APPENDIX J

ENDANGERED SPECIES ACT COMPLIANCE

BIOLOGICAL ASSESSMENT FOR:
PIPING PLOVER (*Charadrius melodus*)
AND SEABEACH AMARANTH (*Amaranthus pumilus*)
RUFA RED KNOT (*Calidris canutus*)
ATLANTIC COAST OF NEW YORK, EAST ROCKAWAY INLET TO ROCKAWAY INLET, and JAMAICA BAY, NEW YORK HURRICANE SANDY GENERAL REEVALUATION

U.S. Army Corps of Engineers
New York District

August 2016

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1.0 INTRODUCTION

1.1 Purpose and Objective of the Biological Assessment

This BA has been prepared in accordance with requirements identified in the Endangered Species Act (ESA) of 1973, to identify and discuss potential impacts to Federally-listed threatened and endangered (T&E) species caused by the U.S. Army Corps of Engineers (USACE), New York District (District) activities associated with implementation of the Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet, New York Hurricane Sandy General Reevaluation (Project), Queens County, New York (Figure 1). T&E species include those species Federally-listed and protected by the U.S. Department of the Interior, Fish and Wildlife Service (USFWS) under the ESA.

In accordance with Section 7(a)(2) of the ESA, as amended, Federal agencies are required to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any habitat of such species determined to be critical unless an exemption has been granted. Additionally, a Biological Assessment (BA) must be prepared if listed species or critical habitat may be present in an area to be impacted by a "major construction activity." A major construction activity is defined at 50 CFR §402.02 as a construction project (or an undertaking having similar effects) which is a major Federal action significantly affecting the quality of the human environment as referred to in the National Environmental Policy Act (NEPA) (42 U.S.C. 4332(2)(C)).

1.1.1 List of Species

The USFWS, through its formal consultation with the District regarding implementation of the Project, identified three T&E species as being present on or near the Project Area. Based on habitat and life history assessments, recommendations from the USFWS in the Fish and Wildlife Coordination Act 2B Report and follow-up consultation for this Project (USFWS 1995a), and a site assessment conducted by the USACE in 2003, the District has determined that the following Federally-listed species are likely to occur in the East Rockaway Island Project Area and warrant a Biological Assessment:

- Piping plover (*Charadrius melodus*), Federally threatened; and,

- Seabeach amaranth (*Amaranthus pumilus*), Federally threatened; and

- Rufa Red Knot (*Calidris canutus),* Federally threatened

The state-listed threatened common tern (*Sterna hirundo*) and least tern (*Sterna antillarum*) and the Federally and state-listed Endangered roseate tern (*Sterna dougallii*), utilize beach habitat similar to that of the piping plover and sea beach amaranth, and have been identified as species that may occur in the Project Area (USACE 1998, USFWS 1995a). Additionally, the state species of special concern, black skimmer (*Rynchops niger*), also is known to nest on coastal beaches and frequently nests in or near tern nesting areas (NatureServe 2002). None of these species have been identified by the USFWS as species requiring further ESA consultation or Biological Assessment (USFWS 1995a). However, measures taken to avoid and protect piping plover, red knot and seabeach amaranth habitats would benefit and protect these species as well.

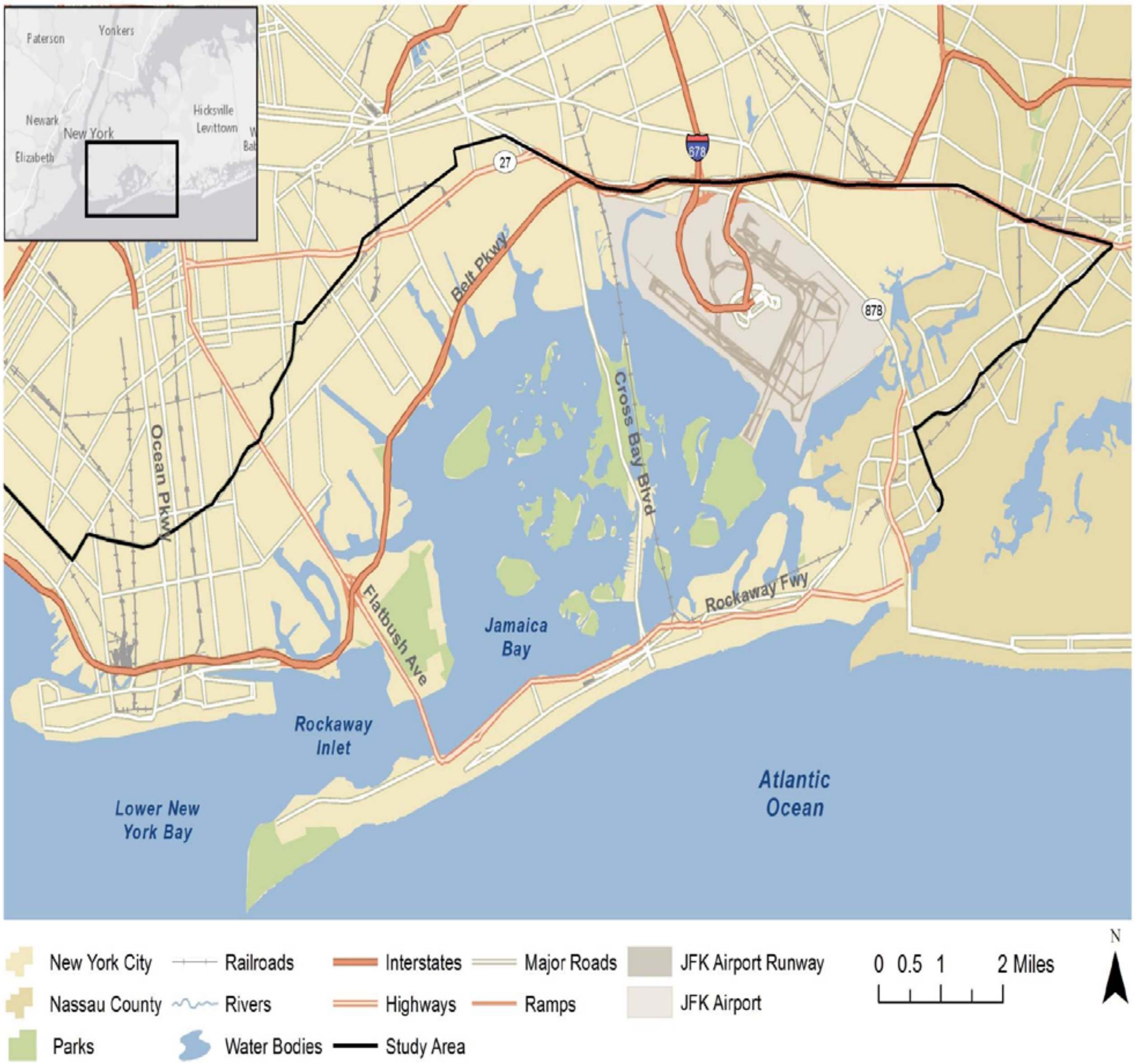

Figure 1 Project Area Location

1.1.2 Objectives for this BA

This BA will facilitate the preparation of the Environmental Impact Statement (EIS) that will identify and evaluate potential environmental impacts associated with the proposed Project and will maintain compliance with Section 7(a)(2) of the ESA. The BA is designed to provide the USFWS with the required information for their assessment of the effects of the proposed Project on Federally-listed endangered and threatened species. This BA does not address environmental issues or species relating to the borrow area portion (located approximately 2 miles south (Rockaway) of the proposed Project.

Specific objectives of this BA are to:

1. Ensure Project actions do not contribute to the loss of viability of T&E species;

2. Comply with the requirements of the ESA, as amended, that Project actions not jeopardize or adversely modify critical habitat for Federally-listed T&E species;

3. Analyze the effects of implementation of Project actions on Federally-listed T&E species;

4. Recommend impact avoidance, minimization, and measures to offset impacts to Federally-listed T&E species; and,

5. Provide biological input to ensure District compliance with the NEPA and the ESA.

1.2 Project Background

Rockaway, New York, has an extensive history of property damage and economic loss as a result of coastal flooding and erosion associated with frequent storms. Significant beach erosion and sand loss has reduced the width of the protective beach front and has exposed properties to a high risk of damage from ocean flooding and wave attack, and existing groins and jetties along the island have deteriorated and are becoming less effective at reducing sand loss along the shoreline and providing wave protection. Non shorefront flooding in Rockaway is attributed to storm surges in Jamaica Bay inundating the bay shorelines of Rockaway (Back Bay Flooding) and storm surges that overtop the high elevations located near the Rockaway beachfront flowing across the peninsula to meet the surge into Jamaica Bay (Cross Shore Flooding).

The Reformulation Study for East Rockaway Inlet to Rockaway Inlet and Jamaica Bay was authorized by the House of Representatives, dated 27 September 1997, as stated within the Congressional Record for the US House of Representatives. It states, in part:

> *"With the funds provided for the East Rockaway Inlet to Rockaway Inlet and Jamaica Bay, New York project, the conferees direct the Corps of Engineers to initiate a reevaluation report to identify more cost-effective measures of providing storm damage protection for the project. In conducting the reevaluation, the Corps should include consideration of using dredged*

material from maintenance dredging of East Rockaway Inlet and should also investigate the potential for ecosystem restoration within the project area."

Public Law 113-2 (29Jan13), The Disaster Relief Appropriations Act of 2013 (the Act), was enacted in part to "improve and streamline disaster assistance for Hurricane Sandy, and for other purposes". The Act directed the Corps of Engineers to:

> "…reduce future flood risk in ways that will support the long-term sustainability of the coastal ecosystem and communities and reduce the economic costs and risks associated with large-scale flood and storm events in areas along the Atlantic Coast within the boundaries of the North Atlantic Division of the Corps that were affected by Hurricane Sandy" (PL 113-2).

In partial fulfillment of the requirements detailed within the Act, the Corps produced a report assessing "authorized Corps projects for reducing flooding and storm risks in the affected area that have been constructed or are under construction". The East Rockaway Inlet to Rockaway Inlet, NY project met the definition in the Act as a constructed project. In accordance with the Act, the Corps is proceeding with this HSGRR to address resiliency, efficiency, risks, environmental compliance, and long-term sustainability within the study area (USACE, 2013a).

1.3 Project Area Description

The communities located on the Rockaway peninsula from west to east include Breezy Point, Roxbury, Neponsit, Belle Harbor, Rockaway Park, Seaside, Hammel, Arverne, Edgemere and Far Rockaway. The former Fort Tilden Military Reservation and the Jacob Riis Park (part of the Gateway National Recreation Area) are located in the western half of the peninsula between Breezy Point and Neponsit. The characteristics of nearly all of the communities on the Rockaway peninsula are similar. Ground elevations rarely exceed 10 feet, except within the existing dune field. Elevations along the Jamaica Bay shoreline side of the peninsula generally range from 5 feet, increasing to 10 feet further south toward the Atlantic coast. An estimated 7,900 residential and commercial structures on the peninsula fall within the FEMA regulated 100-year floodplain.

During Hurricane Sandy, tidal waters and waves directly impacted the Atlantic Ocean shoreline. Tidal waters amassed in Jamaica Bay by entering through Rockaway Inlet and by overtopping and flowing across the Rockaway Peninsula. Effective coastal storm risk management for communities within the study area requires reductions in risk from two sources of coastal storm damages: inundation, wave attack with overtopping along the Atlantic Ocean shorefront of the Rockaway peninsula and flood waters amassing within Jamaica Bay via the Rockaway Inlet.

The study area (Figure 1), consisting of the Atlantic Coast of New York City between East Rockaway Inlet and Rockaway Inlet, and the water and lands within and surrounding Jamaica Bay, New York is vulnerably located within the Federal Emergency Management Agency (FEMA) regulated 100-year floodplain. The shorefront area, which is a peninsula approximately 10 miles in length, generally referred to as Rockaway, separates the Atlantic Ocean from Jamaica Bay immediately to the north. The greater portion of Jamaica Bay lies in the Boroughs of Brooklyn and Queens, New York City, and a section at the eastern end, known as Head-of-Bay, lies in Nassau County. More than 850,000 residents, 48,000 residential and commercial structures, and scores of critical infrastructure features such as hospitals, nursing homes, wastewater treatment facilities, subway, railroad, and schools are within the study area

The Project Area consists of beaches, sand dunes, low-growing shrubs, and tidal flats, and has been highly modified as a result of human development. Upland areas in the vicinity of the Project have been committed to residential, commercial and recreational development. Near shore and upper beach areas in the Project Area are heavily utilized for beach recreation. Numerous stone groins currently exist in the Project Area. The shoreline has been stabilized since the 1880s with beach fill, groins, bulkheads, and a stone jetty at Rockaway Inlet.

1.4 Description of Habitat and Species

Oceanfront beach and deepwater ocean habitats constitute the majority of the Project Area. The beach community includes upper, intertidal, and nearshore subtidal areas. Except for the sparsely vegetated herb and herb/shrub community associated with the upper beach/dune area, most of the Project Area is devoid of vegetation and is significantly impacted from human use of the area for recreational activities. In addition, significant development abuts the upper beach zone in most of the Project Area.

Jamaica Bay which is located on the north side of the peninsula is the largest estuarine waterbody in the New York City metropolitan area covering an approximately 20,000 acres (17,200 of open water and 2,700 acres of upland islands and salt marsh). Jamaica Bay measures approximately 10 miles at its widest point east to west and four miles at the widest point north to south, including approximately 26 square miles in total. The mean depth of the bay is approximately 13 feet with maximum depths of 60 feet in the deepest borrow pits. Navigation channels within the bay are authorized to a depth of 20 feet. Jamaica Bay has a typical tidal range of five to six feet. The portions of New York City and Nassau County surrounding the waters of Jamaica Bay are urbanized, densely populated, and very susceptible to flooding. An estimated 41,000 residential and commercial structures within the FEMA regulated 100-year Jamaica Bay floodplain.

Habitat Types

The upper beach zone extends from dune areas to just above the high water line and includes dunes and supratidal areas of the beach. The upper beach area is dominated by a sandy substrate and is generally sparsely vegetated (< 25% cover). Vegetation is dominated by beach grass (*Ammophila breviligulata*), but may also include < 5% cover of spurge (*Euphorbia polygonifolia*), beach plum (*Prunus maritima*), seaside goldenrod (*Solidago sempervirens*), beach heather (*Hudsonia tomentosa*), and sea rocket (*Cakile edentula*). Vegetation on stable foredunes is denser than that of the upper beach area (up to 50% vegetated cover), and includes similar species. Mixed herb/shrub communities dominate dune crests and protected areas behind dunes. Common species include the herbs found in fordune areas and shrubs such as bayberry *(Myrica pensylvanica)*, shadbush (*Amelanchier Canadensis)* and multiflora rose (*Rosa multiflora*). Only one area of saltmarsh habitat remains on the north shore of the island and is located in the vicinity of Lido Beach. In areas of low human disturbance, these areas can provide nesting and foraging areas for birds.

The intertidal zone extends from the low tide line to the high tide line and is submerged and exposed according to daily tidal cycles. The zone is unvegetated and consists of fine-grained sand substrate. Wrack and ocean debris are common within this zone. Species diversity is relatively low due to limited ability of species to withstand the daily submersion and exposure. Micro and macro-invertebrates known to inhabit this zone include crabs, shrimp, bivalves, and worms. The intertidal zone provides key foraging habitat for shorebirds/seabirds, which feed on these organisms.

The affected near shore subtidal zone extends from the low water line down to 25 ft below mean low water (MLW) and is nearly continuously submerged. The zone is unvegetated and consists of fine-grained sand substrate. The area contains a rich diversity of species including crabs, shrimp, bivalves, worms, and finfish. In addition, numerous man-made groins extend from the intertidal zone into the subtidal zone from 200 to 600 ft (USACE 1998). These structures provide habitat for numerous fish, macro-invertebrates, and birds.

Human use of unrestricted areas of these zones is high and the upper beach area is subjected to periodic beach raking during the summer months.

Tides and Tidal Currents

The mean tidal range along the Atlantic Shorefront project area is 4.5 feet (ft) and the spring tidal range reaches 5.4 ft. The Mean High Water (MHW) level and Mean Low Water (MLW) level relative to NAVD88 are +1.5 ft and - 3.0 ft, respectively for the Atlantic Coast of the Island. With respect to the Bay, the MHW level and MLW level relative to NAVD88 within the Bay are +2.4 and -3.07 respectively.

Currents at Jones Inlet and East Rockaway Inlet have respective average maximum velocities of 3.1 and 2.3 knots at flood tide, and 2.6 and 2.2 knots at ebb tides. Rockaway Inlet is the only tidal inlet to Jamaica Bay with high currents at its narrowest point which is 0.63 miles with an average depth of 23 feet (USFWS 1997). At the entrance to Rockaway Inlet, the prevailing currents slow as they enter the mouth of the Bay and turn to the east and again slow which significantly reducing tidal exchange. Tides in Jamaica Bay are semi-diurnal and average 5 feet. Dredging has deepened the mean depth of the bay from approximately 3 feet in the past to 13 feet now, which has increased the residence time of water from 11 days to an average of 33 days but varying by depth and location (USFWS 1997). The maximum tidal current speeds in North Channel at Canarsie Pier are 0.5 knots (0.84 ft/s) flood and 0.7 knots (0.84 ft/s) ebb (USACE 2005). USGS observations of flow speeds at the USGS Rockaway Inlet gage are generally 1.0 knots or less during neap tide periods and 1.7 knots or less during spring tide periods (Arcadis 2016b).

Finfish and Shellfish

The nearshore waters of the Project Area support seasonally abundant populations of many recreational and commercial finfish (USACE 1998, USFWS 1982, 1995a). Primary recreational fish species include black sea bass (*Centropristis striata*), summer flounder (*Paralichthys* *dentatus*), winter flounder (*Pseudopleuronectes americanus*), weakfish (*Cynosion regalis*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), striped bass (*Morone saxatillis*), and Atlantic mackerel (*Scomber scombrus*) (USFWS 1989). Nearshore waters also contain a number of migrant anadromous and catadromous species such as the Atlantic sturgeon (*Acipenser oxyhinchus*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), striped bass, and American eel (*Anguilla rostrata*) (Woodhead 1992).

Invertebrate Communities

The benthic community of the greater Project Area is dominated by polychaetous annelids, followed by malacostracans, bivalves, and gastropods (Reid et al. 1991, Ray and Clarke 1995, Ray 1996, USACE 2006). Common shellfish species in the Project Area are the hardshell clam (*Mercenaria mercenaria*), softshell clam (*Mya arenaria*), telling (*Tellina agilis*), razor clam (*Ensis directus*), rock crab (*Cancer irroratus*), lady crab (*Ovalipes ocellatus*), American lobster (*Homarus americanus*), hermit crab (*Homarus americanus*) and blue crab (*Callinectes sapidus*) (USACE 1998, 2005). Mussels (*Mytilus* spp) dominate man-made structures such as groins and jetties in the Project Area (USACE 1998). Ghost crabs (*Ocypode* spp) and sand fleas (*Talorhestia* spp.) dominate the beach community (USACE 1998). Surveys conducted by the USACE in 2003 indicate that the borrow area itself contains very small, to no, localized populations of surf clam (USACE 2006).

Significant Habitats

No federally designated critical habitat is found within or near the proposed project area. Jamaica Bay and Breezy Point have been designated Significant Coastal Fish and Wildlife Habitat by the New York State Department of State (NYSDOS), Division of Coastal Resources. Jamaica Bay, Breezy Point, and Rockaway Beaches have also been designated globally Important Bird Areas by Audubon New York. The federally-listed threatened piping plover (Charadrius melodus) 2016 most of the 16 pairs were located at Arverne by the Se) and threatened seabeach amaranth (Amaranthus pumilus) (2016 most of the 166 plants were located in Arverne by the Sea between B57th and B43rd Street) have been identified within the project area. Although use of this area by listed species had been documented there has been a reduction in habitat use. The drop appears to be correlated to severe erosion and loss of suitable nesting habitat in the area.

Based on a review of the National Oceanic and Atmospheric Administration (NOAA) guide to Essential Fish Habitat (EFH) designations in the Northeastern United States, designated EFH habitat does occur in the greater Project Area (NMFS 2004). EFH is defined by congress as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10).

Cell	Coordinates			
	North	East	South	West
Square 1	40º 40.0' N	73º 50.0' W	40º 30.0' N	74° 00.0' W
Square 2	40º 40.0' N	73º 40.0' W	40º 30.1' N	73º 50.0' W

Table 1 EFH Designated Squares

Square 1 Description: Atlantic Ocean waters within the square within the Hudson River estuary affecting the following: western Rockaway Beach, western Jamaica Bay, Rockaway Inlet, Barren I., Coney I. except for Norton Pt., Paerdegat Basin, Mill Basin, southwest of Howard Beach, Ruffle Bar, and many smaller islands.

Square 2 Description: Atlantic Ocean waters within the square within Great South Bay estuary affecting the following: Western Long Beach, NY., Hewlett, NY., Woodmere, NY., Cedarhurst, NY., Lawrence, NY., Inwood, NY., Far Rockaway, NY., East Rockaway Inlet, eastern Jamaica Bay, Brosewere Bay, Grassy Bay, Head of Bay, Grass Hassock Channel, eastern Rockaway Beach, Atlantic Beach, Howard Beach, J. F. K. International Airport, Springfield, NY., and Rosedale, NY., along with many smaller islands.

Listed Species

The Federally and state-listed piping plover, seabeach amaranth, and roseate tern, as well as the state-listed common tern and least tern, and the state species of special concern black skimmer, all nest or carry out a major portion of their life cycle activities (i.e., breeding, resting, foraging) within essentially the same habitat (Table 2). This habitat encompasses areas located between the high tide line and the area of dune formation and consists of sand or sand/cobble beaches along ocean shores, bays and inlets and occasionally in blowout areas located behind dunes (Bent 1929, NatureServe 2002, NJDEP 1997, USACE 2006, USFWS 2004a).

Common Name	Federal Status	State Status
Common Tern	Not Listed	Threatened
Least Tern	Not Listed	Threatened
Piping Plover	Threatened	Endangered
Roseate Tern	Endangered	Endangered
Seabeach Amaranth	Threatened	Imperiled

Table 2 Protection Status of Species that Utilize Habitats Similar to those in the Project Area.

Piping plover have been identified and are known to nest within upper beach areas located within the Project Area (USACE 1998, USFWS 1995a, b, 2002). From the years 2008-2013 there has been 12-15 pairs of nesting plovers with a range of 3-17 fledglings (Figure 3.1) In addition, seabeach amaranth and least tern are known to occur on barrier islands of Long Island. However, seabeach amaranth was found nearby on Jones Beach Island and Rockaway Peninsula and nesting least and common tern have been documented at Nickerson Beach (USFWS 1994a, USACE 1998, 2005). The USFWS has determined that habitats that occur in the Project Area are suitable for piping plover and seabeach amaranth (USFWS 1995a). Therefore, the life histories of piping plover and seabeach amaranth and potential impacts to these species and their associated habitats are discussed in detail in this Biological Assessment. The black skimmer and least, roseate, and common terns, could potentially utilize habitats within the Project Area. Measures taken to avoid and protect plover and seabeach amaranth habitats would benefit and protect these species, as well as numerous other shorebird/seabird species that depend on coastal habitats.

Based on consultation conducted for the FEIS for the original project, no Federal or state-listed marine mammals are known to breed in the Project Area (USACE 1998, 2005). However, the threatened loggerhead (*Caretta caretta*) and the endangered Kemp's ridley (*Lepiduchelvs kempi*), leatherback (*Dermochelys coriacea*), and green (*Chelonia mydas)* turtles have been known to utilize coastal waters of New York during the summer months and early fall (NMFS 1993). Additional consultation may be necessary for these species for the borrow area component of the Project; a component not addressed in this BA.

2.0 PROPOSED FEDERAL ACTION

The recommended plan for this Project are a component of the USACE response to the unprecedented destruction and economic damage to communities within the study area caused by Hurricane Sandy. The recommendations herein include a systems-based approach for coastal storm risk management that provides a plan for the entire area, which has been formulated with two planning reaches to identify the most efficient solution for each reach. Project partners include the New York State Department of Environmental Conservation, the New York City (NYC) Mayor's Office of Recovery and Resiliency, the NYC Department of Parks and Recreation, the NYC Department of Environmental Protection, and the National Park Service.

2.1 Study Objectives

Five principal planning objectives have been identified for the study, based upon a collaborative planning approach. These planning objectives are intended to be achieved throughout the study period, which is from 2020 – 2070:

1. Reduce vulnerability to storm surge impacts;
2. Reduce future flood risk in ways that will support the long-term sustainability of the coastal ecosystem and communities;
3. Reduce the economic costs and risks associated with large-scale flood and storm events;
4. Improve community resiliency, including infrastructure and service recovery from storm effects; and
5. Enhance natural storm surge buffers and improve coastal resilience.

2.2 Tentatively Selected Plan Description

The tentatively selected HSGRR Coastal Storm Risk Management plan for the area from East Rockaway Inlet to Rockaway Inlet and the lands within and surrounding Jamaica Bay New York consists of the following components, which are generally described for 2 Planning Reaches: 1) A reinforced dune and Berm Construction, in conjunction with groins in select locations along the Atlantic Ocean Shoreline; 2) a line of protection along Jamaica Bay and Rockaway Inlet with a storm surge barrier at one of two identified currently identified locations, i.e. plan C1-E and C2; and 3) residual risk features in locations surrounding Jamaica Bay. Twenty-six (26) project residual risk feature locations have been identified for which five (5) have detail available at this time. In general, these features are intended to provide a design height of +6 ft NAVD through various methods to reduce frequent flooding. As additional residual risk features are further developed, additional NEPA documentation and resource agency coordination would be provided. This TSP description includes the maximum footprint for the plan, however the footprint may be reduced in scope based on public and agency comments as well as new information.

2.2.1 Storm Surge Barrier

If plan C1-E is selected for the barrier:
The TSP extends along approximately 152,000 linear feet of project area extending from the eastern end of the Rockaway peninsula at Inwood, Nassau County to the western end of the Rockaway peninsula, at Breezy Point, Queens, where the plan wraps around the existing shoreline past the Gil Hodges Memorial Bridge. Near Jacob Riis Park a storm surge barrier crosses Rockaway Inlet landing at Floyd Bennet Field, Brooklyn. The plan continues up Flatbush Avenue before turning west along the existing shoreline and continuing west until Norton Point. From Norton Point, the line of protection continues on the north side of Coney Island, crossing Coney Island Creek. From Coney Island Creek it continues north along the shoreline to high ground.

If the plan C2 is selected for the barrier:
The TSP extends approximately 111,800 linear feet of project area extending from the eastern end of the Rockaway peninsula at Inwood, Nassau County to the western end of the Rockaway peninsula, at Breezy Point, Queens, where the plan wraps around the existing shoreline. A storm surge barrier crosses Rockaway Inlet from Breezy Point to Sheepshead Bay/Kingsborough Community College, Brooklyn. The plan continues west until Norton Point. From Norton Point, the line of protection continues on the north side of Coney Island, crossing Coney Island Creek. From Coney Island Creek it continues north along the shoreline to high ground.

2.2.2 The Atlantic Ocean Shorefront consists of:

- A reinforced dune (composite seawall) with a structure crest elevation of +17 feet (NAVD88) and dune elevation of +18 feet (NAVD88), and a design berm width of 60 feet extending approximately 35,000 LF from Beach 9th to Beach 149th. The bottom of dune reinforcement extends up to 15 feet below the dune crest.

- A beach berm elevation of +8 ft NAVD and a depth of closure of -25 ft NAVD;
- A total beach fill quantity of approximately 804,000 cy for the initial placement, including tolerance, overfill and advanced nourishment with a 4-year renourishment cycle of approximately 1,021,000 cy, resulting in an advance berm width of 60 feet;
- Obtaining sand from borrow area located approximately 2 miles south of the Rockaway Peninsula and about 6 miles east of the Rockaway Inlet. It is about 2.6 miles long, and 1.1 miles wide, with depths of 36 to 58 feet and contains approximately 17 million cy of suitable beach fill material, which exceeds the required initial fill and all periodic renourishment fill operations.
- Extension of 5 existing groins; and
  Construction of 13 new groins.

If the C1-E plan is selected, the alignment along Jamaica Bay and Rockaway Inlet consists of:

- Reinforced Dune along the shoreline in Reaches 1 and 2 of the Atlantic Coast Planning Reach, from Beach 149th to Breezy Point.
- Levee and from approximately B227th St. north overland across Breezy Point, thence eastward from B222nd St. to B201st St. Approximately 450,000 cy of sediment required for levee construction.
- Concrete floodwall south along B201st St. extending east along north side of Rockaway Blvd to B184th St., thence north to existing shoreline. Concrete floodwall continues east to storm surge barrier approximately 2300 ft. east of the Gil Hodges Memorial Bridge/Marine Parkway Bridge.
- A 3,970-foot storm surge barrier across Rockaway Inlet from near Jacob Riis Park to Floyd Bennet Field;
- A concrete floodwall on land running north along Flatbush Avenue towards the Belt Parkway;
- A berm-faced elevated promenade running west along the waterside of the Belt Parkway to a concrete floodwall at Gerritsen Inlet;
- A sector gate across Gerritsen Inlet, which ties in to a concrete floodwall;
- Elevated promenades (berm faced and vertical faced) extend from Gerritsen Inlet around Plumb Beach westward to the inlet at Sheepshead Bay;
- A sector gate across Sheepshead Bay
- Seawall reconstruction around the eastern end of Coney island at Kingsborough Community College;
- A reinforced dune across sandy beach at Kingsborough Community College/Oriental and Manhattan Beach, and
- Seawall reconstruction from Manhattan Beach to approximately Corbin Place,
- The Coney Island tie-in, where the line of protection continues west until Norton Point. From Norton Point, the line of protection continues on the north side of Coney Island, crossing Coney Island Creek. From Coney Island Creek it continues north along the shoreline to high ground.

If the C2 plan is selected, the alignment along Jamaica Bay and Rockaway Inlet consists of:

- Reinforced Dune along the shoreline in Reaches 1 and 2 of the Atlantic Coast Planning Reach, from Beach 149th to Breezy Point.

- Levee from approximately B227th St. north overland across Breezy Point, to approximately B218th St.
- A 5,715-foot storm surge barrier across Rockaway Inlet from Breezy Point to Sheepshead Bay/Kingsborough Community College;
- Seawall reconstruction from the base of the surge barrier at Sheepshead Bay/Kingsborough Community College to Kingsborough College/Oriental Beach;
- A reinforced dune across sandy beach at Kingsborough Community College/Oriental and Manhattan Beach, and
- Seawall reconstruction from Manhattan Beach to approximately Corbin Place,
- The Coney Island tie-in, where the line of protection continues west until Norton Point. From Norton Point, the line of protection continues on the north side of Coney Island, crossing Coney Island Creek. From Coney Island Creek it continues north along the shoreline to high ground.

2.2.3 The 5 residual risk features currently identified (of up to 26 residual risk features)

1) Edgemere - contains 2 features (berm and bulkhead) in an area with an existing ground elevation of +4 ft. NAVD, with a design height of +6 ft. NAVD)

- A berm with one section that is approximately 225' long from intersection of northern portion of Conch Place terminating at Norton Ave and Beach 45th Street,
- A second berm section approximately 3400' long along the eastern shore approximately at Beach 43rd St. extending along the shoreline terminating roughly at the northern corner of beach 35th St.
- A bulkhead approximately 600' from terminus of Beach 44th St. around northern tip of point, to eastern shore approximately at Beach 43rd St.

2) Norton Basin - contains 2 features (bulkhead and I-wall) in an area with an existing ground elevation of +4 ft NAVD, with a design height of +6 ft NAVD)

- A bulkhead approximately 200' from the intersection between Norton Drive and Coldspring Rd, extending parallel to Norton Drive along the shoreline.
- An I-Wall from the eastern end of the bulkhead along Norton Drive and north on Westbourne Ave, terminating at intersection with Dunbar St. with a length of 2070 ft.

3) Mott Basin - contains 2 features (berm and bulkhead) in an area with an existing ground elevation of +4 ft NAVD, with a design height of +6 ft NAVD)

- A berm section beginning near the northern end of Eggert Pl. running along the shoreline, extending inland to terminus of McBride St. and along Battery road and Pinson St., terminating roughly at intersection between Horton Ave. and Pinson St. with a length: 1360 ft.
- A bulkhead extending from a location approximately 80' from terminus of Dickens St. parallel to Enright road, then running northward parallel to and on the nearest side to Pearl Street and terminating at the shoreline.

4) Brookville Boulevard - contains 2 features (road raising and two sections of I-wall) in an area with an existing ground elevation of +4 ft NAVD, with a design height ranging from +5.5 ft NAVD to +6 ft NAVD)

- A road raising segment approximately 2800' long, along Brookville Boulevard, starting from a location approximately 200' north of intersection with Rockaway Boulevard extending northward terminating at Brookville Boulevard and 149th Ave.
- An I-Wall western segment, which is approximately 410' long starting at 231-08 148th Ave and running north, past end of 148th Ave along high ground to 147-51 231st St.
- An I-Wall western segment, which is approximately 1090 ft. long starting at 148-74 Brookville Blvd and running northward along high ground at rear of properties until northern terminus at 148-99 235th St.

5) Canarsie contains 1 feature (revetment) in an area with an existing ground elevation of +4 ft NAVD, with a design height of +6 ft NAVD)

- A revetment extending approximately 240' from intersection between E 108th St. and Flatlands 1st St. and extending along the shoreline a length of 410 ft.

2.3 Project Elements

Beach fill for the proposed project is available from an offshore borrow area containing approximately 17 million cy of suitable beach fill material, which exceeds the required initial fill and all periodic renourishment fill operations. The borrow area is located approximately two miles offshore (south) of the Rockaway peninsula.

Structural and non-structural management measures, including NNBFs, were developed to address one or more of the planning objectives. Management measures were developed in consultation with the non-federal sponsor (NYSDEC), state and local agencies, and non-governmental entities. Measures were evaluated for compatibility with local conditions and relative effectiveness in meeting planning objectives. Effective measures were combined to create CSRM alternatives for two geographically discrete reaches: the Atlantic Ocean shorefront and Jamaica Bay. Integrating CSRM alternatives for the two reaches provides the most economically efficient system-wide solution for the vulnerable communities within the study area. It is important to note that any comprehensive approach to CSRM in the study area must include an Atlantic Ocean shorefront component because overtopping of the Rockaway peninsula is a source of flood waters into Jamaica Bay. Efficient CSRM solutions were formulated specifically to address conditions at the Atlantic Ocean shorefront. The best solution for the Atlantic Shorefront reach was included as a component of the alternative plans for the Jamaica Bay reach.

The Atlantic Ocean shorefront reach is subject to wave attack, wave run up, and over topping along the Rockaway peninsula. The general approach to developing CSRM along this reach was to evaluate erosion control alternatives in combination with a single beach restoration plan to select the most cost effective renourishment approach prior to the evaluation of alternatives for coastal storm risk management. The most cost effective erosion control alternative is beach restoration with increased erosion control (Figure 2). This erosion control alternative had the lowest annualized costs over the 50-year project life and the lowest renourishment costs over the project life. A screening analysis was performed to evaluate the level of protection provided by a range of dune and berm dimensions and by reinforced dunes, which would be combined with beach restoration with increased erosion control to optimize CSRM at the Atlantic Ocean shorefront.

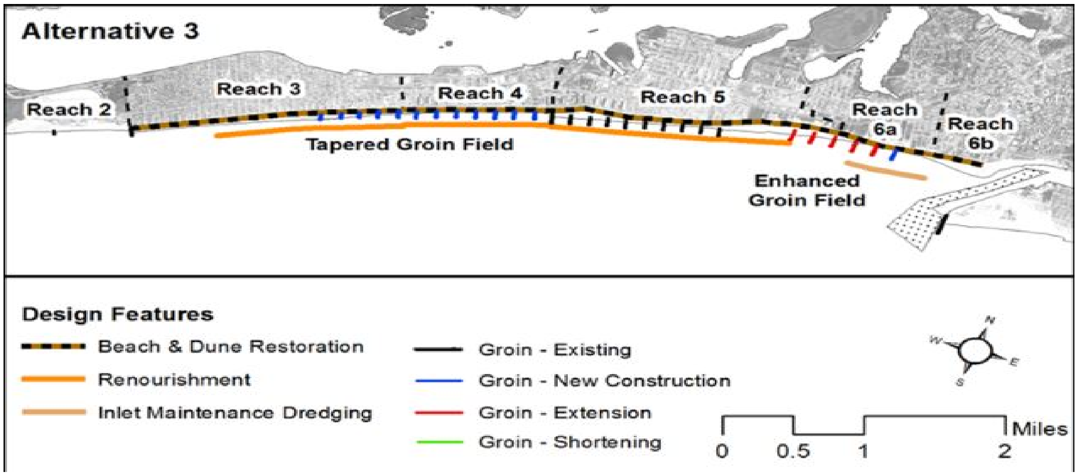

Figure 2: Beach Restoration with Increased Erosion Control

Other factors such as prior projects at Rockaway Beach, project constraints, stakeholder concerns, and engineering judgment were also applied in the evaluation and selection. A composite seawall was selected as the best coastal storm risk management alternative. The composite seawall protects against erosion and wave attack and also limits storm surge inundation and cross-peninsula flooding (Figures 3 and 4). The structure crest elevation is +17 feet (NAVD88), the dune elevation is +18 feet (NAVD88), and the design berm width is 60 feet. The armor stone in horizontally composite structures significantly reduces wave breaking pressure, which allows smaller steel sheet pile walls to be used in the design if the face of the wall is completely protected by armor stone. The composite seawall may be adapted in the future to rising sea levels by adding 1-layer of armor stone and extending the concrete cap up to the elevation of the armor stone.

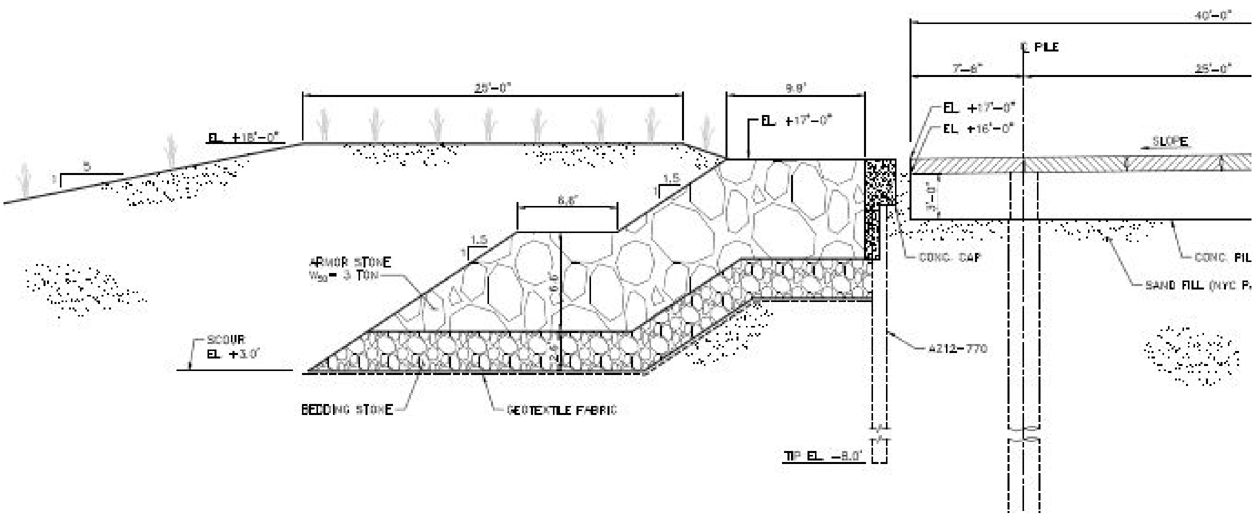

Figure 3: Composite Seawall Beach 19th St. to Beach 126th St,

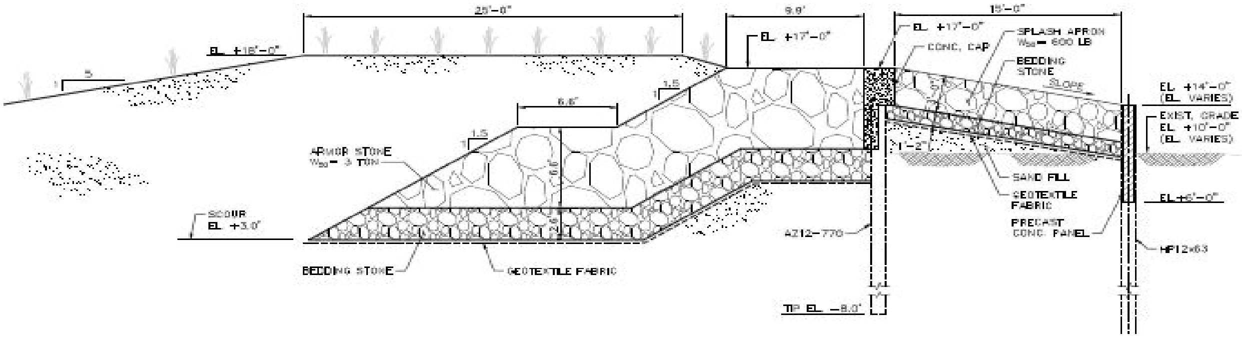

Figure 4: Composite Seawall Beach 126th St. to Beach 149th St,

2.3.1 The Atlantic Ocean Shorefront

Beachfill

The selected storm damage reduction plan including changes from the authorized project, comprises approximately 152,000 lf of dune and beach fill and generally extends from the eastern end of the barrier island at Beach 19th street to the western boundary of Breezy Point. This component of the Project includes the following: 1) a dune with a top elevation of +18 ft above NAVD88, a top width of 25 ft, and landward and seaward slopes of 1V:5H that will extend along the entire footprint (1V:3H on landward slope fronting the boardwalk).

All beachfill quantities include an overfill factor of 11% based on the compatibility analysis for the borrow areas. In addition the initial construction quantities include an additional 15% for construction tolerance. It is noted that the advance fill and renourishment quantities do not include tolerance since the purpose of the advance fill and renourishment is to place a specific volume of sediment to offset anticipated losses between renourishment operations, rather than build a specific template. Beachfill quantities required for initial construction of each alternative are estimated based on the
expected shoreline position in June of 2018. It is impossible to predict the exact shoreline position in June 2018 since the wave conditions vary from year to year and affect shoreline change rates. The shoreline position in June of 2018 was estimated based on a 2.5 year GENESIS-T simulation representative of typical wave conditions.

Reach	Length (ft)	TSP
Reach 1	12,480	
Reach 2	11,090	
Reach 3	10,320	279,000
Reach 4	5,380	74,000
Reach 5	10,650	227,000
Reach 6a	3,730	204,000
Reach 6b	2,000	20,000
Total	**55,650**	**804,000**

Table 3 Initial Construction Beachfill Quantities

Construction of New Groins and Extension of Existing Groins

Three types of groin measures are considered in the alternative analysis: new groin construction, groin extension, and groin shortening. The exact dimensions and stone sizes of the existing groins at Rockaway is not available. Therefore, it is assumed that the existing groins in Reaches 5 and 6 are similar to the proposed new groin designs. Generally a groin is comprised of three sections: 1) horizontal shore section (HSS) extending along the design berm; (2) an intermediate sloping section (ISS) extending from the berm to the design shoreline, and (3) an outer sloping section
(OS) that extends from the shoreline to offshore. The head section (HD) is part of the OS and is typically constructed at a flatter slope than the trunk of the groin and may require larger stone due to the exposure to breaking waves.

The spacing between groins in this study is based on the existing spacing in Reach 5 (720 ft) and Reach 6a (780 ft). The required lengths of the new groins is based on the GENESIS-T model simulations.

The Project requires the immediate construction of a 12 new groins in reach 3 and 4 (between 92nd Street to 121st Street) and an additional groin in reach 6a (34th street). The 5 groin extension are located in Reach 6a (between 37th Street – 49th Street). The extension of the groin lengths vary and range from 75 ft to 200 ft. Groin widths will be 13 ft. See Table 4

Alternative	Reach	Number	Street	HSS (ft)	ISS (ft)	OS (ft)	Total (ft)	Notes:
Alt 3	6a	1	34th St	90	108	328	526	new 526'
Alt 3	6a	2	37th St	90	108	328	526	extension 175'
Alt 3	6a	3	40th St	90	108	328	526	extension 200'
Alt 3	6a	4	43rd St	90	108	228	426	extension 75'
Alt 3	6a	5	46th St	90	108	228	426	extension 150'
Alt 3	6a	6	49th St	90	108	228	426	extension 200'
Alt 3	4	1	92nd St	90	108	128	326	new 326
Alt 3	4	2	95th St	90	108	128	326	new 326
Alt 3	4	3	98th St	90	108	128	326	new 326
Alt 3	4	4	101st St	90	108	128	326	new 326
Alt 3	4	5	104th St	90	108	128	326	new 326
Alt 3	4	6	106th St	90	108	128	326	new 326
Alt 3	4	7	108th St	90	108	128	326	new 326
Alt 3	3	8	110th St	90	108	153	351	new 351
Alt 3	3	9	113th St	90	108	178	376	new 376
Alt 3	3	10	115th St	90	108	178	376	new 376
Alt 3	3	11	118th St	90	108	178	376	new 376
Alt 3	3	12	121st St	90	108	128	326	new 326

Table 4 Summary of Groin Lengths

2.3.2 Sand Removal from Offshore Borrow Area

An offshore borrow area which is 2.6 miles long and 1.1 miles wide, located approximately 2 miles south of East Rockaway Island (Figure 5) between 35 feet mean low water and about 60 feet mean low water, has been identified as a potential source of sand material for beach fill and dune construction activities. The borrow area contains approximately 17,000,000 CY of suitable beach fill material.

Figure 5 Location of the East Rockaway Borrow Area.

2.4 Reasonably Foreseeable Future Actions

Reasonably foreseeable future actions of the Project include beach renourishments and maintenance of beach access locations. Renourishments will be conducted every 4-years or as needed over the 50-year life of the Project. During each renourishment, approximately 1, 100,000 CY of sand will be added to the beach from the borrow area located approximately 2 miles offshore to the south of East Rockaway. Inlet maintenance dredging (115,000 cy/yr) is included in the 1.1 million cys of material needed for the renourishments

3.0 SPECIES OCCURENCE

Previous surveys conducted by NYSDEC and USFWS confirmed presence of piping plover and seabeach amaranth, as well as suitable habitat for red knot in the Project Area (USFWS 1982, 1994a, 1995a, 1995b, 1996). Therefore, in accordance with the ESA recommendations, the following section provides species profiles for each of these Federally-listed T&E species. This information, along with the knowledge of local experts, wildlife biologists, botanists, and District and USFWS personnel, was utilized to identify potential impacts to these species as a result of implementation of the proposed action.

3.1 PIPING PLOVER

The piping plover was listed as a threatened/endangered species on January 10, 1986, under provisions of the ESA, as amended (USFWS 1984, 1985). This species breeds only in North America in three geographic regions. The Atlantic Coast population breeds on sandy beaches along the east coast of North America, from Newfoundland to South Carolina. The Atlantic Coast population of piping plover was 1,150 pairs in 1994 (USFWS 1995b). However, although New York populations appear to have increased overall during the past 18 years, there has been a 50–80 percent decline over the past 50 years in the Atlantic Coast population (Table 5) (USFWS 1992, 2003, NatureServe 2002).

Available data suggest that the most recent Atlantic Coast-wide population decline began in the late 1940's or early 1950's (Haig and Oring 1988). Reports of local or statewide declines between 1950 and 1985 are numerous and are summarized by Cairns and McLaren (1980) and by Haig and Oring (1988). Wilcox (1939) estimated more than 500 pairs of piping plovers on Long Island. A 1990 survey of long Island recorded 197 pairs (Litwin et al. 1993). Similarly, numbers of pairs of breeding piping plovers declined 50–100% at seven Massachusetts sites between the early 1970's and 1984 (Griffin and Melvin 1984). Significant habitat loss and lack of plover management are key factors in this decline (USFWS 1985, 1992, 2003).

However, there are approximately 65 sites that have been surveyed annually since 1986 as part of the NYSDEC's Long Island Colonial Waterbird and Piping Plover Census Survey Program (USFWS 2004). These active breeding areas are located across the north and south shore of Long Island from Queens County in the west to Suffolk County in the east. Based on an evaluation of recent trends (i.e., within the past 10 years) after a 3% decline between 1997 and 1999, the estimate of breeding pairs on the U.S. Atlantic coast has steadily increased; posting a 4% increase between 1999 and 2000, followed by a 6% gain in 2001, and a 10% gain in 2002 (USFWS 2003). Preliminary survey results indicate that the total 2003 U.S. Atlantic breeding pair count of 1,419 pairs is the highest since the species' 1986 listing under the U.S. Endangered Species Act (USFWS 2003). Increases occurred in all three U.S. Atlantic recovery units, with the largest percentage gains occurring in New York-New Jersey. Population estimates in the New York – New Jersey recovery unit grew by 15% in 2000, 7% in 2001, 15% in 2002, and based on preliminary results, a 4% increase in 2003 (USFWS 2003). Increases have occurred in both states, but 2003 results indicate that New York has again exceeded the previous year's record number of nesting pairs (369) by 4% (USFWS 2003).

Researchers note, however, that the trends in piping plover populations over the past 20 years for the Atlantic coast of New York are questionable. Although protection of beach nesting birds in New York increased after 1983, survey effort has also intensified and may be a factor in the positive trends (Ducey-Ortiz et al. 1989, Downer and Leibelt 1990).

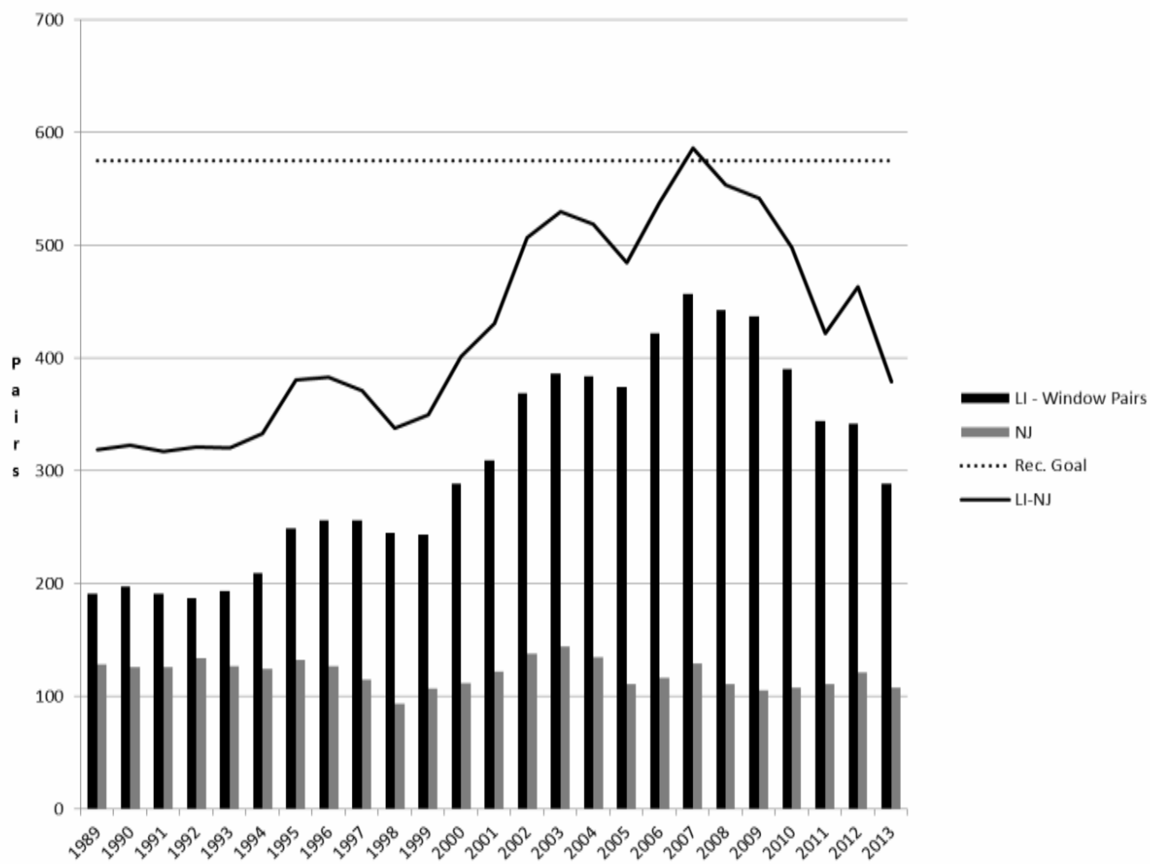

Table 5 **Graph showing Long Island and New Jersey piping plover populations in relation to the New York- New Jersey Recovery Unit recovery goal.**

3.1.1 Life History

The piping plover is a small robin-sized shorebird 17–18 cm (7.25 in) in length, a wingspan of 47 cm (19 in), and an average weight of 55 g (1.9 oz) (Sibley 2000). Piping plover breed and nest on coastal beaches from Newfoundland and southeastern Quebec to North Carolina and winter primarily on the Atlantic coast from North Carolina to Florida. Along the Atlantic coast, plover nest mainly on gently sloping foredunes above the high tide line, in blow-out areas behind primary dunes of sandy coastal beaches, and on suitable dredge spoil deposits (USFWS 1988, Cashin Associates 1993, NPS 1994). Nests are usually found in sandy areas with little or no vegetation. Vegetation, when present, consists of beach grass, sea rocket, and/or seaside goldenrod.

Plover begin northward migration to breeding grounds from southern U.S. wintering areas in March, and arrive on nesting grounds from March – May; males arrive prior to females. Fall migration to southern wintering grounds begins in mid- to late summer. Juvenile plover may remain on breeding grounds later but are generally gone by mid- to late August (Cuthbert and Wiens 1982). Atlantic coast breeders migrate primarily to Atlantic coast sites located farther south of breeding areas (i.e., Virginia to Florida, Bahamas) (Haig and Oring 1988, Haig and Plissner 1993).

The adult males arrive earliest, select beach habitats, and defend established territories against other males (Hull 1981). When adult females arrive at the breeding grounds several weeks later, the males conduct elaborate courtship rituals including aerial displays of circles and figure eights, whistling song, posturing with spread tail and wings, and rapid drumming of feet. The breeding season begins when adult female plovers reach the breeding grounds in mid- to late-April or in mid-May in northern parts of the range. (Bent 1929, Hull 1981).

Plover typically return to the same general nesting area in consecutive years (but few return to natal sites). Plover are known to shift breeding location by up to several hundred kilometers between consecutive years (NatureServe 2002). However, Wilcox (1959) found that plover a relatively site faithful and only 20 percent settled at a nest site farther than 1,000 ft from the previous year's locality. Previous reproductive success does not appear to increase the probability of returning to specific breeding sites (NatureServe 2002).

Nest sites are simple depressions or scrapes in the sand (Bent 1929, Wilcox 1959). The average nest is about 6 to 8 cm in diameter, and is often lined with pebbles, shells, or driftwood to enhance the camouflage effect. Males make the scrapes and may construct additional (unused) nests in their territories, which may be used to deceive predators or may simply reflect over-zealousness (Wilcox 1959, Hull 1981). Occupied nests are generally 50 to 100 meters apart (Wilcox 1959, Cairns 1977, Cuthbert and Wiens 1982).

Egg-laying commences soon after mating (Hull 1981, Cuthbert and Wiens 1982). Eggs are laid every second day. The average clutch size is four eggs (Wilcox 1959) and three-egg clutches occur most commonly in replacement clutches. The average number of young fledged per nesting pair usually is two or fewer. The young hatch about 27 to 31 days after egg laying. Incubation is shared by both adults (Wilcox 1959, Hull 1981).

Young plover leave the nest about two hours after hatching and immediately are capable of running and swimming. The young usually remain within about 200 meters of the nest, although they do not return after hatching (Wilcox 1959, Johnsgard 1979, Hull 1981). When disturbed or threatened, the young either freeze or combine short runs with freezing and blend very effectively into their surroundings (Wilcox 1959, Hull 1981). Adults will feign injury to draw intruders away from the nest or young (Bent 1929, Wilcox 1959). Adults also defend the nest territory against other adult piping plovers, gulls, and songbirds (Wilcox 1959, Matteson 1980). First (unsustained) flight has been observed at around 18 days, with chicks molting into first juvenile plumage by day 22 (NatureServe 2002).

Nest success depends heavily upon camouflage (Hull 1981). Hatching success ranges widely as follows: 91 percent for undisturbed beaches on Long Island (Wilcox 1959), 76 percent for undisturbed beaches in Nova Scotia (Cairns 1977), 44 percent on relatively undisturbed beaches at Lake of the Woods (Cuthbert and Wiens 1982), and 30 percent maximum at disturbed Michigan beaches (Lambert and Ratcliff 1979).

Plover diet consists of worms, fly larvae, beetles, crustaceans, mollusks, and other invertebrates (Bent 1929). In New Jersey, intertidal polychaetes were the main prey of plovers (Staine and Burger 1994). Plover forage along ocean beaches, on intertidal flats and tidal pool edges. Studies by Cuthbert and Weins (1982) indicate that open shoreline areas are preferred and vegetated beaches are avoided. Plover obtain their food from the surface of the substrate, or occasionally will probe into the sand or mud.

Most time-budget studies reveal that chicks spend a very high proportion of their time feeding. Cairns (1977) found that chicks typically tripled their weight during the first two weeks post-hatching; chicks that failed to achieve at least 60 percent of this weight-gain by day 12 were unlikely to survive. Courtship, nesting, brood-rearing, and feeding territories are generally contiguous to nesting territories (Cairns 1977), although instances when brood-rearing areas are widely separated from nesting territories are common, thus increasing the geographic boundaries of their breeding area. Feeding activities of both adults and chicks may occur during all hours of the day and night (Burger 1994) and at all stages during the tidal cycle (Goldin 1993; Hoopes 1993).

In New York, 95.8 percent of piping plover pairs nested on non-federal land in 1999 (Rosenblatt 2000). Piping plover protection in this recovery unit, therefore, is highly dependent on the efforts of state and local government agencies, conservation organizations, and private landowners. Landowner efforts are often contingent on annual commitments. While many landowners are supportive and cooperative, others are not.

In Massachusetts, plover preferred mudflat, intertidal and wrack habitats for foraging (Hoopes et al. 1992a). On Assateague Island, bay beaches and island interiors were much more favorable as brood-rearing habitats than were ocean beaches (Patterson et al. 1992).

3.1.2 Threats to Species

The wide, flat, sparsely vegetated barrier beaches preferred by the piping plover are an unstable habitat, dependent on natural forces for renewal and susceptible to degradation by development and shoreline stabilization efforts. In high use recreational areas such as East Rockaway, the primary threat to piping plover is disturbance by recreational beach users during the breeding season. Other significant threats include destruction and degradation of habitat and predation (USFWS 1988, 1995b, Burger 1993, NJDEP 1997).

Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat if natural coastal dynamics are impeded by numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the overwashing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments. Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20-70 percent of current intertidal foraging habitat (Galbraith et al. 2002). These authors estimated probabilistic sea-level changes for specific sites partially based on historical rates of sea-level change (from tide gauges at or near each site); they then superimposed this on projected 50 percent and 5 percent probability of global sea-level changes by 2100 of 34 cm and 77 cm, respectively.

3.1.3 Human Disturbance

Recreational disturbance: Disturbance, i.e., human and pet presence that alters bird behavior, disrupts piping plovers as well as other shorebird species. Disturbance can cause shorebirds to spend less time roosting or foraging and more time in alert postures or fleeing from the disturbances (Johnson and Baldassarre 1988; Burger 1991; Burger 1994; Elliott and Teas 1996; Lafferty 2001a, 2001b; Thomas et al. 2002), which limits the local abundance of piping plovers (Zonick and Ryan 1995; Zonick 2000). Shorebirds that are repeatedly flushed in response to disturbance expend energy on costly short flights (Nudds and Bryant 2000). Shorebirds are more likely to flush from the presence of dogs than people, and birds react to dogs from farther distances than people (Lafferty 2001a, 2001b; Thomas et al. 2002). Dogs off leash are more likely to flush piping plovers from farther distances than are dogs on leash; nonetheless, dogs both on and off leashes disturb piping plovers (Hoopes 1993). Pedestrians walking with dogs often go through flocks of foraging and roosting shorebirds; some even encourage their dogs to chase birds.

Off-road vehicles (ORVs) can significantly degrade piping plover habitat (Wheeler 1979) or disrupt the birds' normal behavior patterns (Zonick 2000). The Recovery Plan cites tire ruts crushing wrack into the sand, making it unavailable as cover or as foraging substrate (Hoopes 1993; Goldin 1993). The Recovery Plan also notes that the magnitude of the threat from ORVs is particularly significant, because vehicles extend impacts to remote stretches of beach where human disturbance will otherwise be very slight. Godfrey et al. (1980 as cited in Lamont et al. 1997) postulated that ORVs may compact the substrate and kill marine invertebrates that are food for the piping plover. Zonick (2000) found that the density of ORVs negatively correlated with abundance of roosting piping plovers on the ocean beach. Cohen et al. (2008) found that radio-tagged piping plovers using ocean beach habitat at Oregon Inlet in North Carolina were far less likely to use the north side of the inlet where ORV use is allowed, and recommended controlled management experiments to determine if recreational disturbance drives roost site selection. Ninety-six percent of piping plover detections were on the south side of the inlet even though it was farther away from foraging sites (1.8 km from the sound side foraging site to the north side of the inlet versus 0.4 km from the sound side foraging site to the north side of the inlet; Cohen et al. 2008).

3.1.4 Habitat Loss/Alteration

Along the Atlantic coast, development, encroachment of beach vegetation, flooding and erosion are primary factors in the loss of suitable breeding and nesting habitat for piping plover (Haig 1992). In Maine, construction of seawalls, jetties, piers, homes, parking lots, and other structures has reduced historic nesting habitat by more than 70%; where more than 20 miles of historic habitat may have supported more than 200 pairs of piping plovers, 32 pairs nested in 1993 on habitat with an estimated capacity of 52 pairs (Maine Department of Inland Fisheries and Wildlife 1995). Wilcox (1959) pointed to summer home and road construction as causes of declining plover nesting along Moriches Bay on Long Island, New York, between 1939 and 1951. Raithel (1984) cited coastal development and shoreline stabilization, including construction and dredging of permanent breachways, building of breakwaters, and planting of dune areas, as major contributors to the decline of the piping plover in Rhode Island. Analysis of 4 years of piping plover nest location data on a New York site revealed that the nests were significantly farther from concrete walkways leading from the dunes to the berm than were random points, suggesting that the walkways decrease the carrying capacity of the beach (Hoopes 1995). In 1993 NYSDEC documented a reduction in nest sites and habitat use by piping plover and least terns at a colony on Long Island and attributed the reduction to severe erosion and loss of suitable habitat in the area (USACE 1998, USACE 2006).

The location of developments on beaches where they are vulnerable to erosion often leads to impacts that go far beyond the footprint of the facilities themselves. Requests from private communities within the Fire Island National Seashore, New York, to construct artificial dunes on adjacent undeveloped National Park Service lands in 1993 (NPS 1992, 1993) exemplify situations where shoreline development has created demand to modify and stabilize habitat suitable for plover nesting.

Plover are also likely experiencing loss of habitat in areas where the vegetation in the upper beach zone exceeds levels desired by piping plover. In general, plover prefer to nest in sparsely vegetated areas (Cohen et al. 2002, 2003a, 2003b). However, dense vegetation located near the breeding area is also desirable for plover foraging and cover.

3.1.5 Predation

Predation has been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites (Burger 1987a, MacIvor 1990, Patterson et al. 1991, Cross 1992, Elias-Gerken 1994). As with other limiting factors, the nature and severity of predation is highly site-specific. Predators of piping plover eggs and chicks include red fox, striped skunk, raccoon, Norway rat, opossum, crows, ravens, gulls, common grackles, American kestrel, domestic and feral dogs and cats, and ghost crabs.

Human activities affect the types, numbers, and activity patterns of predators, thereby exacerbating natural predation. Human activities have abetted the expansions in the populations and/or range of other species such as gulls (Drury 1973, Erwin 1979) and opossum (Gardner 1982). The availability of trash at summer beach homes increases local populations of skunks, raccoons and fox (Raithel 1984, Strauss 1990). In Massachusetts, predators, primarily red fox (*Vulpes vulpes*), destroyed 52 – 81 percent of nests in one study area (MacIvor et al. 1990). Similarly, on Assateague Island, Maryland and Virginia, predators, mainly red fox and raccoon (*Procyon lotor*), accounted for about 90 percent of the known causes of nest loss (Patterson et al. 1992). In addition, gulls, grackles (*Quiscalus quiscula*), crows (*Corvus* spp.), and in developed, high recreational use areas such as East Rockaway, domestic and free-roaming cats and dogs are equally as detrimental to plover populations by direct predation or disturbance of nest sites (Cartar 1976, Lambert and Ratcliff 1979, Cairns and McLaren 1980, Nol 1980, USFWS 1988, Patterson et al. 1990, NJDEP 1997).

3.2 Seabeach Amaranth

Seabeach amaranth is a native annual plant that inhabits barrier island beaches along the Atlantic Coast. This plant historically occurred in 31 counties in nine states from Cape Cod in Massachusetts to South Carolina. However, by 1990, only 55 populations remained, which were located in South Carolina, North Carolina, and New York (USFWS 1996). In 1993, the USFWS listed the plant as a Federally-threatened species because of the declining population and its overall vulnerability to habitat destruction (USFWS 1993). Seabeach amaranth is also listed as threatened or endangered throughout its current and historical range, including New York where it is imperiled (i.e., endangered). Accordingly, the ESA, as well as several state-level endangered species laws and regulations, protect this species.

Due to the protection afforded to it by the ESA and state laws, seabeach amaranth has returned to several states after years of extirpation. Known populations of this species occur in New York, Delaware, Maryland, Virginia, North Carolina, and South Carolina (USFWS 2004b). Many of these new occurrences are the result of reintroduction and restoration programs conducted by Federal, state, and local governments and non-profit organizations. Long Island supports the largest population of seabeach amaranth within its historical range, which extends from South Carolina to Massachusetts. Each year Endangered Species Biologists from the Long Island Field Office of the USFWS assist the New York Natural Heritage Program in conducting annual surveys for this threatened species. In 2001, a total of 179,300 plants were surveyed at 23 sites stretching from Breezy Point, Queens County to Hampton Beach in Suffolk County along the south shore of Long Island (USFWS 2004b).

3.2.1 Life History

Seabeach amaranth germinates as small, unbranched, fleshy red colored sprigs between June and July in New York State (USFWS 2004b). These sprigs develop into a rosette of small, wrinkled leaves that branch out from the low-lying reddish stems. As the plant matures, it develops into a clump with numerous stems, which can reach a diameter of 3 ft. The small (1.3 to 2.5 centimeters in diameter) rounded leaves are clustered around the tip of the stems, exhibit a spinach-green color, and have a small notch at the rounded tip of the leaf (USFWS 1996). Inconspicuous flowers develop in clusters around the stem in mid-summer and can produce seed by July. Seed production continues until the plant dies, usually in mid to late fall, but can continue into January (USFWS 1996).

Seabeach amaranth is most likely wind-pollinated, based on the morphology of the flower and inflorescence and lack of visual, chemical, or nectar attractants. Additionally, this species is capable of self-pollination, as are other species of *Amaranthus* (USFWS 1996). Seed dispersal is carried out by water (hydrochory) and wind (anemochory) (USFWS 1996).

The primary habitat for seabeach amaranth consists of the dynamic and ever changing seaward facing areas of barrier islands, including overwash flats at accreting ends of islands, lower foredunes, and upper strands of non-eroding beaches located landward of the wrack line (USFWS 1996). Seabeach amaranth occasionally establishes populations in other habitats, including sound-side beaches, foredune blowouts, and on replenished beaches. Typical of the species, on Fire Island in New York, seabeach amaranth tends to grow on the ocean beach in bare or sparsely vegetated swales and along overwash zones (National Park Service [NPS] 1998).

Seabeach amaranth occupies a narrow beach zone that lies above mean high tide at the lowest elevations at which vascular plants regularly occur. Seaward, the plant grows only above the high tide line, as it is intolerant of even occasional flooding during the growing season. Landward, seabeach amaranth does not occur more than a meter or so above the beach elevation on the foredune, or anywhere behind it, except in overwash areas. The species is, therefore, dependent on a terrestrial, upper beach habitat that is not flooded during the growing season. This zone is absent on beaches that are experiencing high rates of erosion. Seabeach amaranth is never found
on beaches where the foredune is scarped by undermining water at high or storm tides (Weakley and Bucher 1992).

No other vascular plant species regularly occupies a lower topographic position than seabeach amaranth (USFWS 1996). Seabeach amaranth's range correlates with a zone of tidal amplitude of 5 or 6 ft and occupies elevations that range from 8 inches (in) to 5 ft above high mean high tide (USFWS 1996). Although it grows in a very low topographical position, it is highly intolerant of inundation by saltwater, and often perishes if exposed (USFWS 1996). The plant is usually found growing on nearly pure silica sand substrate, which is mapped as 'Beach-Foredune Association' or 'Beach (occasionally flooded)' by the U.S. Natural Resources Conservation Service (NRCS).

In areas where it occurs, seabeach amaranth is an important beach stabilizing and dune building species because it acts as a 'sand binder' by trapping wind-blown sand under its lower leaves and branches. This trapped sand accumulates in a mound and eventually buries the lower leaves and stems, while the plant continues to grow. A single large clump of seabeach amaranth can trap a mound of 2 to 3 cubic yards (cy) of sand (USFWS 1996).

Seabeach amaranth has a very low tolerance for vegetative competition and does not occur on well-vegetated sites. However, habitat occupied by seabeach amaranth may be sparsely vegetated with other annual forbs, or less commonly, perennial grasses and scattered shrubs (USFWS 1996). Once other vegetation, such as American beach grass, begins to encroach upon habitat occupied by seabeach amaranth, the amaranth is quickly out competed and the individual or population is replaced by the encroaching vegetation. Scientists believe that availability of water and certain plant species are probably the limiting factors because the more extensive root systems of species such as beach grass are more efficient for the uptake of these resources (USFWS 1996).

Ecologists consider seabeach amaranth a ‘fugitive’ species because of its ability to escape competition and to quickly occupy new habitat as it becomes available (Randall 2002). Hurricanes and storms that re-shape shorelines may have both a positive and negative effect on the species. For example, a storm event that causes severe beach erosion may displace existing individuals, but also may uncover seed banks that have been buried for years. Following hurricanes Bertha and Fran in 1996, several new populations of seabeach amaranth appeared that were likely linked to the effects of the storms (Randall 2002).

3.2.2 Threats to Species

Habitat loss/alteration, human disturbance, and herbivory all are significant threats to seabeach amaranth. Inundation of piping plover habitat by rising seas could lead to permanent loss of habitat if natural coastal dynamics are impeded by numerous structures or roads, especially if those shorelines are also armored with hardened structures. Without development or armoring, low undeveloped islands can migrate toward the mainland, pushed by the overwashing of sand eroding from the seaward side and being re-deposited in the bay (Scavia et al. 2002). Overwash and sand migration are impeded on developed portions of islands. Instead, as sea-level increases, the ocean-facing beach erodes and the resulting sand is deposited offshore. The buildings and the sand dunes then prevent sand from washing back toward the lagoons, and the lagoon side becomes increasingly submerged during extreme high tides (Scavia et al. 2002), diminishing both barrier beach shorebird habitat and protection for mainland developments. Modeling for three sea-level rise scenarios (reflecting variable projections of global temperature rise) at five important U.S. shorebird staging and wintering sites predicted loss of 20-70 percent of current intertidal foraging habitat (Galbraith et al. 2002). These authors estimated probabilistic sea-level changes for specific sites partially based on historical rates of sea-level change (from tide gauges at or near each site); they then superimposed this on projected 50 percent and 5 percent probability of global sea-level changes by 2100 of 34 cm and 77 cm, respectively.

3.2.3 Human Disturbance

Vehicular use on beaches generally has an adverse effect on seabeach amaranth. The plant is a brittle species and individuals generally do not survive even a single pass by an off road vehicle (ORV) tire (USFWS 1996). In northern beaches, such as in New York, these beaches are relatively narrow and vehicular traffic is often concentrated in the elevation zone required by seabeach amaranth (USFWS 1996). Accordingly, areas open to moderate to heavy ORV use during the seabeach amaranth growing season typically do not have populations of the plant in ORV travel corridors. However, during the dormant season, limited ORV use may actually be beneficial to seabeach amaranth because physical disturbance of the beach helps prevent colonization by perennial species, such as beach grass (USFWS 1996).

Another detrimental vehicle-based activity to seabeach amaranth is beach grooming (USFWS 1996). Mechanical rakes are dragged along the beach surface by a tractor or other vehicle to rid the beach of vegetation, trash, and wrack. This practice is usually carried out on heavily used bathing beaches and results in the exclusion of seabeach amaranth by precluding the plant from becoming established.

Humans use beaches for a variety of activities, including sunbathing, swimming, jogging, walking, birding, and beachcombing. Accordingly, pedestrians walking on beaches occupied by seabeach amaranth have the potential to crush individual plants. However, because most pedestrians prefer to walk on packed sand near the wetted shoreline seaward of seabeach amaranth habitat, the effects of pedestrian traffic are generally negligible (USFWS 1996).

3.2.4 Habitat Loss/Alteration

Shoreline stabilization is detrimental to pioneer species, such as seabeach amaranth, that require unstable, unvegetated, or 'new' land (USFWS 1996). Construction of both 'hard' and 'soft' shoreline stabilization structures are often associated with deteriorated seabeach amaranth habitat (USFWS 1996).

Hard structures are constructed of stone, concrete, steel, or wood and include rip-rap, seawalls, revetments, groins, terminal groins, and breakwaters. Soft structures include construction using non-permanent materials, such as sand, for replenishing beaches and dune construction, rehabilitation, or enhancement.

Many of these structures, both hard and soft, often occupy the same elevation range that is required by seabeach amaranth. Additionally, when structures such as bulkheads and seawalls are built, wave action and wind often lower the beach profile seaward of the structure, creating an area unsuitable for seabeach amaranth (USFWS 1996). During seabeach amaranth status surveys conducted from 1987 to 1990, no seabeach amaranth populations were observed on shorelines that were associated with bulkheads, sea walls, or rip-rap zones (USFWS 1996).

Beach nourishment and dune stabilization have varying degrees of potential effects on seabeach amaranth. Beach nourishment, for example, may have both a negative and positive effect on seabeach amaranth populations (USFWS 1996). On one hand, an adverse effect of sand placement is burial of the existing seed bank within the placement zone. On the other hand, the new beach created by placement is without other vegetation that might out compete seabeach amaranth and would likely be at an elevation that is suitable for the reestablishment of seabeach amaranth if there is a seed source nearby.

Beach nourishment can have positive site-specific impacts on seabeach amaranth. Although more study is needed before the long-term impacts can be accurately assessed, seabeach amaranth has colonized several nourished beaches, and has thrived in some sites through subsequent re-applications of fill material (FWS 1993). However, on the landscape level, beach nourishment is similar to other beach stabilization efforts in that it stabilizes the shoreline and curtails the natural geophysical processes of barrier islands

3.2.5 Herbivory/Predation

Herbivory by webworms (caterpillars of small moths) may be detrimental to localized populations of seabeach amaranth (USFWS 1996). Although not unheard of in the northern part of seabeach amaranth range, herbivory appears to be a much more common problem in southern populations (USFWS 1996). In South Carolina, four species of webworm are known to consume seabeach amaranth and include beet webworm (*Loxostege similialis*), garden webworm (*Achyra rantilis*), southern beet webworm (*Herpetogramma bipunctalis*), and Hawaiian beet webworm (*Spoladea recurvalis*) (USFWS 1996). The ranges of several of these species extend into New York. In 1994, an infestation of saltmarsh moth (*Estigmene acraea*) caterpillars totally consumed leaves of many seabeach amaranth plants at Jones Beach Island East (USFWS 1996).

3.3 RUFA RED KNOT

The red knot (*Calidris canutus*) was added to the list of Federal candidate species in 2006. A proposed rule to list the rufa subspecies (*C. c. rufa*), the subject of this Opinion, as threatened under the Endangered Species Act (ESA) was published on September 30, 2013, and a final decision is expected in the fall of 2014. Red knots are federally protected under the Migratory Bird Treaty Act, and are New Jersey State-listed as endangered. The red knot is currently listed as endangered or threatened in New York State.

Red knots were heavily hunted for both market and sport during the 19th and early 20th centuries in the Northeast and the mid-Atlantic. Red knot population declines were noted by several authors of the day, whose writings recorded a period of intensive hunting followed by the introduction of regulations and at least partial population recovery.

Calidris canutus is classified in the Class Aves, Order Charadriiformes, Family Scolopacidae, Subfamily Scolopacinae. Six subspecies are recognized, each with distinctive morphological traits (i.e., body size and plumage characteristics), migration routes, and annual cycles. Each subspecies is believed to occupy a distinct breeding area in various parts of the Arctic but some subspecies overlap in certain wintering and migration areas (FWS BO 2014).

Calidris canutus canutus, C. c. piersma, and *C. c. rogersi* do not occur in North America. The subspecies *C.c. islandica* breeds in the northeastern Canadian High Arctic and Greenland, migrates through Iceland and Norway, and winters in western Europe (Committee on the Status of Endangered Wildlife in Canada. *C. c. rufa* breeds in the central Canadian Arctic (just south of the *C. c. islandica* breeding grounds) and winters along the Atlantic coast and the Gulf of Mexico coast (Gulf coast) of North America, in the Caribbean, and along the north and southeast coasts of South America including the island of Tierra del Fuego at the southern tip of Argentina and Chile (FWS BO 2014).

3.3.1 Life History

The rufa red knot is a medium-sized shorebird about 9 to 11 inches (in) (23 to 28 centimeters (cm)) in length. The red knot migrates annually between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States (Southeast), the

Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. During both the northbound (spring) and southbound (fall) migrations, red knots use key staging and stopover areas to rest and feed (FWS BO 2014).

The red knot is a large, bulky sandpiper with a short, straight, black bill. During the breeding season, the legs are dark brown to black, and the breast and belly are a characteristic russet color that ranges from salmon-red to brick-red. Males are generally brighter shades of red, with a more distinct line through the eye. When not breeding, both sexes look alike – plain gray above and dirty white below with faint, dark streaking. As with most shorebirds, the long-winged, strong-flying knots fly in groups, sometimes with other species. Red knots feed on invertebrates, especially small clams, mussels, and snails, but also crustaceans, marine worms, and horseshoe crab eggs. On the breeding grounds, knots mainly eat insects (FWS BO 2014).

Small numbers of red knots may occur in New Jersey year-round, while large numbers of birds rely on New Jersey's coastal stopover habitats during the spring (mid-May through early June) and fall (late-July through November) migration periods. Smaller numbers of knots may spend all or part of the winter in New Jersey. Red knots also rely on New York's coastal stopover habitats during the spring and fall migration periods. As stated above, several stopover habitats in New York are being proposed for critical habitat designations (FWS BO 2014).

The primary wintering areas for the rufa red knot include the southern tip of South America, northern Brazil, the Caribbean, and the southeastern and Gulf coasts of the U.S. The rufa red knot breeds in the tundra of the central Canadian Arctic. Some of these robin-sized shorebirds fly more than 9,300 miles from south to north every spring and reverse the trip every autumn, making the rufa red knot one of the longest-distance migrating animals. Migrating red knots can complete non-stop flights of 1,500 miles or more, converging on critical stopover areas to rest and refuel along the way. Large flocks of red knots arrive at stopover areas along the Delaware Bay and New York/New Jersey's Atlantic coast each spring, with many of the birds having flown directly from northern Brazil. The spring migration is timed to coincide with the spawning season for the horseshoe crab (*Limulus polyphemus*). Horseshoe crab eggs provide a rich, easily digestible food source for migrating birds. Mussel beds on New Jersey's southern Atlantic coast and intertidal/wrack line areas on New York's coast are also important forage habitats for migrating knots. Birds arrive at stopover areas with depleted energy reserves and must quickly rebuild their body fat to complete their migration to Arctic breeding areas. During their brief 10- to 14-day spring stay in the mid-Atlantic, red knots can nearly double their body weight.

Major spring stopover areas along the Atlantic coast include Río Gallegos, Península Valdés, and San Antonio Oeste (Patagonia, Argentina); Lagoa do Peixe (eastern Brazil, State of Rio Grande do Sul); Maranhão (northern Brazil); the Virginia barrier islands (United States); and Delaware Bay (Delaware, New Jersey and New York, United States) (Cohen *et al.*. 2009, p. 939; Niles *et al.*. 2008, p. 19; González 2005, p. 14). However, large and small groups of red knots, sometimes numbering in the thousands, may occur in suitable habitats all along the Atlantic and Gulf coasts from Argentina to Massachusetts (Niles *et al.*. 2008, p. 29). In Massachusetts, red knots use sandy beaches and tidal mudflats during fall migration. In New York and the Atlantic coast of New Jersey, knots use sandy beaches during spring and fall migration (Niles *et al.*. 2008, p. 30).

From geolocators, examples of spring migratory tracks are available for three red knots that wintered in South America. One flew about 4,000 mi (6,400 km) over water from northeast Brazil in 6 days. Another flew about 5,000 mi (8,000 km) from the southern Atlantic coast of Brazil (near Uruguay) over land and water (the eastern Caribbean) in 6 days. Both touched down in North Carolina, and then used Delaware Bay as the final stopover before departing for the arctic breeding grounds (Niles *et al.*. 2010a, p. 126). A third red knot, which had wintered in Tierra del Fuego, followed an overland route through the interior of South America, departing near the Venezuela-Colombia border. This bird then flew over the Caribbean to Florida, and finally to Delaware Bay (Niles 2011a).

In Delaware Bay, red knots preferentially feed in microhabitats where horseshoe crab eggs are concentrated, such as at horseshoe crab nests (Fraser *et al.*. 2010, p. 99), at shoreline discontinuities (e.g., creek mouths) (Botton *et al.*. 1994, p. 614), and in the wrack line (Nordstrom *et al.*. 2006a, p. 438; Karpanty *et al.*. 2011, pp. 990, 992). (The wrack line is the beach zone just above the high tide line where seaweed and other organic debris are deposited by the tides.) Wrack may also be a significant foraging microhabitat outside Delaware Bay, for example where mussel spat (i.e., juvenile stages) are attached to deposits of tide-cast material. Wrack material also concentrates certain invertebrates such as amphipods, insects, and marine worms (Kluft and Ginsberg 2009, p. vi), which are secondary prey species for red knots (see Migration and Wintering Food, below).

For many shorebirds, the supra-tidal (above the high tide) sandy habitats of inlets provide important areas for roosting, especially at higher tides when intertidal habitats are inundated (Harrington 2008, pp. 4–5). Along the Atlantic coast, dynamic and ephemeral features are important red knot habitats, including sand spits, islets, shoals, and sandbars, often associated with inlets (Harrington 2008, p. 2). From South Carolina to Florida, red knots are found in significantly higher numbers at inlets than at other coastal sites (Harrington 2008, pp. 4–5).

The District is not aware of comprehensive monitoring of red knots on Long Island, New York. Some data is available from individual birders or associated with horseshoe crab monitoring. At Plum Beach in Brooklyn, NY, recorded red knot abundances during horseshoe crab surveys in 2009 and 2010 decreased from 31 (peak of 28 on May 29) in 2009 to 2 (on May 31) in 2010 (New York City Audubon 2010). Individual birders have documented red knot presence at Overlook County Park (May 2013 – 5 red knots) and Cupsogue County Park (June 2007 – 150 red knots) (Ebird website- http://ebird.org/ebird/subnational2/US-NY-103/hotspots)

3.3.2 Threats to Red Knot

Much of the U.S. coast within the range of the red knot is already extensively developed. Direct loss of shorebird habitats occurred over the past century as substantial commercial and residential developments were constructed in and adjacent to ocean and estuarine beaches along the Atlantic and Gulf coasts. In addition, red knot habitat was also lost indirectly, as sediment supplies were reduced and stabilization structures were constructed to protect developed areas.

Sea level rise and human activities within coastal watersheds can lead to long-term reductions in sediment supply to the coast. Damming of rivers, bulkheading highlands, and armoring coastal bluffs have reduced erosion in natural source areas and, consequently, the sediment loads reaching coastal areas. Although it is difficult to quantify, the cumulative reduction in sediment supply from human activities may contribute to the long-term shoreline erosion rate. Along coastlines subject to sediment deficits, the amount of sediment supplied to the coast is less than that lost to storms and coastal sinks (inlet channels, bays, and upland deposits), leading to long-term shoreline recession.

Red knots require open habitats that allow them to see potential predators and that are away from tall perches used by avian predators. Invasive species, particularly woody species, degrade or eliminate the suitability of red knot roosting and foraging habitats by forming dense stands of vegetation. Although not a primary cause of habitat loss, invasive species can be a regionally important contributor to the overall loss and degradation of the red knot's nonbreeding habitat.

Commercial harvest of horseshoe crabs has been implicated as a causal factor in the decline of the rufa red knot by decreasing the availability of horseshoe crab eggs in the Delaware Bay stopover (Niles *et al.*. 2008, pp. 1-2). Notwithstanding the importance of the horseshoe crab and Delaware Bay, other lines of evidence suggest that the rufa red knot also faces threats to its food resources throughout its range.

About 40 percent of the U.S. coastline within the range of the red knot is already developed, and much of this developed area is stabilized by a combination of existing hard structures and ongoing beach nourishment programs. In those portions of the range for which data are available (New Jersey and North Carolina to Texas), about 40 percent of inlets, a preferred red knot habitat, are hard-stabilized, dredged, or both. Hard stabilization structures and dredging degrade and often eliminate existing red knot habitats, and in many cases prevent the formation of new shorebird habitats. Beach nourishment may temporarily maintain suboptimal shorebird habitats where they would otherwise be lost as a result of hard structures, but beach nourishment also has adverse effects to red knots and their habitats. Demographic and economic pressures remain strong to continue existing programs of shoreline stabilization and to develop additional areas, with an estimated 20 to 33 percent of the coast still available for development. However, we expect existing beach nourishment programs will likely face eventual constraints of budget and sediment availability as sea level rises. In those times and places that artificial beach maintenance is abandoned, the remaining alternatives would likely be limited to either a retreat from the coast or increased use of hard structures to protect development. The quantity of red knot habitat would be markedly decreased by a proliferation of hard structures. Red knot habitat would be significantly increased by retreat, but only where hard stabilization structures do not exist or where they get dismantled. The cumulative loss of habitat across the nonbreeding range could affect the ability of red knots to complete their annual cycles, possibly affecting fitness and survival, and is thereby likely to negatively influence the long-term survival of the rufa red knot.

In wintering and migration areas, the most common predators of red knots are peregrine falcons (*Falco peregrinus*), harriers (*Circus* spp.), accipiters (Family Accipitridae), merlins (*F. columbarius*), shorteared owls (*Asio flammeus*), and greater black-backed gulls (*Larus marinus*) (Niles *et al.* 2008, p. 28). In addition to greater black-backed gulls, other large gulls (e.g., herring gulls (*Larus argentatus*)) are anecdotally known to prey on shorebirds. Predation by a great horned owl (*Bubo virginianus*) has been documented in Florida Nearly all documented predation of wintering red knots in Florida has been by avian, not terrestrial, predators (2014 FWS BO). However, in migration areas like Delaware Bay, terrestrial predators such as red foxes (*Vulpes vulpes*) and feral cats (*Felis catus*) may be a threat to red knots by causing disturbance, but direct mortality from these p redators may be low (Niles *et al.* 2008, p. 101).

Red knots' selection of high-tide roosting areas on the coast appears to be strongly influenced by raptor predation, something well demonstrated in other shorebirds (Niles *et al.*. 2008, p. 28). Red knots require roosting habitats away from vegetation and structures that could harbor predators (Niles *et al.*. 2008, p. 63). Red knots' usage of foraging habitat can also be affected by the presence of predators, possibly affecting the birds' ability to prepare for their final flights to the arctic breeding grounds (Watts 2009) (e.g., if the knots are pushed out of those areas with the highest prey density or quality). In 2010, horseshoe crab egg densities were very high in Mispillion Harbor, Delaware, but red knot use was low because peregrine falcons were regularly hunting shorebirds in that area (Niles 2010a). Growing numbers of peregrine falcons on the Delaware Bay and New Jersey's Atlantic coasts are decreasing the suitability of a number of important shorebird areas (Niles 2010a). Analyzing survey data from the Virginia stopover area, Watts (2009) found the density of red knots far (greater than 3.7 mi (6 km)) from peregrine nests was nearly eight times higher than close (0 to 1.9 mi (0 to 3 km)) to peregrine nests. In addition, red knot density in Virginia was significantly higher close to peregrine nests during those years when peregrine territories were not active compared to years when they were (Watts 2009).

The quantity and quality of red knot prey may also be affected by the placement of sediment for beach nourishment or disposal of dredged material. Invertebrates may be crushed or buried during project construction. Although some benthic species can burrow through a thin layer of additional sediment, thicker layers (over 35 in (90 cm)) smother the benthic fauna. By means of this vertical burrowing, recolonization from adjacent areas, or both, the benthic faunal communities typically recover. Recovery can take as little as 2 weeks or as long as 2 years, but usually averages 2 to 7 months (Burlas et al 2001; Peterson and Manning 2001, p. 1). Although many studies have concluded that invertebrate communities recovered following sand placement, uncertainty remains about the effects of sand placement on invertebrate communities and how these impacts may affect red knots.

3.3.3 Human Disturbance

Sea level rise and human activities within coastal watersheds can lead to long-term reductions in sediment supply to the coast. Damming of rivers, bulkheading highlands, and armoring coastal bluffs have reduced erosion in natural source areas and, consequently, the sediment loads reaching coastal areas. Although it is difficult to quantify, the cumulative reduction in sediment supply from human activities may contribute substantially to the long-term shoreline erosion rate. Along coastlines subject to sediment deficits, the amount of sediment supplied to the coast is less than that lost to storms and coastal sinks (inlet channels, bays, and upland deposits), leading to long-term shoreline recession

In addition to reduced sediment supplies, other factors such as stabilized inlets, shoreline stabilization structures, and coastal development can exacerbate long-term erosion (Herrington 2003). Coastal development and shoreline stabilization can be mutually reinforcing. Coastal development often encourages shoreline stabilization because stabilization projects cost less than the value of the buildings and infrastructure. Conversely, shoreline stabilization sometimes encourages coastal development by making a previously high-risk area seem safer for development (U.S. Climate Change Science Program [CCSP] 2009). Protection of developed areas is the driving force behind on-going shoreline stabilization efforts. Large-scale shoreline stabilization projects became common in the past 100 years with the increasing availability of heavy machinery. Shoreline stabilization methods change in response to changing new technologies, coastal conditions, and preferences of residents, planners, and engineers. Along the Atlantic and Gulf coasts, an early preference for shore-perpendicular structures (e.g., groins) was followed by a period of construction of shore-parallel structures (e.g., seawalls), and then a period of beach nourishment, which is now favored (Morton et al. 2004; Nordstrom 2000).

3.3.4 Habitat Loss

Structural development along the shoreline and manipulation of natural inlets upset the naturally dynamic coastal processes and result in loss or degradation of beach habitat (Melvin et al. 1991). As beaches narrow, the reduced habitat can directly lower the diversity and abundance of biota (life forms), especially in the upper intertidal zone. Shorebirds may be impacted both by reduced habitat area for roosting and foraging, and by declining intertidal prey resources, as has been documented in California (Defeo et al. 2009; Hubbard 2003). In an estuary in England, Stillman et al. (2005) found that a 2 to 8 percent reduction in intertidal area (the magnitude expected through sea level rise and industrial developments including extensive stabilization structures) decreased the predicted survival rates of 5 out of 9 shorebird species evaluated (although not of *Calidris canutus*).

In Delaware Bay, hard structures also cause or accelerate loss of horseshoe crab spawning habitat (U.S. Climate Change Science Program [CCSP] 2009; Botton et al. *in* Shuster et al. 2003; Botton et al. 1988), and shorebird habitat has been, and may continue to be, lost where bulkheads have been built (Clark 2009). In addition to directly eliminating red knot habitat, hard structures interfere with creation of new shorebird habitats by interrupting the natural processes of overwash and inlet formation. Where hard stabilization is installed, the eventual loss of the beach and its associated habitats is virtually assured (Rice 2009), absent beach nourishment, which may also impact red knots as discussed below. Where they are maintained, hard structures are likely to significantly increase the amount of red knot habitat lost as sea levels continue to rise.

3.3.5 Predation

In wintering and migration areas, the most common predators of red knots are peregrine falcons (*Falco peregrinus*), harriers (*Circus* spp.), accipiters (Family Accipitridae), merlins (*F. columbarius*), shorteared owls (*Asio flammeus*), and greater black-backed gulls (*Larus marinus*) (Niles et al. 2008). In addition to greater black-backed gulls, other large gulls (e.g., herring gulls [*Larus argentatus*]) are anecdotally known to prey on shorebirds (Breese 2010). Predation by a great horned owl (*Bubo virginianus*) has been documented in Florida (Schwarzer, *pers. comm*., June 17, 2013). Nearly all documented predation of wintering red knots in Florida has been by avian, not terrestrial, predators (Schwarzer, *pers. comm*., June 17, 2013). However, in migration areas like Delaware Bay, terrestrial predators such as red foxes (*Vulpes vulpes*) and feral cats (*Felis catus*) may be a threat to red knots by causing disturbance, but direct mortality from these predators may be low (Niles et al.et al. 2008).

At key stopover sites, however, localized predation pressures are likely to exacerbate other threats to red knot populations, such as habitat loss, food shortages, and asynchronies between the birds' stopover period and the occurrence of favorable food and weather conditions. Predation pressures worsen these threats by pushing red knots out of otherwise suitable foraging and roosting habitats, causing disturbance, and possibly causing changes to stopover duration or other aspects of the migration strategy.

4.0 EFFECT ANAYLSIS

4.1 PIPING PLOVER

The piping plover area managed by the NYC Department of Parks and Recreation is located at the Rockaway Peninsula which extends from B9th Street to B149th Street on the ocean side, accounting for 6.5 miles of coastline. This stretch of beach is split into three continuous management areas Far Rockaway (B9th -B35th Street), Arverne by the Sea (B35th -B73rd

Street) and Rockaway Beach (B73rd- B149th Street). Collectively, these three management areas are known as the Rockaway Beach Endangered Species Nesting Area (RBESNA). RBESNA has been managed as a breeding site for piping plovers since 1996.

Recent sightings and documentation of nesting piping plover in the vicinity of the Project. 1.7 miles of shorefront were used by 16 piping plover pairs in 2015. Thirteen of these pairs nested within the traditional pre-fenced nesting site, located between B38th -B56th Street in Arverne by the Sea. The other three piping plover pairs nested in Far Rockaway between B19th -B28th Street. Despite the development and high recreational use of the area by humans, piping plover are utilizing suitable habitats in the Project Area Figure 6. As a result, the USFWS has requested a Potential Effect determination on populations of piping plover related to the implementation the proposed action. Piping plover are typically dependent upon intertidal and upper beach zones, using gradually sloping sparsely vegetated areas of the upper beach and foredune for nesting and intertidal areas for foraging. Habitats such as these are known to be present within the Project Area and are likely to experience some impacts as a result of proposed Project activities. The following section provides an evaluation of the potential impacts from No-Action and proposed the Project alternative on populations of piping plover. Affect determinations for the No-Action alternative and for various components of the proposed Project are presented in Table 9.

During the 2015 nesting season (Figure 6), 16 of the 17 nests recorded where considered viable nests and were evaluated for the nesting habitat analysis. Piping plover nest #3A (1 egg nest) was not included due to its placement outside of a nesting scrape and lack of any parental care. All piping plover nests were located in non-flooded areas, but some nesting scrapes were washed out by the ocean. Most piping plover pairs (71%) established their nests more than 200 feet away from the shore; 29% (5 pairs) used the back dune as the location for their nests, while 7 pairs (41%) used the back of the site to establish their nests. Four piping plover nests (24%) were established at the backshore, at least 88 feet away from the shore. One of the piping plover nests located at the backshore was predated by gulls. The predated nest was located 123 feet from the water. The second attempt of this pair was 133 feet away from the water. Piping plovers nested an average of 404 feet away from each other. The closest distance between two piping plover nests was 88 feet at B47th Street. For piping plovers, the 2015 breeding season for both Arverne by the Sea and Far Rockaway lasted from April 26th (first complete clutch) to July 31st (last fledglings). Most of the piping plover nests hatched between May 24th and June 26th with the last hatch on July 12th

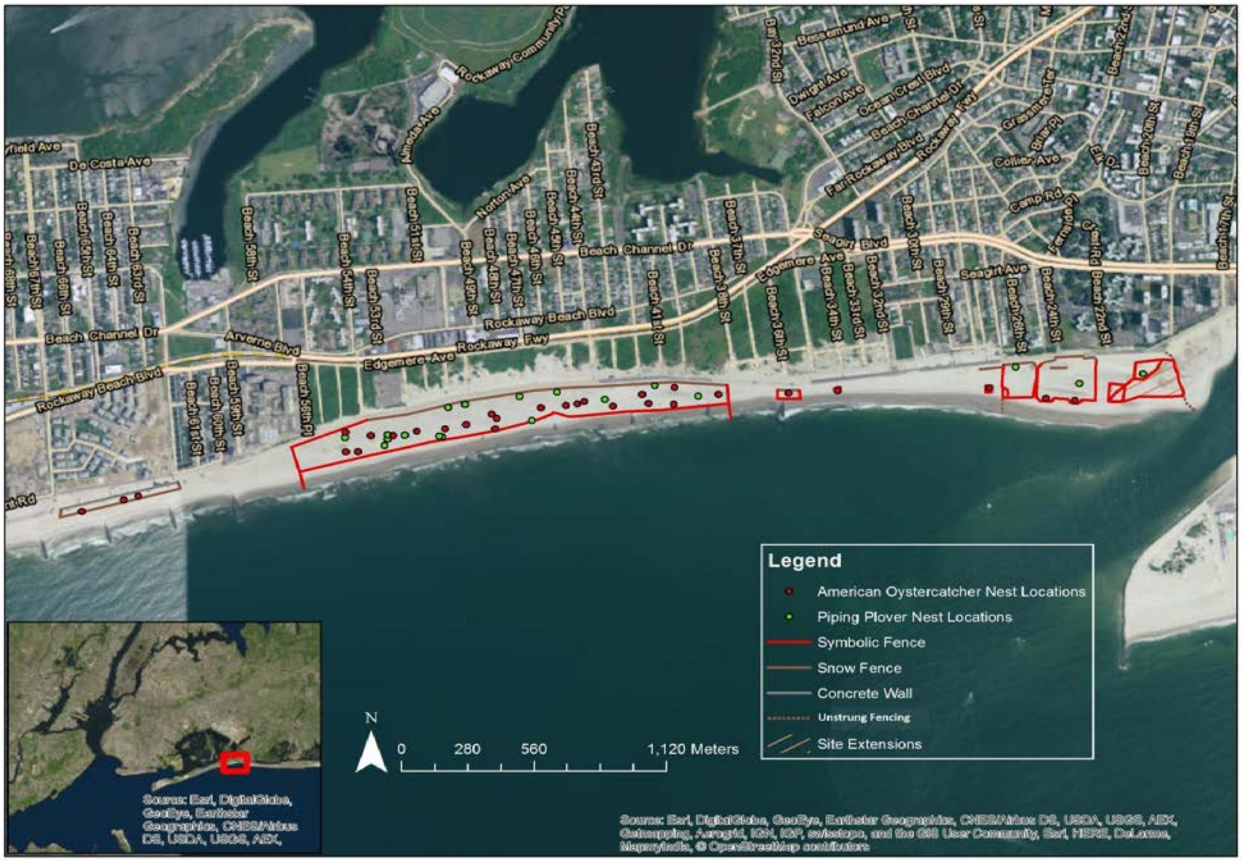

Figure 6 2015 Nesting Season

During the 2015 nesting season (Figure 6), 16 of the 17 nests recorded where considered viable nests and were evaluated for the nesting habitat analysis. Piping plover nest #3A (1 egg nest) was not included due to its placement outside of a nesting scrape and lack of any parental care. All piping plover nests were located in non-flooded areas, but some nesting scrapes were washed out by the ocean. Most piping plover pairs (71%) established their nests more than 200 feet away from the shore; 29% (5 pairs) used the back dune as the location for their nests, while 7 pairs (41%) used the back of the site to establish their nests. Four piping plover nests (24%) were established at the backshore, at least 88 feet away from the shore. One of the piping plover nests located at the backshore was predated by gulls. The predated nest was located 123 feet from the water. The second attempt of this pair was 133 feet away from the water. Piping plovers nested an average of 404 feet away from each other. The closest distance between two piping plover nests was 88 feet at B47th Street. For piping plovers, the 2015 breeding season for both Arverne by the Sea and Far Rockaway lasted from April 26th (first complete clutch) to July 31st (last fledglings). Most of the piping plover nests hatched between May 24th and June 26th with the last hatch on July 12th

4.1.1 Historic Trends

The 2015 piping plover breeding season had an increase of four nesting pairs, with a total of 16 pairs, compared to 2014 that had 12 pairs (UPR, 2014). The number of fledges was lower in

2015, with a total of 22 fledges compared to 25 fledges in 2014 (Table 6). The number of nest abandonments went from one nest in 2014 (UPR, 2014) to two nests this year. But in the case of last year, the pair who abandoned the nest fledged one chick from the previous nest (UPR, 2014).

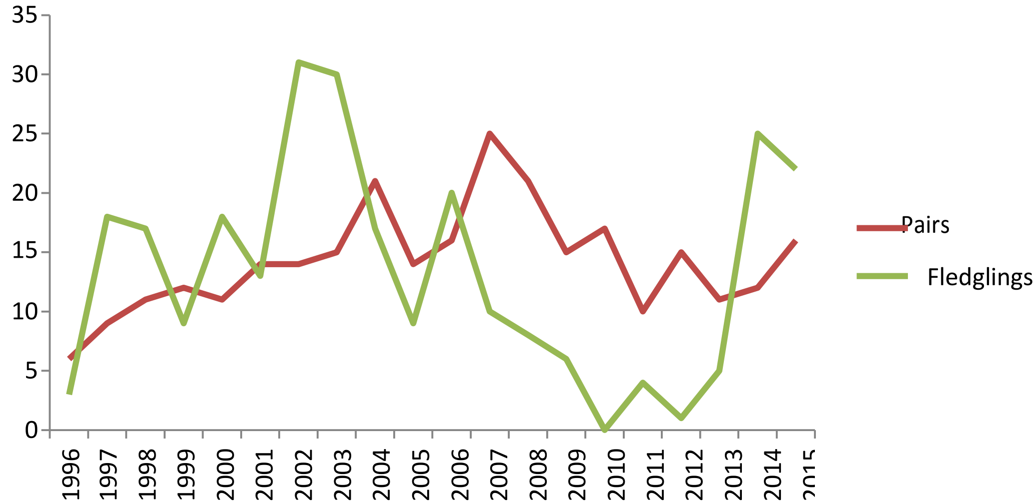

Table 6 Piping plover (*Charadrius melodus*) pair and fledge count at RBESNA from 1996 to 2015

Despite the decrease in the productivity and fledge rates from last year (2.08), this year had four times the productivity rate of the 2013 piping plover breeding season at RBESNA (Figure 7). That means that the management strategies implemented since then likely have had a positive effect on the productivity and overall piping plover population.

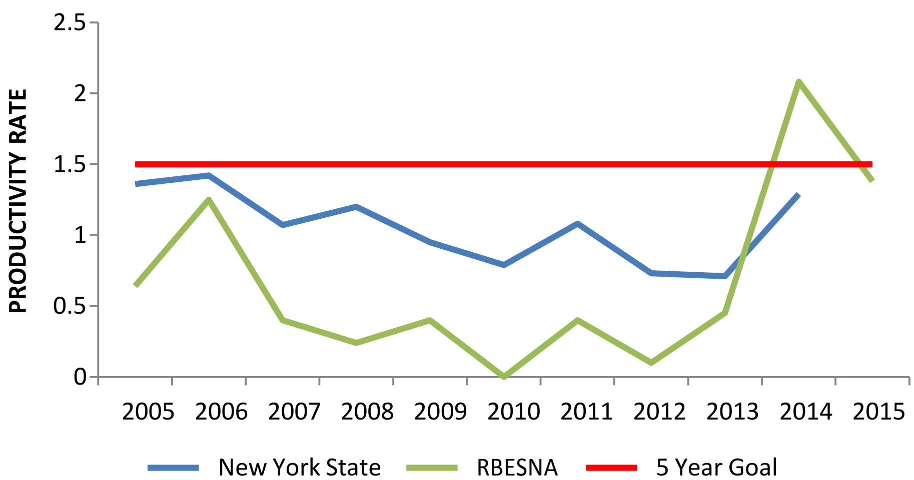

Table 7 Piping plover (*Charadrius melodus*) productivity rate for RBESNA and New York State* from 1996 to 2015. Data for NYS provided by Frederick Hamilton from the NYSDEC 2015.

In 2015, the chick mortality rate for piping plover was 0.57 (29 chicks lost), with most of the mortality happening at Arverne by the Sea (0.60). Far Rockaway had a mortality rate of 0.45. The causes of most of the mortality were unknown, but some may have been due to predation, and others through antagonistic interactions with other species.

Year	Pairs	Nests	Eggs	Chicks	Fledglings	Productivity Rate
1996	6	8	26	3	3	0.50
1997	9	11	39	27	18	2.00
1998	11	16	62	30	17	1.55
1999	12	18	64	24	9	0.75
2000	11	17	53	35	18	1.64
2001	14	20	63	38	13	0.93
2002	14	18	65	44	31	2.21
2003	15	28	87	47	30	2.00
2004	21	27	95	53	17	0.81
2005	14	18	68	39	9	0.64
2006	16	27	103	40	20	1.25
2007	25	35	128	53	10	0.40
2008	21	32	108	29	8	0.24
2009	15	23	68	41	6	0.40
2010	17	23	83	51	0	0.00
2011	10	12	42	30	4	0.40
2012	15	19	69	50	1	0.10
2013	11	14	51	36	5	0.45
2014	12	14	54	43	25	2.08
2015	16	18	64	51	22	1.38

Table 8 Data Collected from 1996 to the present (2015) for piping plovers nesting at RBESNA

4.1.2 No Action

Future habitat conditions in the Project Area without the Project would be varied. Based on past experience in coastal areas of New York and New Jersey, the upper beach zone and dunes would continue to erode in many areas and may even be eliminated entirely in areas of severe erosion. This would result in significant loss of habitat upon which the piping plover and other shorebirds/seabirds depend on for nesting habitat. However, in other areas along the shoreline, the upper beach zone would accrete sand and increase in size, thereby potentially increasing available piping plover habitat. Although some accretion may occur in the Project Area over time, many areas are expected to experience erosion and loss of upper beach and dune habitats without the proposed Project activities (USACE 1989, 1998, 2002, 2005). The intertidal and subtidal zones would retain their current width and substrate composition. However, the locations of these zones would shift off-shore or on-shore depending on erosion and accretion rates in the area. Accordingly, the overall impact of the No Action alternative on piping plover habitat would likely be negative.

4.1.3 Proposed Action

Although some minor, short-term, impacts to plover food resources and habitat will result from proposed Project modifications, overall improvements to plover habitat can be expected to result from the proposed activity. Therefore, after a full evaluation of plover life history, habitats in the Project Area, plover management activities, and proposed Project activities, a Not Likely to Adversely Affect determination was made by the District on populations of piping plover as a result of implementation these proposed activities (Table 9). Details of this determination are provided below.

The primary direct impacts resulting from implementation of the Project will be disturbance and direct impact of benthic, immobile invertebrate and plant communities currently living in these areas due to burial from beach fill material. As a result, piping plover will experience some short-term loss of food resources within the beach fill placement. However, the direct placement of beach fill is not expected to cause long-term significant impacts on the piping plover. The area of actual permanent plover habitat loss due to permanent structures is small and would result in a negligible loss of foraging substrate for the species. In addition, although plover would avoid foraging within areas of direct sand placement in the intertidal zone until benthic food sources recolonized the site, recolonization of benthic communities in the intertidal zones typically takes place within six months to two years following beach fill placement activities (USFWS 1991, Burlas et al 2001, Peterson and Manning 2001). Therefore, overall impacts are expected to be short-term and not likely to negatively affect plover populations. Thus, a May Affect, but Not Likely to Adversely Affect determination was made by the District as a result of implementation of these proposed activities.

Placement of beach fill and dune restoration is likely to increase overall habitat value for piping plover along the affected beachfront by expanding the area of suitable breeding, nesting and foraging habitat. Therefore, a Potentially Beneficial Impact determination was made by the District for piping plover for this proposed Project activity for the reasons stated below. Studies of beach nourishment projects along the Atlantic Coast have documented that when construction windows and best plover management practices are adhered to, beach nourishment generally provides valuable habitat for beach nesting birds such as the piping plover (NJDEP 1997, USFWS 2004a). Construction activities occurring in the Project Area are likely to halt further loss of existing plover nesting habitat and will likely increase the amount of suitable habitat by increasing the size of the upper beach zone. Unpublished data from piping plover monitoring conducted by the District in beach fill placement areas near Shinnecock and the Hamptons, Long Island, NY, shows that piping plover and least terns (species that nest on upper beach habitats) returned to breed on sites within 1 year following construction activities (Cohen et al. 2002, 2003a, 2003b).

Permanent hard structures such as groins, sand fence, access ways, and walkovers also would eliminate any suitable foraging or nesting areas directly within the footprint of these structures. However, the area of overall impact from these structures is expected to be minimal (< 1.0 ac) and most of the habitat that will be impacted is not of high habitat value to plover. Specifically, plover forage primarily in the intertidal zone and nest in the upper beach zone in front of dunes. The areas in which hard structures are proposed include mostly subtidal areas that would be affected from groin placement, and portions of the upper dune that would be affected by sand fence, access ways, and walkovers. Overall impacts directly within the footprint of these structures would be permanent, but are not expected to significantly affect piping plover breeding or foraging activities. Thus, a May Affect, but Not Likely to Adversely Affect determination was made by the District as a result of implementation of these proposed activities.

Other short-term impacts, such as a slight decrease in water quality and an increase in turbidity, also are likely to occur during beach fill and groin construction and rehabilitation activities. Changes in water quality and turbidity may cause some short-term avoidance of the intertidal zone by piping plover during periods of low water quality resulting from construction activities. These impacts to plover foraging activities will be short term and will have a minimal effect on plover because plover are mobile and can utilize unaffected foraging areas nearby. In addition, construction activities will be scheduled to avoid any active plover nesting periods (i.e., construction scheduled from approximately September 2 through April 1), which will avoid potential impacts to less-mobile plover chick foraging activities. Plover also are expected to avoid active construction areas due to noise and activities. Limiting construction in known active nesting areas to September 2 through April 1 will also minimize this impact. Impacts from these activities are expected to be short-term and cause no significant negative effects on plover populations. Therefore, a May Affect, but Not Likely to Adversely Affect determination was made by the District for piping plover for these proposed activities.

Construction of new vehicle and pedestrian access points pose potential threat to piping plover because these activities are likely to provide access to new areas of the beach and may increase vehicle and public use of beach areas. This increase in human activity may disrupt nesting plover in areas in proximity to access points and beach activities. Plover are known to be sensitive to disturbance and experience lower reproductive success in areas where they are disturbed frequently (Flemming et al. 1988, Burger 1991, 1994, Goldin 1992, 1993, Cross and Terwilliger 1993, Collazo et al. 1995).

Despite the fact that much of the Project Area is currently highly developed and is used extensively for recreational activities by humans, the District will follow recommendations provided by the NYSDEC and USFWS, to reduce the impacts to plover in the Project Area (USFWS 1989, 1994, 1999, USACE 1998,). These impact minimization measures are detailed in Section 5 and in summary include the following: pre and post-construction surveys of the Project Area to determine the presence of nesting plover; restricting construction activities within areas of known plover populations; education of residents, landowners, beach visitors, and beach managers; three consecutive years of post-construction monitoring of the Project Area to document beach use/nesting activities of plover and to deter human use of potential nesting areas; and the use of physical deterrents (signage, restricted vehicle access, and symbolic fencing) to deter human use of potential plover nesting habitat.

Efforts to restrict human access and activities near the nest sites, and use of exclusion devices to reduce predation, are believed to be major contributing factors in nesting success of plovers in coastal areas such as those found in (USFWS 1995b, 2003, Cohen et al. 2002, 2003a, 2003b). In addition, NatureServe (2002) notes that population declines may have been countered with intensive management efforts that include creation of habitat using dredge material. Therefore, a May affect, but Not Likely to Adversely Affect determination was made by the District on piping plover for proposed Project activities.

4.1.4 Cumulative Effects

The proposed beach renourishment activities would cause short-term impacts to plover foraging by directly covering the benthic organisms that plover feed on and causing short term availability in benthic species (USFWS 1991, Burlas et al 2001, Peterson and Manning 2001). These impacts are similar to the impacts from initial beach fill activities as discussed above. However, as discussed previously, these impacts will have minimal short-term impact on plover populations. Renourishment activities will provide long-term protection of potential breeding and nesting areas in the upper beach and primary dune areas. To further reduce potential impacts, beach renourishment activities will adhere to recommended construction windows. In addition, the District will conduct pre-nourishment field surveys for active piping plover nesting areas. Beach fill would not be placed within 1000 m of active populations of piping plover or other state or Federally-listed shorebirds/seabirds during the breeding season. Therefore, a Potentially Beneficial Impact determination was made by the District for piping plover from this proposed Project activity.

Occasional maintenance of beach access locations, boardwalks, and comfort stations will be required. These activities have the potential to disturb plover. However, as noted above, the District will conduct surveys to identify the location of nesting plover in the vicinity of these areas. Maintenance activities would be scheduled outside of key breeding and nesting periods should it be determined that activities would take place within an unsuitable distance from nesting plover.

Activities	Potentially Beneficial	Not Likely to Adversely Affect	Likely to Adversely Affect	No Effect
No-Action			X	
Project				
Staging Area Construction and Use				X
Beach Fill	X			
Groin Extension				X
Groin Construction				X
Dune and Seawall Construction		X		
Tide Barrier		X		
Residual Risk Features				
Cumulative Impacts				
Periodic re-nourishment	X			
Periodic maintenance of infrastructure		X		
Long Term Impacts from Groins		X		
Long Term Impacts from Tide Barrier				X
Long Term Impacts from Residual Risk Features		X		

Table 9 Summary of Project Effects on Populations of Piping Plover.

Groin construction and extension may cause habitat degradation by robbing sand from the down-drift shoreline. For example, the Coastal Barriers Study Group (1987) and the Ocean City, Maryland and Vicinity Water Resources Study Reconnaissance Report (USACE 1994) attribute the accelerated, landward shoreline recession of the north end of Assateague Island in Maryland to cumulative effects on the natural drift system from inlet stabilization and nourishment of the rapidly eroding beaches at Ocean City. However, loss of sand down-drift of a jetty or groin may be partially off-set by habitat accretion on the up-drift side of a structure. Breezy Point at the western end of southern Long Island, New York, serves as an example of concentrated piping plover numbers on the accreting side of a jetty (Goldin 1990). Beaches on the accreting side of jetties may also be subject to plant succession that makes them less attractive to piping plovers over time (NJDEP 1997, USFWS 2004). The District will monitor the long-term effects of groin placement on habitat for known populations of piping plover or other state or Federally-listed shorebirds/seabirds identified in the greater Project Area and appropriate ameliorative action would be taken. Therefore, because potential impacts and benefits are offsetting, a May Affect, but Not Likely to Adversely Affect determination was made by the District for piping plover from this proposed Project activity. No additional cumulative effects are likely.

4.2 Seabeach Amaranth

In 2015 a total of 166 plants were located and measured (Figure 7). Most plants were found in Arverne by the Sea between B57th and B43rd Street inside the fenced off area. Two plants were found at Far Rockaway at B26th Street. Diameter of the plants fluctuated from 0.25 to 17 inches. Most plants had a diameter of 1 inch (Table 10), and the biggest plant presented mature infructescences with seeds.

Count	Mean	Median	Mode	Minimum	Maximum
166 plants	**2.6”**	**2”**	**1”**	**0.25”**	**17”**

Table 10 Seabeach Amaranth (*Amaranthus pullium*) Survey Results

Figure 7 Seabeach Amaranth 2015 Location Map

4.2.1 Historic Trends

Historically, seabeach amaranth occurred in nine states from Massachusetts to South Carolina. The populations, which have been extirpated, are believed to have succumbed as a result of hard shoreline stabilization structures, erosion, tidal inundation, and possibly, herbivory by webworms (U.S. Fish and Wildlife Service 1994). The continued existence of the plant is threatened by these activities (Elias-Gerken 1994, Van Schoik and Antenen 1993), as well as the adverse alteration of essential habitat primarily as a result of “soft” shoreline stabilization (beach nourishment, artificial dune creation, and beach grass plantings), but also from beach grooming and other causes (Murdock 1993). Populations of seabeach amaranth at any given site are extremely variable (Weakley and Bucher 1992) and can fluctuate by several orders of magnitude from year to year. For example, seabeach amaranth declined from 55,832 plants in 2003 to 2,639 plants in 2006 at the Westhampton Island West survey site (NYNHP 2006). The primary reasons for the natural variability of seabeach amaranth are the dynamic nature of its habitat and the significant effects of stochastic factors, such as weather and storms, on mortality and reproductive rates. Although wide fluctuations in species populations tend to increase the risk of extinction, variable population sizes are a natural condition for seabeach amaranth; the species is well-adapted to its ecological niche (U.S. Fish and Wildlife Service 1996a).

Year	DE	NY	MD-VA	NC	NJ	SC	RI-CT-MA	Total
1987	0	0	0	10278	0	1341	0	11619
1988	0	0	0	20261	0	1800	0	22061
1989	0	0	0	0	0	0	0	0
1990	0	331	0	4459	0	188	0	4978
1991	0	2251	0	1170	0	0	0	3421
1992	0	422	0	32160	0	15	0	32597
1993	0	195	0	22214	0	0	0	22409
1994	0	182	0	13964	0	560	0	14706
1995	0	599	0	33514	0	6	0	34119
1996	0	2263	0	8455	0	0	0	10718
1997	0	11918	0	1445	0	2	0	13365
1998	0	10699	2	11755	0	141	0	22597
1999	0	31196	1	596	0	196	0	31989
2000	37	244608	1160	105	1039	2312	0	249261
2001	71	205233	3331	5088	5813	231	0	219767
2002	417	193412	2794	4387	10908	0	0	211918
2003	12	114535	503	11230	5087	1381	0	132748
2004	9	30942	535	11214	6817	2110	0	51627
2005	6	16813	627	19978	5795	671	0	43890
2006	39	32553	1551	3190	6522	721	0	44576

2007	19	3914	2179	872	2191	60	0	9235
2008	11	4416	1048	1575	1141	51	0	8242
2009	44	5402	1260	798	3226	26	0	10756
2010	29	534	203	2299	936	0	0	4001
2011	33	2662	24	373	2641	0	0	5949
2012	302	1213	251	152	1238	0	0	3156
2013	104	729	8	153	314	0	0	1308

Table 11. Seabeach Amaranth Range-Wide Plant Counts 1987-2013.

Seabeach amaranth has been identified as occurring within the Project Area. Seabeach amaranth inhabits dynamic, sparsely vegetated seaward facing beaches at elevations of 8 in to 5 ft above mean high water. Habitat such as this is known to be present within the Project Area and is likely to experience some impacts as a result of proposed Project activities. The following section provides an evaluation of the potential impacts from No-Action and proposed Project alternatives on populations of seabeach amaranth. Affect determinations for the No-Action alternative and for various components of the proposed Project are presented in Table 12.

4.2.2 No Action

As with the no-action scenario for piping plover, future habitat conditions without the Project would include both loss and accretion of sediment in the upper beach and dune areas. However, much of the Project Area is expected to experience erosion and loss of upper beach and dune habitats without the proposed Project activities (USACE 1989, 1998, 2002, 2005). In these areas, the upper beach zone would lose sand and would decrease in size, thereby potentially reducing available seabeach amaranth habitat. The width of intertidal and subtidal zones will remain stable. But, locations of these zones may shift off-shore or on-shore depending on erosion and accretion rates in the area. Accordingly, the overall impact of the No Action alternative on seabeach amaranth habitat would likely be negative

4.2.3 Proposed Action

Implementation of the Project actions will affect the upper, intertidal, nearshore subtidal beach zones and primary dune areas of coastal beaches in the Project Area through the direct placement of beach fill and structures such as retaining walls, walkovers, and beach access areas. These activities could bury amaranth communities and historic seed banks. In addition, hard structures such as groins, would not result in any permanent loss of potential habitat because these structures will impact areas of the beach/dune that are not typically suitable for amaranth. A summary of Project activities and their effects on populations of seabeach amaranth are presented in Table 12.

Activities	Potentially Beneficial	Not Likely to Adversely Affect	Likely to Adversely Affect	No Effect
No-Action			X	
Project				
Staging Area Construction and Use				X
Beach Fill	X			
Groin Extensions				X
Groin Construction				X
Dune and Seawall Construction				X
Tide Barrier				X
Residual Risk Features				
Cumulative Impact				
Periodic Re-nourishment	X			
Periodic Maintenance of Dunes and Infrastructure		X		
Long term impacts from Groins				X
Long term impacts from Tide Barrier				X
Long term impacts from Residual Risk Features				X

Table 12 Summary of Project Effects on Populations of Seabeach Amaranth

Vehicle and pedestrian access points pose potential threats to seabeach amaranth because these activities are likely to provide access to new areas of the beach and may increase vehicle and public use of beach areas. This increase in human activity could directly impact unprotected amaranth if they were to occur in the Project Area. In addition, similar to the recommendations provided by NYSDEC, USFWS, and NMFS for the piping plover, the District will implement several measures in an effort to minimize potential adverse impacts to existing seabeach amaranth populations (USACE 1998, USFWS 1999). These impact minimization measures are detailed in Section 5 and in summary include the following: pre and post-construction surveys of the Project Area to determine the presence/absence of seabeach amaranth; limiting construction activities during the growing season within areas of known amaranth populations (i.e., limited activities from approximately June through November); education of residents, landowners, beach visitors, and beach managers; and the use of physical deterrents to deter human use of potential seabeach amaranth habitat. Because measures will be taken to minimize access to areas that are shown to have amaranth, No Effect determination was made by the District for populations of seabeach amaranth related to the implementation of these actions.

Construction of the Project is likely to increase overall habitat suitability for seabeach amaranth along the affected beachfront. Although the planned beach berm is designed for an elevation of 9 ft NAVD, which is slightly higher than seabeach amaranth's preferred elevation, as the beach berm slopes toward the ocean, there will be a zone that falls within the plants preferred elevation range. Expanding the beach and particularly the zone most suitable for amaranth would likely provide habitat for seabeach amaranth. Therefore, a Potentially Beneficial Impact determination was made by the District for seabeach amaranth from this proposed Project activity.

4.2.4 Cumulative Effects

The proposed beach renourishment activities will provide long-term protection of potential habitat for seabeach amaranth in the upper beach and primary dune areas. To further reduce potential direct impacts, the District will conduct pre-nourishment field surveys for amaranth. Beach fill material would not be placed within 25 ft of the perimeter of population clusters or individual stems of seabeach amaranth.

Because of the limited extent of disturbance and because the species was identified as occurring in a small portion of the Project Area, implementation of the proposed action could not reasonably be considered as contributing to cumulative adverse impacts on seabeach amaranth. Therefore, because the proposed Project would serve to protect amaranth habitat, a Potentially Beneficial Impact determination was made by the District for seabeach amaranth from this proposed Project activity.

4.3 Red Knot

There have been recent sightings and documentation of a few red knots in the vicinity of the Project. Despite the development and high recreational use of the area by humans, red knot are utilizing the suitable habitats in the Project Area. As a result, the USFWS has requested a Potential Effect determination on populations of red knot related to the implementation of the proposed action. Red knot are typically dependent upon intertidal and upper beach zones, using gradually sloping sparsely vegetated areas of the upper beach, bay shoreline and intertidal areas for foraging. Habitats such as these are known to be present within the Project Area and are may experience some impacts as a result of proposed Project activities. The following section provides an evaluation of the potential impacts from No-Action and proposed the Project alternative on populations of red knot. Affect determinations for the No-Action alternative and for various components of the proposed Project are presented in Table 12.

4.3.1 No Action

As with the no-action scenario for piping plover, future habitat conditions without the Project would include both loss and accretion of sediment in the upper beach and dune areas. However, much of the Project Area is expected to experience erosion and loss of upper beach and dune habitats without the proposed Project activities (USACE 1989, 1998, 2002, 2005). In these areas, the upper beach zone would lose sand and would decrease in size, thereby potentially reducing available red knot habitat. The width of intertidal and subtidal zones will remain stable. But, locations of these zones may shift off-shore or on-shore depending on erosion and accretion rates in the area. Accordingly, the overall impact of the No Action alternative on red knot habitat would likely be negative

Activities	Potentially Beneficial	Not Likely to Adversely Affect	Likely to Adversely Affect	No Effect
No-Action			X	
Project –				
Staging Area Construction and Use				X
Beach Fill	X			
Groin Extension				X
Groin Construction				X
Dune and Seawall Construction		X		
Residual Risk Features				
Tide Barrier		X		
Cumulative Impacts				
Periodic Re-nourishment	X			
Periodic Maintenance of Infrastructure		X		
Long Term Impacts from Groins		X		
Long Term Impacts from Tide Barrier		X		
Long Term Impacts from Residual Risk Features		X		

Table 13 Summary of Project Effects on Populations of Red Knot

4.3.2 Proposed Action

Although some minor, short-term, impacts to the red knot food resources and habitat will result from proposed Project modifications, overall improvements to habitat can be expected to result from the proposed activity. Therefore, after a full evaluation of red knot life history, habitats in the Project Area, management activities, and proposed Project activities, a Not Likely to Adversely Affect determination was made by the District on populations of red knot as a result of implementation these proposed activities (Table 13). Details of this determination are provided below.

The primary direct impacts resulting from implementation of the Project will be disturbance and direct impact of benthic, immobile invertebrate and plant communities currently living in these areas due to burial from beach fill material. As a result, red knots will experience some short-term loss of food resources within the beach fill placement. However, the direct placement of beach fill is not expected to cause long-term significant impacts on the red knot. The area of actual permanent red knot habitat loss due to permanent structures is small and would result in a negligible loss of foraging substrate for the species. In addition, although the red knot would avoid foraging within areas of direct sand placement in the intertidal zone until benthic food sources recolonized the site, recolonization of benthic communities in the intertidal zones typically takes place within six months to two years following beach fill placement activities. Therefore, overall impacts are expected to be short-term and not likely to negatively affect plover populations. Thus, a May Affect, but Not Likely to Adversely Affect determination was made by the District as a result of implementation of these proposed activities.

Placement of beach fill and dune restoration is likely to increase overall habitat value along the affected beachfront by expanding the area of suitable foraging habitat. Therefore, a Potentially Beneficial Impact determination was made by the District for piping plover for this proposed Project activity for the reasons stated below. Studies of beach nourishment projects along the Atlantic Coast have documented that when construction windows and best management practices are adhered to, beach nourishment generally provides valuable habitat for beach nesting birds such as the red knot. Construction activities occurring in the Project Area are likely to halt further loss of existing habitat and will likely increase the amount of suitable habitat by increasing the size of the upper beach zone.

Permanent hard structures such as groins, would eliminate any suitable foraging habitat directly within the footprint of these structures. However, the area of overall impact from these structures is expected to be minimal and most of the habitat that will be impacted is not of high habitat value to red knot. Specifically, red knot forage primarily in the intertidal zone along the coastline and bay shoreline. The areas in which hard structures are proposed include mostly subtidal areas that would be affected from groin placement. Overall impacts directly within the footprint of these structures would be permanent, but are not expected to significantly affect red knot foraging activities. Thus, a May Affect, but Not Likely to Adversely Affect determination was made by the District as a result of implementation of these proposed activities.

Other short-term impacts, such as a slight decrease in water quality and an increase in turbidity, also are likely to occur during beach fill and groin construction and rehabilitation activities. Changes in water quality and turbidity may cause some short-term avoidance of the intertidal zone by the red knot during periods of low water quality resulting from construction activities. These impacts to their foraging activities will be short term and will have a minimal effect on them because red knot are mobile and can utilize unaffected foraging areas nearby. In addition, construction activities will be scheduled to avoid any active plover nesting areas (i.e., construction scheduled from approximately September 2 through April 1), which will avoid potential impacts to the red knot foraging activities. Impacts from these activities are expected to be short-term and cause no significant negative effects on plover populations. Therefore, a May Affect, but Not Likely to Adversely Affect determination was made by the District for the red knot, for these proposed activities.

These impact minimization measures are detailed in Section 5 and in summary include the following: pre and post-construction surveys of the Project Area to determine the presence of red knot; restricting construction activities within areas of known red knot populations; education of residents, landowners, beach visitors, and beach managers; three consecutive years of post-construction monitoring of the Project Area to document beach use of red knot and to deter human use of potential forging areas; and the use of physical deterrents (signage, restricted vehicle access, and symbolic fencing) to deter human use of potential red knot habitat. Therefore, a May affect, but Not Likely to Adversely Affect determination was made by the District on piping plover for proposed Project activities.

4.3.3 Cumulative Effect

The proposed beach renourishment activities would cause short-term impacts to red knot foraging by directly covering the benthic organisms that red knot feed on and causing short term availability in benthic species (USFWS 1991, Burlas et al 2001, Peterson and Manning 2001). These impacts are similar to the impacts from initial beach fill activities as discussed above. However, as discussed previously, these impacts will have minimal short-term impact on red knot populations. Renourishment activities will provide long-term protection of potential stop over areas in the upper beach and primary dune areas. To further reduce potential impacts, beach renourishment activities will adhere to recommended construction windows. In addition, the District will conduct pre-nourishment field surveys for active red knots in the area. Therefore, a Potentially Beneficial Impact determination was made by the District for red knot from this proposed Project activity.

Occasional maintenance of beach access locations, boardwalks, and comfort stations will be required. These activities have the potential to disturb red knots. However, as noted above, the District will conduct surveys to identify the location of red knots in the vicinity of these areas. Maintenance activities would be scheduled outside of key stop over periods.

Groin construction and extension may cause habitat degradation by robbing sand from the down-drift shoreline. For example, the Coastal Barriers Study Group (1987) and the Ocean City, Maryland and Vicinity Water Resources Study Reconnaissance Report (USACE 1994) attribute the accelerated, landward shoreline recession of the north end of Assateague Island in Maryland, to cumulative effects on the natural drift system from inlet stabilization and nourishment of the rapidly eroding beaches at Ocean City. However, loss of sand down-drift of a jetty or groin may be partially off-set by habitat accretion on the up-drift side of a structure. Beaches on the accreting side of jetties may also be subject to plant succession that makes them less attractive to red knot over time. The District will monitor the long-term effects of groin placement on habitat for known populations of red knot or other state or Federally-listed shorebirds/seabirds identified in the greater Project Area and appropriate ameliorative action would be taken. Therefore, because potential impacts and benefits are offsetting, a May Affect, but Not Likely to Adversely Affect determination was made by the District for red knot from this proposed Project activity. No additional cumulative effects are likely.

5.0 RECOMMENDATIONS

To minimize adverse impacts on the piping plover and seabeach amaranth, the USACE will follow recommendations provided by the NYSDEC and USFWS as described below (USACE 1998, USFWS 1999). These measures are expected to minimize potential adverse impacts on numerous other species that may use coastal habitats in the Project Area, including several state-listed shorebird species.

5.1 PIPING PLOVER

1) The USACE will conduct surveys during the spring/summer, and prior to construction activities, to identify nesting plover in the Project Area and to document all known

locations of plover. In addition, the USACE will document any other Federal or state-listed wildlife species observed in the Project Area during survey and will initiate consultation with appropriate state and Federal agencies.

2) Symbolic fence and signs will be placed around all plover nests and brood rearing areas located in the construction area to deter use of the area and to protect sites from incidental disturbance from construction activities.
3) The USACE will conduct construction activities near active plover nesting areas from September 2 through April 14 to avoid the key shorebird nesting period.
4) Construction activities will avoid all delineated locations of the species during the breeding season and will undertake all practicable measures to avoid incidental taking of the species.
5) The USACE will reinitiate consultation with the USFWS to identify acceptable alternatives should any plover nest sites be identified within the direct construction footprint.
6) The USACE will monitor the Project Area before, during and after construction.
7) The USACE will educate residents, landowners, beach visitors and beach managers on piping plover.
8) The USACE will encourage local agencies to place time restrictions on beach use by vehicles to avoid key nesting and fledging periods.
9) The USACE will conduct follow-up surveys of plover habitat within the Project Area. Surveys will be conducted for three consecutive nesting seasons post-construction and a summary report regarding habitat use and nesting will be provided annually to the USFWS.

5.2 SEABEACH AMARANTH

1) The USACE will conduct surveys during July/August to determine the presence/absence of seabeach amaranth within the Project Area and to document all known locations of amaranth. In addition, the USACE will document any other Federal or state-listed plant species observed in the Project Area during the survey and will initiate consultation with appropriate state and Federal agencies.
2) Symbolic fence and signs will be placed around all seabeach amaranth plants located in the construction area to deter use of the area and to protect plants.
3) The USACE will restrict construction activities in areas of known populations during the growing season (allow limited activities only, from June through November).
4) Construction activities will avoid all delineated locations of the plant and will undertake all practicable measures to avoid incidental taking of the plant.
5) The USACE will reinitiate consultation with the USFWS to identify acceptable alternatives should any seabeach amaranth plants are identified within the direct construction footprint.
6) The USACE will educate residents, landowners, beach visitors, and beach managers on seabeach amaranth.
7) The USACE will conduct follow-up surveys of amaranth habitat within the Project Area. Surveys will be conducted for three consecutive growing seasons post-construction and a summary report will be provided annually to the USFWS.

5.3 RED KNOT

1) The USACE will conduct surveys during the spring/summer, and prior to construction activities, to identify red knots in the Project Area and to document all known locations.

In addition, the USACE will document any other Federal or state-listed wildlife species observed in the Project Area during survey and will initiate consultation with appropriate state and Federal agencies.

2) Symbolic fence and signs will be placed around all red knot nests and brood rearing areas located in the construction area to deter use of the area and to protect sites from incidental disturbance from construction activities.
3) The USACE will conduct construction activities near active red knot areas from September 2 through April 14 to avoid the key shorebird nesting period.
4) Construction activities will avoid all delineated locations of the species during the breeding season and will undertake all practicable measures to avoid incidental taking of the species.
5) The USACE will reinitiate consultation with the USFWS to identify acceptable alternatives should any plover nest sites be identified within the direct construction footprint.
6) The USACE will monitor the Project Area before, during and after construction.
7) The USACE will educate residents, landowners, beach visitors and beach managers on red knot.
8) The USACE will encourage local agencies to place time restrictions on beach use by vehicles to avoid key nesting and fledging periods.
9) The USACE will conduct follow-up surveys of red knot habitat within the Project Area. Surveys will be conducted for three consecutive nesting seasons post-construction and a summary report regarding habitat use and nesting will be provided annually to the USFWS.

6.0 CONCLUSIONS

When trying to promote conservation goals using iconic species such as Piping Plover, Sea Beach Amaranth, or Red Knot, it is important to keep in mind that there are conflicting uses among stakeholders with competing legitimate goals. When a consensus is meet on the management goals among these stalk holders you will accomplish a more productive public policy to progress the species.

It is essential when formulating this management plan to work within the limitations of our location, rather than create a plan based on management plans for other areas with different characteristics (e.g. Westhampton Dunes). To accomplish this the FWS needs to look at management practices aimed at urban ecosystems, which differ greatly from managing foreverwild or rural locations. There are many reports on urban ecosystems that successfully support native wildlife, as well as the active management efforts that accomplish this (DiCicco, 2014, Feinburg et al. 2014, Fisher 2011, Flores et al. 1998,). Central Park is an example of an early a planned construction intended as a naturalistic pastoral design (Brown 2013). Urbanization produces a variety of unprecedented and intense manipulations to an ecosystem. These include changes in disturbance regimes, biota, landscape structure, physiological stresses (e.g. air pollution), as well as include cultural, economic and political factors (McDonnell and Pickett 1990).

Assateague Island, Maryland is another location that should not be compared to East Rockaway. A relevant difference between the locations is that Assateague was in a natural state prior to the protective dune construction with a variety of habitats that included foraging and nesting areas inland from the barrier dune (Loegering et al. 1995) and most nests had been located behind and further away from the ocean than the constructed dune (Schupp et al 2013), therefore the creation of notches through the constructed dune that mimicked previously existing paths was logical and successful (Schupp et al. 2013). East Rockaway, however, was completely developed over 100 years ago, and all of the Piping Plover activity for the past decades has been in front of existing dune system that is part of the Project, some of which is over 60 years old. No plover activity is known to have occurred in the much wider, unsuitable area behind these dunes, so providing access to unsuitable areas would not achieve the success of this listed species.

It is the USACE's determination that implementing the proposed action in accordance with the standards and guidelines recommended by USFWS and NYSDEC, will not jeopardize the continued existence or contribute to the loss of viability of either of the Federally-listed endangered or threatened species listed identified by the USFWS. In addition, the proposed action would not significantly contribute to cumulative impacts associated with piping plover, red knot and seabeach amaranth. Therefore, the USACE requests USFWS concurrence for a May Affect, but Not Likely to Adversely Affect determination for the piping plover, red knot and seabeach amaranth.

Each of the alternatives will affect East Rockaway shoreline as well as the species that inhabit them. The No Action Alternative appears to have the most unpredictable short and long-term impacts on natural resources due to the changeable nature of coastal dynamics and inlet/overwash formation. It could create additional overwash and back bay habitat with inlet formation, which may be advantageous to higher plover abundance and productivity. But the ephemeral nature of shoreline dynamics makes it difficult to predict the longevity and morphology of such newly created habitat as seen at Old Inlet. Additionally, though the creation of a new inlet could provide additional beaches suitable for plovers and other beach-dependent species, it is unclear whether the total shoreline of East Rockaway would gain or lose suitable habitat due to the changes in sand transport caused by the new inlet. Serious consideration should be given to the existing nesting beach habitat which may be affected by altered sand transport conditions along the coast as a result of a breach. A breach clearly would have significant adverse impacts on both cultural and human resources, due to the potential loss of numerous structures.

The implementation of this long-term proposed beach restoration project is intended to reintroduce sediment that is passing through the system (that would be lost to the inlet) and recycle it back to the erosive areas in the least intrusive way. It is one of the numerous NY/NJ shoreline stabilization projects, therefore contributing to the overall loss of natural coastal habitat. However, this project is in response to the adjacent pre-existing man induced changes which threaten the area, and attempts to simulate the most natural shoreline processes possible through this sand recycling method. Continual replenishment of the beach by recycling smaller quantities of sand on a regular basis through a sand slurry pipeline operation would more closely mimic natural shoreline dynamics while increasing and stabilizing the beach habitat necessary to sustain the area's rare flora and fauna. The potential natural resource loss associated with this alternative is the prevention of overwash and back bay habitat formation which may at some point benefit or limit piping plover nesting populations on the Rockaways

As previously discussed, this proposed action would result in impacts to benthic communities (potential burial and habitat disturbances) and water quality (turbidity and dissolved oxygen) during active construction activities. However, these effects would be short-term, as the benthic communities will naturally begin to re-establish shortly after construction is completed, forming a similar community within a period of 6 months to 2 years (USFWS 1991, Burlas et al 2001, Peterson and Manning 2001). These impacts may result in a short-term reduction of forage material for piping plover in the immediate Project Area. However, plover will utilize nearby undisturbed areas for feeding. In addition, because sediments in the Project Area are sandy, any increased turbidity effects would generally be limited to the period of in-water construction, as this type of substrate tends to settle out of suspension quickly.

The Project would potentially result in direct and/or indirect disturbances to seabeach amaranth, red knot and piping plover and other nesting shorebirds/seabirds, including the Federally and state-listed least tern, roseate tern, and the state-listed common tern, if any are present in the Project vicinity during the time of construction. However, these impacts can largely be avoided if the period of construction is limited to periods outside of the active piping plover nesting season which occurs from April 1 through September 1, and outside of the active growing season for seabeach amaranth which extends from June through November in the designated historic (past three years) nesting areas. Therefore, the USACE has incorporated these construction window recommendations, as well as other recommendations from past biological opinions from the USFWS, into the Project construction plans. In addition, the USACE will conduct a pre-construction survey for the piping plover and seabeach amaranth and will avoid disturbing these species if any are found within the construction area. As a result, significant adverse impacts to these species are not expected. The USACE is in the process of completing coordination and consultation processes with the USFWS pursuant to the Fish and Wildlife Coordination Act and the ESA.

Because a site-specific survey will be conducted prior to implementation of the Project and NYSDEC and USFWS, standards and guidelines would be followed regarding the protection of species and potential habitat, implementation of the proposed action May Affect but, Not Likely Adversely Affect the piping plover, red knot or seabeach amaranth. Implementation of the proposed action would not contribute to the loss of viability of the piping plover, red knot or seabeach amaranth and thus, no additional measures to offset impacts to these species are necessary. When compared to the No Action alternative, implementation of the proposed action would benefit piping plover, red knot and seabeach amaranth, as well as other shorebird/seabird species, through habitat improvement and an increase in the availability of suitable habitat.

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NOAA'S National Marine Fisheries Service Protected Resources Division

55 Great Republic Drive

Gloucester, MA 01930

Attn: Mrs. Kimberly Damon-Randall

Re: Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet to Jamaica Bay Coastal Storm Risk Management Project

Dear Mrs. Damon-Randall,

The U.S. Army Corps of Engineers (ACOE) is proposing to provide shoreline protection per the Atlantic Coast of New York East Rockaway Inlet to Rockaway Inlet to Jamaica Bay (ER) Coastal Storm Risk Management (CSRM) Project. We have made the determination that the proposed activity, which for this consultation is limited to the Atlantic Shoreline segment, only, of the overall project, may affect, but is not likely to adversely affect, any species listed as threatened or endangered by NMFS under the ESA of 1973, as amended. Our supporting analysis, which incorporates and cites whole excepts of analyses provided by NOAA to USACE in response to USACE's ESA consultation on the Long Beach, NY and Fire Island to Montauk Point, NY CSRM beach nourishment projects, is provided below.

1. Proposed Project

The ER Tentatively Selected Plan (TSP), as defined in the Draft Hurricane Sandy General Reevaluation Report/Environmental Impact Statement (HSGRR/EIS, see enclosure), integrates CSRM structures that provide system-wide benefits to the vulnerable communities within the study area. The TSP identifies the overall project features, with the acknowledgement that the specific details and dimensions of the plan for the Jamaica Bay surge barrier feature, have not been finalized. The HSGRR/EIS will undergo public review, policy review, Agency Technical Review (ATR), and Independent External Peer Review (IEPR). Final design and selection of the Jamaica Bay Storm Surge Barrier alignment and associated tie-ins are deferred until additional analyses and design refinements can be conducted. Final storm surge barrier design, if that is the preferred alternative for the Jamaica Bay Planning reach, will be made in the future based on responses and input from public, policy, and technical reviews of this Draft HSGRR/EIS and any additional investigations conducted for that purpose. The USACE study team will respond to review comments, then present a recommended plan and develop a Final HSGRR/EIS. Therefore, this analysis will address the Atlantic Coast Shoreline Protection features of the overall project that will involve water-based equipment being utilized within and possibly affecting the marine environment, only (Figure 1). USACE will reinitiate consultation with NMFS as soon as the Jamaica Bay element of the recommended plan is available in sufficient detail for the required analyses for that component of the overall project.

The proposed beach nourishment project element will begin in approximately 2018 and consist of the renourishment of approximately 3.5 miles of beach along the Rockaway Peninsula, extending from approximately 2.5 miles east of Breezy Point, eastward to the East Rockaway Inlet. The construction of the project will involve use of a cutterhead dredge. The proposed project will extract sand from one of the three identified borrow areas (BAs, see Figure 1 insert), which are located approximately 2 miles south of Rockaway Beach, NY, as the source of beach nourishment sediments, composed largely of sand and similarly other large grain sediments. Approximately 804KCY will be removed from the BAs and deposited onto the beach via a pipeline connected to the dredge for the initial construction element of the project.

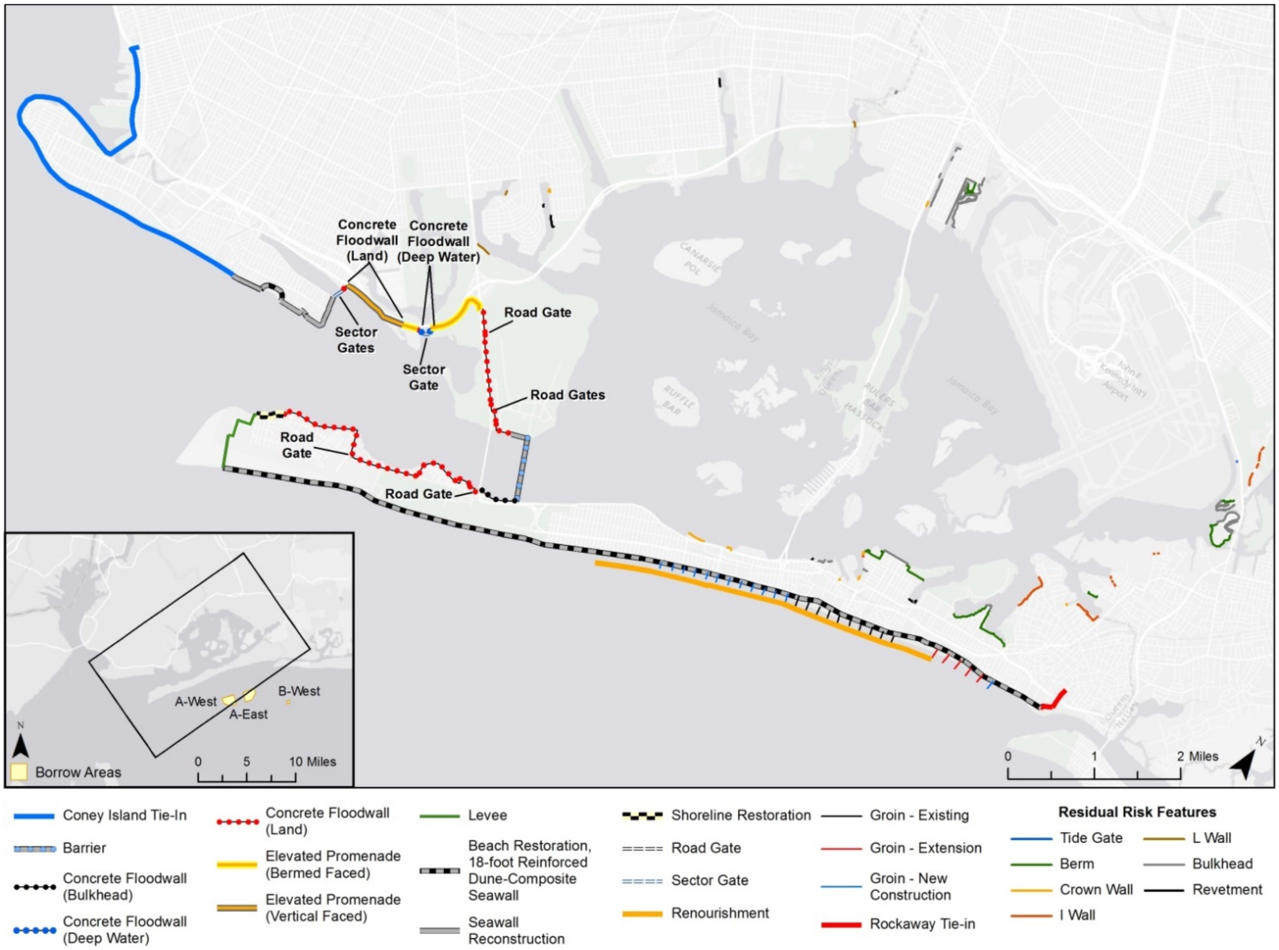

Figure 1. East Rockaway CSRM TSP, with Borrow Areas insert.

Stone groins will also be repaired and constructed using a crane aboard a barge. Approximately 5 stone groins will be repaired (extended) and 13 will be constructed (Figure 2).

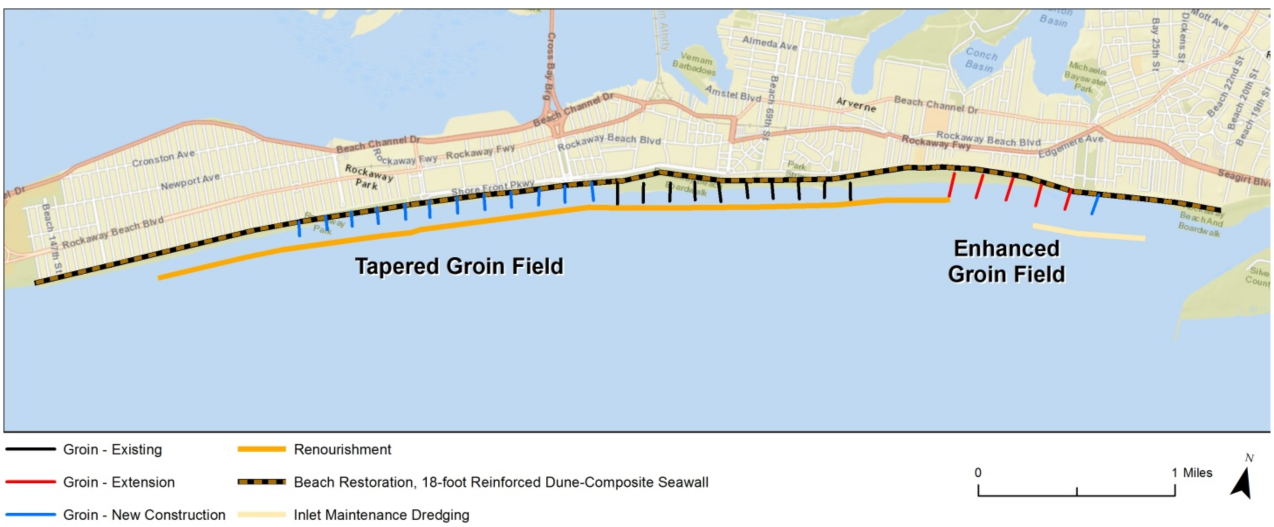

Figure 2. Atlantic Shoreline TSP.

Table 1 : Beachfill and Renourishment Quantities (cubic yards)

Sub-Reach	Beachfill	Renourishment per Cycle
Sub-Reach 3	279,000	444,000
Sub-Reach 4	74,000	133,000
Sub-Reach 5	227,000	444,000
Sub-Reach 6a	204,000	0
Sub-Reach 6b	20,000	0
Totals	804,000	1,021,000

Note: Renourishment would occur on a four-year cycle

Mitigation and other Best Management Practices (BMP): In addition to any mitigation or BMPs that will be implemented specific to NOAA ESA concerns, construction activities will be seasonally restricted from April 1 to September 30 to ensure protection of the possibility of nesting piping plover. Therefore, beach nourishment activities will occur only from October 1 through March 30 of any given year of construction, a time of year when few, if any potentially affected (ex. marine turtles) ESA species individuals are in, utilizing or transiting the project action area between the borrow area and the Rockaway Beach coastline.

2. Description of the Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR§402.02). For this project, the action area includes the offshore borrow area, the vessel transit route within the borrow area, the area of the pipeline from the dredge to the beach nourishment sites, and the underwater areas where the effects of dredging and fill placement (i.e., increases in suspended sediment) will be experienced. In the vicinity of hopper dredging operations, a near-bottom turbidity plume of resuspended bottom material may extend 2,300 to 2,400 feet down current from the dredge (USACE 1983). In the immediate vicinity of the dredge, a well-defined upper plume is generated by the overflow process. Approximately 1,000 feet behind the dredge, the two plumes merge into a single plume (USACE 1983). By a distance of 4,000 feet from the dredge, plume concentrations are expected to return to background levels (USACE 1983). For cutterhead dredging, the maximum distance of increased suspended sediment is likely to be a distance of 1,150 feet from the dredge (ACOE 1983), with a width of up to 492 feet (ACOE 2012). Wilber *et al.* (2006) reported that elevated total suspended sediment (TSS) concentrations associated with the active beach nourishment site will be limited to within 1,312 feet of the discharge pipe in the swash zone (defined as the area of the nearshore that is intermittently covered and uncovered by waves). Other studies found that the turbidity plume and elevated TSS levels are expected to be limited to a narrow area of the swash zone up to 1,640 feet down current from the discharge pipe (Schubel *et al.* 1978, Burlas *et al.* 2001).

Based on this information, the action area consists of the project footprint of the area that will be dredged, the area of where the pipeline will be, areas within 4,000 feet down current of the dredging operation, as well as the area within 1,640 feet down current from the beach where sediments will be deposited. These areas are expected to encompass all of the direct and indirect effects of the operations. The sediments in the areas to be dredged consist of mostly sand and gravel (90% sand). Benthic resources at the borrow area is limited, but does include a diversity of species including those types considered primary prey species for sturgeon and sea turtles (crustaceans and mollusks). There are no sea grasses and no SAV at the borrow areas.

Figure 1. East Rockaway Beach Renourishment Study (Action) Area.

3. NMFS Listed Species in the Project Area

Whales

Federally endangered North Atlantic right, humpback, and fin whales are seasonally present in the waters of New York. These species use the near shore, coastal waters of the Atlantic Ocean as they migrate to and from calving and foraging grounds. Humpback and fin whales primarily occur in the waters of New York during the spring, summer and fall months, while the North Atlantic right whale primarily occurs in these waters from November 1 through April 30, although transient right whales can be present outside of this time frame. Although humpback, right, fin whales are not expected to occur in the portions of the action area located in the shallow near shore waters of New York where sand will be placed, ESA listed species of whales may occur in the portion of the action area located in the borrow area locations (i.e., the Atlantic Ocean). Based on the information above, and the following factors, we conclude that the risk factors that increase the likelihood for whale entrainment are not present since cutterhead dredges pose no risk to whales.

Each species has a published recovery plan:

- Humpback whale (Megaptera novaeangliae)(35 FR 18319; Recovery plan: NMFS 1991)
- North Atlantic Right whale (Eubalaena glacialis)(73 FR 12024; Recovery plan: NMFS 2005)
- Fin whale (Balaenoptera physalus)(35 FR 18319; Recovery plan: NMFS 2010)

Sea Turtles

Four species of federally threatened or endangered sea turtles under our jurisdiction are found seasonally in the coastal waters of New York: federally threatened Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead *(Caretta caretta),* and the federally endangered Kemp's ridley *(Lepidochelys kempi),* green *(Chelonia mydas)* and leatherback *(Dermochelys coriacea)* sea turtles. In general, listed sea turtles are seasonally distributed in coastal U.S. Atlantic waters, migrating to and from habitats extending from Florida to New England, with overwintering concentrations in southern waters. As water temperatures rise in the spring, these turtles begin to migrate northward. As temperatures decline rapidly in the fall, turtles in northern waters begin their southward migration. Sea turtles are expected to be in the waters of New York in warmer months, typically when water temperatures are at least l5°C. This typically coincides with the months of May through November, with the highest concentration of sea turtles present from June-October (Morreale 1999; Morreale 2003; Morreale and Standora 2005; Shoop and Kenney 1992).

Several studies have examined the seasonal distribution of sea turtles in New York waters. In most years, sea turtles begin to arrive in New York waters in June (Morreale and Standora, 1993; Morreale and Burke, 1997). Tracking studies on juvenile Kemp's ridleys demonstrate that all tagged turtles had traveled south from New York coastal waters by the first week in November (Standora *et al.* 1992). In 2002 and 2003, Morreale conducted a study of loggerhead, Kemp's ridley and green sea turtles captured in pound nets fishing in the Peconic Bay area. Sea turtles were not encountered after the last week in October (Morreale 2003). Tracking studies summarized in Morreale and Standora (2005) indicate that loggerhead and Kemp's ridley sea turtles begin leaving New York waters in October and generally by the first week of November, turtles head southward past the Virginia border. Similar migratory patterns are expected for green and leatherback sea turtles (Shoop and Kenney 1992; Morreale 1999). Based on this information, sea turtles may occur in the action area between May through November.

Each species has a published recovery plan:

- Kemp’s Ridley turtle (Lepidochelys kempii)(35 FR 18319; Recovery plan: NMFS et al. 2011)
- Leatherback turtle (Dermochelys coriacea)(35 FR 8491; Recovery plan: NMFS &USFWS 1992)
- Loggerhead turtle (Caretta caretta)(76 FR 58868; Recovery plan: NMFS & USFWS 2008)
- Green turtle (Chelonia mydas)(81 FR 20057; Recovery plan: NMFS & USFWS 1991)

Atlantic Sturgeon

There are five DPSs of Atlantic sturgeon listed as threatened or endangered. Atlantic sturgeon originating from the New York Bight, Chesapeake Bay, South Atlantic and Carolina DPSs are listed as endangered, while the Gulf of Maine DPS is listed as threatened. The marine range of all five DPSs extends along the Atlantic coast from Canada to Cape Canaveral, Florida.

At around three years of age, subadults exceeding 2.3 feet in total length begin to migrate to marine waters (Bain et al. 2000). After emigration from the natal river/estuary, subadults and adult Atlantic sturgeon travel within the marine environment, typically in waters less than 164 feet in depth, using coastal bays, sounds, and ocean waters (ASSRT 2007). In rivers and estuaries, Atlantic sturgeon typically use the deepest waters available; however, Atlantic sturgeon also occur over shallow (8.2 feet), tidally influenced flats and mud, sand, and mixed cobble substrates (Savoy and Pacileo 2003). Occurrence in these shallow waters is thought to be tied to the presence of benthic resources for foraging.

Based on the above information, adult and subadult Atlantic sturgeon from any of five DPSs could occur in the project area; however, as Atlantic sturgeon spawn in freshwater portions of large rivers and early life stages are not tolerant of salinity, no eggs, larvae or juvenile Atlantic sturgeon occur in the action area.

4. Effects of the Action

The primary concerns for loggerhead, Kemp's ridley, and green sea turtles is entrainment and loss of forage, while the primary concern for leatherbacks is vessel collision as the dredge transits the borrow area. Due to their large size, whales are not vulnerable to entrainment in dredges; as such, effects of impingement or entrainment on whales will not be considered in this consultation. The primary concern for listed species of whales is the possible effects of total suspended solids (TSS), or water quality, and the potential for vessel collisions as the dredge transits the borrow area. The primary concerns for Atlantic sturgeon is entrainment, loss of forage, and vessel collision as the dredge transits the borrow area. The potential effects of a possible temporary increase in turbidity or TSS and sedimentation as a result of dredging and beach nourishment on listed species are also discussed below.

The pipeline connecting the dredge to the shore will float on the surface of the water or will be laid on the bottom, presenting no possibility of intake of an ESA-listed species or adverse interaction with an ESA-listed species, and will not present a barrier to ESA-listed species. These effects will not be discussed further in this consultation.

Below, we discuss the effects of cutterhead dredging on ESA-listed species and exposure to: (A) entrainment and impingement of Atlantic sturgeon and sea turtles; (B) alteration of listed species prey items and foraging behavior due to dredging; (C) suspended sediment (or TSS) associated with dredging operations, and the potential for interactions (i.e., vessel strikes) between project vessels and (D) individual Atlantic sturgeon, whales or sea turtles.

A) Effects of Impingement / Entrainment

Atlantic Sturgeon

Atlantic sturgeon are not known to be vulnerable to entrainment and/or impingement in cutterhead dredges. Cutterhead dredges operate with the dredge intake buried in the sediment; therefore, in order to contact the dredge intake, sturgeon would have to be on the bottom. Factors that are believed to contribute to the risk of Atlantic sturgeon entrainment include: 1) dredge duration (e.g., greater number of interactions associated with longer duration dredging); 2) the location, habitat, and geography of the project site (e.g., open estuarine environment versus confined channel areas); and, 4) the species' use of, and behavior within, the affected location (e.g., foraging, overwintering, spawning, resting).

Information suggests that Atlantic sturgeon in the marine environment do not move along the bottom, but instead move further up in the water column during their migratory movements along the coast line. Atlantic sturgeon do, however, occur on the benthos while foraging. Atlantic sturgeon feed on benthic invertebrates (e.g., amphipods, gastropods, annelids, decapods) and occasionally on small fish. The benthos within the borrow area (BA) is limited and has limited shellfish beds. As such, the BA is unsuitable for Atlantic sturgeon foraging. Based on this information, Atlantic sturgeon are not expected to be foraging in this portion of the action area and thus, are not expected to be on the benthos where the cutterhead dredge will be operating. If, however, an Atlantic sturgeon is foraging opportunistically within this portion of the project area, there could be a risk of interacting with the dredge. However, because the dredge moves very slowly, and there is ample space for movements it is likely that subadult or adult Atlantic sturgeon can easily avoid the dredge. This assumption is supported by recent monitoring work, completed in the James River (Virginia) and the Delaware River (New Jersey) (Cameron 2010; ERC 2011), as well as work undertaken on a related species, the white sturgeon, in the Columbia River (Parsley and Popoff2004). During these studies, the movements of tagged Atlantic, white, and/or shortnose sturgeon were tracked near the dredge (mechanical and hydraulic). No interactions between sturgeon and the dredge occurred. Some tagged sturgeon moved through the area where the dredge was operating multiple times during the study, while others remained within the vicinity of the dredging operation with no incidence. The risk is further increased at overwintering areas because evidence suggests that sturgeon may be less responsive to stimuli while overwintering, which may make it less likely that sturgeon would avoid a dredge during this time period. However, overwintering grounds are not known to exist in the borrow area locations and therefore, no overwintering sturgeon were likely to occur in the portion of the project area where dredging operations will occur. As a result, these increased risk factors are not present.

Impingement or entrainment in hydraulic cutterhead dredges may kill or injure sturgeon.
In order for sturgeon to be impinged or entrained in the cutterhead dredge, sturgeon would have to be on the bottom. Sturgeon do occur on the bottom, especially while foraging; however, studies indicate that small, juvenile sturgeon (less than 0.6 foot fork length) need to be within 4.9 feet to 6.6 feet of the cutterhead for there to be any potential entrainment (Boysen and Hoover 2009). Sturgeon in the action area are considerably bigger (subadults and adults), and as they are stronger swimmers, are even less vulnerable to being overcome by the suction of the dredge and to becoming entrained. Because the dredge moves slowly and sturgeon are highly mobile, strong swimmers, it is likely that sturgeon would easily be able to avoid the dredge. This assumption is supported by recent monitoring work completed in the James River (Virginia) and the Delaware River (New Jersey) (Reine et al. 2014; ERC 2012). During these two studies, while the movements of tagged sturgeon were traced near a dredge, there were no interactions between tagged sturgeon and the dredge. Furthermore, tagged sturgeon moved through the dredge area during the study multiple times while the dredge was operating.

While entrainment of smaller sturgeon in cutterhead dredges has been observed (as evidenced by the presence of a few individual shortnose sturgeon at the Money Island Disposal Site in the Delaware River in 1996 and 1998), these instances are rare and have been limited to dredging events that occur near sturgeon overwintering areas where sturgeon are known to form dense aggregations. However, although sturgeon may be present in the action area year round, the action area is not a known overwintering area for Atlantic sturgeon. The risk of entrainment is also higher for small fish, including early life stages and small juveniles. Because these life stages are not present in the action area and the smallest sturgeon present would be at least 2.3 feet (the size at which we expect them to begin migrations from their natal river), the risk of entrainment is minimal in the action area. Increased risk factors (i.e., small fish, overwintering area) are not present in the action area, overall.

In addition to the habitat characteristics of the project area, the location and geography of a project may also affect the likelihood of entrainment. The risk of entrainment is believed to be highest in areas/environments where the movements of animals are restricted (e.g., rivers, narrow confined channels, small semi-enclosed harbors) and therefore, where the animal has limited opportunity to move away from the dredge. If these restricted areas also occur within sites in which a species is known to concentrate, the likelihood of an interaction further increases. These characteristics; however, are not present within the project area. The borrow area is situated within the Atlantic Ocean, an area we consider an open ocean environment; that is, an unconfined, body of water in which the shorelines of the surrounding land masses do not encroach on the body of water to an extent that narrow waterways are created. The distance from the BA to the nearest shoreline is approximately 2 miles to the north. As dredging operations will occur in an open environment, Atlantic sturgeon movements will be unrestricted, with ample space surrounding the project area for sturgeon to move and avoid the dredge, or dredge site and continue normal behaviors in other waterways of New York. Further, because Atlantic sturgeon are expected to be using the BA only as they move to other areas, the density of Atlantic sturgeon in any portion of the project area is expected to be low and thus, if an Atlantic sturgeon occurs in the area to be dredged, there is ample space and ability for the sturgeon to avoid the dredge. Based on this information, combined with the fact that Atlantic sturgeon are not expected to occur at the bottom of the BA, the potential for an interaction with a dredge is further reduced.

Based on the information above, and the following factors, we conclude that the risk factors that increase the likelihood for Atlantic sturgeon entrainment are not present since the BA is not constricted and cutterhead dredges historically have not posed significant risk to sturgeon. Based on this information, it is extremely unlikely that any impingement or entrainment of Atlantic sturgeon will occur. Effects of dredging on Atlantic sturgeon are discountable. Therefore, it is extremely unlikely that any sturgeon would be impinged or entrained in a cutterhead dredge operating within the project site; effects to sturgeon from the proposed hydraulic dredging operations are discountable.

Sea Turtles

The BAs are situated within the near shore waters of the Atlantic Ocean, an area we consider an open environment; that is, an unconfined body of water in which the shorelines of the surrounding land masses do not encroach on the body of water to an extent that narrow waterways are created. The distance from the BA project site to the nearest shoreline is approximately 1.5 to 2 miles to the north (Rockaway Beach, NY). As dredging operations will occur in an open environment, sea turtle movements will be unrestricted, with ample space surrounding the dredging area for sea turtles to move and avoid the dredge or dredge site and continue normal behaviors in other waterways of New York. Further, because sea turtles are only expected to transit the project area, and not congregate, the density of sea turtles in any portion of the project area is expected to be low. Based on this information, combined with the fact that sea turtles are not expected to occur on the benthos to forage or rest, the potential for an interaction with a dredge is further reduced.

Based on the information above, and the following factors, we conclude that the risk factors that increase the likelihood for sea turtle entrainment are not present since cutterhead dredges pose no risk to turtles since sea turtles are not known to be vulnerable to entrainment in cutterhead dredges. Sea turtles are not known to be vulnerable to entrainment in cutterhead dredges, presumably, because they are able to avoid the relatively small intake area and low intake velocity. Thus, if a sea turtle were to be present at the dredge site, it would be extremely unlikely to be injured or killed as a result of dredging operations carried out by a hydraulic cutterhead dredge. Impingement or entrainment is extremely unlikely to occur due to the nature of the dredge. We expect any sea turtles in the project area will be able to avoid interaction with the dredge because of the low density of turtles in the area and the low intake velocity of the machinery. Based on this information, it is extremely unlikely that there will be any impingement or entrainment of sea turtles. Based on this information, effects to sea turtles from the hydraulic cutterhead dredge are discountable.

B. Effects of Alteration on Prey items and Foraging due to Dredging

Atlantic Sturgeon and Sea Turtles

Dredging can cause effects on Atlantic sturgeon and sea turtles by reducing prey species through the alteration of the existing biotic assemblages and habitat. As forage for both species may be present in the project area (e.g., polychaetes, bivalves, and gastropods), opportunistic foraging may occur at the site and thus, dredging and the placement of fill (e.g., beach nourishment, groin construction) may cause effects to sturgeon and sea turtles by reducing prey species through the alteration of existing biotic assemblages and habitat. This reduction, however, will be temporary (i.e., recolonization will begin within two months, with complete recolonization in a year; Burlas *et al.* 2001; Guerra-Garcia and Garcia-Gomez 2006). Due to the limited benthic foraging in the borrow area, some nearshore areas may be more desirable to certain turtles or sturgeon due to prey availability. There is no information to indicate that the dredged areas or beach nourishment sites have more abundant sturgeon and turtle prey or better foraging habitat than other surrounding areas. The assumption can be made that sturgeon and sea turtles are not likely to be more attracted to the waters of the action area than to other foraging areas in the waters of NY and were able to find sufficient prey in these alternate areas.

While dredging and beach nourishment activities may temporarily disrupt normal feeding behaviors for sturgeon and sea turtles by causing them to move to alternate areas, dredging and beach nourishment activities are not likely to remove critical amounts of prey resources. Based on this and the best available information, we believe the impacts of dredging and fill operations on Atlantic sturgeon and sea turtle foraging are insignificant.

During dredging operations, ESA-listed species will avoid the immediate area when dredging or fill placement takes place. The proposed action will not alter the habitat in any way that prevents sturgeon or sea turtles from transiting the action area to other near-by areas suitable for foraging.

Additionally, as the purpose of the project is to renourish the beach, placement of fill will not impede the transiting or passage of sea turtles or Atlantic sturgeon through the area. Based on this and the best available information, we believe the impacts of dredging and fill operations on Atlantic sturgeon and sea turtle migration are insignificant.

Whales

ESA listed species of whales will not occur in the area where the construction of groins will occur and will not experience any effects from beach fill placement activities. ESA listed species of whales may be present within the BA where dredging will occur. As dredging operations will not be undertaken significantly within the migratory pathway of listed species of whales as that pathway is significantly expansive when compared with the BA footprint, migratory behaviors of whales will also not be affected.

C. Effects on Water Quality: Beach Nourishment, Groin Construction and Dredging

Beach Nourishment

Beach nourishment operations require the placement of large quantities of sand below the mean high water mark of a shoreline. The placement of dredged material along beaches or shorelines may cause an increase in localized turbidity in the nearshore environment. Nearshore turbidity impacts from fill placement are directly related to the quantity of fines (silt and clay) in the nourishment material. As the material from the borrow areas consists of beach quality sand of similar grain size and composition as indigenous beach sands, we expect short suspension time and containment of sediment during and after placement activities. As such, turbidity impacts would be short-term *(i.e.,* turbidity impacts will dissipate completely within several hours of the cessation of operations (Greene 2002) and will be spatially limited to the vicinity of the dredge outfall pipe, the pump out buoy/mooring station, and dredge anchor points.

The Atlantic States Marine Fisheries Commission (Greene 2002) review of the biological and physical impacts of beach nourishment cites several studies that report that the turbidity plume and elevated total suspended solids (TSS) levels drop off rapidly seaward of the sand placement operations. Wilber et al. (2006) evaluated the effects of a beach nourishment project along the coast of northern New Jersey and reported that maximum bottom surf zone and nearshore TSS concentrations related to nourishment activities were 64.0 mg/L and 34.0 mg/L, which were only slightly higher than background maximum bottom TSS concentrations in the surf and nearshore zones on unnourished portions of beach (i.e., less than 20.0 mg/L). Additionally, Wilber et al. (2006) reported that elevated TSS concentrations associated with the active beach nourishment site were limited to within 1,312 feet of the discharge pipe in the swash zone (defined as the area of the nearshore that is intermittently covered and uncovered by waves), while other studies found that the turbidity plume and elevated TSS levels are expected to be limited to a narrow area of the swash zone up to 1,640 feet down current from the discharge pipe (Schubel et al. 1978; Burlas et al. 2001). Based on this and the best available information, turbidity levels created by beach nourishment operations along the shoreline are expected to be between 34.0 to 64.0 mg/1; limited to an area approximately 1,640 feet down current from the area of sand placement; and, are expected to be short term, only lasting several hours.

Groin Construction

The placement of stone fill for the groin construction and repair will be done at depths of up to 20 feet from a crane aboard a barge and will disturb shoreline sediments and may cause a temporary increase in suspended sediment in the near-shore area. However, suspended sediment is expected to settle out of the water column within a few hours and any increase in turbidity will be short term.

Turbidity levels associated with any sediment plume are expected to be only slightly elevated above background levels. The crane will move at slow speeds which will allow any ESA-listed species to avoid being directly struck by the placement of fill. Based on this information, effects of stone placement to ESA-listed species are extremely unlikely, and therefore, discountable.

Dredging

Dredging operations cause sediment to be suspended in the water column. This results in a sediment plume in the water, typically radiating from the dredge site and decreasing in concentration as sediment falls out of the water column as distance increases from the dredge site. The nature, degree, and extent of sediment suspension around a dredging operation are controlled by many factors including: the particle size distribution, solids concentration, and composition of the dredged material; the dredge type and size, discharge/cutter configuration, discharge rate, and solids concentration of the slurry; operational procedures used; and the characteristics of the hydraulic regime in the vicinity of the operation, including water composition, temperature and hydrodynamic forces (i.e., waves, currents, etc.) causing vertical and horizontal mixing (ACOE 1983).

Cutterhead Dredging

Information on sediment plumes associated with hydraulic cutterhead dredges indicates that the concentration of suspended sediments resulting from hydraulic dredging would be highest close to the bottom and would decrease rapidly downstream and higher in the water column. Based on a conservative (i.e., low) total suspended solids (TSS) background concentration of 5.0 mg/L, the modeling results indicated that elevated TSS concentrations (i.e., above background levels) would be present at the bottom 6.6 feet of the water column for a distance of approximately l,150 feet (ACOE 1983). Based on these analyses, elevated suspended sediment levels are expected to be present only within 1,150 feet of the location of the cutterhead. Turbidity levels associated with cutterhead dredge sediment plumes typically range from 11.5 to 282.0 mg/L with the highest levels detected adjacent to the cutterhead and concentrations decreasing with greater distance from the dredge.

Effects on Whales, Atlantic Sturgeon, and Sea Turtles

No information is available on the effects of TSS on juvenile and adult sea turtles. Studies of the effects of turbid waters on fish suggest that concentrations of suspended solids can reach thousands of milligrams per liter before an acute toxic reaction is expected (Burton 1993).

TSS is most likely to affect sea turtles, subadult and adult Atlantic sturgeon, or whales if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting sea turtle or sturgeon prey. As whales, sturgeon, and sea turtles are highly mobile, they are likely to be able to avoid any sediment plume and any effect on their movements is likely to be insignificant. Additionally, the TSS levels expected from dredging (11.5 to 475.0 mg/L) or beach nourishment (34.0 to 64.0 mg/1) are below those shown to have an adverse effect on fish (580.0 mg/L for the most sensitive species, with 1,000.0 mg/L more typical; see summary of scientific literature in Burton 1993).
While the increase in suspended sediments may cause whales, Atlantic sturgeon, and sea turtles to alter their normal movements, any change in behavior is not able to be measured or detected, as it will only involve minor movements that alter their course out of the sediment plume which will not disrupt any essential life behaviors. Based on this information, we believe the effects of suspended sediment on whales, Atlantic sturgeon, and sea turtles resulting from increased turbidity from dredging and beach nourishment operations are insignificant.

D) Effects of Vessel Interactions

Whales, sea turtles, and sturgeon may be injured or killed as a result of being struck by boat hulls or propellers. The factors relevant to determining the risk to these species from vessel strikes vary, but may be related to the size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of individuals in the area (e.g., foraging, migrating, overwintering, etc.). We have considered the likelihood that an increase in vessel traffic associated with the project increases the risk of interactions between listed species and vessels in the project areas, compared to baseline conditions. The use of one cutterhead dredge will cause a small, localized, temporary increase in vessel traffic. Given the large volume of traffic in the project area, the increase in traffic associated with the projects is extremely small. Based on this information, we believe the effects of vessel traffic on whales, sea turtles, and sturgeon from dredging operations are insignificant.

There have not been any reports of dredge vessels colliding with listed species but contact injuries resulting from dredge movements could occur at or near the water surface and could therefore involve any of the listed species present in the area. Because the dredge will not be moving at great speeds during dredging operations, blunt trauma injuries resulting from contact with the hull are extremely unlikely during dredging. It is more likely that contact injuries during actual dredging would involve the propeller of the vessel. Contact injuries with the dredge are more likely to occur when the dredge is moving from the dredging area to its port, or between dredge locations.

The dredge vessel may collide with marine mammals and sea turtles when they are at the surface or, in the case of Atlantic sturgeon, in the water column when migrating. These species have been documented with injuries consistent with vessel interactions, and it is reasonable to believe that the dredge vessels could inflict such injuries on Atlantic sturgeon, marine mammals and sea turtles, should they collide. As mentioned, sea turtles are found distributed throughout the action area in the warmer months, generally from May through November; Right whales primarily from November 1 through April30; humpback and fin whales, spring, summer, and fall; and, Atlantic sturgeon throughout the year.

Whales

Large whales, particularly right whales, are vulnerable to injury and mortality from ship strikes. Ship strike injuries to whales take two forms: (1) propeller wounds characterized by external gashes or severed tail stocks; and (2) blunt trauma injuries indicated by fractured skulls, jaws, and vertebrae, and massive bruises that sometimes lack external expression (Laist *et al.* 2001). Collisions with smaller vessels may result in propeller wounds or no apparent injury, depending on the severity of the incident. Laist *et al.* (2001) reports that of 41 ship strike accounts that reported vessel speed, no lethal or severe injuries occurred at speeds below ten knots, and no collisions have been reported for vessels traveling less than six knots. Most ship strikes have occurred at vessel speeds of 13-15 knots or greater (Jensen and Silber 2003; Laist *et al.* 2001). An analysis by Vanderlaan and Taggart (2006) showed that at speeds greater than 15 knots, the probability of a ship strike resulting in death increases asymptotically to 100%. At speeds below 11.8 knots, the probability decreases to less than 50%, and at ten knots or less, the probability is further reduced to approximately 30%. As noted above, the speed of the dredge will not exceed 10-13.5 knots while transiting to and from the dredging areas.
In addition, all vessels will have lookouts on board to avoid vessel strikes with all protected species. Based on this information, we believe the effects of vessel traffic on whales from dredging operations are insignificant.

Sea Turtles

Interactions between vessels and sea turtles occur and can take many forms, from the most severe (death or bisection of an animal or penetration to the viscera), to severed limbs or cracks to the carapace which can also lead to mortality directly or indirectly. Information is lacking on the type or speed of vessels involved in turtle vessel strikes. However, there does appear to be a correlation between the number of vessel struck turtles and the level of recreational boat traffic (NRC 1990). Although little is known about a sea turtle's reaction to vessel traffic, it is generally assumed that turtles are more likely to avoid injury from slower-moving vessels since the turtle has more time to maneuver and avoid the vessel. The speed of the dredge will not exceed 1 0-13.5 knots while transiting to and from the dredging areas. In addition, the risk of ship strike is influenced by the amount of time the animal remains near the surface of the water. The presence of an experienced endangered species observer who could advise the vessel operator to slow the vessel or maneuver safely if sea turtles were spotted will be on board for all the dredging operations which further reduces the potential risk for interaction with vessels. Based on this information, we believe the effects of vessel traffic on sea turtles from dredging operations are insignificant.

Atlantic Sturgeon

The factors relevant to determining the risk to Atlantic sturgeon from vessel strikes are currently unknown, but they may be related to size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of Atlantic sturgeon in the area (e.g., foraging, migrating, etc.). Large vessels have been implicated because of their deep drafts (up to 40-45 feet) compared to smaller vessels (15 feet), which increases the probability of vessel collision with demersal fishes like sturgeon, even in deep water (Brown and Murphy 2010). Smaller vessels and those with relatively shallow drafts provide more clearance with the ocean bottom and reduce the probability of vessel-strikes. Because dredges have shallow drafts relative to the offshore environment, the chances of vessel- related mortalities are low.

The majority of documented vessel strikes have been observed in the Delaware and James rivers and current thinking suggests that there may be unique geographic features in these areas (e.g., potentially narrow migration corridors combined with shallow/narrow river channels) that increase the risk of interactions between vessels and Atlantic sturgeon. These geographic features are not present in the project area, which is sufficiently wide and deep enough to allow sturgeon passage while vessels were in the project area. We have considered the likelihood that an increase in vessel traffic associated with the project increased the risk of interactions between Atlantic sturgeon and vessels in the project area, compared to baseline conditions. The use of dredges will cause a small, localized, temporary increase in vessel traffic. Given the large volume of traffic in the project area, the increase in traffic associated with the project is extremely small. Based on this information, we believe the effects of vessel traffic on Atlantic sturgeon from dredging operations are insignificant.

Conclusion

Based on the analysis that all effects of the proposed action will be insignificant and/or discountable, we have determined that the East Rockaway Atlantic Shoreline beach nourishment segment of the TSP is not likely to adversely affect any listed species or critical habitat under NMFS' jurisdiction. We conclude that we have used the best scientific and commercial data available to complete this analysis. We request your concurrence with this determination.

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