also, Highway 17 is a major transportation artery and disrupting that critical traffic flow for any period of time would involve political, public relations, and financial challenges, a longer period for project planning with South Carolina Department of Transportation and project delay.

Environmental and Socio-Economic Impacts
The environmental impacts of this project would be similar in nature to those of the proposed project and largely beneficial (i.e., would add ecological services comparable to those lost, including habitat and food sources needed to enhance fish, invertebrates, and affected bird populations, would be largely self-sustaining, and would provide an uninterrupted flow of services into the future). The effects would benefit a wide variety of fish and wildlife, including those of recreational and commercial importance. Construction may disturb or displace resources within the footprint and immediate vicinity of the project area, but these impacts would be minimal, largely temporary, and result in no long-term

effects other than the positive effects associated with the increased tidal hydrology and exchange resulting from the restoration project.

5.2.4 Saltmarsh Enhancement at Long Branch Creek (Greenway Culvert Replacement) – This project involves increasing tidal flow through a large berm that is the first point of tidal restriction on Long Branch Creek. The berm is part of a community greenway that is built over two undersized culverts, located approximately 1300 feet downstream from Highway 17. This project alternative would increase tidal exchange for the entire Long Branch Creek system by constructing a pedestrian bridge and/or incorporating properly sized culverts. This action would improve hydrologic conditions by increasing tidal flow that would result in enhanced functioning of an existing salt marsh.

Evaluation of Alternative

This project would have a high likelihood of success and is consistent with the goals and objectives of the restoration planning for this Spill, however, several factors weighed against its selection. Costly preliminary studies (i.e.: detailed hydrological modeling) are needed to assess the extent to which increasing the tidal prism at this point in the creek would put undue pressure on the undersized box culverts located at Highway 17. The results of these studies are critical to determining the project's overall desirability and feasibility. These studies have not been conducted by local agencies to date due to lack of funds. There is also uncertainty as to whether increasing the flow to the creek system would result in sufficient improvement in the system to meet the compensatory goal of this restoration plan. All of these factors weighed against preferring this alternative.

Environmental and Socio-Economic Impacts

The environmental impacts of this project would be similar in nature to those of the proposed project and largely beneficial (i.e., would add ecological services comparable to those lost, including habitat and food sources needed to enhance fish, invertebrates, and affected bird populations, would be largely self-sustaining, and would provide an uninterrupted flow of services into the future. The effects would benefit a wide variety of fish and wildlife, including those of recreational and commercial importance. Construction may disturb or displace resources within the footprint and immediate vicinity of the project area, but these impacts would be minimal, largely temporary, and result in no long-term effects other than the positive effects associated with the increased tidal hydrology and exchange resulting from the restoration project.

5.2.5 Saltmarsh Creation/Enhancement at Noisette Creek (Concrete Perimeter Road Removal) – This project, which would also occur on the former Charleston Naval Shipyards site, involves removing an existing concrete causeway and removing and re-grading fill material to reintroduce tidal flow and restore salt marsh.

Evaluation of Alternative

While this project could conceptually meet the Trustees' goals and objectives in this Final RP/EA, the project site is the subject of ongoing environmental investigations for soil and sediment contamination. The potential presence of contamination raises questions about its suitability for restoration and its likelihood of success. Further, these investigations will delay planning and implementation of any restoration project and may

lead to further delays and costs if clean up is determined to be necessary. The Trustees did not prefer this alternative for these reasons.

Environmental and Socio-Economic Impacts
The environmental impacts of this project would be similar in nature to those of the selected project and largely beneficial (i.e., would add ecological services comparable to those lost, including habitat and food sources needed to enhance fish, invertebrates, and affected bird populations, would be largely self-sustaining, and would provide an uninterrupted flow of services into the future). The effects would benefit a wide variety of fish and wildlife, including those of recreational and commercial importance. Construction may disturb or displace resources within the footprint and immediate vicinity of the project area, but these impacts would be minimal, largely temporary, and result in no long-term effects other than the positive effects associated with the increased tidal hydrology and exchange resulting from the restoration project. .

5.2.6 No Action – Under this alternative, the Trustees would take no direct action to restore injured natural resources or compensate for lost services pending natural recovery.

Evaluation of the Alternative
NEPA requires the Trustees to consider a "no action" alternative, and the OPA regulations require consideration of the natural recovery option. These alternative options are equivalent. Under this alternative, the Trustees would rely on natural processes for recovery of the injured natural resources. While natural recovery would occur over varying time scales for the injured resources, the interim losses suffered would not be compensated under the "no action" alternative.

Environmental and Socio-Economic Impacts
This approach relies on the capacity of ecosystems to "self-heal". The principal advantages of this approach, where it is appropriate, are its ease of implementation and low cost. In this restoration planning process, however, the Trustees objective is to compensate for assessed losses in the form of actions that will restore, replace, or provide services equivalent to those lost. Under the "no action" alternative, restoration actions needed to make the environment and the public whole for its losses would not occur. This is inconsistent with the goals of natural resource damage provisions under OPA, and the compensatory objective of this restoration plan. Thus, the Trustees have determined that the "no action" alternative *(*i.e., no compensatory restoration) must be rejected on that basis.

6.0 NEPA, ENDANGERED SPECIES ACT AND ESSENTIAL FISH HABITAT: ANALYSES AND FINDING OF NO SIGNIFICANT IMPACT

6.1 NEPA Significance Analyses and Finding of No Significant Impact

As noted in subsection 1.5, NEPA requires federal agencies to prepare an environmental impact statement (EIS) if they are contemplating implementation of a major federal action expected to have significant impacts on the quality of the human environment. 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 a project, including beneficial effect, must be evaluated. 40 C.F.R. § 1508.8. Federal agencies prepare an environmental assessment (EA) to consider these effects and evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required.

In accordance with NEPA and its implementing regulations, an EA is integrated into this Final RP/EA. The main body of this document summarizes the environmental setting, describes the purpose and need for restoration, identifies the alternatives considered, assesses their applicability and potential environmental consequences and summarizes the opportunity the Trustees provided for public participation in the development of this Final RP/EA.

This section of the document specifically addresses the factors and criteria that federal agencies are to consider in evaluating the potential significance of proposed actions, as identified in Section 1508.27 of the NEPA regulations. 40 C.F.R. § 1508.27. The regulations explain that significance embodies considerations of both context and intensity. In the case of a site-specific restoration project, as proposed in this Final RP/EA**,** the appropriate context for considering significance of the action is local, as opposed to national or worldwide.

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

- likely impacts of the proposed project including on biodiversity and/or ecosystem function
- likely effects of the project on public health and safety,
- unique characteristics of the geographic area in which the project is 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 sites listed on the National Register of Historic Places, or likely impacts to significant cultural, scientific or historic resources,

- degree to which the project may adversely affect endangered or threatened species or their critical habitat
- likely impacts resulting from the introduction or spread of nonindigenous species, and
- potential violations of environmental protection laws.

These factors, together with the federal Trustees' conclusion concerning the likely significance of the preferred restoration Project (preferred alternative), are reviewed below.

Nature of Likely Impacts, including on Biodiversity and Ecosystem Function
The anticipated restoration actions will increase tidal exchange to accelerate recovery and enhance 11.7 acres that are slowing transitioning to estuarine wetlands. The restoration actions will increase marsh habitat function and habitat diversity at the site. Additionally, the action will generally provide improved nursery, foraging, and cover habitat for numerous species of fish that utilize fringe marsh, as well as other species that inhabit or utilize interior estuarine marsh and surrounding areas. The anticipated actions will restore wetlands and increase their services and benefits to resources within the Charleston Harbor Estuary. The enhanced and increased marsh habitat resulting from these actions will also provide improved (from current conditions) areas for birds and other wildlife species to nest, forage, and seek protection. Aesthetic and recreational benefits to humans will also accrue, consistent with public access and usage afforded by owners and managers of the Noisette Preserve.

Effects on Public Health and Safety
The Trustees evaluated the potential for the planned restoration actions to impact public health and safety by considering the following: air and noise pollution, water use and quality, geological resources, soils, topography, environmental justice, energy resources, recreation, traffic, and contaminants.

Air Quality: Minor temporary adverse impacts would result from the Project's construction activities. Exhaust emissions from earth-moving equipment would occur but only during the construction phase of the project, the amounts would be small, and should be quickly dissipated by prevailing winds. There would be no long-term negative impacts to air quality.

Noise: Noise associated with earth-moving equipment represents a short-term adverse impact during the construction phase. Though present wildlife usage of the site appears to be limited, it is possible that equipment may temporarily disturb wildlife in the immediate vicinity, or cause movement of wildlife away from the site. Similarly, though the site does not support much if any active recreation by humans, it is possible that some persons may avoid this area due to noise during construction, but as with wildlife, such disruption will be limited to the construction phase, and there are many better substitute recreation sites readily available in the Cooper River and Charleston Harbor area. No long-term effects would occur as a result of noise during construction.

Water Quality: In the short term earth moving activities might temporarily increase turbidity in waters immediately adjacent to the site. If this is a risk, there are measures that can be taken during construction (*e.g.*, turbidity curtains) that will minimize this effect. Over the longer term, the anticipated restoration actions will accelerate recovery of and enhance estuarine wetlands at the site. Local water quality will benefit from increased exchange and filtration of tidal waters.

Geology: None of the anticipated restoration actions have the potential to directly or indirectly affect, positively or negatively, the geology of the area.

Energy: No energy production, transport, or infrastructure occurs in vicinity of the restoration site and none of the anticipated restoration actions have the potential to in any way affect energy production, transport, or infrastructure in the Cooper River or Charleston Harbor area.

Recreation: Though noise and increased turbidity of surface waters due to earth-moving activities during construction can temporarily discourage and decrease recreational activities in the vicinity of a site, this site does not currently support much if any active recreation. Nonetheless, it is possible that some persons may avoid this area due to noise during construction, but such disruption would be minor and limited to the construction phase, and there are many better substitute recreation sites readily available in the Cooper River and Charleston Harbor area. In the longer term, the anticipated restoration actions may increase and enhance the aesthetics and recreational opportunities within the Noisette Preserve, consistent with public access and usage afforded by owners and managers of that area.

Traffic: Land-based equipment traffic will occur or increase at the site during the period of construction. There is little to no other land-based traffic in the area, so no affects on other land-based traffic will occur. Once construction is complete, the added land-based equipment traffic will end. No other impacts to traffic in the area are indicated.

Contaminants: The Trustees have no reason to believe there are any contaminants of concern at the restoration site. As part of the process for closure of the former naval base and prior to transfer of those lands to the City of North Charleston, extensive investigations of the former naval base lands were undertaken for the purpose of identifying contaminants on the property and defining necessary clean-up actions. These investigations did not identify any contaminants of concern associated with lands comprising the former base golf course.

Unique Characteristics of the Geographic Area

The project will be conducted in an area that has been significantly influenced by human disturbance. Originally a saltmarsh, the area was filled in order to serve as a golf course, but has been abandoned in recent years. Today, the site is occasionally inundated during periods of extreme high tides. There area contains limited amount of coastal wetland plants, exotic invasive plants and passerine birds. Due to the former disturbance of the area, no unique or rare habitat would be lost or affected in undertaking the proposed restoration actions.

Controversial Aspects of the Project or its Effects

The planned restoration actions are expected to benefit ecological resources and to benefit local aesthetics and humans consistent with public access and usage afforded by owners and managers of the Preserve. There are no known historic sites or cultural resources in the area that will be affected by these restoration actions. This has been confirmed with the South Carolina State Historic Preservation Office (SHPO) within the South Carolina Department of Archives and History. The project appears to have no elements or environmental effects that are controversial or likely to cause adverse public reaction.

Uncertain Effects or Unknown Risks
Given the setting and information available, the federal Trustees do not believe there is any significant uncertainty as to potential effects or unknown risks to the environment associated with implementing the planned restoration actions.

Precedential Effects of Implementing the Project
Wetland restoration and creation projects have previously been planned and undertaken in coastal South Carolina environments, including as a means of compensating the public for other natural resource damage claims. The project does not, in and of itself, create a precedent for future actions of a type that would significantly affect the quality of the human environment.

Possible, Significant Cumulative Impacts
Project impacts will be cumulative in the sense that accelerating the recovery and enhancement of estuarine marsh at this site will provide ecological services into the future. The project is not expected to have a significant cumulative effect on the human environment since it alone, or in combination with other wetland restoration projects in the vicinity, will not result in any change in the larger current pattern of hydrologic discharge, boat traffic, economic activity or land-use in the Charleston Harbor watershed. The project actions will only restore habitat that originally existed and occurred naturally at this location. Further, the restoration actions to be undertaken will compensate the public, *i.e.*, make the public and the environment whole, for resources injuries caused by an oil spill in the Charleston Harbor area. The planned restoration actions are not part of any larger systematic or comprehensive plan for restoration of coastal wetlands in South Carolina.

Effects on Sites Listed on the National Register of Historic Places or Significant Cultural, Scientific or Historic Resources
NOAA, in consultation with the South Carolina State Historic Preservation Officer (SHPO) pursuant to 36 C.F.R. Part 800 of the regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. § 470f), recognized that the restoration action may have an adverse effect on the Charleston Navy Yard Officers' Quarters District, which is listed in the National Register of Historic Places. While there may be a minor adverse effect to the historic property, NOAA and the Trustees have determined that the effect will be minimal and will not significantly impact the quality of the human environment.

In order to account for the effect of the restoration action on historic properties, NOAA, the SHPO and Evergreen International S. A. have agreed that the undertaking shall be implemented in accordance with specific stipulations regarding the development and inclusion of interpretative signage at the project site. This agreement is documented by a Memorandum of Agreement (MOA) between NOAA, the SHPO and Evergreen International S.A. This MOA is part of the Administrative Record.

Effects on Endangered or Threatened Species, and Their Critical Habitat
Endangered and threatened species known to occur in the Charleston Harbor estuary are listed in Table 6.1 (USFWS 2005, Sandifer et al. 1980). Many of these species, including the wood stork (*Mycteria americana*), piping plover (*Charadrius melodus*), green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempi*), and loggerhead sea turtle (*Caretta caretta*) have been documented in or are believed to utilize the Charleston Harbor estuary. Most species would be present in the estuary incident to migration through the area. The estuary's habitats provide

general support for any threatened and endangered species migrating through or utilizing these communities.

Likely impacts resulting from the introduction or spread of nonindigenous species
As discussed in section 5.1.5, measures will be taken to prevent possible introduction of nonidigenous species during construction. Therefore no adverse impacts resulting from the introduction or spread of nonindigenous species from project construction activities are anticipated.

Table 6.1 Federal and State Endangered or Threatened Species in the Charleston Harbor Area

Common Name	**Scientific Name**	**Status**
Mammals		
West Indian manatee	*Trichechus manatus*	FE, SE
Birds		
Bachman's warbler	*Vermivora bachmanii*	FE, ST
Kirtland's warbler	*Dendroica kirtlandii*	FE, ST
Piping plover	*Charadruis melodus*	FT, Critical Habitat
Red-cockaded woodpecker	*Picoides borealis*	FE, ST
Bald eagle	*Haliaeetus leucocephalus*	ST
Wood stork	*Mycteria americana*	FE, SE
Reptiles and Amphibians		
Green sea turtle	*Chelonia mydas*	FT
Leatherback turtle	*Dermochelys coriacea*	FE, SE
Loggerhead sea turtle	*Caretta caretta*	FT, ST
Kemp's ridley turtle	*Lepidochelys kempii*	FE, SE
Flatwoods salamander	*Ambystoma cingulatur*	FR
Fish		
Shortnose sturgeon	*Acipenser brevirostrum*	FE, SE
Plants		
Sea-beach amaranth	*Amaranthus pumilus*	FT
Canby's dropwort	*Oxypolis canbyi*	FE
Pondberry	*Lindera melissifolia*	FE
Chaff-seed	*Schwalbea americana*	FE

Recent studies of the project site indicated no presence of endangered or threatened species. Additionally, the general locale where the restoration actions would be sited is not critical habitat for any listed species. The Trustees know of no direct or indirect impacts of the proposed restoration actions on threatened or endangered species, or their designated critical habitats.

Violation of Environmental Protection Laws
Wetland restoration projects have been implemented in coastal South Carolina consistent with federal, state and local laws designed to protect the environment. The proposed Project has no unique attributes or characteristics in that regard. Therefore, the Trustees have no reason to believe, and do not anticipate, that any federal, state or local laws would be violated incident to or as a consequence of the implementation of the proposed restoration actions.

Finding of No Significant Impact
Under 40 C.F.R. §§ 1501.5 and 1501.6, for the purposes of this NEPA analysis, NOAA is the lead agency and USFWS is a cooperating agency. Based on the analysis of the available information presented in this document, the federal Trustees have concluded that implementation of the Noisette Creek Golf Course Wetland Restoration Project, as described in this Final RP/EA, will not significantly impact the quality of the human environment. All potential beneficial and adverse impacts have been considered in reaching this conclusion. No potential for significant impacts was revealed through the public review and comment process on the Draft RP/EA. Accordingly, an Environmental Impact Statement (EIS) will not be prepared with respect to the selected restoration actions.

Based upon the Environmental Assessment included in this document, NOAA has issued a Finding of No Significant Impact (FONSI) on behalf of NOAA and the USFWS. Issuance of this FONSI fulfills and concludes all requirements for compliance with NEPA by the federal Trustees. A copy of the FONSI determination signed by NOAA is included as Appendix D.

6.2 Likely Impacts of the Project on Essential Fish Habitat (EFH)

The Trustees do not believe that the planned restoration actions will have a net adverse impact on EFH as designated under the Magnuson-Stevens Fishery Conservation and Management Act, as amended and reauthorized by the Sustainable Fisheries Act (Public Law 104-297) (Magnuson-Stevens Act), 16 U.S.C. §§1801 et seq. During the construction phase of this project, some short-term and very localized adverse impacts could occur from increases in turbidity within and near the project site during construction. These conditions may affect fish and filter feeders in the local area, by clogging gills, increasing mucus production and smothering organisms found in any shallow open-water area in the vicinity. Mobile fish and invertebrates would probably not be affected, since these would most likely leave the area, and return after project completion. Increased noise levels due to the operation of earth-moving equipment would also cause mobile fish to leave the area until operations end. The EFH would be positively impacted by the accelerated recovery and enhancement of marsh services that will be achieved through the proposed restoration actions, including by increasing and providing continual access to marsh within the site. The restored marsh will serve as habitat for prey species for a variety of managed fish species and provide a nursery for the larvae and juvenile stages of many managed species.

7.0 COMPLIANCE WITH OTHER KEY STATUTES, REGULATIONS AND POLICIES

***Clean Water Act (CWA), 33 U.S.C. § 1251* et seq.**
The CWA is the principal law governing pollution control and water quality of the nation's waterways. Section 404 of the law authorizes a permit program for the beneficial uses of dredged or fill material. The U. S. Army Corps of Engineers administers the program. Wetland restoration projects usually involve movement of material into or out of jurisdictional waters or wetlands, including in hydrologic restoration of marshes, and therefore require 404 permits. Under Section 401 of the CWA, restoration projects that involve discharge or fill into wetlands or navigable waters must obtain certification of compliance with state water quality standards. All necessary 404 permits and 401 certifications will be obtained for the selected Project prior to implementation.

***Rivers and Harbors Act, 33 U.S.C. § 401* et seq.**
The Rivers and Harbors Act regulates development and use of the nation's navigable waterways. Section 10 of the Act prohibits unauthorized obstruction or alteration of navigable waters and vests the U. S. Army Corps of Engineers with authority to regulate discharges of fill and other materials into such waters. Restoration actions that must comply with the substantive requirements of Section 404 must also comply with the substantive requirements of Section 10.

Coastal Zone Management Act (CZMA), 16 U.S.C. § 1451* et seq., *15 C.F.R. Part 923
The goal of the CZMA is to encourage states to preserve, protect, develop, and, where possible, restore and enhance the nation's coastal resources. Under Section 1456 of the CZMA, restoration actions undertaken or authorized by federal agencies within a state's coastal zone are required to comply, to the maximum extent practicable, with the enforceable policies of a state's federally approved Coastal Zone Management Program. The Trustees believe that the restoration Project is consistent with the South Carolina CZMA program. NOAA and USFWS – the involved federal trustee agencies - submitted that determination to the South Carolina Office of Ocean and Coastal Resource Management (OCRM) for review and concurrence via letter dated August 12, 2009. That determination is now final.

Endangered Species Act (ESA), 16 U.S.C. § 1531* et seq., *50 C.F.R. Parts 17, 222, & 224
The ESA requires all federal agencies to conserve endangered and threatened species and their habitats to the extent their authority allows. Under the ESA, the Department of Commerce (through NOAA) and the Department of the Interior (through USFWS) publish lists of endangered and threatened species. Section 7 of the Act requires federal agencies to consult with these departments to minimize the effects of federal actions on these listed species.

As summarized in subsection 6.1 above, the Trustees believe the actions selected in this Final RP/EA to restore estuarine marsh at the Project site are not likely to adversely affect threatened or endangered species or their designated critical habitats. Informal consultations with appropriate USFWS and National Marine Fisheries Service (NMFS) offices were initiated and both agencies have concurred in that determination. The records of this consultation are included in the Administrative Record.

***Fish and Wildlife Conservation Act, 16 U.S.C. § 2901* et seq.**
The planned restoration actions will either encourage the conservation of non-game fish and wildlife, or have no adverse effect.

***Fish and Wildlife Coordination Act (FWCA), 16 U.S.C. § 661* et seq.**
The FWCA requires that federal agencies consult with the USFWS, NOAA's National Marine Fisheries Service, and state wildlife agencies regarding activities that affect, control, or modify waters of any stream or bodies of water, in order to minimize the adverse impacts of such actions on fish and wildlife resources and habitat. The Trustees have coordinated with NOAA Fisheries, the USFWS, and the SCDNR (the appropriate state wildlife agency under FWCA). This coordination is also incorporated into compliance processes used to address the requirements of other applicable statutes, such as Section 404 of the CWA. The restoration actions described herein will have a positive effect on fish and wildlife resources.

***Magnuson-Stevens Fishery Conservation and Management Act, as amended and reauthorized by the Sustainable Fisheries Act (Public Law 104-297) (Magnuson-Stevens Act), 16 U.S.C. §§1801* et seq.**
The Magnuson-Stevens Act provides for the conservation and management of the Nation's fishery resources within the Exclusive Economic Zone (from the seaward boundary of every state 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 (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat. After EFH has been described and identified in fishery management plans by the regional fishery management councils, federal agencies are obligated and other agencies are encouraged to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by such agency that may adversely affect any EFH.

As summarized in subsection 6.2 above, the Trustees do not believe that the planned restoration actions will have a net adverse impact on EFH as designated under the Act. This finding was submitted to NMFS via letter dated December 1, 2009 and NMFS has concurred. The records of this consultation are included in the Administrative Record.

***Marine Mammal Protection Act, 16 U.S.C. § 1361* et seq.**
The Marine Mammal Protection Act provides for the long-term management of and research programs for marine mammals. It places a moratorium on the taking and importing of marine mammals and marine mammal products, with limited exceptions. The Department of Commerce is responsible for whales, porpoise, seals, and sea lions. The Department of the Interior is responsible for all other marine mammals. The planned restoration actions will not have an adverse effect on marine mammals.

***Migratory Bird Conservation Act, 16 U.S.C. § 715* et seq.**
The planned restoration actions will have no adverse effect on migratory birds. Migratory birds are likely to benefit from the re-establishment and enhancement of estuarine marsh that will be achieved through the planned restoration actions.

Migratory Bird Treaty Act, 16 U.S.C. § 703 – 712
The planned restoration actions will have no adverse impacts on migratory birds under the purview of this Act. No migratory birds will be pursued, hunted, taken, captured, killed, attempted to be taken, captured or killed, possessed, offered for sale, sold, offered to purchase, purchased, delivered for shipment, shipped, caused to be shipped, delivered for transportation, transported, caused to be transported, carried, or caused to be carried by any means whatever, received for shipment, transported or carried, or exported, at any time, or in any manner.

***National Historic Preservation Act, 16 U.S.C. § 470* et seq.**
Section 106 of the NHPA requires federal agencies, or federally funded entities, to consider the impacts of their projects on historic properties. NHPA regulations require that federal agencies take the lead in this process, and outline procedures to allow the Advisory Council on Historic Preservation to comment on any proposed federal action.

NOAA's compliance with the National Historic Preservation Act, 16 U.S.C. § 470 et seq. is summarized in subsection 6.1 above. The project was found to present an adverse effect on the Charleston Navy Yard Officers' Quarters district, which is listed in the National Register of Historic Places but that effect was determined to be minimal. Measures to address this effect were identified in consultation with the South Carolina State Historic Program Officer and shall be implemented at the site. NOAA also provided the opportunity for the Advisory Council on Historic Preservation to comment on the action.

Information Quality Guidelines Issued Pursuant to Public Law 106-554
Information disseminated by federal agencies to the public after October 1, 2002, is subject to information quality guidelines developed by each agency pursuant to Section 515 of Public Law 106-554 that are intended to ensure and maximize the quality of such information (i.e., the objectivity, utility and integrity of such information). This Final RP/EA is an information product covered by information quality guidelines established by NOAA and DOI for this purpose. The quality of the information contained herein is consistent with the applicable guidelines.

Executive Order 12898 (59 Fed. Reg. 7629) - Environmental Justice
This Executive Order requires each federal agency to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations. EPA and the Council on Environmental Quality have emphasized the importance of incorporating environmental justice review in the analyses conducted by federal agencies under NEPA and of developing mitigation measures that avoid disproportionate environmental effects on minority and low-income populations. The restoration Project selected in this Final RP/EA has no potential to affect any low income or ethnic minority communities, therefore the Trustees have concluded that such communities would not be adversely affected by the planned restoration actions.

Executive Order Number 11514 (35 Fed. Reg. 8,693) – Protection and Enhancement of Environmental Quality
An Environmental Assessment is integrated within this RP/EA and environmental analyses and coordination have taken place as required by NEPA.

Executive Order Number 11988 (42 Fed. Reg. 26,951) – Floodplain Management
The planned restoration actions will directly or indirectly support development of the floodplain.

Executive Order Number 11990 (42 Fed. Reg. 26,961) - Protection of Wetlands
The planned restoration actions will not result in adverse effects on wetlands or the services they provide, but rather will provide for the enhancement of wetlands and wetland services.

Executive Order Number 12962 (60 Fed. Reg. 30,769) - Recreational Fisheries
The planned restoration actions will not result in adverse effects on recreational fisheries but will contribute to the enhancement of, and help support, such fisheries.

8.0 LIST OF PERSONS/AGENCIES CONSULTED

Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140

Deborah French McCay
Applied Science Associates
70 Dean Knauss Drive
Narragansett, RI 02882

Dr. Rick Dunford
(formerly of) Triangle Economic Research
11000 Regency Parkway
West Tower, Suite 205
Cary, NC 27511-8518

Gary S. Mauseth
Greg E. Challenger
Polaris Applied Sciences, Inc.
12525 131st Court NE
Kirkland, WA 98034

Roy R. "Robin" Lewis III
Professional Wetland Scientist
Lewis Environmental Services
P.O. Box 5430
Salt Springs, FL 32134-5430

9.0 LIST OF PREPARERS

National Oceanic and Atmospheric Administration

Frank Csulak
Lisa DiPinto
Eric English
Tom Moore
Rob Ricker
Howard Schnabolk
Stephanie Willis

South Carolina Department of Natural Resources
Priscilla Wendt

South Carolina Department of Health and Environmental Control
David Graves
Van Whitehead
Susan Lake

Fish and Wildlife Service, United States Department of the Interior
Harriet Deal
Diane K. Beeman

Appendix A - Notice of Intent to Conduct Restoration Planning, *The Post and Courier, 11/25/03*.

USD Of Commerce, NOAA
9721 Executive Center Dr N. Koger Bldg., Ste 114
St. Petersburg FL 33702
Attn: Dolores Toscano

Number of Copies: 1

AFFIDAVIT OF PUBLICATION

The Post and Courier

State of South Carolina

County of Charleston

Personally appeared before me the undersigned advertising Clerk of the above indicated newspaper published in the City of Charleston, County and State aforesaid, who, being duly sworn, says that the advertisement of

(Copy attached)

appeared in the issues of said newspaper on the following day(s):

11/25/2003

at a cost of **$ 618.51**
Account# **H704225**
Order# **C250LA9F**
P.O. Number: **ever reach**

Subscribed and sworn to before me this 26th day of November A.D. 2003

Keisha Cobbings
Advertising Clerk

Shelly Dukes
NOTARY PUBLIC, SC
My Commission expires
My Commission Expires 10/10/

Form 3020

PUBLIC NOTICE

SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES, THE OFFICE OF THE GOVERNOR OF SOUTH CAROLINA, THE SOUTH CAROLINA DEPARTMENT OF HEALTH & ENVIRONMENTAL CONTROL, THE NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION, THE UNITED STATES FISH & WILDLIFE SERVICE, and THE UNITED STATES NAVY

NOTICE OF INTENT TO CONDUCT RESTORATION PLANNING pursuant to 15 C.F.R. Section 990.44

M/V EVER REACH OIL SPILL of September 30, 2002

On or about September 30, 2002, #6 fuel oil was discharged or released into the waters of the Cooper River and Charleston Harbor, in South Carolina, from the containership M/V EVER REACH as that vessel entered, left or prepared to leave the river and harbor for its next port of call (hereinafter, generally referred to as "the oil spill"). The volume of oil discharged is not precisely known but has been estimated to be approximately 12,500 gallons. The distribution of oil was predominately concentrated along the western shore of the Cooper River between the Interstate 526 Bridge and the Cooper River Bridge, in the vicinity of the North Charleston Terminal and the Old Navy Base piers and docks; however, other shoreline areas were also exposed to varying degrees. These included tidal creeks and back water areas adjacent to James Island, Fort Johnson, Shutes Folly, Crab Bank, Morris Island, Folly Beach and Sullivan's Island. In all, the oil ranged over approximately 30 linear miles of shoreline comprised of a variety of shoreline types, including tidal flats, fringing marshes, intertidal oyster reefs, sandy beaches and manmade structures (i.e., docks, piers, bulkheads), and their associated sediments. The oil spill also resulted in the oiling of a number of shorebirds, a shellfish bed closure, and a temporary disruption to recreational shrimp baiting in area waters.

Evergreen International, S.A., the owner and/or operator of the M/V EVER REACH, was officially designated as the responsible party (RP) for the oil spill. Since the source of the oil was discovered, Evergreen International, S.A., has cooperated with relevant agencies in performing response and initial data collection activities, including activities to assist in determining whether injuries to natural resources likely occurred.

The South Carolina Department of Natural Resources (SCDNR), the Office of the Governor of South Carolina (SCOG), the South Carolina Department of Health and Environmental Control (SCDHEC), the National Oceanic and Atmospheric Administration (NOAA) of the United States Department of Commerce, the United States Fish and Wildlife Service (USFWS) of the United States Department of the Interior, and the United States Navy (USN) (collectively, "the Trustees") each have authority to seek damages for injuries to natural resources resulting from the oil spill under the Federal Water Pollution Control Act, 33 U.S.C. §§ 1251 et seq., the Oil Pollution Act of 1990 (OPA), 33 U.S.C. §§ 2701 et seq., and other applicable federal laws, including Subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300.600 et seq. SCDNR, SCOG, and SCDHEC also have such authority under the South Carolina Pollution Control Act, S.C. Code Ann 48-1-10 et seq. (Supp. 2002), or other applicable State laws.

The Trustees have determined (as outlined below) that the Spill warrants conducting a natural resource damage assessment (NRDA). This assessment will be conducted in accordance with the NRDA regulations for oil spills at 15 C.F.R. Part 990 (NRDA Regulations). This Notice serves to inform the public that the Trustees are proceeding with natural resource injury assessment and restoration planning for the oil spill and, further, seeks early input from the public on the restoration alternatives which should be included for consideration in the development of that plan. The public will have a future opportunity to comment on a draft of the restoration plan before it is finalized by the Trustees.

TRUSTEE DETERMINATIONS

The decision to proceed with a NRDA for this oil spill is based on and supported by the following determinations of the Trustees, as specified in the NRDA regulations:

A. *Determination of Jurisdiction to Pursue Restoration;* 15 C.F.R. 990.41 - In accordance with 15 C.F.R. 990.41, the facts relating to this oil spill show:

1. The M/V EVER REACH is a "vessel", as that term is defined by Section 1001(37) of OPA, 33 U.S.C. 2701(37) and 15 C.F.R. 990.30.
2. The subject discharge of # 6 fuel oil from the M/V EVER REACH into the Cooper River and Charleston Harbor on or about September 30, 2002, constitutes an "incident" as that term is defined by Section 1001(14) of OPA, 33 U.S.C. 2701(14) and 15 C.F.R. 990.30.
3. This incident was not permitted under any Federal, State, or local law, nor did it involve either a public vessel as defined by OPA Section 1001(29), 33 U.S.C. 2701(29) or an onshore facility subject to the Trans-Alaska Pipeline Authority Act, 43 U.S.C. 1651, et seq.
4. Further, data and other information gathered during the response or collected pursuant to 15 C.F.R. 990.43 as part of pre-assessment phase activities indicate that natural resources under their trusteeship were injured as a result of the oil spill, including but not limited to estuarine habitats and birds. The oil spill, including necessary response actions, also disrupted recreational shrimp baiting and prompted the temporary closure of one shellfish bed to recreational harvest.

Accordingly, the Trustees have determined that they have jurisdiction to pursue natural resource restoration under OPA.

B. Determination to Conduct Restoration Planning, 15 C.F.R. 990.42 - The Trustees have also concluded that it is appropriate to proceed with restoration planning for this incident. This determination is based upon the data and other information (noted above) relating to this oil spill which indicates:

1. Natural resource injuries and resource service losses have resulted from the oil spill, including but not limited to injuries to estuarine habitats, birds and lost recreational use of area shrimp and shellfish resources.
2. Response actions have not adequately addressed, and are not expected to address, these injuries and losses. Response actions included actions such as protective booming, oil containment and partial removal from some shoreline areas (primarily, from beaches, man-made structures, and/or where pooling occurred); the capture, treatment and release of some oiled birds; protective closure of a shellfish bed, and the public dissemination of information or advisories intended to avoid or minimize the potential for human exposure. Oil could not be completely removed, however, from sensitive shoreline habitats such as marshes and tidal flats. Response actions could not wholly restore or rehabilitate any injured natural resources. Further, such actions do not compensate the public for resource service losses attributable to the oil spill, including the lost recreational use of area shrimp and shellfish resources.
3. Feasible restoration opportunities exist in the spill area for natural resources injured by the spill. Restoration planning will focus on the specific resource injuries and service losses caused by this oil spill, including those associated with affected salt marshes, tidal flats, shellfish beds, birds, and the lost recreational use of area shrimp and shellfish resources. Opportunities for restoration appropriate to address these injuries and losses may include but are not necessarily limited to alternatives such as monitored natural recovery, oyster reef restoration or creation, estuarine habitat preservation or enhancement, land acquisition, and establishment of upland buffers to protect estuarine areas.

NRDA COORDINATION

The Trustees are entering into a Memorandum of Agreement (MOA) to provide for ongoing coordination of this NRDA process by and among the Trustees. Further, by letter dated December 11, 2002, issued pursuant to 15 C.F.R. 990.14(c), the Trustees invited the RP to participate cooperatively in any NRDA initiated for this oil spill and the RP has officially confirmed its interest in participating in a cooperative NRDA. The Trustees may enter into a Memorandum of Agreement with the RP to provide for its participation in the NRDA process.

ADMINISTRATIVE RECORD

Concurrent with the issuance of this Notice, the Trustees have opened an Administrative Record (AR) to hold the information, records and other documents relied upon by the Trustees as they proceed with the NRDA for this oil spill. The AR is public. It is being maintained locally and is accessible by appointment during normal business hours at the offices of the United States Fish & Wildlife Service, Division of Ecological Services, 176 Croghan Spur Road, Charleston, S.C. Appointments to review the AR may be arranged by contacting Diane Duncan at that address, or by phone at 843-727-4704, ext. 29. The AR contains a copy of this Notice. The Trustees' MOA and other documents will be added as each is finalized or becomes available, including a planned Preassessment Data Report, a compilation of the preassessment data for this oil spill. The report, currently being developed, will include information and data that supports the Determinations of the Trustees set forth in this Notice. Today's Notice is intended to ensure that the public is aware that a coordinated assessment of natural resource damages for this oil spill is proceeding and to provide the public with an early opportunity to submit information to the Trustees on potential restoration opportunities in the spill area which might be appropriate to address natural resource injuries and losses caused by this oil spill. To submit such information on potential restoration alternatives, or for further information related to this Notice, contact: Tom Moore, NOAA Restoration Center, 9721 Executive Center Dr. N., Suite 114, St. Petersburg, FL 33702, by phone at 727-570-5716, by fax at 727-570-5390, or by email: Tom.Moore@noaa.gov.

Appendix B - *Final Modeling of Physical Fates and Biological Injuries Report,*

Executive Summary,2006.

FINAL

M/V Ever Reach Spill of 30 September 2002 in Charleston Harbor, SC: Modeling of Physical Fates and Biological Injuries

by

Deborah French McCay[1], Jill Rowe[1], Matthew Ward[1], and Dennis Forsythe[2]

[1]Applied Science Associates
70 Dean Knauss Drive
Narragansett, RI 02882
Voc: 401-789-6224
Fax: 401-789-1932
dfrench@appsci.com

[2]The Citadel, Biology Department
171 Moultrie Street, 322 Bond Hall,
Charleston, SC 29409 (843) 953-7877

Prepared for:

Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140

for Submission to:

NOAA Damage Assessment Center
Silver Spring, MD
Frank Csulak, Task Order Manager

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SUMMARY

Oil spill modeling was performed for the 30 September 2002 spill into Charleston Harbor, SC, from the container ship *M/V Ever Reach*. Figure S-1 is a map of the spill-affected area with the ship's path and observed shoreline oiling. The objectives were to provide (1) an assessment of the pathways and fate of the oil, and thus estimate exposure to the water surface, shoreline and other habitats, water column, and sediments; and (2) an estimate of injuries to wildlife (birds, marine mammals, sea turtles) and subtidal aquatic organisms (water column and benthic biota, exposed by the water pathway and subtidal sediment contamination) that can be used to scale compensatory restoration. Observations and data collected during and after the spill were used as much as possible as input to and to calibrate the model. Where data from the event were not available, historical information was used to make the assessment as site-specific as possible.

The analysis was performed using the model system SIMAP (Spill Impact Model Analysis Package). The physical fates model in SIMAP estimates the distribution of oil (as mass and concentrations) on the water surface, on shorelines, in the water column and in the sediments, accounting for spreading, evaporation, transport, dispersion, emulsification, entrainment, dissolution, volatilization, partitioning, sedimentation, and degradation. The biological effects model estimates short-term (acute) exposure of biota of various behavior types to floating oil and subsurface contamination (in water and subtidal sediments), resulting percent mortality, and sublethal effects on production (somatic growth). For each wildlife behavior group, a portion of the animals in the area swept by surface oil over a threshold thickness (10 g/m^2) is assumed to die, based on probability of encounter with the oil on the water surface multiplied by the probability of mortality once oiled. Toxicity to aquatic biota in the water column and subtidal sediments is estimated from dissolved aromatic concentrations and exposure duration, using laboratory-based bioassay data for oil hydrocarbon mixtures. Losses are estimated by species or species group for fish, invertebrates and wildlife by multiplying percent loss by abundance. The model has been validated using simulations of over 20 spill events where data are available for comparison.

The model uses incident specific wind data, current data, and transport and weathering algorithms to calculate mass balance in various environmental compartments (water surface, shoreline, water column, atmosphere, sediments, etc.), surface oil distribution over time (trajectory), and concentrations of the oil components in water and sediments. Geographical data (habitat mapping and shoreline location, Figure S-2) were obtained from existing Geographical Information System (GIS) databases based on Environmental Sensitivity Indices (ESI). Water depth is available from National Oceanic and Atmospheric Administration (NOAA) National Ocean Service (NOS) soundings databases. Hourly wind speed and direction data during and after the spill was obtained from a nearby meteorological station. Tidal and other currents were modeled based on known water heights, using a hydrodynamic model based on physical laws, and that conserves mass and momentum.

Specifications for the scenario (date, timing, amount, duration of release, etc.) were based on information obtained and distributed during the response by NOAA HAZMAT, the US Coast Guard, state responders and trustees, and the Responsible Party (RP). The spill was 12,500 gal (= 46.4 MT) of intermediate fuel oil (IFO 380). It appears to have been caused by grounding on a submerged dredge pipe in the Cooper River, which occurred as the vessel came into port early on 30 September 2002. Based on the distribution of oil observed (Figure S-1) after the spill and modeling results, the release must have been protracted: as the ship was traveling from the grounding site (32 ^{o} 51.167' N, 79^{o} 56.195' W) into Berth 1 NC Terminal (05:35 to 07:18 hours), and again as the ship left the harbor later the same day (left berth at 19:00 hours, passed harbor entrance about 20:30 hours, path in Figure S-1). Oiling in the harbor and outside along Morris and Folly Islands cannot be accounted for assuming oil was released only at or up-river of the submerged dredge site. Considerable oil must have been released in the lower harbor and outside in offshore waters. The leak apparently stopped while the ship was at the berth, as the U.S. Coast Guard did not observe any oil around the ship while in port. (Hydrostatic pressure would retain oil in the hull while the ship was stationary, but when the ship moved, lower pressure over the hull surface and turbulence would draw oil out of the ship.)

The surface oil trajectory agreed with observations from over-flights, mapping of shoreline oil (from SCAT surveys and other observations), and other field records, and was thus considered the best simulation of the event. The model replicates well the overall movement of the oil. The model conserves oil mass, estimates losses to evaporation, and so the surface oil area estimates are realistic estimates of the oil mass on the water at any given time.

A total of 18-23 brown pelicans were observed in the field as moderately or heavily oiled, with 30 other pelicans showing spots or oil stain. Tri-State treated 21 of the oiled pelicans (1 adult and 20 juveniles) and released them. Other oiled birds observed were: 1 great blue heron, several egrets, 1 double-crested cormorant, and 15 ruddy turnstones. Aquatic bird injuries were estimated using the model from the area swept by enough surface oil to oil a bird above a threshold dose level for effects. Tables S-1 and S-2 list the model-estimated direct kill of wildlife for the best fates model simulation, along with the observed oiled birds. The estimated numbers are probabilities, and thus may be fractions of an animal. The model estimate of the total birds oiled is 175, including 75 brown pelicans, 7.3 black skimmers, 3.4 terns, 3.3 gulls, 16.4 wading birds, 69 shorebirds, and fractions of waterfowl and raptors (estimated as probabilities). The estimate numbers of sea turtles and dolphins oiled were insignificant, and the injury assumed zero. The number of oiled pelicans estimated by the model is 75, as opposed to the 18-23 observed as significantly oiled. This difference is in part accounted for in that the model estimates injuries to pelicans that are distributed around the harbor and in the rivers, and not just those concentrated in areas of heavy oiling at Crab Bank (which were the ones observed). The colony at Crab Bank was explicitly modeled, and 70 birds were estimated oiled there, in addition to 5 pelicans distributed around the area. Oiled skimmers, terns, and shorebirds would be unlikely to be observed or captured for cleaning. Note that if the pre-spill abundance were, for example, a factor two different,

the model kill estimate would change by that same factor. Thus, the model estimates and the field data agree within the uncertainty of both estimates.

Table S-2 also lists the total injury interim loss, which is the sum (annually) of the numbers killed that would still be alive each year after the spill, as #-years, using standard demographic modeling and discounting the future losses at 3% annually. The interim loss includes the direct kill of birds and the first generation of their progeny. To express the injury in units that could be used to scale restoration, which is likely to be based on increased production of fledglings, the interim loss of mixed ages is divided by the bird-years gained per fledgling to estimate the number of fledglings required in compensation. The interim loss was translated to the equivalent number of age 0 animals (fledglings) at the time of the spill (2002) and if they were to be replaced in the year 2006 (i.e., discounted for 4 years of delay before restoration, a possible time-frame for restoration to be implemented). Scaling for restoration accomplished in other years than 2006 can be easily calculated by discounting the 2002 fledgling equivalents by 3% each year of delay after 2002. The majority of the injury is due to seabirds (mostly pelicans) and shorebirds, with a smaller loss of waders. The raptor and waterfowl injuries would be compensated by less than one fledgling each (in 2006).

The best estimate of total injury to subtidal fish and invertebrates is 0 kg. Subsurface concentrations of oil hydrocarbons and dissolved aromatics did not exceed 1 ppb in any water volume >140 m^3 (the resolution of the model grid for the subsurface plume) at any time after the spill. Thus, the exposure to water column and bottom-dwelling organisms in subtidal habitats was not significantly toxic and no significant impacts to these organisms from acute exposure to oil would be expected.

Injuries to intertidal biota other than birds were not included in the modeling assessment. The field-collected data (sediment and oyster tissue samples) from intertidal areas contaminated by the spill may be used to evaluate potential injuries there from exposure to oil hydrocarbons. Table S-3 lists the areas of intertidal habitat oiled to varying degrees in the (best) model simulation. The threshold 0.1 mm (~100 g/m^2) is the minimum (dose) in the model for impact to waders and shorebirds in the intertidal areas. Mortality of the vegetation in marshes occurs above about 14 mm of oil, according to literature reviewed in French et al. (1996a). In the model simulations, none of the wetlands exceeded 14 mm thick oil. Figure S-3 shows the areas oiled. Over-laid on the map are locations of intertidal oyster reefs along the Cooper River, in Charleston Harbor, and near Folly Beach. When the majority of the oil mass came ashore, 95% of the PAHs remained in the oil. Thus, the PAH content of the shoreline oil was about 2%, inferring 1 g/m^2 of total hydrocarbons (THC) is equivalent to about 0.02 g PAH/m^2. Assuming the oil was mixed into the top 1 cm of sediment, a sediment porosity of 40%, and a sediment dry weight of 2.6 g/cm^3, 1 g THC/m^2 is equivalent to 64 μg THC/g of dry sediment (64 ppm). The PAH concentration in dry sediment that is equivalent to 1 g THC/m^2 is 1.3 μg PAH/g dry sediment (1.3 ppm). The intertidal contamination predicted by the model can be broadly compared to observations based on sampling. However, detailed comparisons to sample stations are inappropriate, as the model's resolution does not address the patchy nature of the actual contamination on shore.

The accuracy of the biological injury assessment depends primarily on the accuracy of (1) the fates model results, (2) the assumed toxicity values, and (3) the biological abundance data input to the model. Since the wind and current data input to the model are reasonably accurate, the fates model simulation agrees well with observations after the spill and uncertainty associated with the fates model assumptions is relatively low. With more accurate wind data (more spatial detail), the fates model and bird mortality results would be more accurate, but the estimated losses would change by much less than an order of magnitude. Because species and life stages vary considerably in their sensitivity to aromatics in oil, the injury was quantified for the range of possible toxicity values, including for sensitive species. Even for the most sensitive species where bioassay data are available, subtidal fish and invertebrate injury from acute exposure is not indicated or likely, given the spill scenario and environmental conditions after the spill. For birds, the biomass losses are directly proportional to the pre-spill abundance assumed in the model inputs. Thus, a change (or uncertainty) in abundance is directly translated to a proportional change (uncertainty) in the quantified injury.

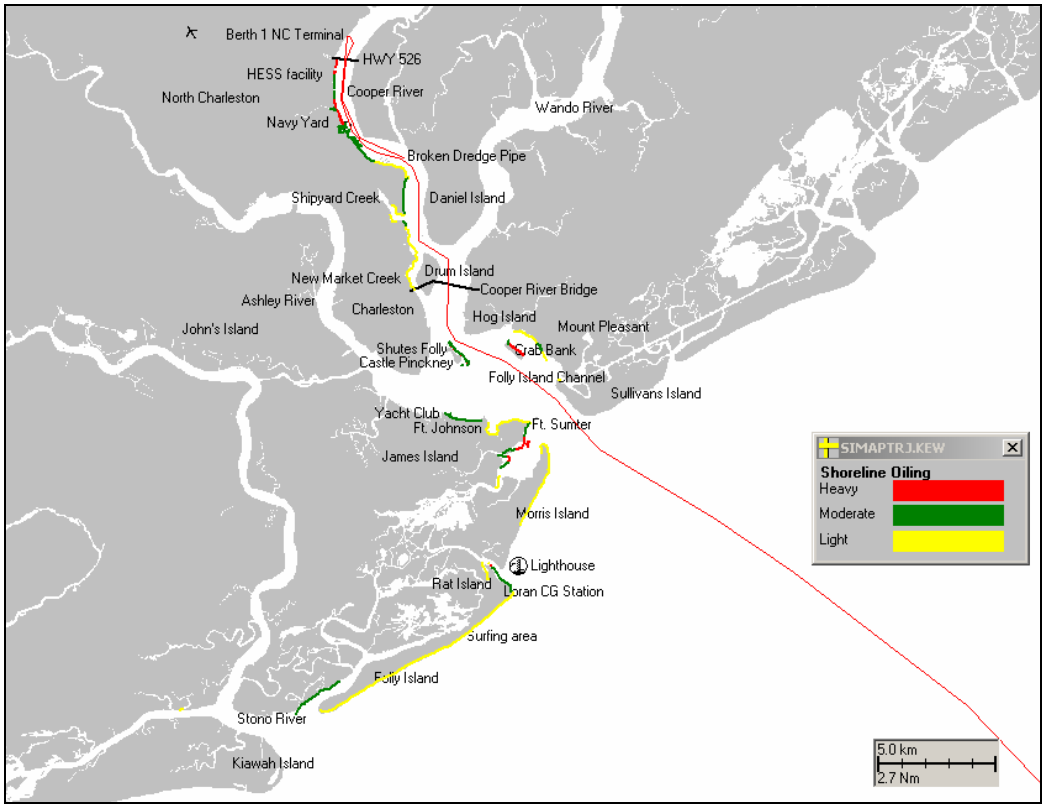


Figure S-1. Map of Charleston Harbor area, the *Ever Reach*'s path and observed shoreline oiling after the spill.

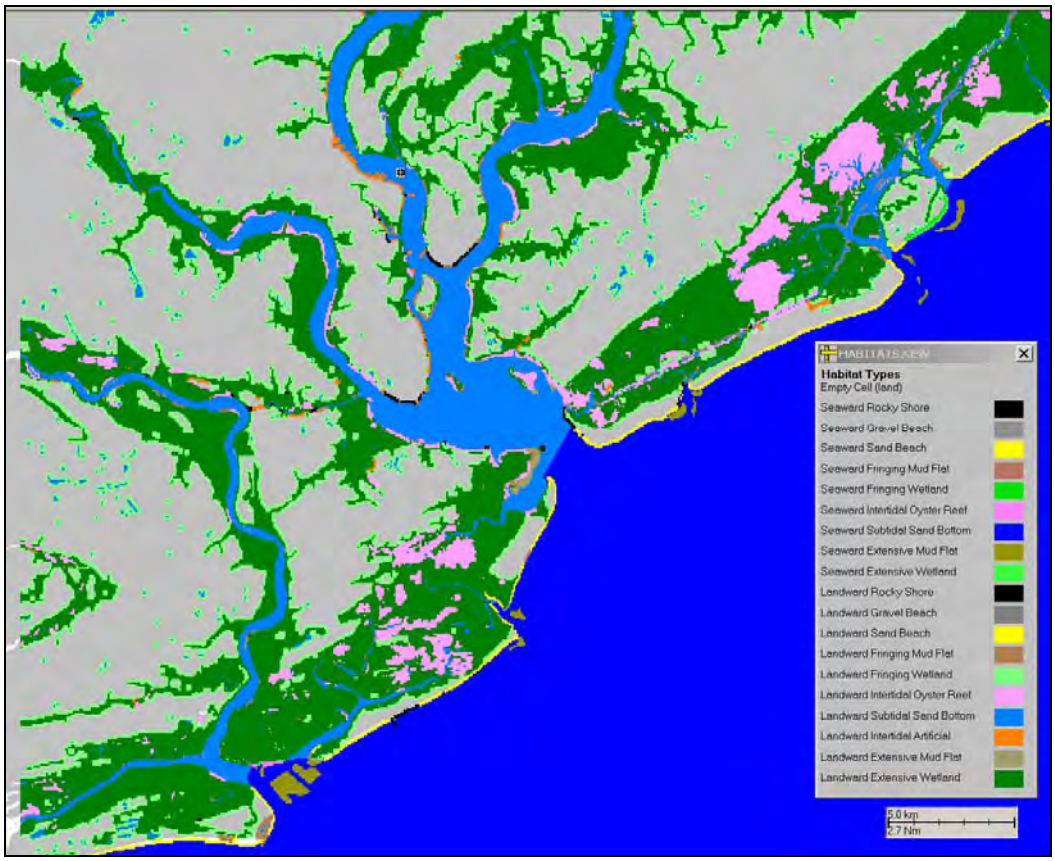


Figure S-2. Habitat grid used in modeling in the area affected by the spill.

Table S-1. Estimated injuries to birds, marine mammals and sea turtles for the best simulation of the spill. The model estimate is a probability, and thus may be a fraction of an animal. Observations of oiled birds are also listed for comparison.

Species	Model (#)	Observed (#)
Waterfowl (ducks, geese)	0.06	
Black skimmer	7.28	
Black tern	0.61	
Bonaparte's gull	0.00	
Brown pelican	75.20	48-53
Caspian tern	0.16	
Common tern	2.04	
Double-crested cormorant	1.07	1
Forster's tern	0.04	
Gull-billed tern	0.47	
Herring gull	0.10	
Laughing gull	0.56	
Least tern	0.04	
Ring-billed gull	2.60	
Royal tern	0.05	
Sandwich tern	0.01	
Black-crowned night-heron	0.02	
Clapper rail	0.05	
Great egret	12.0	several
Great blue heron	4.0	1
Green heron	0.16	
Little blue heron	0.01	
Tricolored heron	0.07	
Snowy egret	0.05	
Wood stork	0.03	
American oystercatcher	0.91	
Black-bellied plover	0.35	
Dunlin	0.99	
Greater yellowlegs	0.02	
Marbled godwit	0.37	
Ruddy turnstone	60.0	15
Semipalmated plover	2.44	
Short-billed dowitcher	2.99	
Willet	0.71	
Bald eagle	0.01	
Osprey	0.13	
Loggerhead turtle	-	

Table S-2. Summary of estimated injuries to birds, marine mammals and sea turtles for the best simulation of the spill. The model estimate is a probability, and thus may be a fraction of an animal. Observations of oiled birds are also listed for comparison.

Group Totals	Model (#)	Observed (#)	Interim Loss (# -years)	# Fledgling Equivalents (in 2002)	# Fledgling Equivalents (in 2006)
Waterfowl	0.06	-	0.1	0.1	0.1
Seabirds	89.2	49-54	556	384	433
Wading birds	16.4	approx. 4	31	36	40
Shorebirds	68.8	15	531	260	293
Raptors	0.14	-	1.0	0.5	0.6
Marine mammals (dolphins)	0	-	0	-	-
Sea turtles	0	-	0	-	-
Total birds	**174.6**	**68-73**	**1120**	**681**	**766**

Table S-3. Area (m2) of intertidal zone, by shore type, contaminated by oil of various thicknesses (1 mm thick oil ~ 1000 g/m^2 ~64 ppm total hydrocarbons, THC, ~ 1300 ppm of PAH) in the best model simulation.

Total Hydrocarbons	**>1000 g/m^2**	**>100 g/m^2**	**>10 g/m^2**	**> 1 g/m^2**	**>0.1 g/m^2**
Oil Thickness	**>1 mm**	**>0.1 mm**	**>0.01 mm**	**>0.001 mm**	**>0.0001 mm**
THC concentration (µg TPH/g dry sediment)	**> 64 mg/g**	**> 6400 µg/g**	**> 640 µg/g**	**> 64. µg/g**	**> 6.4 µg/m^2**
PAH concentration (ppm)	**> 1300 ppm**	**> 130 ppm**	**> 13 ppm**	**> 1.3 ppm**	**> 0.13 ppm**
PAH concentration (µg PAH/g dry sediment)	**> 1300 µg/g**	**> 130 µg/g**	**> 13 µg/g**	**> 1.3 µg/g**	**> 0.13 µg/m^2**
Shore Type:					
Rocky shoreline	140	2,737	2,737	2,737	2,737
Gravel beach	211	772	772	772	772
Sand beach	702	6,317	6,317	6,317	6,317
Mud flat	702	2,456	2,456	2,456	2,456
Wetland	772	2,737	2,737	2,737	2,737
Oyster reef	0	2,035	2,035	2,035	2,035
Artificial shoreline	2,527	6,387	6,387	6,387	6,387
Total	5,053	23,442	23,442	23,442	23,442

Table S-4. Area (acres) of intertidal zone, by shore type, contaminated by oil of various thicknesses (1 mm thick oil ~ 1000 g/m2 ~64 ppm total hydrocarbons, THC, ~ 1300 ppm of PAH) in the best model simulation.

Total Hydrocarbons	**>1000 g/m^2**	**>100 g/m^2**	**>10 g/m^2**	**> 1 g/m^2**	**>0.1 g/m^2**
Oil Thickness	**>1 mm**	**>0.1 mm**	**>0.01 mm**	**>0.001 mm**	**>0.0001 mm**
THC concentration (µg TPH/g dry sediment)	**> 64 mg/g**	**> 6400 µg/g**	**> 640 µg/g**	**> 64. µg/g**	**> 6.4 µg/m^2**
PAH concentration (ppm)	**> 1300 ppm**	**> 130 ppm**	**> 13 ppm**	**> 1.3 ppm**	**> 0.13 ppm**
PAH concentration (µg PAH/g dry sediment)	**> 1300 µg/g**	**> 130 µg/g**	**> 13 µg/g**	**> 1.3 µg/g**	**> 0.13 µg/m^2**
Shore Type:					
Rocky shoreline	0.03	0.68	0.68	0.68	0.68
Gravel beach	0.05	0.19	0.19	0.19	0.19
Sand beach	0.17	1.56	1.56	1.56	1.56
Mud flat	0.17	0.61	0.61	0.61	0.61
Wetland	0.19	0.68	0.68	0.68	0.68
Oyster reef	0.00	0.50	0.50	0.50	0.50
Artificial shoreline	0.62	1.58	1.58	1.58	1.58
Total	1.25	5.79	5.79	5.79	5.79

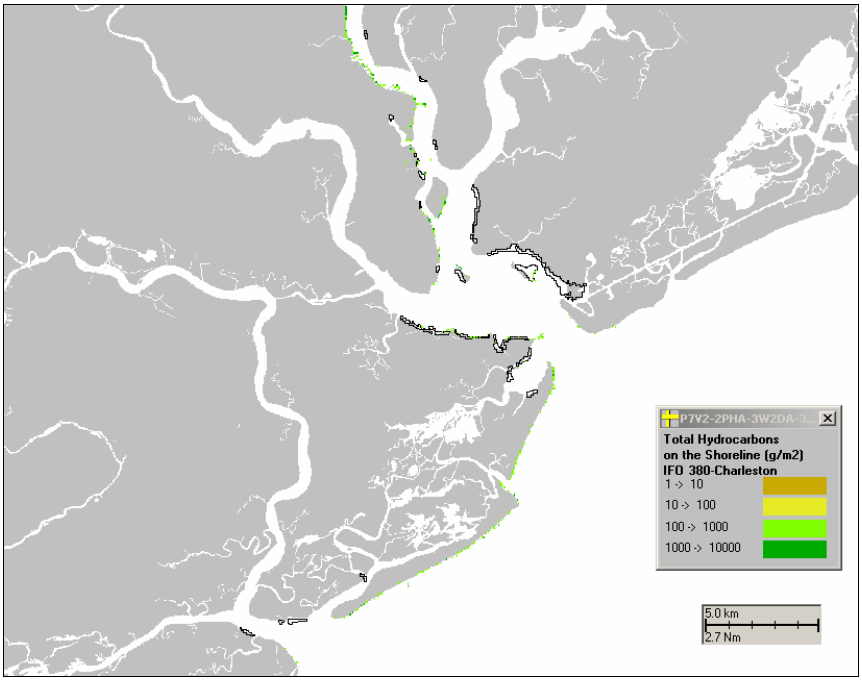


Figure S-3. Total hydrocarbons on shorelines predicted by the (best) model simulation. The polygons over-laid on the map are locations of oyster reefs that are along the shore of the Cooper River, in Charleston Harbor, and near Folly Beach, i.e., that were oiled or near areas oiled in the model simulation. (Note: Figure S-2 shows the location of all oyster reefs in the model grid.)

Appendix C - *Final Report on Restoration Scaling for Bird Injuries*, November 13, 2006.

FINAL

M/V Ever Reach Spill of 30 September 2002 in Charleston Harbor, SC: Restoration Scaling for Bird Injuries

by

Deborah French McCay

Applied Science Associates
70 Dean Knauss Drive
Narragansett, RI 02882
Voc: 401-789-6224
Fax: 401-789-1932
dfrench@appsci.com

Prepared for:

Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140

for Submission to:

NOAA Damage Assessment Center
Silver Spring, MD
Frank Csulak, Task Order Manager

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SUMMARY

The injury to birds caused by the 30 September 2002 spill into Charleston Harbor, SC, from the container ship *M/V Ever Reach* was estimated as 175 birds, including 89 seabirds (including 75 pelicans), 69 shorebirds, 16 wading birds, and less than the equivalent of one bird (as a probability) of others. Table 1-1 lists the injuries, as numbers killed, bird-years lost, and number of fledgling equivalents.

Estimates of the scale of restoration required to compensate for the injuries (with the project initialed in 2007) were made as summarized in Table S-1.

Table S-1. Summary of estimated scale of compensatory restoration required for injuries to birds.

Basis of Restoration Scaling	Injury Units	Injury Amount	Compensation
Food requirements to produce fledglings and trophic transfer modeling to the bird prey trophic level	# fledgling equivalents (in 2007)	789 fledglings	2.28 ha (5.64 acres) of saltmarsh

Trophic transfer modeling to the birds' trophic level could underestimate the saltmarsh area that would be compensatory if there are more trophic levels between the benthic invertebrate level and the birds injured than that assumed in modeling, and that some of the prey production is not consumed by the target (injured) species of birds. Thus, the method used was to estimate food requirements to produce fledglings and use trophic transfer modeling to the bird prey trophic level. An assumed rate of trophic transfer from prey to bird is not needed, and instead food requirements and fledgling production were modeled in detail. This method does assume the saltmarsh provides food that would be consumed by the target species of birds or their prey, a reasonable assumption for the present case.

1. INTRODUCTION

Oil spill fates and biological effects modeling was performed for the 30 September 2002 spill into Charleston Harbor, SC, from the container ship *M/V Ever Reach*. The injury caused by the spill was evaluated for birds, marine mammals, sea turtles, and subtidal fish and invertebrates. The report "M/V Ever Reach Spill of 30 September 2002 in Charleston Harbor, SC: Modeling of Physical Fates and Biological Injuries" contains the description of the modeling and injury quantification (French McCay et al., 2005). Table 1-1 contains the injury estimates for the birds. Injuries to marine mammals, sea turtles, and subtidal fish and invertebrates were estimated as negligible.

Table 1-1. Summary of estimated injuries to birds. The model estimate is a probability, and thus may be a fraction of an animal.

Group Totals	Birds Killed (#)	Dominant Species	Interim Loss (#-years)	# Fledgling Equivalents (in 2002)	# Fledgling Equivalents (in 2007)
Waterfowl	0.06	Canada goose	0.1	0.1	0.1
Seabirds	89.2	Brown pelican	556	384	446
Wading birds	16.4	Egrets, herons	31	36	41
Shorebirds	68.8	Ruddy turnstone	531	260	301
Raptors	0.14	Osprey	1.0	0.5	0.6
Total birds	**174.6**	**-**	**1120**	**681**	**789**

2. SCALE OF COMPENSATORY HABITAT RESTORATION

Food web modeling and Habitat Equivalency Analysis (HEA) calculations were performed to estimate the amount of saltmarsh that would be compensatory to the bird injury, following the methods in French McCay and Rowe (2003) and with some additional methods to be described below. This was a two step process:

1. Use trophic transfer modeling to estimate compensatory bird food production rate per unit of salt marsh created.
2. Determine the food required to produce additional fledglings and then use the compensatory (bird) food production rate per unit of salt marsh created to calculate the area of marsh required.

The scaling of the compensatory restoration uses methods currently in practice by NOAA and state trustees, i.e., Habitat Equivalency Analysis (HEA). Scaling methods used here were initially developed for use in the *North Cape* case, as described in French McCay and Rowe (2003). These methods have also been used in several other cases, as well as in successful claims for 23 cases submitted by the Florida Department of Environmental Protection to the US Coast Guard, National Pollution Fund Center (French McCay et al., 2003a).

Restoration should provide equivalent quality biota to compensate for the losses. Equivalent quality implies same or similar species with equivalent ecological role and value for human uses. The equivalent production or replacement should be discounted to present-day values to account for the interim loss between the time of the injury and the time restoration provides equivalent ecological and human services.

Habitat creation or preservation projects have been used to compensate for injuries of wildlife, fish and invertebrates. The concept is that the restored habitat leads to a net gain in wildlife, fish and invertebrate production over and above that produced by the location before the restoration. The size of the habitat (acreage) is scaled to just compensate for the injury (interim loss).

In the model used here, the habitat may be seagrass bed, saltmarsh, oyster reef or other structural habitats that provide such ecological services as food, shelter, and nursery habitat and are more productive than open bottom habitats. The injuries are scaled to the new primary (plant) or secondary (e.g., benthic) production produced by the created habitat, as the entire food web benefits from this production. A preservation project that would avoid the loss of habitat could also be scaled to the production preserved. The latter method would only be of net gain if the habitat is otherwise destined to be destroyed.

One approach is to use primary production to measure the benefits of the restoration project. The total injuries in kg are translated into equivalent plant (angiosperm) production as follows. Plant biomass passes primarily through the detrital food web via detritivores consuming the plant material and attached microbial communities. When macrophytes are consumed by detritivores, the ecological efficiency is low because of the high percentage of structural material produced by the plant, which must be broken down by microorganisms before it can be used by the detritivore. Each species group is assigned a trophic level relative to that of the detritivores. If the species group is at the same trophic level, it is assumed 100% equivalent, as the resource injured would presumably have the same ecological value in the food web as the detritivores. If the injured resource preys on detritivores or that trophic level occupied by the detritivores, the ecological efficiency is that for trophic transfer from the prey to the predator. Values for production of predator per unit production of prey (i.e., ecological efficiency) are taken from the ecological literature, as reviewed by French McCay and Rowe (2003).

Alternatively, the habitat requirements may be scaled using secondary (e.g., benthic invertebrate) production instead of primary production. Scaling to primary production assumes that all the benefits to animals are generated by the additional plant production as food. However, the habitat provides other ecological services to animals, such as supplying shelter, nursery areas, refuge from predators, etc. Benthic invertebrate production gains are calculated as the difference between production in shallow unvegetated habitats and in vegetated or otherwise structured habitat. Similarly, scaling could be based on differences in nekton production (before and after restoration). The animal production in the habitat is typically larger than that which can be accounted for

by additional primary (plant) production. Using benthic (or other animal) production for scaling implicitly includes these habitat services gained.

Equivalent compensatory angiosperm (plant) or secondary (benthic) production of the restored resource is calculated as kg of injury divided by ecological efficiency. For primary production, the ecological efficiency is the product of the efficiency of transfer from angiosperm to invertebrate detritivore and efficiency from detritivore to the injured resource. For secondary production, the ecological efficiency is the product of the efficiency of transfer for each step up the food chain from the secondary level to the trophic level of concern. Discounting at 3% per year is included for delays in production because of development of the habitat, and delays between the time of the injury and when the production is realized in the restored habitat. The equations and assumptions may be found in French McCay and Rowe (2003).

The needed data for the scaling calculations are:

- number of years for development of full function;
- annual primary or secondary production rate per unit area (P) of restored habitat at full function;
- delay before restoration project begins; and
- project lifetime (years).

In South Carolina, it is most likely that saltmarsh restoration would be undertaken as restoration for bird injuries. Oyster reef restoration is also an option. However, this requires good water quality and appropriate environmental conditions to be successful.

HEA calculations for saltmarsh are performed here, following the methods in French McCay and Rowe (2003). It is assumed that the saltmarsh requires 15 years to recover (based on French et al., 1996a) ultimately reaching 80% of full function, the restoration begins 5 years after the spill, and the project lifetime is 50 years. Above-ground primary production rates of saltmarsh cord grasses in the southeast US (Georgia marshes) have been estimated as 1290 g dry weight m^{-2} yr^{-1} (Teal, 1962) and 2,555-4,526 g dry weight m^{-2} yr^{-1} (Dai and Wiegert, 1996). The annual primary production rate used in these analyses is the mean for the two studies, 2,415 g dry weight m^{-2}. In addition, saltmarsh benthic microalgal production provides another 40% (966 g dry weight m^{-2}; Currin et al., 1995). Thus, estimated primary production rates in southeast US (Georgia) saltmarshes total 3381 g dry weight m^{-2} yr^{-1}. Rates of secondary production are not available.

2.1 Trophic Transfer Modeling

It is assumed that creation of saltmarsh that increases invertebrate and fish production will be of direct benefit to the bird species where restoration is required, i.e., the additional production will be appropriate bird food (i.e., additional prey biomass). The amount of saltmarsh required in compensation for the quantified bird injuries was estimated using trophic transfer efficiencies for each step in the food web from benthic invertebrates to the prey of each of the bird categories. No correction is made for the

possibility that the target species of birds will not obtain that food. If correction for availability were made, the scale of the project would increase proportionately.

Pelicans feed primarily on young menhaden, which consume primarily pelagic and benthic invertebrates. Thus, the pelican's prey is at the trophic level of small fish feeding on plankton and benthic invertebrates. The ecological efficiency of small fish preying on benthic invertebrate detritivores is 20% (French McCay and Rowe, 2003). Similar assumptions are made for the other groups based on their trophic level (Table 2-1). These efficiencies are used to translate the compensatory bird prey production requirements to saltmarsh area (as described above). Calculations were made per 1000 kg of bird food required, as shown in Table 2-1. To the extent that there are more trophic levels between the benthic invertebrate level and the prey of the birds injured, and/or some of the prey production is not consumed by those species of birds, this compensatory scale is a low estimate.

Table 2-1. Scaling of compensatory restoration (if project begun in 2007) per unit of required bird food (of 1000 kg) for saltmarsh based on primary production as the measurement of net gain.

Species Category	Unit Requirement (kg)	Trophic Level	Production Yield Relative to Benthic Detritivores (%)	Compen-satory Produc-tion (kg wet wt) per Unit Require-ment	Habitat Area (m^2) per Unit Require-ment	Habitat Area (acres) per Unit Require-ment
Benthic invertebrates	1000	detritivores	100	5,083	111	0.027
Small fish and decapods	1000	bottom feeders	20	25,416	556	0.137
Large fish	1000	piscivores	4	127,079	2781	0.687

2.2 Food Requirements to Produce Fledglings

The scaling was performed using the food web model and trophic efficiencies described in French McCay and Rowe (2003) and described above, up to the step of the prey of the bird species groups involved. The amount of saltmarsh required in compensation was then estimated by developing an estimate of food requirements to rear an additional fledgling, multiplied by the number of fledgling equivalents to the interim loss (from Table 1-1). Thus, this method evaluates in more detail the benefits of food production to the bird species injured than a full trophic transfer model. The assumption is that food is limiting to bird production.

The majority and most significant injuries were to pelicans. Hingtgen et al. (1985) reviewed the life history of eastern brown pelicans, stating that the major limitation to fledgling production was the ability of the adults to obtain sufficient food for rearing. Thus, provision of additional food (fish) should increase fledgling production of the remaining pelican population in the area of the spill.

Hingtgen et al. (1985) state that pelican chicks require 57 kg of fish between hatching and fledging. Breeding adult pelicans require 90 kg of fish for themselves during this period. However, if the adult were not breeding, it would require some lesser amount of fish over that period than the 90 kg. Thus, the net amount of fish to rear a chick to fledging is 57 + 90 kg, minus the amount required for non-breeding adult birds in the same time period.

Furness and Cooper (1982) describe a bioenergetics model for seabirds (and other aquatic birds) where food requirements can be estimated from body weight (W). The calculation begins with an estimate of basal metabolic needs (EE, kJ/g/day), a function of temperature. These equations were used, assuming a summer-time temperature of 30^{o}C:

$$\text{At } 30^{o}\text{C: } EE = 4.472 * W^{0.6637}$$

To account for normal daily activities, total daily energy needs are 2.444 times the basal rate (Furness and Cooper, 1982). Assuming a digestive efficiency of 80% (Furness, 1978), the daily ration required is 2.444*EE/0.8. Conversion from kJ to g wet weight was made assuming 5.33 kJ/g (Gremillet et al., 2003). The daily ration was converted to the mass of food required by non-breeders over the time from hatching to fledging (using the data in the injury quantification report, French McCay et al., 2004, Tables 3-8 to 3-12).

For pelicans, the breeding-period ration for a non-breeder was subtracted from the total of 57 + 90 kg required by a breeding bird to rear a chick to estimate the amount of fish required to rear an additional chick. Similar data of food needs to rear chicks of the other species were not available. Thus, the ratio of food need for rearing a pelican chick divided by the ration for a non-breeding pelican was used to estimate the food needs to rear extra chicks of the other species. The results of the calculations of food requirements are in Table 2-2.

Using the trophic transfer model, it is assumed that creation of saltmarsh that increases invertebrate and fish production will be of direct benefit to the bird species where restoration is required. No correction is made for the possibility that breeding birds will not obtain that food. If correction for availability were made, the scale of the project would increase proportionately. Thus, food requirements to rear a fledgling are used to scale the saltmarsh area.

Pelicans feed primarily on young menhaden, which consume primarily pelagic and benthic invertebrates. Thus, the pelican's prey is at the trophic level of small fish feeding on plankton and benthic invertebrates. The ecological efficiency relative to benthic invertebrate detritivores is that for the prey, 20%. Similar assumptions are made for the

other groups based on their trophic level (Table 2-2). This efficiency is used to translate the compensatory food requirements to saltmarsh area (as described above).

Table 2-2. Estimated food needs for metabolism and rearing chicks and compensatory wetland areas (if project begins in 2007).

	Waterfowl	Seabirds	Wading Birds	Shorebirds	Raptors
Body weight (g)	5000	3500	1300	30	1900
Daily ration of a non-breeder (g/day)	730.7	576.7	298.9	24.5	384.5
Ration of a non-breeder during rearing period (kg)	43.9	44.4	17.9	0.73	23.1
Ration for rearing an additional fledgling (kg)	101.3	102.6	41.4	1.7	53.3
Total food required to compensate for injuries (kg wet weight)	13	39,439	1,482	442	29
Production yield of prey relative to benthic detritivores (%)	100	20	20	100	20
Saltmarsh area required (m^2)	1	21,936	825	49	16
Saltmarsh area required (acres)	0.0003	5.42	0.204	0.012	0.004

The results of the calculations of food requirements and the scale of compensatory restoration (assuming saltmarsh creation begins in 2007) are in Table 2-2. The total area required is 2.28 ha (5.64 acres). To the extent that there are more trophic levels between the benthic invertebrate level and prey the injured birds would consume, and that some of the prey production is not consumed by those species of birds, this compensatory area is a low estimate.

The inferred small fish production via trophic transfer from primary production using this trophic transfer model is 3.2 g dry weight/m^2/yr. Small fish production in Delaware marshes has been estimated as about 10 g dry weight/m^2/yr (Kneib, 2000). If the higher small fish production rate were used, the required acreage would be about 1/3 that in Table 2.2. However, given that all the small fish production would not be consumed by pelicans and other injured bird species, the estimates based on the 3.2 g dry weight/m^2/yr are reasonable.

The suggestion was made that acreage requirements might be based on feeding the restored fledglings for their entire lifespan. However, the scaling calculations were made

translating the older bird injuries to units of equivalent fledglings lost. Thus, replacement of the required number of fledglings would compensate for the injury. This does implicitly assume that once the fledglings are produced they will survive at the same rates as the injured birds before the spill. While there is evidence that the production of new birds (i.e., fledglings) is food-limited, mortality of older birds is from a mix of causes and not specifically starvation. Thus, the assumption that post-fledgling survival will be similar to that for the same species before the spill without providing additional food resources is a reasonable approximation.

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Appendix D- Signed FONSI Determination

DETERMINATION

In view of the information presented in the supporting Restoration Plan and Environmental Assessment prepared for the Noisette Creek Golf Course Wetland Restoration in North Charleston, South Carolina it is hereby determined that the preferred alternative identified for implementation will not significantly impact the quality of the human environment as described in the EA. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an Environmental Impact Statement for this action is not necessary.

Brian T. Pawlak
Acting Director, Office of Habitat Conservation
NOAA National Marine Fisheries Service

3/7/2012
Date

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

In Reply Refer To:
FWS/R4/ES

APR 27 2012

Ms. Stephanie Willis
National Oceanic and Atmospheric Administration
Office of General Council
263 13th Avenue South, Suite 177
St. Petersburg, Florida 33701

Dear Ms. Willis:

The U.S. Fish and Wildlife Service (Service) has reviewed the Final Restoration Plan and Environmental Assessment (RP/EA) and Finding of No Significant Impact (FONSI) for the 2002 M/V Everreach Oil Spill Charleston, South Carolina for its applicability to meet the Service's responsibilities for compliance under the National Environmental Policy Act (NEPA) as described in 40 CFR 1506.3. The review was completed by Richard Warner, Service NEPA Specialist.

Based on this review, the Service concludes that the Final RP/EA adequately describes the action planned by the National Oceanic and Atmospheric Administration (NOAA), the Service, and their co-trustee agencies. We also conclude that the analysis and findings are appropriate to describe the nature, scope, and scale of the planned action, and that the process of public comment is appropriate for the planned undertaking.

The Service agrees with NOAA's conclusion that implementation of the Noisette Creek Golf Course Wetland Restoration Project, as described in the final RP/EA, will not significantly impact the quality of the human environment. The Service therefore agrees with NOAA's determination to issue a FONSI for the Project on behalf of NOAA and the Service.

If you have any questions concerning this matter, please contact Diane Beeman, Regional Natural Resource Damage Assessment and Restoration Coordinator, at (404) 679-7094 or diane_beeman@fws.gov.

Sincerely yours,

for Cynthia K. Dohner
Regional Director