

DRAFT RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT

For the Bermuda Islander Oil Spill, Delaware Bay



Photo Credit: Sherry Krest, USFWS

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This Draft Restoration Plan and Environmental Assessment was prepared by the U.S. Fish and Wildlife Service on behalf of the natural resource Trustee agencies: the National Oceanic and Atmospheric Administration, Delaware Department of Natural Resources and Environmental Control, and the U.S. Fish and Wildlife Service. These agencies have conducted a natural resource damage assessment (NRDA) for the undetermined amount of oil released from the Bermuda Islander container ship into the Delaware Bay on or about April 25, 2006. The goal of the NRDA is to restore the public's natural resources injured by the oil spill. This document also serves as an Environmental Assessment to analyze the potential effects of the actions and projects on the quality of the human environment, in accordance with the National Environmental Policy Act.

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Executive Summary

This Draft Restoration Plan and Environmental Assessment (RP/EA) has been prepared by the United States Fish and Wildlife Service (USFWS) on behalf of the Natural Resource Trustees (the Trustees) for the natural resources impacted by the release of an undetermined amount of oil from the M/V Bermuda Islander (“Bermuda Islander”), a container ship, into the marine waters and shoreline habitats of the Delaware Bay, Delaware on or about April 25, 2006. The Trustees for the natural resources impacted by the spill include the United States Fish and Wildlife Service (USFWS) on behalf of the U.S. Department of the Interior (DOI), the National Oceanic and Atmospheric Administration (NOAA) of the U. S. Department of Commerce and the Delaware Department of Natural Resources and Environmental Control, Division of Fish and Wildlife (DNREC). In this document, the Trustees present their proposed plan to restore the natural resources, including ecological and recreational services that were injured, lost or destroyed as a result of the spill. The Responsible Parties (“RPs”) were M.S. Elegance Scheepvaartbedrijf C.V. (Elegance Shipping and JR Ship Management B.V., the registered owner and the operator of the Bermuda Islander, respectively.

In this Draft RP/EA, the Trustees present the restoration alternatives that they identified and evaluated and the preferred projects proposed for implementation to restore the natural resource injuries resulting from the spill.

The Trustees, in cooperation with the RPs, determined that potential natural resources injuries attributable to the spill included:

- **Shoreline habitat.** Approximately forty (40) miles of shoreline were oiled to varying degrees. The affected shoreline was predominantly vegetated sand beach.
- **Horseshoe crabs and their habitat.** The spill occurred just prior to the height of horseshoe crab spawning season and the oiled shorelines are considered prime spawning habitat.
- **Surface water resources,** including fish.
- **Intertidal sediments.** At least one sediment core confirmed that oil from this spill penetrated into the subsurface (5 to 20 cm) of the intertidal zone.
- **Wildlife.** Several birds were oiled during the release; however, there were no known bird mortalities as a result of this oil release.
- **Recreational uses.** Including general shoreline activities such as boating and fishing.

In December of 2008, the Trustees and the RPs executed an administrative settlement agreement which resolved the Trustees’ natural resource damage (“NRD”) claim relating to injuries caused by the spill. Under the terms of the settlement agreement, the RPs paid \$270,000 to the Trustees to fund restoration projects and reimburse the Trustees’ past assessment costs. The Trustees’ past assessment costs totaled \$63,645; the remaining amount, \$206,355, will be used to restore, replace, rehabilitate, or acquire natural resources similar to those that were lost or injured as a result of the spill.

The Trustees utilized the following criteria to evaluate all potential restoration projects/alternatives:

- Extent to which the project meets the Trustees' goals and objectives to restore injured natural resources and services of the same type as the natural resources injured by the oil spill (in-kind restoration). In the case of the Bermuda Islander oil spill, restoring beach, saltwater wetlands, or directly benefitting the organisms that depend on these habitats were the Trustees' primary goals when selecting restoration alternatives.
- Locate the restoration project within the spill zone, if possible (in-place restoration).
- The expected costs versus the expected benefits from the potential restoration project.
- Technical feasibility of implementing the project.
- Compliance with federal, state, and local laws.
- Likelihood of project success.

The Trustees used all of these criteria, and considered the first element (compensating for injured in-kind natural resources and services) to be the most important; therefore, beach and saltwater marsh restoration and acquisition projects were given top priority. The second element was also considered by the Trustees to be an important consideration during the selection process. Therefore, in review of the potential restoration/alternatives, the Trustees considered projects that both addressed the injured resources and were within the spill zone.

The Trustees identified and considered seven restoration alternatives, including a "no action" alternative as discussed later in this document. The preferred restoration alternatives selected by the Trustees were:

- 1) Marsh restoration of the Fitzgerald Property near the mouth of the Mispillion River.
- 2) Restoration of a Mispillion Harbor (Swain's) Beach.
- 3) Educational signage and/or kiosks along the Delaware Bay beaches informing the public about the ecology and importance of horseshoe crabs and the area as a migratory shorebird stopover.

In this Draft RP/EA the Trustees present: the restoration alternatives they identified and considered, their evaluation of the restoration alternatives, an explanation of the rationale for their selection of the preferred alternatives that they propose to implement, and their consideration of any potential environmental impacts that could result from the implementation of the proposed preferred restoration projects. The purpose of the proposed restoration, as outlined in this draft RP/EA, is to compensate and make the environment and the public whole for injuries resulting from the spill.

The Trustees have made this Draft RP/EA available for public comment. The public will have thirty (30) days to review and comment upon this Draft RP/EA. After considering any comments received from the public that are submitted during the public comment period, and assuming the issuance of a Finding of No Significant Impact is appropriate, the Trustees will make their final determination and issue a Final Restoration Plan and Environmental Assessment ("Final RP/EA").

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1.0 Introduction

This Draft Restoration Plan and Environmental Assessment (RP/EA) was prepared by the Federal and State Natural Resource Trustees (Trustees) for the natural resources impacted by the Bermuda Islander oil spill. The Trustees for the natural resources impacted by this oil spill are the Delaware Department of Natural Resources and Environmental Control, Division of Fish and Wildlife (“DNREC”), the National Oceanic and Atmospheric Administration (“NOAA”) of the U.S. Department of Commerce and the U.S. Fish and Wildlife Service (“USFWS”) on behalf of the U.S. Department of the Interior (collectively the “Trustees”). It is important to note that a minimal amount of New Jersey shoreline was oiled during this spill; therefore the State of New Jersey did not assert any NRD claim relating to the spill and did not participate in this assessment.

The Trustees are required to use settlement funds to compensate for the natural resource injuries resulting from the spill and have determined that it is appropriate to utilize the funds to restore shoreline habitat and associated fauna, as well as recreational losses that were injured by the spill. In this Draft RP/EA the Trustees present the restoration projects that they identified and considered and the restoration projects they have selected as proposed preferred restoration projects to be implemented with the settlement funds. The purpose of conducting and NRDA and implementing restoration activities is to make the environment and the public whole for injuries resulting from the spill by restoring injured natural resources and lost recreational uses, and compensating for interim lost services.

1.1 Overview of the Incident

On or about April 25, 2006, an undetermined volume of oil was released from the Bermuda Islander container ship into the marine waters and shoreline habitats of the Delaware Bay, Delaware (the “release” or the “spill”). Approximately forty (40) miles of Delaware shoreline and less than one (1) mile of New Jersey shoreline were impacted by the spill (Figure 1).

The spill zone extended from Smyrna, Delaware to Cape Henlopen, Delaware and deposited various amounts of oil (light, very light or no oil) on forty (40) miles of beach and shoreline. The impacted area included two National Wildlife Refuges (Bombay Hook National Wildlife Refuge (“NWR”) and Prime Hook NWR); several Delaware State Wildlife Areas (WA) and Parks (SP) (Little Creek WA, Milford Neck WA, and Cape Henlopen SP); and numerous beaches (Pickering, Bowers, Big Stone, Cedar, Slaughter, Fowlers, Prime Hook, and Broadkill). The beaches along the lower portion of the Delaware Bay were and continue to be popular recreational and tourist areas.

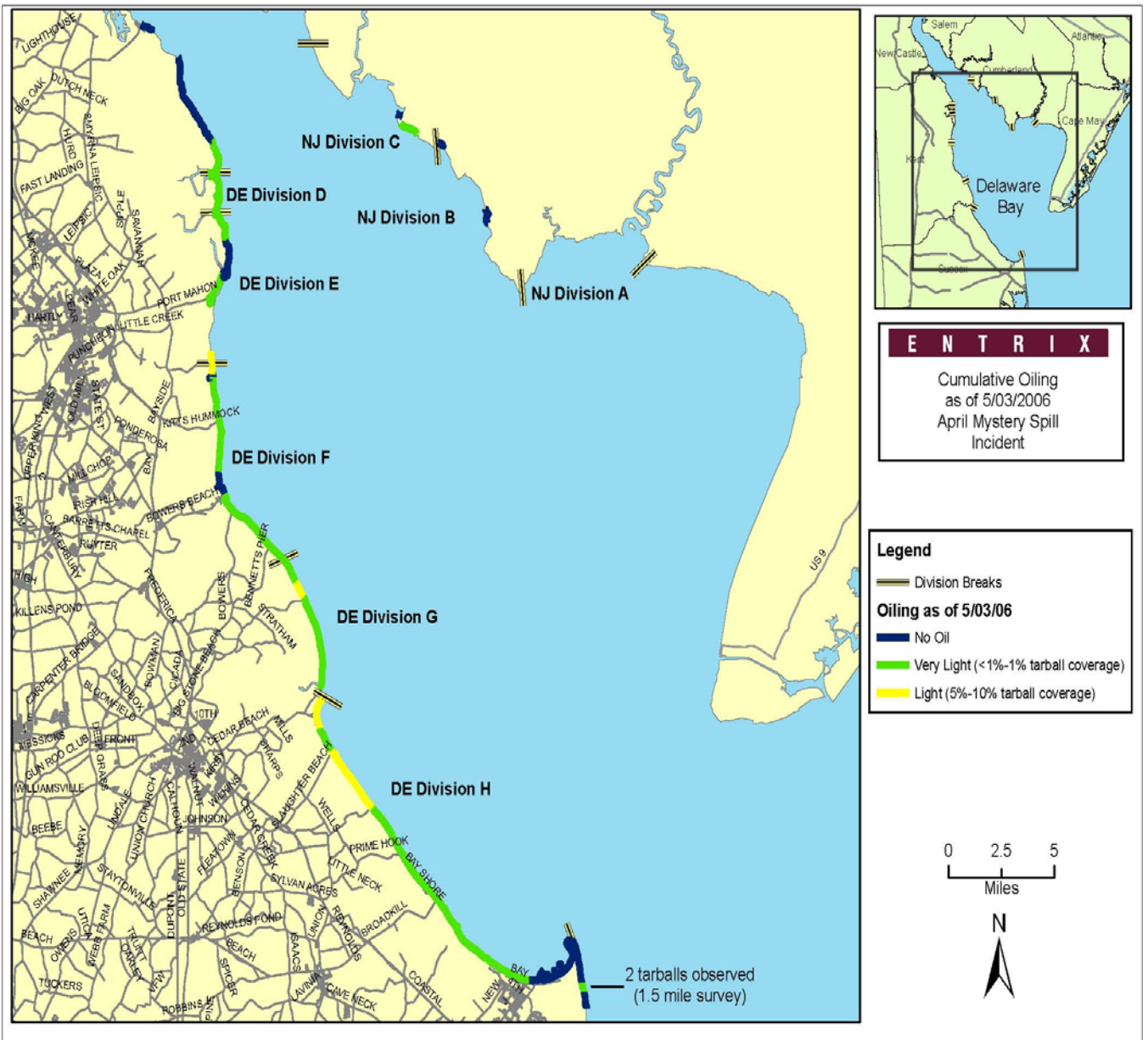


Figure 1: Assessment Area for the Bermuda Islander oil spill. The colored shoreline segments depict the level of oiling observed following the spill.

1.2 Summary of Natural Resource Injuries

The Trustees, in cooperation with the RPs and their representatives, assessed the nature and extent of injuries to trust resources associated with the Delaware Bay and its tributaries. Analyses of sediment samples, horseshoe crab eggs, and water samples, as well as field observations and best professional judgment, were used to assess the ecological impacts resulting from the oil spill. The Trustees also assessed recreational losses, including general shoreline uses such as boating and fishing. The Trustees determined that potential natural resource injuries included:

- **Shoreline habitat.**
- **Horseshoe crabs and their habitat.** The oiled shorelines are prime spawning habitat and the spill occurred just prior to the height of horseshoe crab spawning season.
- **Surface water resources,** including fish.
- **Intertidal sediments.** At least one sediment core demonstrated that oil from this spill penetrated into the subsurface (5 to 20cm) of the intertidal zone.
- **Wildlife.** Although there were no confirmed bird mortalities as a result of the spill, several birds were oiled during the release.
- **Recreational uses.**

1.3 Summary of Preferred Restoration Alternatives

The Trustees generally scale the injury to a restoration project(s) that would restore, replace, or acquire the equivalent of the injured resources. In this case, based on the type and quality of oil released, and after conducting field work and modeling, the Trustees determined that an expedited settlement approach focusing on a cash settlement was appropriate. Pursuant to negotiations, the parties agreed to settle the Trustees' natural resource damage claim for \$270,000. The Trustees' past assessment costs totaled \$63,645 and the remaining amount, \$206,355, will be used to restore, replace, rehabilitate, or acquire resources similar to those that were injured or lost as a result of the spill.

The Trustees considered restoration projects that: (1) replaced shoreline and saltwater marsh habitats and associated lost ecological and recreational services and (2) were located within the forty (40) mile area of Delaware that was oiled. These projects included:

- Land acquisition at Prime Hook National Wildlife Refuge (NWR).
- Creation of a dike to protect a freshwater marsh at Prime Hook NWR.
- Tidal marsh restoration/mudflat creation on a recently acquired (Fitzgerald) property near the mouth of the Mispillion River.
- Dune restoration at Prime Hook NWR.
- Educational signs or kiosks on selected beaches informing the public about the ecology and importance of horseshoe crabs and the area as a migratory shorebird stopover.
- Debris removal and beach restoration at a recently acquired beach (Swain's) property in the Mispillion Harbor.

Each of these projects is described in detail in Chapter 5 of this document. The Trustees developed and used criteria to evaluate the proposed restoration projects. At the conclusion of their analysis, the Trustees selected three projects as preferred alternatives:

1. The Fitzgerald Property Restoration Project involves the restoration of a recently purchased 52-acre parcel located near the mouth of the Mispillion River. The Fitzgerald Property is a saltwater marsh that was grid ditched in the 1930s to drain the area and control mosquito populations. Restoration will involve ditch plugging, creating shallow open water and mud flat habitat for roosting shorebirds, and controlling invasive plant species. This area is part of the Milford Neck Wildlife Area, and one of the most important horseshoe crab nesting areas within in the Delaware Bay, which annually attracts large numbers of migrating red knots (*Calidris canutus rufa*), a federal candidate species. This project will be permanently protected as part of a State Wildlife Area, and is owned and managed by the Delaware Division of Fish and Wildlife.
2. Educational kiosks or interpretive signs will be installed at key sites along the Delaware Bay to highlight the importance of the area for horseshoe crab spawning and as a migratory shorebird stopover.
3. Mispillion Harbor Beach Restoration involves the removal of debris and the replacement of sand on a recently acquired beach. The property is owned and managed by the Delaware Division of Fish and Wildlife and is permanently protected as part of a Milford Neck Wildlife Area.

2.0 Purpose and Need for Restoration

This Draft RP/EA was prepared by the Trustees to identify and evaluate restoration alternatives and to select preferred alternative projects for restoring natural resources injured by the Bermuda Islander oil spill. The goals of the preferred proposed restoration alternatives, as outlined in this Draft RP/EA, are to make the environment and the public whole for injuries resulting from the oil spill.

2.1 Authorities and Legal Requirements

The federal and state agencies that prepared this Draft RP/EA, USFWS, NOAA, and DNREC, are the designated Trustees for natural resources injured by the Bermuda Islander oil spill pursuant to the Oil Pollution Act (“OPA”), U.S.C. §2706(b), the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. §§ 300.600 *et seq.*, and the Federal Water Pollution Control Act of 1972, as amended (“the Clean Water Act”), 33 U.S.C. 1251 *et seq.*. As designated Trustees, each agency is authorized to act on behalf of the public to protect and restore natural resources that have been threatened and/or injured by the spill.

2.1.1 Review of OPA

OPA provides the statutory authority for natural resource Trustees to assess and restore injuries resulting from oil spill incidents. OPA's implementing regulations (15 CFR Part 990) define "injury" as "an observable or measurable adverse change in a natural resource or impairment of a natural resource service" (15 CFR §990.30). The OPA regulations define "restoration" as "restoring, rehabilitating, replacing, or acquiring the equivalent of injured natural resources and services." This definition includes both primary and compensatory restoration (15 CFR §990.30).

A NRDA, as described under Section 1006 of OPA (33 U.S.C §2706), and its implementing regulations (15 C.F.R. 990) consists of three phases: 1) preassessment; 2) restoration planning; and, 3) restoration implementation. The Trustees may initiate a damage assessment provided that: an incident has occurred; the incident is not from a public vessel or an onshore facility subject to the Trans-Alaskan Pipeline Authority; the incident is not permitted under federal, state or local law; and, Trustee natural resources may have been injured as a result of the incident.

Information collected during the preassessment phase, is used by the Trustees to estimate what natural resources have been or are likely to be injured as a result of the spill. The Trustees next determine whether the oil spill response actions will eliminate the injury or the threat of injury to natural resources. If injuries are expected to continue and feasible restoration alternatives exist to address such injuries, the Trustees may proceed with the restoration planning phase. Even if degradation from injuries is not expected to continue, restoration planning may be necessary if injuries resulted in interim losses requiring compensatory restoration.

The purpose of the restoration planning phase is to evaluate the potential injuries to natural resources and services, and to use that information to determine the need for, type of, and scale of restoration actions. OPA defines natural resources as: "land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any state or local government or Indian tribe, or any foreign government (33 U.S.C. 2701(20))." Services (or natural resource services) are functions performed by a natural resource for the benefit of another natural resource and/or the public.

Restoration planning under OPA has two components: injury assessment and restoration selection. The goal of injury assessment is to determine the nature and extent of injuries to natural resources and services, thus providing a factual basis for evaluating the need for, type of, and scale of restoration actions. Restoration selection involves identifying a reasonable range of restoration alternatives; evaluating and selecting the preferred alternative(s); developing a draft Restoration Plan/Environmental Assessment (EA); presenting the alternative(s) to the public; soliciting public comment on the draft Restoration Plan/EA; and considering those comments before issuing a final Restoration Plan/EA.

During the restoration implementation phase, the final Restoration Plan/EA is presented to the RPs to implement or to provide the necessary funds to the Trustees' to implement the Plan, thereby providing an opportunity for settlement of damage claims without litigation. The

projects described in the Final RP/EA are implemented to compensate the public for the loss and are monitored to evaluate the projects' success and benefits.

2.1.2 Public Participation

This document provides the public with information about:

- the nature and extent of natural resource injuries resulting from the Bermuda Islander oil spill;
- the natural resource damage settlement;
- the restoration alternatives the Trustees identified and evaluated ; and
- The Trustees' identification and selection of proposed preferred restoration alternatives.

The Trustees have developed and published this Draft RP/EA to provide the public with notice of, and an opportunity to comment on, their environmental assessment and restoration planning activities, as well as, the proposed preferred restoration alternatives. In accordance with Federal and Delaware state laws, including but not limited to the National Environmental Policy Act of 1969 ("NEPA"), 42 U.S.C. §4231 et seq., OPA and OPA's implementing regulations, this Draft RP/EA will be available for public review and comment for thirty (30) days to allow interested parties to provide input on the proposed restoration plan.

2.1.3 Administrative Record

The Trustees have placed the Draft RP/EA and other applicable documents relating to the Bermuda Islander oil spill in an Administrative Record (AR). The AR may be reviewed by interested members of the public at:

Delaware Department of Natural Resources and Environmental Control
Office of Public Affairs
89 Kings Highway
Dover, DE 19901

Written comments should be sent to:

Rob Hossler
Delaware Division of Fish and Wildlife
6180 Hay Point Landing Road
Smyrna, DE 19977

Access to and copying of documents in the AR are subject to all applicable laws and policies including, but not limited to, laws and policies related to copying fees and the reproduction or use of any material that is copyrighted.

2.2 NEPA Compliance

Restoration of natural resources under OPA must comply with NEPA (42 U.S.C. §4371 et seq.)

And its implementing regulations (40 C.F.R. 1500 et seq.). In compliance with NEPA, this draft Restoration Plan (RP) also serves as an Environmental Assessment (EA). As such, it includes a summary of the current environmental setting, describes the purpose and need for action, and identifies alternative actions and their potential environmental consequences.

The Trustees will use information contained in this assessment, along with the comments and additional information received during the comment period, to make a threshold determination as to whether preparation of an Environmental Impact Statement (EIS) is required prior to the selection of the final restoration action (i.e., whether the proposed action is a major federal action that may significantly affect the quality of the human environment).

3.0 Affected Environment

This chapter presents a brief description of the physical, biological, and cultural environment affected by the Bermuda Islander oil spill.

3.1 Physical Environment

The Delaware River is a principal river along the east coast. It extends approximately 330 miles from Hancock, New York, to the mouth of the Delaware Bay and includes 216 tributaries (Final RP/EA for Athos I 2009). The Bermuda Islander oil spill impacted approximately forty (40) miles of Delaware shoreline from Bombay Hook National Wildlife Refuge, Smyrna, Delaware to Cape Henlopen, Delaware, and less than one (1) mile of New Jersey shoreline. Extensive saltwater marshes are found along the northern portion of the Delaware Bay, whereas beaches and sand dunes are typically found along the lower Delaware Bay shoreline. Both saltwater marshes and beach habitats were impacted to various degrees by the oil. Other impacted resources include surface water, sediments, and shoreline habitats along the Delaware Bay and its tributaries, including the Mispillion River. The public use of the natural resources for boating, beach-going and other recreational activities was also adversely impacted by the spill.

3.2 Biological Environment

3.2.1 Birds

Delaware Bay has global significance for six species of shorebirds, as it is one of the few known major spring stopover areas for long-distance migratory species. Species of Greatest Conservation Need (SCGN) including red knot (*Calidris canutus*) (a candidate species for “federal listing”), ruddy turnstone (*Arenaria interpres*), semipalmated sandpiper (*Calidris pusilla*), and sanderling (*Calidris alba*) (Allen et al. 2005) comprise the majority of the spring shorebird population in Delaware Bay; in addition, several other species also migrate through Delaware Bay during their spring migration (Clark et al. 1993). The spring migration of these species is timed perfectly to take advantage of the superabundant supply of horseshoe crab (*Limulus polyphemus*) eggs deposited on the beaches of Delaware Bay during the spring spawning period (Botton et al. 1994). Due to the huge concentration of horseshoe crab eggs in the area, eighty percent of the migrating red knots utilize the Mispillion Harbor located just east

of Milford, Delaware on the border between Kent and Sussex Counties, as a major feeding area during their migration from South America to the Arctic (Conservation Fund 2007).

The Delaware Bay is the second largest stopover location for northern bound migrating shorebirds in the Western Hemisphere (Crockett 1998). The red knot (*Calidris canutus rufa*), which depends upon Delaware Bay as a stopover feeding location, flies more than 9,300 miles along the Atlantic Flyway between its nesting grounds in the Canadian Arctic and its wintering grounds in southern Brazil. Migrating birds double their weight during their brief migratory stopover by feeding on horseshoe crab eggs. The numbers of red knots, now a candidate species, have correspondingly declined as a result of the loss of this critical food source (American Bird Conservancy 2007). In addition, the populations of other shorebird, such as semipalmated sandpipers and sanderlings, are also declining (Niles et. al. 2007).

3.2.2 Horseshoe Crabs and Fish

The Delaware Bay hosts the world's largest spawning population of Atlantic horseshoe crabs (*Limulus polyphemus*). The horseshoe crab is a living fossil, has been on earth for approximately 500 million years (Maryland DNR 2005) and plays a vital role in the ecology of the Delaware Estuary. Each spring, horseshoe crabs migrate from their overwintering areas in deeper waters of the bay and the Continental Shelf to the Delaware Bay beaches. Males arrive first and attach themselves to the females. During high tide, each female digs a nest in the sand and lays between 15,000-80,000 small green eggs at a depth of 15-20 cm. These eggs are a vital food source for migrating shorebirds, which time their arrival to coincide with the peak of spawning in late May/early June.

Delaware bay horseshoe crabs have a long history of harvest and use by humans; however since the early 1990's the population of horseshoe crabs has been declining as a result of several factors including loss of habitat and overharvesting for use as bait for American eels, whelk, and conch trapping. This decline in the horseshoe crab population has resulted in the reduced production of horseshoe crab eggs.

The Delaware River provides nursery habitat for many species of anadromous fish. The Atlantic sturgeon (*Acipenser oxyrinchus*) was added to the Federal Endangered Species list in 2012 because less than 300 spawning adults remain in the Delaware River (Dept. of Commerce 2012). The federally endangered shortnose sturgeon (*Acipenser brevirostrum*) spends its first year in the Estuary (Price et al. 1988; Final RP/EA Athos I 2009) and over-winters in the Delaware River (USFWS 2006; Final RP/EA Athos I).

3.3 Economic and Cultural Environment

The Delaware Estuary is home to the sixth largest port and third largest petrochemical port in the United States (Final RP/EA Athos I 2009; http://www.delawareestuary.org/news_oilspill_updates.asp). Approximately 3,000 deep draft vessels arrive each year and nearly 42 million gallons of crude oil are moved daily on the Delaware River. The port system generates approximately 19 billion dollars in revenue each year and supports more than half of the largest east coast refineries (Final RP/EA Athos I 2009).

Since the Delaware River is too shallow to enable large oil tankers to reach the refineries, the lower Delaware Bay is one of the world's largest lightering areas. In this area, oil is transferred from large ocean oil tankers to smaller barges (Delaware River Basin Commission). Lightering occurs daily and usually without incident (Committee on Oil Spill Risks from Tank Vessel Lightering, National Research Council 1998), however, occasionally spills occur as a result of this process.

4.0 Injury Determination

The Trustee's initiated preassessment activities on April 28, 2006. Preassessment activities, as defined by OPA, focused on collecting ephemeral data essential to determine whether: 1) injuries had resulted, or were likely to result from the incident; 2) response actions had adequately addressed, or were expected to address the injuries resulting from the incident; and, 3) feasible restoration actions exist to address the potential injuries.

The Trustees, in a cooperative assessment process with the RPs, estimated the potential injury to shoreline sediments (intertidal and sand beach), horseshoe crabs, and migratory birds from the undetermined volume of oil released from the Bermuda Islander container ship. Field data, including reported observations of oiled shorelines and birds, and the results of intertidal sediment sample analyses were used to develop inputs for the Habitat Equivalency Analysis (HEA) model used to calculate ecological injury. The Trustees used the results of the sediment and horseshoe crab egg polycyclic aromatic hydrocarbon (PAH) analyses, oiled bird observations, and Shoreline Cleanup and Assessment Technique (SCAT) data to develop estimates for the required HEA parameters. SCAT data was used to determine the acreage of Delaware Bay shoreline affected by PAHs from the release. Calculations were based on the length and width of oiled shoreline as recorded on the SCAT data sheets. The Trustees estimated that 7.57 acres of non-vegetated sand beach was very lightly oiled and 5.99 acres of non-vegetated sand beach was lightly oiled. Intertidal shoreline affected by oil was not recorded by SCAT data, but analysis of a sediment core sampled from the lower intertidal zone on May 2, 2006 contained oil in the deep sediments which matched the oil released from the Bermuda Islander and contained an extremely high level of total PAH (26,785 ng/g dry weight). Acknowledging the sediment cores in other areas of the intertidal zone did not contain Bermuda Islander oil, the Trustees assumed that 25% of the intertidal zone along the 40 miles of oiled shoreline was adversely impacted by oil from the release. The degree of oiling in a given segment of the intertidal zone was assumed to be the same as the degree of oiling observed on the corresponding beach segment. The width of the intertidal zone in this region ranged from 150 to 300 feet. Using the low end of this range, the Trustees calculated the area of the potentially affected intertidal zone (25% of the total) to be 152.14 acres very lightly oiled and 31.64 acres lightly oiled.

The Trustees used an expedited assessment approach and decided to forego efforts to determine the exact level of injury to migratory birds and horseshoe crabs. Instead the Trustees considered the services provided by intertidal sediments and sand beaches to these animals (shelter, feeding, nesting, breeding, etc.) and expressed the injury to the shoreline and associated fauna as one service loss value. The HEA model yielded a shoreline 'debit' of 16.54 discounted service acre years (DSAYs). The HEA model yielded a shoreline 'credit' of 11.20 DSAYs per acre of

created beach habitat restoration, therefore, 1.47 acres of beach habitat would be required to compensate the public for the injury associated with the Bermuda Islander.

The Trustees and Entrix, the technical consultant hired by the Responsible Parties (RPs), undertook a cooperative assessment of recreational losses attributable to the release. Helicopter overflights and in-person recreation surveys were conducted for the assessment. The helicopter trips were used to determine the total trips to the affected areas and the recreation surveys were used to determine the effects of the spill on recreation behavior. The results of the counts and surveys were combined and demonstrated that 1,181 trips for boating, fishing and general shoreline use were affected by the release. The types and effects of recreational injuries caused by the spill included a reduction in total trips, a change in location of trips to substitute sites not affected by oil, and a diminution in value of trips taken to oiled locations.

Affected trips were then multiplied by a per-trip value to determine monetary losses. The Trustees and Entrix did not engage in a cooperative effort to determine the appropriate per-trip value. The Trustees utilized per-trip values calculated for previous oil-spill impacts on the Delaware River. Accounting for the types of activities affected and the specific estimates of lost, substituted, and trips whose value was diminished, the Trustees determined that the average value of an affected trip was \$22.48. Therefore, the resulting total estimate of recreational losses due to Bermuda Islander oil spill is \$26,548.¹

5.0 Restoration Planning Process and Analysis of Alternatives

The objective of the restoration planning process is to identify restoration alternatives to restore, rehabilitate, replace or acquire the equivalent of the natural resources and services that were lost or injured as a result of the spill. The two potential components of restoration are primary restoration and compensatory restoration. Primary restoration is designed to assist or accelerate the return of resources and services to their baseline condition (their condition prior to the spill). In contrast, compensatory restoration actions are taken to compensate for interim losses of natural resources and services from the date of injury to the date when they return their baseline level. During this spill, tar balls were removed from the beaches and oil remaining in the system was estimated to be gradually broken down chemically and physically through wave action and the tides. Given the light to very light level of oiling observed along the impacted shorelines, it is estimated that the shorelines would return to conditions that existed prior to the spill (i.e., baseline conditions) within one year. Therefore, in this case, the Trustees determined that primary restoration was unnecessary and only compensatory restoration was needed to compensate for the injuries resulting from the spill.

5.1 Restoration Strategy

In accordance with the NRDA regulations, the Trustees identified and evaluated a wide range of project alternatives capable of restoring ecological services to those lost due to the injury and recreational resources at or in the vicinity of the spill. These alternatives were identified by first searching for potential projects within the watershed. The Trustees utilized restoration

¹ The \$26,548 total was derived by multiplying 1,181 (the number of trips lost or impacted due to the spill) by \$22.48 (the value per trip as calculated by the Trustees).

evaluation criteria to screen and reduce the number of identified alternatives to a reasonable number for further consideration. The “No Action” alternative was also included for consideration, as required by NEPA and OPA NRDA regulations. These reasonable alternatives were then evaluated more carefully by the Trustees based on the criteria outlined in Section 5.2.

5.2 Restoration Evaluation Criteria

All potential restoration projects were evaluated by the Trustees using the following criteria:

- Nexus between the injured resource/s and the restoration project. The Trustees must utilize restoration funds to restore, replace, or acquire the equivalent of the injured natural resources. In the case of the Bermuda Islander oil spill, the Trustees’ goal is to restore beach areas, saltwater wetlands, and the organisms that depend on these habitats, that were injured by the spill (in-kind restoration) and to implement restoration projects located within the spill zone (in- place restoration), if possible.
- Cost/Benefit Analysis. The Trustees have considered the expected costs of the restoration alternatives in relation to the expected benefits to be derived from implementing the restoration alternatives.
- Technical feasibility of implementing the project.
- Compliance with federal, state, and local laws.
- Likelihood of project success.

The Trustees used all of these criteria, and considered the first element to be the most important. Therefore, beach and saltwater marsh restoration and acquisition projects were given top priority. Projects that created or improved tidal exchange were also given high priority. Other projects that created or enhanced freshwater wetlands were considered but were not preferred.

DNREC, the USFWS, and other federal and state sources provided restoration ideas and expertise. In 2006, the USFWS Trustee asked the managers of Prime Hook NWR and Bombay Hook NWR for restoration project ideas, and the DNREC Fish and Wildlife Trustee asked for proposals within his agency. The Trustees also received and considered a proposal submitted by a group of private landowners.

5.3 Restoration Alternatives

5.3.1 Alternative 1 (Non Preferred): No Action

Under the No Action Alternative, no restoration, rehabilitation, replacement or acquisition actions would occur. This alternative costs the least because no action would be taken. If selected, there would be no restoration or replacement of the lost resources or services, and the public would not be made whole for past injuries from the spill. Although the No Action Alternative cannot be selected as the preferred alternative since compensatory restoration is already required under the terms of the Settlement Agreement, this alternative is being retained for comparative purposes.

5.3.2 Alternative 2 (Non Preferred): Fowler’s Beach Acquisitions

Eight tracts of Delaware Bay beachfront property were proposed for acquisition by the Prime Hook NWR Manager. These tracts represent some of the last remaining areas of open shoreline (undeveloped and unprotected) on the Bay between the Mispillion River and the Broadkill River. This area provides important habitat for horseshoe crabs and migratory shorebirds that rely on horseshoe crab eggs for survival. Acquisition of these parcels is a priority for the NWR and the USFWS (Schafler 2006). The proposal called for acquisition of one or more of these properties.

Although these properties are ecologically valuable, the Trustees determined that acquiring them would not result in significant habitat improvement. Under the OPA guidelines, property acquisition projects must result in a net gain of natural resources or services. In other words, if a property is purchased, it must be enhanced or restored so that the project provides additional resources and/or services. The acquisition of property, without making improvements, can only be justified if the property is under a significant threat of development (i.e., is currently for sale, or is in an area where development is rapidly occurring). The Trustees determined that imminent development of these parcels is unlikely because: 1) access to them is debatable (vehicular access is only available through existing NWR property and the only direct access to these properties is by boat; 2) these properties have no electrical hookup; and 3) septic service is not available to these properties. Therefore, it is the opinion of the Trustees that it is extremely unlikely that any of these properties is threatened by imminent development.

After considering the above-described information, the Trustees determined that the purchase and restoration of the Fowler's Beach parcels was not an appropriate preferred alternative.

5.3.3 Alternative 3 (Non Preferred): Fowler's Beach Freshwater Impoundment Barrier

Trustee representatives received a proposal from a private landowner and local community representatives for Prime Hook Beach. The proposal called for the isolation and protection of one of the freshwater impoundments on Prime Hook NWR (Unit 2) from saltwater intrusion. The saltwater marsh area north of Fowler's Beach Road (Unit 1) (Figure 2) had a dune failure and overwash from the 2006 Hurricane Ernesto which increased daily tidal exchange into it. Prior to the storm, the salt marsh was partially open to tidal flow; however, the dune system provided a buffer and limited tidal exchange between the Bay and the freshwater impoundment located on the south side of Fowler's Beach Road (Unit 2). The storm completely changed the ecosystem of this area, which is now an expansive saltwater marsh with significant tidal exchange that provides a nesting area for piping plovers (*Charadrius melodus*), American oystercatchers (*Haematopus palliatus*) and other shorebirds. When this project was proposed, the increased tidal exchange threatened the freshwater impoundment through saltwater intrusion via culverts, and overtopping/flooding of the existing road. It should be noted the breach resides on private land.



Figure 2: Vicinity map of Prime Hook NWR (Draft EA, July 2010).

The proposal contained three recommendations:

- 1) Construct an earthen, concrete, or sheet metal barrier parallel to the road to separate the areas. No dimensions for the barrier were provided but a cost of \$100,000 was estimated.
- 2) Build a stronger dune along the breach to limit the amount of saltwater entering the marsh.
- 3) Install flood control devices in the culverts under Fowler's Beach Road to reduce the amount of saltwater entering the freshwater marsh.

The Trustees and the Prime Hook Refuge Manager met with the landowner and other residents of Prime Hook Beach to discuss this proposal. It was decided that an earthen barrier would not be feasible as it would have significant wetland impacts and would cost much more than \$100,000. The landowner and community representatives then suggested a line of concrete Jersey road barriers in place of the earthen dam. The Jersey barrier idea was discussed with restoration experts within the Trustee agencies. It was decided that this proposal was not feasible because Jersey barriers are not designed to hold water and could separate or topple creating a surge of flood water across the road. Additionally, it is highly likely that the barriers would become an attractive nuisance for graffiti resulting in a future eyesore. Sheet metal barriers placed in a marsh would also create permitting problems and would likely require mitigation to compensate for the loss of marsh habitat similar to the earthen barrier. Furthermore, the Trustees concluded that any barrier would provide only a temporary solution. A permanent solution would require raising Fowler's Beach Road 1'-3'. This would cost several million dollars and would have to be completed by the Delaware Department of Transportation (DelDOT).

The Trustees carefully considered the objectives and issues associated with this project and their obligations pursuant to OPA. They decided that this project failed to meet the required criteria for a restoration project pursuant to OPA. Most importantly, this proposed project is inconsistent with the priority objective to restore the same type of habitat that was lost or injured as a result of the spill. During the Bermuda Islander spill, beach/shoreline and saltwater marsh habitat were injured; however, the goal of the barrier project is to protect a freshwater impoundment by reducing or eliminating tidal exchange through placement of a man-made structure. Therefore, this alternative is not preferred by the Trustees.

5.3.4 Alternative 4: Prime Hook NWR Dune Restoration

Sand dunes provide natural protection for interior marshes and upland habitats and act as storage reservoirs for sand that is made available to replenish the beach during severe storms. Dunes also move inland over time from waves, wind and sea level rise; however, beach grass helps to stabilize the dunes and slow these erosive forces. The dunes on the beaches at Prime Hook NWR have been battered over the years by severe storms and sea level rise. The 2008 Mother's Day Storm widened a northern breach and initiated another overwash area south of Fowler's Beach Road. The overwash area to the south of Fowler's Beach Road was initially impacted in 2008 and the dunes were restored in the fall of 2008. In November 2009, by the storms following Hurricane Ida, and again in 2010, the dunes were repeatedly overwashed. The dunes were leveled allowing a breach directly into the impounded freshwater wetlands of Prime Hook NWR.

In August 2011, the State repaired the breaches south of Fowler Beach Road by replacing the dunes. In the fall, high tides and excessive winds destroyed the reconstructed dunes and breached the impoundment again. The former impoundment is now open water and mudflat. The FWS and the State are reviewing restoration options, including the possibility of increasing the marsh elevation by using dredge spoil. Because the dunes continue to breach or wash away and the on-going controversy whether to restore the former impoundment or to allow it to become a saltwater marsh, the Trustees decided not to pursue this alternative.

5.3.5 Alternative 5 (Preferred): Fitzgerald Marsh Restoration

Recently Mispillion Harbor located just east of Milford, Delaware on the border between Kent and Sussex Counties, has been identified as one of, if not the most, important feeding area for shorebirds within the Delaware Bay (particularly for red knots). The importance of this area has increased as the populations of red knots and several other shorebirds remain low and problems, which have resulted in reduced population growth, continue to plague shorebirds in Delaware Bay and elsewhere (Niles et al. 2007). The limited number of suitable roost sites in close proximity to feeding areas in Delaware Bay, including Mispillion Harbor, has been identified as a potential limiting/critical factor for red knots and other shorebird species of concern. Suitable shorebird roosting sites consist of large open areas of mud flat or very short vegetation that provides both a shallow roosting substrate as well an area of high visual acuity allowing for the quick identification of potential predators. These areas are most critical during the nighttime and periods of high tides when feeding opportunities are limited. Previous observations and preliminary telemetry studies suggest there are times when shorebirds will spend the day feeding in Delaware, fly to the Atlantic Coast of New Jersey to roost at night, and fly back to Delaware to feed again the next day, a 32-mile round trip (Kalasz, unpubl. report). Therefore, at certain times the limited availability of roosting sites in Delaware appears to cause shorebirds to expend more energy than they should to find suitable roosts. Other roosting locations have been identified in state-managed impoundments, but these areas have multiple management demands (mosquito control, waterfowl, and fishery resources) and on an annual basis it is not always possible to maximize shorebirds use of these areas as roosting sites. Additionally the vegetative growth within these impoundments is difficult to manage due to weather factors (e.g., drought) that allow open areas to become vegetated or surrounded by high vegetation exposing shorebirds to potential predation. Therefore the development and management of suitable roosting sites in close proximity to critical feeding areas such as Mispillion Harbor is vital, particularly in light of the fact that increasing levels of boat traffic and other human activities in the Harbor continue to decrease the attractiveness of roosting in some shoreline areas.

Description of Preferred Alternative

Restoration Objectives

The Trustees propose to create, protect, manage and monitor critical roosting site habitat for shorebirds in the Mispillion Harbor area of Delaware Bay by restoring 52 acres of degraded tidal marsh adjacent to an existing state wildlife area (Milford Neck Wildlife Area); this habitat is within 0.3 miles of one of the most significant shorebird stopover sites in Delaware Bay – the Mispillion Harbor (Attachment 1). Restoration efforts will include creating mudflat roosting

habitat, controlling *Phragmites*, plugging grid ditches and conducting monitoring to ensure that these restoration benefits are maintained. This restoration and enhancement project will provide suitable roosting sites benefitting several migratory and resident nesting shorebird species of greatest conservation need (SGCN), including a candidate under the Federal Endangered Species Act (red knot). More specifically, creation of suitable roosting sites near this important feeding area will provide protection from predation and reduce the energy demand placed on red knots just prior to the last leg of their migration to their breeding grounds in the Arctic. This property was added to the Milford Neck Wildlife Area and when restored will provide improved habitat and protection for numerous other migratory, breeding and resident wildlife species that are associated with Delaware's tidal marshes.

Comprehensive Restoration Plan

The Trustees, in cooperation with other federal, state, and local environmental resource agencies and interest groups, developed a comprehensive restoration plan for the proposed preferred project. The Trustees have identified the 52-acre Fitzgerald Marsh (Attachment 1) as a suitable site for restoration. The property was purchased with State funds and a matching Federal grant from the USFWS and has been added to the Milford Neck Wildlife Area and is protected and managed as such by the Delaware Division of Fish and Wildlife (Division).

The restoration plans for this property are the following: 1) create approximately 2 acres of mudflat habitat in currently degraded marsh habitat, 2) plug numerous grid ditches from historic mosquito control and draining practices; and 3) control approximately 10 acres of invasive *Phragmites*. Mud flat habitat creation will consist of 3 or 4 shallow circular excavations/compactions between 0.5 and 0.7 acres in size. Locations of excavations will be targeted in areas currently degraded within the tidal marsh. Intertidal mudflat depth will range from 1-3 inches below the surrounding marsh plain elevation and will slope gently downward from the surrounding marsh elevation at the outer perimeter to their maximum depth toward the center. Within the center of each mudflat, a small sump will be created 24 to 36 inches in depth with vertical sides to provide habitat diversity, open water and act as a refuge for small fish. Spoil generated from the mudflat creation will be used to backfill existing grid ditches, with any remaining spoil placed on the upland fringe near the roadway. This roadside area might then be used in the future to support an elevated viewing area or kiosk information sign describing the project for the public; however Bermuda Islander settlement funds will not be used for this purpose.

Existing grid ditches will be filled with spoil generated from the mudflat creation in areas where tidal creek channels have not reestablished or cannot be connected. In selected places, ditch plugs made of coconut fiber will be used to hold the backfilled material in place until it consolidates and revegetates. Prior to excavation, all areas dominated by *Phragmites* will be aerially treated by helicopter with a glyphosate-based herbicide (Aqua Neat) and a nonionic surfactant (LI-700). The herbicide will be applied at a rate of four pints Aqua Neat/acre plus 0.5% nonionic surfactant (LI-700) per total spray volume in five gallons of water per acre.

Excavation work will be conducted by a licensed contractor or personnel from the Division's Mosquito Control Section who have recently conducted similar restoration work at the James Farm Ecological Preserve in Ocean View, Delaware. All restoration work will be monitored by

the State Fish and Wildlife Division (Division) and other Trustee agencies. Following completion of restoration, the property will be monitored for shorebird use, as well as bird breeding activity and other wildlife and fish use, for 5 years post-restoration by Division staff.

Probability of success

Numerous tidal wetland restoration projects have been conducted in the State of Delaware by the Division. In 2008 the Division's Mosquito Control Section completed a 24-acre tidal restoration at the James Farm Ecological Preserve in Ocean View, Delaware, which was very similar in both habitat type and objectives to this preferred alternative. The Fitzgerald property has been purchased and is protected and managed by the State. For these reasons the Trustees believe this project has a high likelihood of success.

Performance Criteria and Monitoring

Successful implementation of the project would be measured using numerous criteria. The marsh restoration component of this project would be measured by: restoration of degraded habitat (*Phragmites* control, grid ditch plugging and mudflat creation); increase in the habitat heterogeneity within the tidal marsh; and increased use of the area by shorebirds, particularly as roosting habitat. Settlement-funded field surveys conducted to monitor habitat restoration, shorebird use, and bird breeding activity for a five year period post-restoration.

Approximate Project Costs

Restoration and enhancement of the Fitzgerald marsh (52 acres) would create approximately 2 acres of critical mudflat roosting habitat for shorebirds in the Mispillion Harbor area of Delaware Bay, control approximately 10 acres of *Phragmites* and plug wetland draining grid ditches. Project costs are based on the following assumptions: 2 acres of created mud flat habitat is sufficient to create adequate shorebird roosting habitat; and spoil excavating/relocation costs remain constant. The restoration implementation costs are \$67,800 (Table 2). Bermuda Islander settlement funds would be used to cover the planning, design, implementation and monitoring of the marsh restoration project at a total cost of approximately \$126,400.

Table 2: Summary of Anticipated Marsh Restoration and Monitoring Costs.

<u>Phase</u>	<u>Estimated Cost</u>
Planning	\$24,300
Design	\$11,000
Implementation	\$67,800
Monitoring	\$23,300

TOTAL	\$126,400
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5.3.6. Alternative 6 (Preferred): Shorebird Interpretive Signs

Shorebird habitat along the Delaware Bay is extensive and varied; it includes bayshore beaches, coastal marshes and managed impoundments. Although Delaware Bay has global significance for several species of shorebirds, most people driving by these habitats or visiting these beaches have no knowledge about the importance of these areas for some of the world's rarest species. Providing educational opportunities that highlight the ecological value of Delaware's coastal habitat will increase public awareness of the importance of these beaches, marshes and managed impoundments for shorebirds as well as other species. This will hopefully translate into increased public concern and stewardship for species such as the red knot and their habitat requirements.

Description of Preferred Alternative

Restoration Objectives

The Trustees propose to install interpretive signs at key sites along the Delaware Bay to accomplish the following objectives:

- Highlight the importance of Delaware Bay as a migratory shorebird stopover.
- Emphasize red knot stopover ecology and population status and the critical role performed by Delaware Bay in their conservation.
- Explain the role various shorebird habitats along the Delaware Bay play in migratory shorebird stopover ecology.
- Provide additional educational and recreational opportunities at selected bayshore beaches, coastal marshes, and managed impoundments.

Comprehensive Restoration Plan

Signs will be installed at a minimum of six locations along the Delaware bayshore and coastal marshes. Locations will be identified that not only represent the ecology of Delaware Bay and migratory shorebirds but also will maximize visibility by the public while minimizing disturbance to shorebirds and other wildlife. The content of each sign will be tailored to specific locations, depending on the habitat type, species, and conditions.

Signs will be fabricated by a company specializing in interpretive signs, with text and photos developed and provided by Division staff. Installation will be conducted by Division staff and will consist of minor excavations and the pouring of concrete around the aluminum metal bases. Signs will then be attached to these bases. Division staff will periodically monitor the signs for vandalism and weathering and repair them as appropriate.

Probability of success

Interpretive signs have been shown to be valuable educational and recreational tools; numerous signs have been used throughout Delaware's state parks, wildlife refuges and wildlife areas with good success. For these reasons the Trustees have concluded that this preferred project has a high likelihood of success.

Performance Criteria and Monitoring

Successful installation of the signage at selected habitats of importance will be the performance criteria. Monitoring will occur periodically by Division staff to assess and repair any damage caused by weather or vandalism.

Approximate Project Costs

Development, fabrication and installation of at least 6 interpretive signs is outlined in Table 3.

Table 3: Summary of Anticipated Costs Associated with Shorebird Interpretive Signs

Item	Description	Cost	Quantity	Total
Content Development and Graphic Design	Creating text and identifying photos	\$2,100	3	\$6,300
Fabrication of Sign and Stand	Printing graphic onto panel	\$800	6	\$4,800
Installation	Placement of final product	\$600	6	\$3,600
TOTAL				\$14,700

5.3.7 Alternative 7 (Preferred): Mispillion Harbor (Swain's) Beach Restoration

Sand beaches and their intertidal zone are important habitats for a variety of wildlife and aquatic resources. These habitats provide a host of services including shelter, feeding, nesting and breeding habitats. One species for which these habitats are particularly important is the horseshoe crab (*Limulus polyphemus*). Horseshoe crabs annually come ashore on sandy beaches, primarily during spring tides in May and June, where they spawn, burying their eggs in beach sediments. These eggs hatch approximately 14 - 30 days later but during this incubation period the 10,000's of eggs laid by each female are important food resources for a variety of species, most notably migrating shorebirds. Beach shorelines are very dynamic in nature and constantly exposed to natural and manmade forces such as sea level rise and increases in erosion caused by boat wakes and landscape changes. These same habitats and their associated fauna are also highly susceptible to potential impacts associated with oil spills, as oil can be readily deposited on the sand as well as penetrating into the subsurface of the intertidal zone. These potential impacts and the dynamic nature of beach habitats are reason why there is an urgent need to restore beach and intertidal habitats and maintain or increase their biodiversity.

Beach habitat within the Mispillion Harbor is particularly important as it is one of the most important spawning areas for horseshoe crabs within the Delaware Bay. Sections of beaches within Mispillion Harbor commonly have 50 to 75 times the horseshoe crab egg density of other

comparable sites within the Bay. The reason why egg densities are so high is because two major upland drainages converge in Mispillion Harbor (Mispillion River and Cedar Creek) and these upland drainages warm the water faster than waters in the ‘outer’ bay achieving 59 °F (a point where spawning becomes more consistent) before the exposed bayfront beaches. Additionally, horseshoe crabs prefer to spawn in calm wave conditions and the protective nature of the Harbor creates calmer water than outer bay beaches provide, allowing crabs to spawn on virtually every high tide. . These conditions make Mispillion Harbor the most important site in Delaware Bay for horseshoe crab spawning and, possibly, on the Atlantic flyway for north-bound migratory shorebirds. In particular, the red knot (*Calidris canutus rufa*) is designated as a Candidate Species by the USFWS under the Endangered Species Act. Mispillion Harbor is the most important site in Delaware Bay for this and other migratory shorebirds. In fact, as much as 90% of the red knot population can be found in Mispillion Harbor at any one time and depend on the resources found there to meet their energetic requirements to complete their migration to the Arctic.

Unfortunately Mispillion Harbor also has its problems and is threatened on multiple fronts. Increasing boat traffic, a failing jetty system, and sea level rise have all contributed to erosion of several of the beaches within the harbor reducing the suitable area for horseshoe crab spawning and shorebird foraging. One beach which has had moderate erosion, Swain’s Beach, was recently purchased by the Delaware Division of Fish and Wildlife (Division). Although this beach has not significantly eroded, it is in need of restoration due to a large amount of construction debris stock-piled on the property associated with its history as a marina in the 1980's and attempts by subsequent owners to re-develop the site back to a marina.

Description of Preferred Alternative

Restoration Objectives

The Trustees propose to restore, manage and monitor approximately 450 feet of degraded shoreline along Swain’s Beach in the Mispillion Harbor to provide enhanced horseshoe spawning and shorebird feeding habitat (Attachment 2). This beach is within the dedicated Mispillion Harbor Nature Preserve and encompassed within the Milford Neck Wildlife Area. Restoration efforts will include amending the beach and extending it both landward and seaward with approximately 2000 cubic yards of sand of selected grain size and composition suitable for horseshoe crab spawning. Additionally, the site will be cleared of existing construction debris although some material currently providing beneficial erosion control along the shoreline might be retained, if appropriate. This restoration and enhancement project will provide 450 linear feet of shoreline and 0.41 acres of improved horseshoe spawning habitat within one of Delaware Bay’s most important spawning areas. This restoration and enhancement project will also provide suitable feeding habitat for numerous migratory and resident shorebirds drawn to the Delaware Bay , including several species of greatest conservation need (SGCN), and a “candidate” species under the Federal Endangered Species Act (red knot, *Calidris canutus rufa*). Mispillion Harbor is the most important site in Delaware Bay for red knots. In fact, as much as 90% of the red knot population can be found in Mispillion Harbor at any one time and most depend on the resources found there to meet their energetic requirements to complete their migration to the Arctic.

Comprehensive Restoration Plan

The Trustees, in cooperation with other federal, state, and local environmental resource agencies and NGO partners are developing a comprehensive restoration plan for the proposed preferred project. The Trustees have identified Swain's Beach (Attachment 2) as a suitable site for restoration. The property was purchased with State funds and has been added to the Mispillion Harbor Nature Reserve being managed and protected by the Division as part of the Milford Neck Wildlife Area.

The restoration plan for this property is the following: 1) remove construction debris from the site and 2) amend the beach with approximately 2000 cubic yards of sand. Construction debris associated with attempts by prior owners to redevelop the site into a marina will be removed from the 4.7-acre site, although some material currently providing beneficial erosion control along the shoreline might be retained and incorporated into the beach restoration. Additionally, the existing pilings located seaward of the beach will be left in place because they currently provide additional protection to the beach by reducing near shore boat traffic and increasing wave attenuation. Approximately 2000 cubic yards of truck-hauled sand will be amended to approximately 450 feet of shoreline, creating a 0.41-acre beach approximately 40 feet wide. Land-based hauling of sand will be less expensive and can reduce environmental impacts. The sand selected will be of suitable grain size (0.3-0.6 mm or matching existing conditions) and composition (containing a gravel component). Sand will be spread on the beach utilizing specialized wide-tracked dozers and efforts will be made to reduce impacts to adjacent upland vegetated areas and tidal marsh habitat. The final slope and elevation of the beach will be determined after the construction debris has been removed, but typically we desire to achieve a slope of less than 8% (U.S. Fish and Wildlife Service, 1995). All restoration work on the site, except the truck hauling of sand, will be done by Division staff in consultation with DNREC's Shoreline and Waterway Management Section. All restoration work will be monitored by the Division and other Trustee agencies. Following completion of restoration, the property will be monitored for horseshoe crab spawning activity and shorebird use for 5 years post-restoration by Division and DNREC staff. Pre-restoration monitoring is also anticipated in order to provide a benchmark for comparison.

Probability of Success

Numerous Delaware Bay beach restoration projects have been conducted in the State of Delaware by the Shoreline and Waterway Management Section of DNREC. Since 1962 more than 3 million cubic yards of sand have been placed on Delaware Bay beaches in Delaware. Studies of horseshoe crab spawning activities on several of these re-nourished/restored beaches indicated that beach restoration can have a positive effect on spawning site selection and egg viability (Smith et al. 2002). Additionally a Coastal Engineering Assessment of Habitat Restoration Alternatives at Mispillion Inlet (Moffatt and Nichols 2008) was recently completed and provides structural and nonstructural options and feasibilities for restoring important horseshoe crab and shorebird habitat in Mispillion Harbor. And finally the Swain property has been purchased and is protected and managed by the State of Delaware. For these reasons the Trustees believe this project has a high likelihood of success, even though beach shorelines are

very dynamic in nature and constantly exposed to natural and manmade forces such as sea level rise and increases in erosion caused by boat wakes and landscape changes.

Performance Criteria and Monitoring

Successful implementation of the project would be measured using numerous criteria including stability of the restored beach, horseshoe crab spawning activity and shorebird use. Settlement-funded field surveys will be conducted to measure these criteria for a five-year period post-restoration.

Approximate Project Costs

Restoration of Swain's Beach will restore 0.41 acres of beach and associated intertidal zone along 450 feet of degraded shoreline in the dedicated Mispillion Harbor Nature Reserve to provide enhanced horseshoe spawning and shorebird feeding habitat. Project costs are based on land-based removal of existing construction debris and amending the beach with of 2000 cubic yards of suitable sand. All restoration work on the site, except the truck hauling of sand will be done by Division staff. The restoration implementation costs are \$45,389 (Table 2). Bermuda Islander settlement funds would be used to cover the planning, design, implementation and monitoring of the beach restoration project.

Table 2: Summary of Anticipated Beach Restoration and Monitoring Costs

<u>Phase</u>	<u>Estimated Cost</u>
Planning	\$ 2,877
Design	\$ 1,302
Purchase of Truck-Hauled Sand	\$ 29,700
Construction and Removal of Debris	\$ 5,986
Monitoring	\$ 5,524
TOTAL	\$ 45,389

5.4 Estimated Costs of Preferred Alternatives

Table 3: Summary of Restoration and Recreational Project Costs

Project	Location	Cost
Fitzgerald Property Restoration	Mispillion River Inlet	\$126,400
Shorebird Interpretive	DE Bay Beaches	\$14,700

Signs		
Mispyllion Harbor Beach Restoration	Mispyllion River Inlet Shoreline	\$45,389
Oversight		\$19,866
TOTAL		\$206,355

5.5 Description of Environmental Impacts Associated with Preferred Restoration Alternatives

Air Quality Impacts

Minor increases in the amounts of carbon monoxide or other pollutants associated with the use of heavy machinery might be temporarily associated with the proposed activities during the construction phase. Construction activities should have no long-term air quality impacts on the site or surrounding environment.

Water Quality Impacts

A temporary increase in turbidity is expected during construction and would be timed to occur during periods of reduced or non-critical usage by fish and bird resources. This would occur through the use of best management practices and time-of-year restrictions. Erosion control devices to minimize or prevent sediments from entering the water column such as turbidity curtains would be used on-site during construction activities. This project is anticipated to have no long-term negative water quality impacts.

Sediment Quality Impacts

Existing sediment characteristics on the project site include fine silts and clays in the wetland and sand at the beach. There would be no adverse impact to sediment at the project site.

Vegetation Impacts

At the Fitzgerald Marsh, *Phragmites* has invaded portions of the proposed project site resulting in an area less favorable to many plant and animal species. The Division intends to control *Phragmites* through the spraying of wetland -approved herbicides and controlled burns. In addition, excavation activities will be conducted in a small area (approximately 2 acres) for the creation of mudflat habitat. Surface elevations would be lowered within the mudflat areas reducing the amount of emergent marsh vegetation. The overall goal is to restore wetlands with native vegetation and increase biodiversity at the proposed project site by increasing the heterogeneity of open water, mudflat and vegetated habitat types. Best management practices would be employed to: minimize compaction of the wetland on the areas of the site required for mudflat creation, reduce the temporary turbidity and effects of sediment disturbance on water

quality, and conduct work during appropriate seasons in order to maximize the control of *Phragmites* and minimize soil/water disturbing activities.

5.6 Description of Socio-Economic Impacts with Preferred Restoration Alternatives

Aesthetics Impacts

This proposed restoration project would not negatively impact the area's aesthetic or scenic resources. Positive impacts on aesthetics are expected due to the restoration of the wetland and the beach to their original structure and appearance.

Noise Impacts

There would be minor increases in noise levels at the proposed project sites during the construction phase of this project. These impacts are expected to be short-term and limited to active periods of construction which would occur between sunrise and sunset. Hauling equipment will be required to transfer equipment and material to the project sites, additionally approximately 133 truckloads of sand will be needed to restore the Swain's Beach project. Heavy equipment and trucks will also be needed to remove debris and regrade the beach. Heavy equipment will be needed to excavate the mudflat habitat in Fitzgerald's Marsh. No sediment is expected to be removed from the project sites. Approximately 133 truckloads of sand will be hauled to the Swain's Beach Restoration Site. No long-term noise impacts are associated with this project

Recreational Impacts

Currently recreational use is limited at both the Fitzgerald Property and Swain's Beach. Therefore, construction activities would not result in any loss of recreational opportunities. Following construction and completion of the restoration plan, the project area, provide enhanced recreational opportunities, such as bird watching, hunting, fishing, and hiking.

Transportation Impacts

Some additional minor impacts to land based transportation in the proposed project area are expected during the construction phase. Trucks would transport construction equipment, materials and workers to the restoration sites. The proposed plan does not anticipate that the restoration project will require the hauling of sediment from the Fitzgerald Property; however, several truckloads of debris will be removed from Swain's Beach. Additionally, approximately 133 truckloads of sand will be hauled from a local gravel pit to restore Swain's Beach. Trucks and heavy equipment (dozers and excavators) will also be required during the grading of Swain's Beach and construction of the mud flats on the Fitzgerald Property. Impacts from truck traffic will be short-term and any damage to roadways will be repaired after restoration activities are completed.

Fish and Wildlife Habitat Impacts

Restoration activities associated with this proposed projects would not adversely impact or curtail any naturally occurring fish and wildlife movement. The Fitzgerald Property consists of a tidal salt marsh that was grid ditched and drained for mosquito control in the 1930s. This project provides for roosting habitat for shorebirds, including the red knot and anadromous fish habitat through the creation of shallow channels and pools. It would also increase tidal exchange and tidal flow retention by reverting some of these historic drainage practices. The existing mosquito control ditches will be plugged with the marsh material removed to create the mudflats, channels and pools. This project would also provide food and habitat for many wildlife species including migratory birds.

The Swain's Beach project will be conducted in the late fall or winter when neither shorebirds nor horseshoe crabs are actively utilizing the area. Restoration efforts will include amending the beach and extending it both landward and seaward with sand suitable for horseshoe crab spawning. Additionally, the site will be cleared of existing construction debris although some material currently providing beneficial erosion control along the shoreline might be retained, if appropriate. This restoration and enhancement project will provide several hundred feet of improved horseshoe crab spawning habitat and will also provide suitable feeding habitat for numerous migratory and resident shorebirds, including several species of greatest conservation need.

Care will be needed to assure that sand amending activities do not significantly impact oyster beds located directly offshore of Swain's Beach and in some cases the presence of oyster beds might limit the extent of seaward placement of sand. In these areas, efforts will be made to insure that sand amending activities do not bury any existing oyster beds. All other potential adverse impacts, such as increased turbidity, from the projects would be temporary in nature and would be minimized via the use of best management practices. These temporary adverse impacts might temporarily displace fish and wildlife species but are not anticipated to have any long-term effect, and the net effect of the project would be an improvement in fish and wildlife functions.

The Trustees know of no direct or indirect impacts of the proposed restoration project on threatened or endangered species, or their designated critical habitats on the Fitzgerald Property or Swains Beach. Although red knots feed at adjacent beaches, they do not extensively utilize the Fitzgerald Marsh or Swain's Beach in its current condition. No unique or rare habitat would be destroyed due to wetland or beach restoration activities. The proposed restoration actions do not require, nor do the Trustees anticipate, any violation of federal, state or local laws, designed to protect the environment, incident to or as a consequence of the implementation of the proposed actions. The restoration actions proposed can and will be implemented in compliance with all applicable state and local permits and approvals, such as the CWA Section 404 permits, state tidal wetland regulations and associated state water quality certification. All required permits will be obtained prior to initiating site activities.

Essential Fish Habitat

The area in which the proposed restoration project would be conducted is not designated as Essential Fish Habitat (EFH), as determined by the National Marine Fisheries Service

(NMFS). The proposed project would not adversely impact EFH.

Historic and Cultural Impacts

The Trustees believe the proposed restoration action would not affect any designated State or National Historic Site or any nationally significant cultural, scientific, or historic resources. Coordination with the Delaware State Historic Preservation Office would continue during the design phase of both preferred proposed projects to ensure that they do not result in any adverse impact to historic or cultural resources.

Cumulative Impacts

Wetland and beach restoration projects such as those proposed have been implemented in Delaware and other coastal States in order to restore tidal exchange, create improved wildlife and anadromous fish habitat, and restore beach habitat. The proposed restorations, therefore, sets no new precedents for future actions of a type that would significantly affect the quality of the human environment. The conceptual design proposed for consideration at the Fitzgerald Property was based on the James Farm (aka Sloughs Gut) Restoration Project which was completed in March 2009. The proposed project would restore the marsh to a condition that existed and naturally occurred in the area before grid ditching was utilized to drain marshes in Delaware. Grid ditching negatively impacted anadromous fish habitat and tidal influence. The mud flat creation will create much need shorebird roosting habitat while increasing the biodiversity and habitat heterogeneity of the Fitzgerald marsh.

Numerous Delaware Bay beach restoration projects have been conducted in the State of Delaware by the Shoreline and Waterway Management Section of DNREC. Since 1962 more than 3 million cubic yards of sand have been placed on Delaware Bay beaches in Delaware. Studies of horseshoe crab spawning activities on several of these re-nourished/restored beaches indicated that beach restoration can have a positive effect on spawning site selection and egg viability (Smith et al. 2002). This restoration and enhancement project will provide several hundred feet of improved horseshoe crab spawning habitat and will also provide suitable feeding habitat for numerous migratory and resident shorebirds, including several species of greatest conservation need.

The Trustees do not anticipate that these proposed projects will create any adverse cumulative impacts. The beach and salt marsh restoration projects restores beach and saltmarsh habitat, habitat types that was injured during the oil spill. Further, the action proposed in this Draft RP/EA is intended to restore the services provided by the natural resources injured or lost as a result of the Bermuda Islander oil spill.

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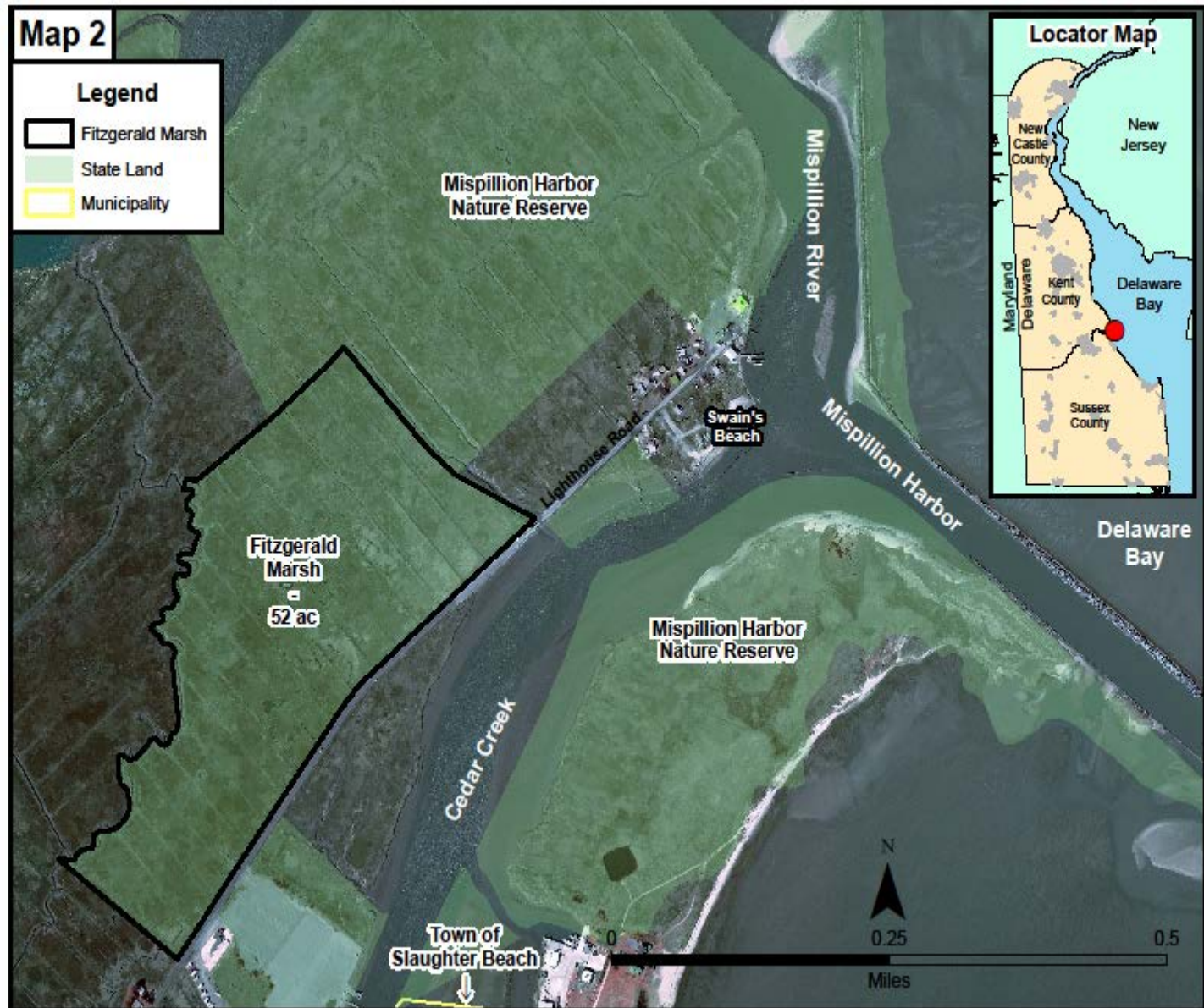
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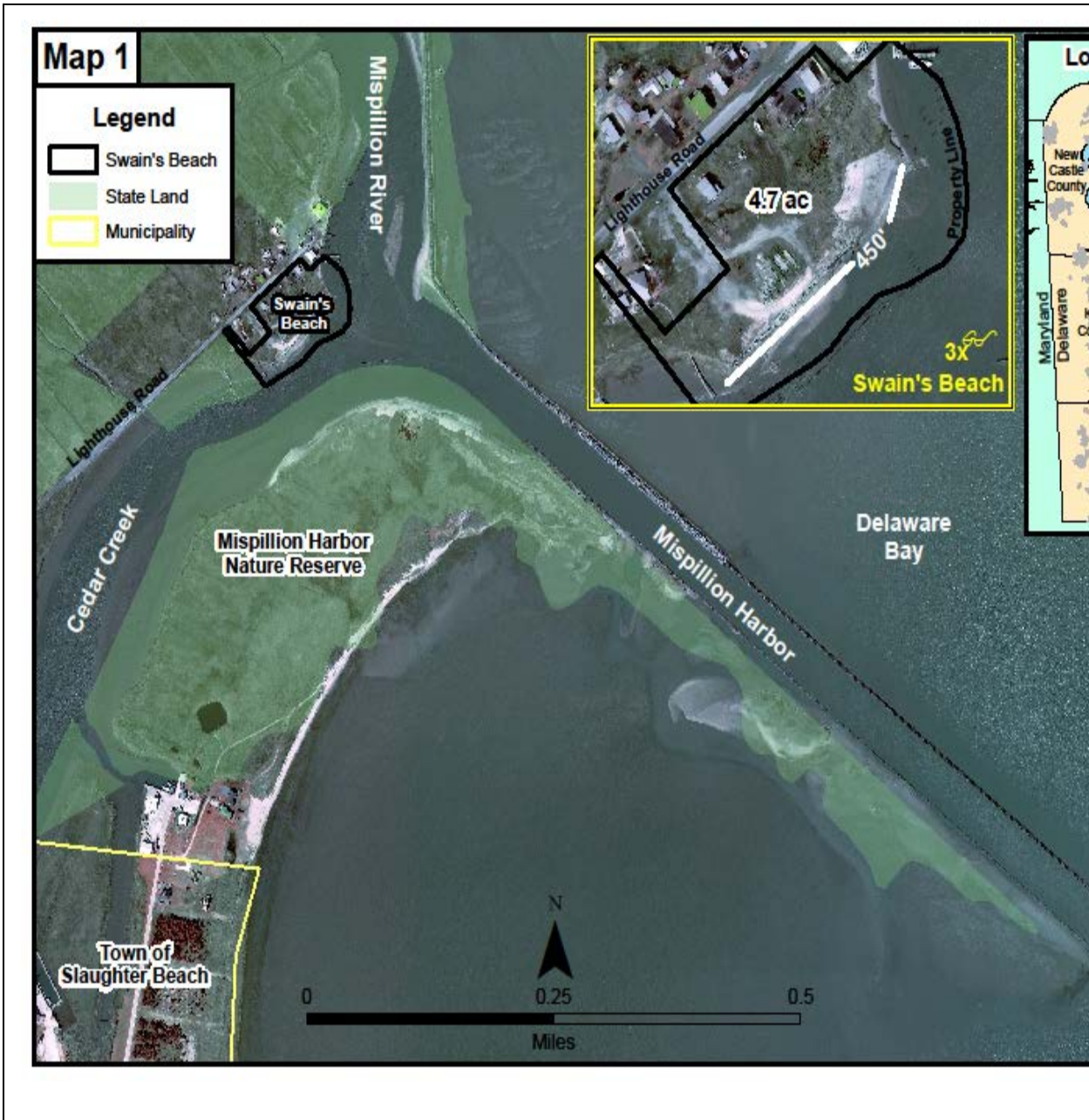
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Attachment 1: Map of Fitzgerald Marsh Restoration Project Location and Area



Attachment 2: Map of Mispillion Harbor (Swain's) Beach Restoration Project Location and Area.