United States Department of the Interior

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In Reply Refer to:

ES-05/119

MAY 2 4 2005

Richard E. Wells, Superintendent
National Park Service
Gateway National Recreation Center, Sandy Hook Unit
P.O. Box 530
Fort Hancock, New Jersey 07732

Dear Mr. Wells:

This letter transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion based on our review of the National Park Service's (NPS) proposed sand slurry pipeline project at the Sandy Hook Unit of Gateway National Recreation Area (Sandy Hook), located in Monmouth County, New Jersey, and the effects of the project on the federally listed (threatened) species piping plover (*Charadrius melodus*), seabeach amaranth (*Amaranthus pumilus*), and northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) in accordance with Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA). The Service commends the NPS for its considerable efforts in working with the Service, the New Jersey Department of Environmental Protection, the U.S. Army Corps of Engineers, and others to revise the originally proposed project and develop a modified project design that notably reduces adverse impacts to federally listed species.

With respect to ESA compliance, all aspects of the NPS's project description will be binding, including the specific nature, timing, and extent of proposed beach nourishment and stabilization activities, as well as all conservation measures proposed by the NPS to protect listed species. Reasonable and prudent measures and the accompanying terms and conditions provided within the enclosed Biological Opinion are nondiscretionary and are designed to minimize incidental take of listed species anticipated as a result of the construction and operation of the NPS's sand slurry pipeline system. In order to be exempt from the prohibitions of Section 9 of the ESA, the NPS must comply with the Terms and Conditions in the Biological Opinion, which implement the Reasonable and Prudent Measures.

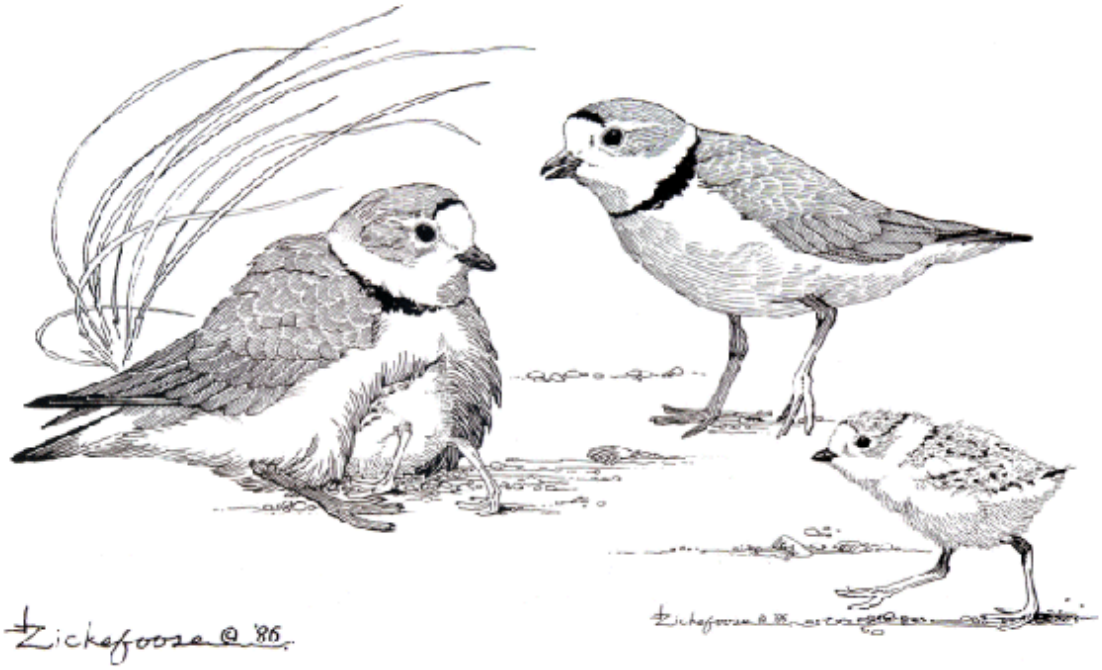
If you have any questions or concerns regarding this consultation, please contact John C. Staples or Annette M. Scherer of my staff at (609) 646-9310, extensions 12 and 34, respectively.

Sincerely,

Clifford G. Day
Supervisor

Enclosure

BIOLOGICAL OPINION ON THE EFFECTS OF CONSTRUCTION AND OPERATION OF A SAND SLURRY PIPELINE SYSTEM AT THE NATIONAL PARK SERVICE, SANDY HOOK UNIT, GATEWAY NATIONAL RECREATION AREA, MONMOUTH COUNTY, NEW JERSEY ON PIPING PLOVER (*Charadrius melodus*), SEABEACH AMARANTH (*Amaranthus pumilus*), AND NORTHEASTERN BEACH TIGER BEETLE (*Cicindela dorsalis dorsalis*)



Prepared by:

U.S. Fish and Wildlife Service
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Pleasantville, New Jersey 08232

May 2005

BIOLOGICAL OPINION ON THE EFFECTS OF CONSTRUCTION AND OPERATION OF A SAND SLURRY PIPELINE SYSTEM AT THE NATIONAL PARK SERVICE, SANDY HOOK UNIT, GATEWAY NATIONAL RECREATION AREA, MONMOUTH COUNTY, NEW JERSEY ON PIPING PLOVER (*Charadrius melodus*), SEABEACH AMARANTH (*Amaranthus pumilus*), AND NORTHEASTERN BEACH TIGER BEETLE (*Cicindela dorsalis dorsalis*)

Prepared for:

National Park Service
Gateway National Recreation Center
Sandy Hook Unit
Fort Hancock, New Jersey 07732

Prepared by:

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May 2005

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

I. INTRODUCTION

This document represents the U.S. Fish and Wildlife Service's (Service) Biological Opinion, in accordance with Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq*.) (ESA), on the effects of the National Park Service's (NPS) proposed sand slurry pipeline project at the Sandy Hook Unit of Gateway National Recreation Area (Sandy Hook), located in Monmouth County, New Jersey, on the federally listed (threatened) species piping plover (*Charadrius melodus*), seabeach amaranth (*Amaranthus pumilus*), and northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*).

To ensure the protection of federally listed species, the NPS proposes to implement conservation measures for piping plover, seabeach amaranth, and northeastern beach tiger beetle as an integral component of the construction and ongoing annual operation of the sand slurry pipeline project. For the purposes of this consultation, the Service evaluated the project description along with the NPS's proposed conservation measures to minimize or avoid adverse impacts to federally listed species. This Biological Opinion is based on information provided within the *Environmental Assessment for Cyclic Beach Replenishment at Sandy Hook Unit, Gateway National Recreation Area, New York – New Jersey* (EA) (National Park Service, 2004), which included the NPS's Biological Assessment (BA) of the effects of the sand slurry pipeline project on federally listed species as an Appendix of the EA. In formulating this Biological Opinion, the Service also considered supplemental information provided by the NPS for Service review, and discussions with the NPS as outlined below.

A complete administrative record of this consultation is on file in the Service's Ecological Services, New Jersey Field Office (NJFO).

II. CONSULTATION HISTORY

A. BACKGROUND

The proposed sand slurry pipeline project is intended as a long-term solution to address erosion at an area of Sandy Hook's southern Atlantic shoreline known as the Critical Zone. Persistent erosion at the Critical Zone threatens vehicular access to the Sandy Hook peninsula, park infrastructure, and important historic and natural features. Since 1974, the NPS has conducted beach nourishment projects approximately every 5 to 7 years to maintain the shoreline at the Critical Zone. Previous fills were conducted in 1977, 1982-83, 1989-90, 1996-97, 1997-98, and 2002 (National Park Service, 2004). Since 1990, management of the Critical Zone has involved responding to critical erosion situations as they arose, including a series of smaller beach fills. The NPS's proposal to provide cyclic, maintenance beach replenishment at the Critical Zone, via a permanent sand slurry pipeline, strives to depart from this past "crisis management" approach.

The NPS has conducted ongoing informal consultation with the Service regarding the proposed sand slurry pipeline since 1997. As part of this consultation, the NPS and the Service reached agreement on several points at a March 12, 2001 meeting, including the need for formation of a technical work group to modify and refine the sand slurry pipeline project to avoid, minimize,

and offset adverse impacts to listed species to the maximum extent possible. As an interim measure, while revisions to the long-range sand slurry pipeline proposal were being developed, and to allow for thorough evaluation of the environmental effects of the long-term project, the NPS conducted a short-term, interim beach replenishment project in conjunction with ongoing renourishment of northern Monmouth County beaches by the U.S. Army Corps of Engineers, New York District (Corps). In 2002, the Service issued a separate Biological Opinion on the interim beach fill at the Critical Zone.

B. CHRONOLOGY OF KEY CORRESPONDENCE, MEETINGS, AND COMMUNICATIONS

During informal consultation and following initiation of formal consultation, the Service, the NPS, and NPS consultants have participated in numerous meetings and engaged in regular communications via telephone, electronic mail, or facsimile to refine the sand slurry pipeline project and clarify and exchange information. A chronology of key correspondence and meetings is provided below.

November 19, 1997	The Service met with representatives of the NPS, Corps, and New Jersey Department of Environmental Protection (NJDEP) to discuss the need for periodic renourishment of the Critical Zone and the NPS's preferred sand slurry pipeline alternative.
March 27, 1998	Via letter, the Service requested that the NPS provide information on historic, current, and anticipated post-project accretion and erosion rates and potential impacts to the piping plover and northeastern beach tiger beetle and their habitats from the proposed sand slurry pipeline.
June 7, 1998	Via letter, the NPS provided the Service with additional project details and information on littoral sand deposition rates and anticipated project impacts on sand transport at federally listed species sites. The NPS requested Service concurrence that the proposed project would have no adverse affect on federally listed species.
September 24, 1998	The NPS was informed via letter that the Service could not concur with the NPS's determination that the project was not likely to adversely affect federally listed species. The Service advised the NPS that formal consultation was required.
May 4, 2000	During a meeting held at the Service's NJFO, the NPS hand-delivered and discussed its preliminary EA, draft BA of potential impacts to piping plovers, and a final revegetation proposal for areas impacted by pipeline construction.
July 13, 2000	Via letter, the Service provided the NPS with comments on the preliminary EA, draft BA and final revegetation proposal. The Service

	recommended that the NPS revise its BA to include an assessment of potential impacts to the northeastern beach tiger beetle at beaches north of the sand borrow site. In addition, due to the recent recolonization by seabeach amaranth of coastal beaches in Long Island, New York, the Service recommended that the BA assess potential impacts to seabeach amaranth and its habitat should the plant become re-established at Sandy Hook over the life of the project. Further, the Service recommended that, in compliance with Executive Order 13112, the NPS revise its revegetation plan to eliminate proposed use of non-native species.
March 12, 2001	The Service met with the NPS and coastal geomorphologists from the U.S. Geological Survey (USGS) and Rutgers University to discuss the proposed sand slurry pipeline project and gain a better understanding of the potential project effects on sand transport and coastal processes along the Sandy Hook shoreline. The Service and the NPS identified the need for formation of a technical focus group to redesign the proposed project and develop measures to lessen project impacts to federally listed species.
July 23, 2001	Via letter, the NPS requested consultation regarding the interim beach fill project at Sandy Hook's Critical Zone.
July 26, 2001	The Service participated in a meeting of the sand slurry pipeline focus group / work team at Sandy Hook to identify outstanding concerns regarding federally listed species and other natural resources. Team participants included representatives of the Service, NPS, Corps, USGS, NJDEP, Terwilliger Consulting, Inc., and Rutgers University.
May 23, 2002	Via electronic mail, on behalf of the NPS, Terwillinger Consulting, Inc. forwarded copies of the draft EA and BA for the sand slurry pipeline project to the Service for review.
May 30, 2002	The Service submitted a final Biological Opinion on the interim beach fill at the Critical Zone.
June 21, 2002	The Service met at Sandy Hook with NPS staff and NPS consultants from Rutgers University and Terwilliger Consulting, Inc. During the meeting, the Service provided verbal comments on the NPS draft EA/BA and offered recommendations to further reduce impacts to federally listed species. The NPS agreed to incorporate the Service's recommendations as conservation measures.
September 13, 2004	Via letter, the NPS transmitted a final EA, prepared pursuant to the National Environmental Policy Act (83 Stat. 852; 42 U.S.C. 4321 *et seq.*), to the Service for review and a request for formal consultation on the sand slurry pipeline project. The EA included the NPS's BA, evaluating the

	effects of the sand slurry pipeline project on federally listed species, as an Appendix.
October 18, 2004	Via electronic mail, the Service informed the NPS that the EA / BA did not provide sufficient information to allow the Service to evaluate the proposed mitigation and conservation measures. The Service recommended scheduling a conference call to discuss additional information needed for initiation of formal consultation.
November 10, 2004	Via telephone, the Service identified additional information that was needed from the NPS to complete the formal consultation initiation package. In particular, additional detailed information was needed regarding the NPS's park-wide predator and piping plover management programs proposed as conservation measures to offset potential project-related impacts to piping plovers nesting at the Critical Zone.
December 20, 2004	By electronic mail, the NPS provided additional information clarifying predator control actions that would be undertaken throughout Sandy Hook as a conservation measure to offset potential project-related impacts to piping plovers nesting at the Critical Zone.
December 28, 2004	Via letter, the NPS was notified that, although additional clarification was needed regarding some aspects of the sand slurry pipeline project and proposed conservation measures, the Service had received sufficient information for initiation of formal consultation.
January 10, 2005	Via e-mail, the Service provided the NPS with a list of topics / issues where further clarification was needed.
January 12, 2005	Representatives of the Service, NPS, and NJDEP, Endangered and Nongame Species Program (ENSP) met to discuss project details and gain a better understanding of how the NPS would implement the proposed conservation measures. Remaining unresolved items that the NPS was unable to address at the meeting were identified.
February 2, 2005	Via electronic mail, the NPS provided the Service with clarification and further information on the anticipated effects of the project on coastal processes, anticipated staffing levels to conduct monitoring of project impacts and implement proposed conservation measures, and the results of seabeach amaranth surveys and monitoring by NPS staff.

III. DESCRIPTION OF THE PROPOSED ACTION

A. OVERVIEW OF SANDY HOOK

Located in Monmouth County, New Jersey, Sandy Hook is an 1,825-acre (730-hectare) accreting, recurved barrier spit that lies at the northern end of the barrier island / barrier beach system within New Jersey. Sandy Hook extends northwest into lower New York Bay along approximately 7 miles (11.2 km) of Atlantic Ocean shoreline, varying in width from 0.06 miles to 1.02 miles (0.1 to 1.7 km), and is bordered to the east by the Atlantic Ocean and to the west by Sandy Hook Bay (Figure 1). A unit of the Gateway National Recreation Area, the entire Sandy Hook peninsula is managed by the NPS for natural and historic resources and recreation, except the northern tip, which is U.S. Coast Guard property. In addition, approximately 1,000 employees work on Sandy Hook at several facilities housing State and federal agencies, schools, and private organizations (National Park Service, 2004). Further information regarding facilities, recreational use, and natural habitats not summarized within this Biological Opinion can be found within the NPS's (2004) EA/BA.

Over two million people visit Sandy Hook annually, attracting approximately 46,000 visitors on summer weekends. Popular recreational uses at Sandy Hook's ocean beaches include swimming and surfing, sunbathing, picnicking, beach walking, kite flying, and fishing. To protect sensitive areas and species from human disturbance, the NPS established six protected areas at Sandy Hook (see Figure 1): North Beach; North Gunnison Beach; South Gunnison Beach; Critical Zone; Hidden Beach; and Fee Beach. These areas, comprising almost 50 percent of the Sandy Hook shoreline and about 90 percent of the park's wide, northern beaches, encompass all of the current piping plovers nesting areas and known northeastern beach tiger beetle sites (National Park Service, 2004). Seabeach amaranth occurs within the protected areas and also on beaches north of the Critical Zone and between the "F" Parking Lot and South Gunnison Beach.

The Atlantic shores of New Jersey are dynamic, high-energy beach environments, characterized by shifting sands, pounding surf, strong wave action, and a semi-diurnal tidal cycle (U.S. Army Corps of Engineers, 1990). Along with coastal storms, these natural coastal processes continually reshape the configuration of the Sandy Hook shoreline and its associated natural habitats. Like most barrier island and barrier spit systems, Sandy Hook has experienced dynamic geomorphologic changes over time. In the past, natural episodes of overwash and breaching have occurred at the narrow, southern portion of Sandy Hook, followed by later periods of deposition. Within the 18th and 19th Centuries, Sandy Hook became an island on several occasions with as many as four inlets forming between the ocean and the Navesink-Shrewsbury River system and was connected to the mainland at two different sites. Beginning in 1900, significant efforts were made to stabilize the New Jersey coast (National Park Service, 2004).

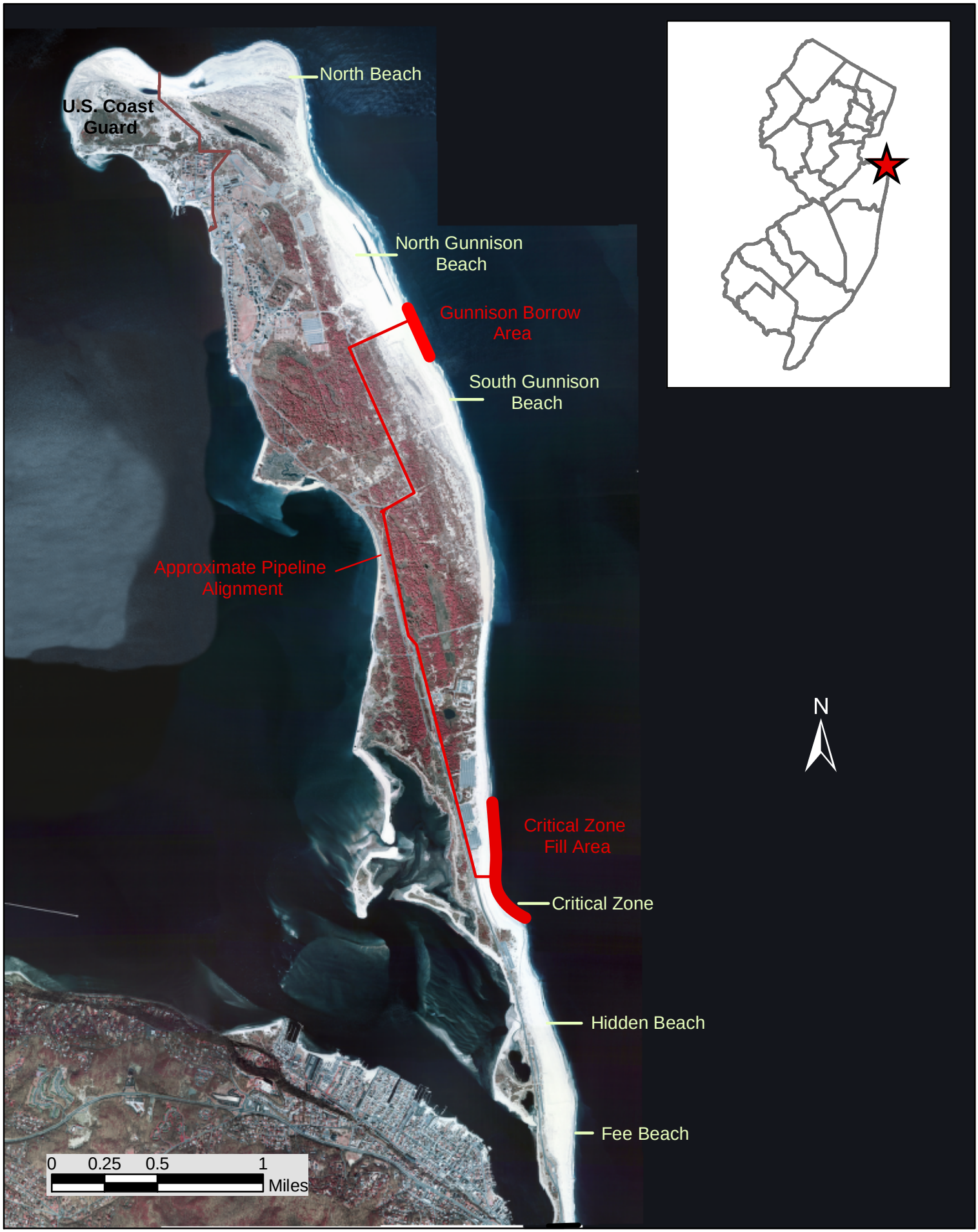


Figure 1. Sandy Hook Sand Slurry Pipeline Project Location

Alongshore currents on the central New Jersey coast run from south to north. These currents cause a northbound littoral drift, which tends to erode sand from Sandy Hook's southern beaches and the municipal beaches in Sea Bright and Monmouth Beach to the south of the park. In recent decades, erosion of southern Sandy Hook has accelerated because of man-made coastal structures. This has been particularly true in the area known as the Critical Zone. Jetties and groins built over the previous century in Monmouth Beach, Sea Bright, and southern Sandy Hook, and a sea wall running approximately 1.5 miles (2 kilometers) north from the park's southern boundary, prevent sand from reaching Sandy Hook's southern beaches. These beach protection structures, designed to prevent erosion, interfere with the northern littoral drift of sand along the shoreline. Hard stabilization structures also interfere with coastal processes by attempting to freeze the shoreline in place, halting the natural process of shoreline migration. These structures generally have the effect of accelerating erosion and curbing accretion. While some sand from southern beaches is deposited at the Critical Zone (particularly following beach replenishment events occurring south of the park), most sand bypasses the Critical Zone and is eventually deposited at the accreting northern end of the Sandy Hook spit. Gunnison, North, and U.S. Coast Guard beaches have all enlarged due to accretion. Some sand bypasses the Sandy Hook spit, drifting into maintained shipping channels in lower New York Bay where it is dredged and removed from the system (National Park Service, 2004).

B. CRITICAL ZONE

Since the establishment of Gateway National Recreation Area in 1974, the Critical Zone has experienced periodic overwash from both the bay and the ocean. Overwash has resulted in occasional closures of Hartshorne Drive, the only vehicle access onto the Sandy Hook peninsular spit (Wells, pers. comm., 2005). Following episodes of severe erosion, beach nourishment activities were undertaken to stabilize the Critical Zone and protect park infrastructure to the north using sand trucked from other areas or sand pumped from offshore sand sources. Previous replenishment projects occurred in 1977, 1982-83, 1989-90, 1996-97, 1997-98, and 2001-02. A sheetpile bulkhead was also installed along the east side of Hartshorne Drive to prevent a breach. A summary of past stabilization efforts at the Critical Zone is presented within the EA/BA (National Park Service, 2004).

Past performance models calculated that approximately 1.5 million cubic yards (cy) of sand would be needed for replenishment at the Critical Zone every 5-7 years, or 250,000 cy per year, to counter beach erosion. The recent large-scale Corps beach replenishment projects immediately south of Sandy Hook at Sea Bright and Monmouth Beach have significantly altered the nearshore sand budget and increased sediment availability in the Critical Zone by providing more sand for transport around and past the seawall into the Sandy Hook system. The total amount of sand needed to maintain a stable system and prevent sand deficit is now estimated to be 100,000 cy per year, less than half of original projections. An estimated 200,000 cy of sand now moves through the Sandy Hook system on an annual basis and is anticipated to continue over the remainder of 50-year life of the nearby Corps project. Therefore, the NPS anticipates that the nearby Corps project will reduce the additional quantity of sand needed to be deposited by the NPS at the Critical Zone to counter erosion (Psuty, pers. comm., 2002; National Park Service, 2004; Wells, pers. comm., 2005). Since the Corps project is dependent on continued

availability of funding and a sufficient off-shore sand source, the NPS anticipates that in some years, sand transport from the adjacent Corps project may be reduced if Corps nourishment cycles are delayed. Therefore, the NPS estimates that the additional amount of sand that the NPS will need to deposit at the Critical Zone via the sand slurry pipeline will average 55,000 cy per year, but may be as high as 100,000 cy in some years (Wells, pers comm., 2005).

C. PROPOSED SAND SLURRY PIPELINE PROJECT

The sand slurry pipeline system will maintain shoreline equilibrium by placing small volumes of sand at the Critical Zone on an annual basis. The system entails a sand retrieval excavator system at the borrow area, a permanent slurry pipeline to transport the sand, booster pumps installed on concrete pads along the pipeline, and temporary pipes that would extend to the source and discharge sites. Life expectancy of the pipeline infrastructure is estimated at 30 years. Key elements of the project are provided below; a more detailed description of the sand slurry pipeline system is provided within the EA/BA (National Park Service, 2004).

Sand would be "borrowed" from the northern, accreting portion of Sandy Hook at the Gunnison Beach recreational beach and deposited on the eroding southern beach at the Critical Zone. The system will provide NPS the flexibility of recycling from 0 to 100,000 cy of sand annually (as needed) to maintain shoreline equilibrium. This system would utilize the sand moving through the Sandy Hook nearshore sediment transport. Sand extraction is anticipated to occur primarily from the swash bar and migratory shoals that weld onto the beach face and extend the intertidal zone seaward. Excavation is not anticipated to lower beach elevation as no excavation will occur above the spring high tide line; sand slurry removal will occur from the intertidal zone seaward. A maximum of 100,000 cy/year of sand would be pumped during suitable weather conditions during the months of October through February (National Park Service, 2004).

The sand retrieval excavator system consists of a crawler mounted crane with an approximate 200-foot-long boom, equipped with an educator nozzle that is lowered to the sand surface for sand retrieval. This movable crawler-mounted system can excavate an area 150 feet long x 60 feet wide x 6 feet deep without being moved (National Park Service, 2004). Taking into account that the crane may be moved several times per season, the anticipated maximum area to be impacted by the dredge in any one season of operation is 1,000 feet in length x 60 feet in width x 6 feet maximum depth (Lane, pers. comm., 2005). With maximum borrow material of 100,000 cy removed, the NPS estimates that a maximum of 50 pumping days of 2,000 cy/day would occur in any one year. The depression created by the excavator is expected to re-fill with sediments transported by nearshore currents within two tidal cycles.

Slurried sand will be transported via permanent pipeline to the Critical Zone beach where it will be ejected out onto the beach face and intertidal zone. The proposed permanent pipeline alignment will follow the park's main access road to avoid sensitive natural and cultural resources (National Park Service, 2004). A total of three discharge outlets will be installed in the pipeline at the southern end to allow the discharge to be targeted where fill is most needed. The NPS anticipates that only one discharge outlet per year will be utilized (Lane, pers. comm., 2005).

Each year, temporary pipelines will be connected to the permanent pipeline at the borrow and deposition areas. Temporary pipelines will be installed with the aid of tracked vehicles. The area to be disturbed annually at Gunnison Beach by activities associated with the sand slurry pipeline system (*i.e.,* set up and removal of crane; motorized vehicle and/or heavy equipment operation) is estimated at approximately 2 acres and the disturbance will occur on the public bathing beach area, avoiding known piping plover nesting and foraging areas. At the southern sand discharge area, project-related disturbance may extend from the Critical Zone to parking Lots D and E. When necessary to restore appropriate beach profiles by March 1, bulldozers may be used at the deposition site(s) to contour any remaining sand mounds. However, since most sand will be deposited seaward of the upper beach during the winter months, the NPS expects that the fill will be shaped and distributed by weather and wave conditions to a beach profile typical for the site under current conditions. The area of disturbance will be relative to the amount of sand needed to replenish eroded areas and is estimated at approximately three acres per year. Most disturbances would occur on beach areas heavily used for recreation and thus not likely to provide suitable habitat for federally listed species (National Park Service, 2004; Lane, pers. comm. 2005).

Periodic beach profile surveys are a maintenance component associated with the proposed project. Surveys will be conducted using a vehicle-mounted Global Positioning System (GPS) for development of a digital atlas of the Sandy Hook shoreline to assess sand conditions at the project borrow and deposition sites and at areas downdrift of the project. Surveys will be conducted monthly at the Critical Zone, quarterly at Gunnison beach, and annually in sensitive beach areas with occurrence of federally listed species. Additional beach profiles will be collected aerially using LIDAR (Light Detection and Ranging) technology.

D. ACTION AREA

As defined in 50 CFR 402.02, the "action area" to be considered during consultation on an activity or program authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas, 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." Indirect effects are "those that are caused by the proposed action and are later in time, but are still reasonably certain to occur."

Approximately 1,000 feet (300 meters) of shoreline at Gunnison Beach, and approximately 3,000 feet (915 meters) of shoreline at the Critical Zone from the northern end of the seawall to the southern end of Parking Lot E will be directly affected by sand removal and deposition activities, respectively. Other areas will be indirectly affected by project-related activities and are therefore included within the action area. The entire shoreline of Sandy Hook will be monitored to assess shoreline changes associated with the project. Areas downdrift of the borrow and deposition sites will be indirectly affected by changes in the amount of available sand moving through the Sandy Hook nearshore sediment transport system. Additionally, by forestalling overwash and/or a breach at the Critical Zone, the NPS is preserving vehicle and pedestrian access to the park, indirectly affecting the entire Sandy Hook spit from the Critical Zone north. Further, the NPS

proposes to implement measures throughout the park to minimize impacts to federally listed species from the direct and indirect effects of the proposed project. Therefore, for the purposes of this Biological Opinion, the action area includes the entire Sandy Hook Unit of Gateway National Recreation Area.

E. CONSERVATION MEASURES PROPOSED TO MINIMIZE IMPACTS TO FEDERALLY LISTED SPECIES

To minimize impacts to federally listed species from the direct and indirect effects of the proposed sand slurry pipeline project, the NPS proposes to implement the following conservation measures as summarized below from the EA/BA (National Park Service, 2004) and supplemental information provided by park staff (Lane, pers. comm., 2004; 2005; Wells, pers. comm., 2005).

1. Conservation Measures to Protect All Species

a. Shoreline Change Monitoring

Shoreline change will be monitored under contract with Rutgers Institute of Marine and Coastal Science. Detailed profiles will measure volumetric changes at the Critical Zone from the end of the seawall at Area C to the north end of Parking Area E to determine where losses are occurring, what facilities or infrastructure are threatened, and where to place sand if necessary. The Gunnison Beach (borrow area) will be monitored for volumetric changes, but on a less detailed scale. Four additional transects will be added to north Beach and Coast Guard beach to provide profiles from the toe of the dune to the water. This will help to evaluate any changes in these areas as a result of the sand recycling operation. Shoreline position will be monitored through aerial photography.

b. Endangered Species Monitoring

Current NPS staff assigned to implementation of federally listed species monitoring and management actions at Sandy Hook includes 2 full-time permanent resource management positions in the Park Ranger job series, and 4 seasonal positions in the Biological Technician job series or through the Student Conservation Assistant volunteer program. In addition, 13 permanent law enforcement employees, supplemented by varying numbers of seasonal law enforcement positions, provide support in enforcing park regulations and preventing unauthorized access into areas closed to protect federally listed species (Lane, pers. comm., 2005).

Two seasonal Biological Technicians will be added to the existing staff to monitor populations and potential adverse impacts to piping plover, seabeach amaranth, and northeastern beach tiger beetle. These staff will also implement conservation measures to protect listed species. The two additional seasonal Biological Technicians will be hired commensurate with initiation of sand slurry pipeline construction activities and continuing annually for the 30-year life of the project (National Park Service, 2004; Lane, pers. comm., 2005).

c. Off-Road Vehicles

Use of off-road vehicles by the public will continue to be prohibited year-round at Sandy Hook to prevent impacts to listed species and their habitats.

d. Remediation of Vegetation and Ground Disturbance

Vegetated areas impacted by construction will be restored to natural pre-project conditions where possible. In dune areas, native beach grasses will be used.

e. Invasive Species Control

The NPS will implement a program to remove invasive non-native vegetation in areas managed for the protection of federally listed species.

2. Conservation Measures to Protect Piping Plovers

Protection for piping plovers will continue throughout Sandy Hook as outlined within the NPS's (1992) piping plover management plan unless superseded by the conservation measures outlined below. For the purposes of this Biological Opinion, a piping plover "nesting area" is defined by the Service as the entire site currently occupied by courting, territorial, incubating, or brood-rearing piping plovers, nests with eggs, or unfledged chicks, or any site so occupied during any of the three most recent nesting seasons (including the current season if territories have already been established for the year). "Potentially suitable" piping plover nesting habitat is habitat that contains natural features associated with known plover habitat and that could reasonably be expected to be occupied by piping plovers either in the upcoming nesting season or in the reasonably foreseeable future. A "fledged chick" is defined as one that has been observed in level flight for more than 15 meters, rather than a chick having reached 25 days of age.

a. Project Timing and Operation

Construction and operation of the sand slurry pipeline system will occur outside of the piping plover breeding season (March 15 – August 15) to avoid direct disturbance to nesting birds and their young. Annual operation of the sand slurry pipeline will be scheduled to begin after October 1 and conclude prior to March 1 each year. Beach profile surveys will be scheduled to avoid and / or minimize impacts to nesting plovers.

At Gunnison Beach, sand removal will occur outside piping plover nesting areas; specifically, sand will be removed from the approximately 1,500-foot portion of Gunnison Beach lying between the North Gunnison and South Gunnison protected areas. Only that amount of sand accreting each year in this area will be removed by the sand slurry pipeline project.

b. Habitat Monitoring and Management

Vegetation and other beach characteristics important to plovers will be monitored and managed to maintain optimum nesting and foraging conditions. Beach characteristics will be monitored through analysis of GPS shoreline profiles and aerial LIDAR surveys. If vegetation succession and / or shoreline changes diminish the amount or quality of piping plover habitat available, the NPS will implement habitat management / restoration efforts.

c. Invertebrate Monitoring

The NPS will contract monitoring of invertebrates in sampling transects downdrift, within, and updrift of the sand borrow and discharge areas to evaluate potential project-related impacts to piping plover prey resources. The purpose of the monitoring would be to determine changes in composition of the invertebrate species and to determine if re-colonization has occurred in the project site. This work would be conducted for the first 2 to 3 years of slurry pipeline operation.

d. Piping Plover Monitoring

The NPS will continue to monitor piping plover nesting and reproductive success throughout the nesting season on all park beaches, using qualified, trained biologists, to ensure the sand slurry pipeline project does not have an adverse effect on nesting piping plovers. Field data will be collected and recorded daily.

e. Monitoring and Management of Public Use Near Nesting Areas

An intensive program will be implemented to monitor and manage all potential public use activities that may harm or harass breeding piping plovers, including kite flying, jogging, walking, fireworks, fishing, picnicking, and other beach activities. All nesting areas will be signed and fenced with wire or string symbolic fencing. Intertidal zones adjacent to piping plover nesting areas will be closed when nests hatch and chicks become mobile (approximately May 15) and will remain closed until all chicks at a site have fledged (approximately August 15). For all potential public use activities that may harm or harass breeding piping plovers, immediate corrective action will be taken and adaptive management will be applied and incorporated into established management practices to prevent further occurrences. An adequate number of trained personnel will be assigned to monitor, prevent, and enforce human and other disturbances at each piping plover nesting site. In particular, trained personnel will be stationed at the ends of the protected zone at the Critical Zone to enforce protective measures.

If piping plovers nest within areas receiving fill or accreting as a result of fill activities, new nesting areas will be closed to public access and the sites will receive the same level of protection afforded existing nesting areas. The area to be closed will, at a minimum, include the nesting area and a 100-meter buffer from the nest site.

f. Outreach and Education

Outreach and educational efforts will be increased at Sandy Hook to increase compliance with protective measures to reduce take of piping plovers from recreational uses at the park.

g. Off-Road Vehicles

Use of off-road vehicles by the public will continue to be prohibited year-round at Sandy Hook to prevent impacts to piping plovers and their nesting habitat[1].

h. Predator Monitoring and Management

An intensive predator monitoring and management program will be implemented to reduce impacts to piping plover nests, adults, and young. Dogs will be prohibited on ocean beaches from March to September. To prevent attracting predators, all trash cans were removed from the beach and adjacent parking areas. The park has implemented a "carry in - carry out" trash policy that requires visitors to remove any trash from items brought into the park. Trapping of free-roaming cats has been expanded to include year-round trapping, including at beach centers and shorebird nesting areas.

Predator exclosures will be used to protect piping plover nests from mammalian and avian predators such as red foxes (*Vulpes vulpes*), raccoons (*Procyon lotor*), crows (*Corvus* sp.) and gulls (*Larus* sp.). Some predators, particularly red fox, may learn that eggs are located within the predator exclosures and, subsequently, key in to other nearby exclosures. In such situations, the NPS will use electrified wire around exclosures in problem areas where the standard non-electrified exclosures have not been sufficient. In nesting areas with a history of fox predation, foxes will be live trapped and released outside of the park in coordination with the NJDEP. Other mammalian predators will be live trapped and relocated to areas of the park outside of the nesting areas. Trapping and relocation will target problem individuals.

3. Conservation Measures to Protect Seabeach Amaranth

The annual operation of the sand slurry pipeline (October 1 - March 1) will occur during the period when seabeach amaranth plants are present on the beach. The growing season of seabeach amaranth in northern New Jersey may extend as late as December in some years. To minimize impacts to seabeach amaranth, the NPS proposes to implement the conservation measures explained below throughout Sandy Hook.

[1] In accordance with the NPS's (1992) piping plover management plan, use of NPS vehicles within piping plover nesting areas is also prohibited except in emergency situations.

a. Surveys and Protection in Construction Areas

Most seabeach amaranth plants can be expected to occur outside of the borrow area and fill template, but plants may occur in areas where construction related motorized vehicles and/or heavy equipment will be operated. Prior to initial project construction and prior to the annual operation of the sand slurry pipeline, the NPS will survey all areas to be impacted by construction-related activities to document the presence or absence of seabeach amaranth. The survey method will provide adequate coverage of potential seabeach amaranth habitat in the work area.

In the event that seabeach amaranth is found within an area to be affected, information regarding the plants will be recorded, including plant locations, numbers of plants and size of plants. The plants and a protective buffer, approximately 10 feet in diameter, will be fenced with string and post fencing to prevent disturbance to the plants. All construction activities will avoid any delineated locations of seabeach amaranth to the greatest practicable extent to prevent damaging or destroying the plants.

b. Restoration of Seabeach Amaranth Plants Likely to be Destroyed

In the event that construction activities cannot avoid damage or destruction of seabeach amaranth plants, the affected plants will be transplanted to a nearby suitable habitat and be protected by fencing. Prior to plants being moved, seeds, if present, will be harvested and stored. The seeds will be distributed the following season to the same area from which they were collected. The NPS will coordinate with the Service and other appropriate agencies / organizations prior to implementing the proposed translocation strategy.

c. Seabeach Amaranth Surveys and Monitoring

The NPS will monitor all suitable habitats at Sandy Hook for the presence of seabeach amaranth during the core growing season (May – October). Plants occurring outside of established protected areas will be fenced using string and post fence to prevent damage or destruction of plants from recreational users or NPS beach management operations.

The NPS will conduct an annual survey of seabeach amaranth plants and will record the GPS location of plants or groups of plants found. Information collected will include, but not be limited to, number of plants, plant size, reproductive state, location on beach profile (position relative to the dune or high water line), plant associates, and evidence of predation or other apparent threats. Populations will be monitored for evidence of herbivory, both insect and mammalian. Herbivores will be identified, if possible.

d. Seed Storage

A program of long-term storage of amaranth seeds, collected from various parts of Sandy Hook, will be implemented as insurance against catastrophic population declines.

4. Conservation Measures to Protect Northeastern Beach Tiger Beetle

No northeastern beach tiger beetles have been found in the borrow or fill areas. However, the NPS recognizes that over the 30-year life of the project, areas at Sandy Hook occupied by the northeastern beach tiger beetle may expand or change. Therefore, the NPS will conduct annual surveys for the northeastern beach tiger beetle in suitable habitats at Sandy Hook, including the Gunnsion Beach borrow area and Critical Zone deposition area. The presence of adult tiger beetles at the borrow or deposition area will trigger the need to survey the affected site for the presence of beetle larvae. If larvae are found, the NPS will reinitiate consultation with the Service to determine if site-specific protective measures can be developed to minimize any adverse impacts to the species from planned activities.

IV. SPECIES STATUS

A. PIPING PLOVER AND SEABEACH AMARANTH

The Service previously provided the NPS with relevant biological and ecological information for the piping plover and seabeach amaranth in a Biological Opinion, dated May 30, 2002, for the NPS's interim beach fill at the Critical Zone and South Beach areas of Sandy Hook (U.S. Fish and Wildlife Service, 2002). That information remains pertinent and was considered by the Service in formulating this Biological Opinion.

B. NORTHEASTERN BEACH TIGER BEETLE

Relevant biological and ecological information for the northeastern beach tiger beetle considered by the Service in formulating this Biological Opinion is presented below. Appropriate information on the species life history, habitats, distribution, and other factors affecting species survival is included to provide background for analyses in later sections. This section also documents the effects of past human and natural activities or events that have led to the current status of the species.

1. Species Description

The northeastern beach tiger beetle is a beach-dwelling insect measuring approximately 1.3 cm in length. The tiger beetle has white to light tan wing covers, often with several fine grayish-green lines, and a bronze-green head and thorax (Knisley, 1991; U.S. Fish and Wildlife Service, 1994). The northeastern beach tiger beetle has a unique arrangement of markings on the wing covers. Individuals from Massachusetts and Rhode Island to Long Island, northern New Jersey, and Chesapeake Bay are known to have varying amounts of these markings that generally decrease from north to south (Knisley, 1987a). In August 1990, the northeastern beach tiger beetle was listed as threatened pursuant to the ESA.

The northeastern beach tiger beetle populations in the Chesapeake Bay and the Atlantic coast are currently physically and genetically isolated from each other. Vogler *et al*. (1993) examined the

genetic variation in the existing populations of northeastern beach tiger beetles found in Chesapeake Bay, Calvert County, Maryland and Martha's Vineyard, Dukes County, Massachusetts. A minimum amount of genetic variability was found within the isolated Martha's Vineyard and Chesapeake Bay populations, which may indicate a history of frequent natural local extinctions. The Martha's Vineyard population can be further distinguished by the presence of an allozyme allele that has not been observed in the Chesapeake Bay beetles (U.S. Fish and Wildlife Service, 1994). Although populations from these two areas represent the same subspecies, they should be considered as separate conservation units (Vogler and DeSalle, 1994; U.S. Fish and Wildlife Service, 1994).

The recovery plan for the northeastern beach tiger beetle defines nine Geographic Recovery Areas (GRAs) (U.S. Fish and Wildlife Service, 1994):

GRA 1- Coastal Massachusetts and Islands;
GRA 2- Rhode Island, Block Island, and Long Island Sound;
GRA 3- Long Island;
GRA 4- Sandy Hook to Little Egg Inlet, New Jersey;
GRA 5- Calvert County, Maryland;
GRA 6- Tangier Sound, Maryland;
GRA 7- Eastern Shore of Chesapeake Bay, Virginia;
GRA 8- Western Shore of Chesapeake Bay (north of Rapahannock River), Virginia;
GRA 9- Western Shore of Chesapeake Bay (south of Rapahannock River), Virginia.

Without the increased protection of the most important tiger beetle populations, the extinction probability within each GRA over the next century is high (Gowan and Knisley, 2001). The GRA 4 encompasses all current and historic northeastern beach tiger beetle habitat in New Jersey. Within GRA 4, the tiger beetle must be restored to a secure status within its historic range to meet recovery criteria (Gowan and Knisley, 2001). Populations must be large enough to be self-sustaining and allow for dispersal among populations. Therefore, at least three populations must be established and permanently protected within New Jersey, with one or more sites obtaining peak counts greater than 500 adults. Sufficient habitat must be protected for population expansion and genetic interchange (U.S. Fish and Wildlife Service, 1994). During a 1994 evaluation of potential habitat in New Jersey, only the Gateway National Recreation Area, Sandy Hook Unit, North and Gunnison Beaches; Island Beach State Park, Northern Natural Area; and the south end of the Holgate Peninsula were found to be suitable to sustain northeastern beach tiger beetle populations (Hill and Knisley, 1994a). Therefore, re-establishment of viable populations at each of these sites will be necessary to meet recovery objectives for this species.

2. Life History

Adult tiger beetles are active, diurnal, surface predators. They forage along the waterline on small amphipods, flies, and other beach arthropods; or scavenge dead amphipods, crabs, and fish (Knisley *et al.*, 1987; U.S. Fish and Wildlife Service, 1994). Most foraging occurs in the damp sand of the intertidal zone; scavenging has been observed to occur more often than predation

(Knisley *et al*., 1987). Larval northeastern beach tiger beetles are sedentary predators that live in permanent burrows, feeding on small arthropods passing near the burrow's mouth. Adult tiger beetles are present on beaches from early June through early September (Knisley *et al*., 1987; Terwilliger and Tate, 1995). Adults are active on warm, sunny days feeding, mating, or basking (U.S. Fish and Wildlife Service, 1994). Northeastern beach tiger beetles are less active on rainy, cool, or cloudy days due to thermoregulation constraints. The species must rely on foraging and basking to maintain its high body temperatures (Knisley *et al*., 1987).

Adult beetles lay eggs on the beach during the summer. In 2 years time, larvae pass through three developmental stages (instar stages) and emerge as adults from their burrow (Knisley *et al*., 1987; U.S. Fish and Wildlife Service, 1994). First instars occur from late July through August, second instars from September to late fall, and third instars from late fall to early spring and through the second year (Knisley *et al*., 1987). However, some larvae that hatch early and catch an abundance of food may develop and emerge after only 1 year (U.S. Fish and Wildlife Service, 1994).

Natural history studies were conducted from 1982 to1986 in three sites known to contain northeastern beach tiger beetle populations: Kilmarnock, Northumberland County; Bavon, Mathews County; and Picketts Harbor, Northampton County, Virginia (Knisley *et al.*, 1987). Beetle distribution was also assessed at 40 beach sites in Maryland and Virginia, and 34 other sites in New Jersey, New York, Rhode Island, and Massachusetts. Larval habitat requirements and potential limiting factors contributing to larval presence/absence were assessed by measuring beach length and width, back beach vegetation, directional orientation, exposure, soil particle size, and human and vehicle activity at 43 sites in Maryland and Virginia (Knisley *et al.*, 1987). Larvae were found to occur in an 8 to12-meter width of beach within and above the intertidal zone. First and second instars were found to have a similar distribution, while higher densities of third instar were found within the mid- to upper-tidal zone on the beach. However, tiger beetle larvae may be found in beaches of various width where washover events occur or where the upper beach is flat and periodically inundated by high tides (Knisley *et al.*, 1987; U.S. Fish and Wildlife Service, 1994).

Distribution of larvae within the tidal zone suggests that most of the burrows are underwater during high tide. Studies have shown that larvae can survive flooding from 3 to 6 days (U.S. Fish and Wildlife Service, 1994). Larvae have been found crawling on the beach, apparently moving to dig a new burrow in a more suitable location. This behavior is likely a response to variations in tide levels, soil moisture, or sand accretion and erosion patterns (U.S. Fish and Wildlife Service, 1994). Larval burrow depths ranged from 9 to 24 cm and increased with distance from the water's edge, indicating that burrow depth may be related to subsurface moisture (Knisley *et al*., 1987).

During the day when conditions are dry and hot, larvae tend to become inactive, plugging up the burrow's entrance. Lacking a hard cuticle, larvae are susceptible to desiccation; therefore, activity occurs primarily at night (U.S. Fish and Wildlife Service, 1994). Larvae overwinter in their burrows and hibernate until mid-March. When sand is damp and cool in the spring, larval

activity is low. The highest periods of larval activity are from late August through early November.

Larvae are not found or may not survive at many sites suitable for adults. Ideal adult tiger beetle beaches are greater than 5 to 8 meters wide. Although narrow beach width is frequently the reason for lack of larvae, there are instances where larvae have variable densities or are absent on wide beaches. Knisley (1997a) found that while beach slope does not appear to affect larval densities, sand particle size does. Larval densities were highly variable relative to sand particle size; however, larvae were rare at sites with greater than 60 percent coarse sand (defined as the percentage of sand particles too large to pass through a 100-size mesh sieve) (Knisley, 1997a).

Adults, like the larval beetles, are found on highly dynamic beaches with great tidal activity and sand movement (Knisley and Hill, 1998). Occurrence of adult beetles has been statistically correlated with beaches containing back beach vegetation; long, wide corridors; low human and vehicular activity; fine sand particle size; and exposed beaches (Knisley *et al.*, 1987; Knisley, 1987a). Adult emergence begins in mid-June, reaches peak abundance in the beginning of July, and declines through August. Low numbers of beetles may still be found as late as September (U.S. Fish and Wildlife Service, 1994). Rainfall appears to enhance emergence since the numbers of adults present increases after a rainfall. There is a period of approximately 2 weeks after adults emerge when there is little to no dispersal, after which a small, but significant, number of beetles disperse to other sites. The regular dispersal phase occurs after peak numbers emerge in early July (Knisley and Hill, 1989; U.S. Fish and Wildlife Service, 1994; Hill and Knisley, 1994b).

Mark-recapture studies have determined that adult tiger beetles may travel 8 to 19 km (Knisley and Hill, 1989) from sites where they were marked; some individuals may disperse up to 24 km (Knisley, 1997b). In Northumberland County, Virginia a total of 10,131 adults were marked and released; 91 beetles dispersed to new sites (mainly between two close, large sites 1.5 km apart) (Hill and Knisley, 1994b). Large sites seem to serve as recruitment areas, while small sites serve as stop-overs during migration (Hill and Knisley, 1994b). Small sites are thought to serve as feeding or resting areas. Without such stop-over areas the larger sites may not experience as much migration (Hill and Knisley, 1994b). Migration serves to disperse genetic material, allow for the colonization of new sites, and enable beetles to leave eroding sites (Hill and Knisley, 1994b).

3. Status of the Species Within its Range

a. Historic Population Trends

Historically, the northeastern beach tiger beetle was a common inhabitant of coastal beaches from Cape Cod, Massachusetts to central New Jersey; and along the Chesapeake Bay from Calvert County, Maryland south through Virginia. The species is extirpated from Rhode Island, Connecticut, and New York (Long Island) (U.S. Fish and Wildlife Service, 1994). Potential habitat for tiger beetles still exists at some of the historical sites along the Atlantic Coast (U.S.

Fish and Wildlife Service, 1994). The only known extant populations along the Atlantic Coast are in southeastern Massachusetts and New Jersey.

Documented historic populations of the northeastern beach tiger beetle in New Jersey were found at Asbury Park, Manasquan, Point Pleasant, and Mantoloking in 1912; Long Beach Island in 1928; Seaside Heights in 1939; Sandy Hook in 1939; and the expanse of barrier beach from Lavalette and Seaside Heights to Island Beach from the 1930's to1951 (Hill and Knisley, 1994a). Entomologists revisiting the Seaside Heights population in the 1950's and 1960's reported no evidence of tiger beetles. Tiger beetles found along the Barnegat and Long Beach-Holgate-Tuckerton Meadows barrier island comprised the southern limit of the beetle's New Jersey range. This area supported beetles until the 1970's (Hill and Knisley, 1994a). New Jersey beaches were evaluated in 1994 by Hill and Knisley for potential repatriation habitats. The sites found suitable for repatriation include Gateway National Recreation Area, Sandy Hook Unit, North and Gunnison Beaches; the Island Beach State Park, Northern Natural Area; and the south end of the Holgate Peninsula (Hill and Knisley, 1994a).

As found in the peak population counts throughout the current northeastern beach tiger beetle's range, population sizes for the beetle are subject to extreme fluctuations (Vogler *et al.*, 1993). Because the northeastern beach tiger beetle is subject to local population extinctions and capable of dispersal and recolonization (U.S. Fish and Wildlife Service, 1994), two- to three-fold or greater year-to-year variations in population densities are common at a given site (Knisley and Hill, 1989; 1990). In addition, comparisons of numbers of tiger beetles over time are difficult because neither adult nor larval activity is completely understood. Surveys may be confounded by differences in weather, disturbance, time of year, time of day, cloud cover, immigration, or differences in surveyor methodology (Knisley and Hill, 1998).

b. Population Trends Since Listing Under the Endangered Species Act

GRA 1: At the time of listing, a single Massachusetts population at Martha's Vineyard was the only known remaining Atlantic Coastal population of the northern beach tiger beetle. There have been ongoing efforts to establish additional populations within GRA 1. The highest number of adult beetles observed at Martha's Vineyard was 1,787 in 1990. In 1995, 1,009 adults were documented, and in 2001, 900 adults were seen; in 2002 approximately 1,600 adults were seen (von Oettingen, pers. comm., 2003). During the summer of 1992, adult beetles from Martha's Vineyard were transferred to Cape Cod National Seashore, Massachusetts (U.S. Fish and Wildlife Service, 1994). The weather became unfavorable during the release and the reintroduction attempt was not successful (U.S. Fish and Wildlife Service, 1994). During this attempt, it was observed that the beetles moved only short distances from the release site. It was hypothesized that non-dispersing beetles have very limited ranges and that to aid recolonization the release of larvae should be investigated.

A second Massachusetts population was discovered in 1994 near Westport (152 adults observed) but had declined to 10 adults in 1995 and to 2 adults in 2001. There were no observations in 2002 (von Oettingen, pers. comm., 2003); therefore the Westport population may have undergone a local extinction. In 2002, 33 larval tiger beetles collected from Martha's Vineyard

were reintroduced at the Monomoy National Wildlife Refuge; 28 adults emerged (von Oettingen, pers. comm., 2003).

GRA 2 and 3: Tiger beetles have not been established within GRA 2 and 3.

GRA 4: The single known extant population in New Jersey is a result of reintroduction of larval beetles at Sandy Hook. Reintroduction efforts using larval beetles collected from Virginia and Maryland began in 1994 and continued through 2000. The reintroduction was initially successful with numbers of adult beetles found during summer surveys increasing through 2001 when a peak count of 749 adult northeastern beach tiger beetles was recorded. Numbers of adults found during summer surveys declined dramatically in 2002 with a peak count of only 142 beetles found. The downward trend continued in 2003 and 2004. The reasons for the decline are not known. The reintroduction efforts and possible causes of decline at Sandy Hook are discussed in greater detail within the Environmental Baseline section of this Biological Opinion.

GRA 5 through 9: Besides the work in New Jersey, limited northeastern beach tiger beetle reintroduction attempts have been made elsewhere. An experimental reintroduction of adult tiger beetles was conducted in 1991 in the Chesapeake Bay to determine appropriate reintroduction methods for use in restoring beetles to their historical range along the Atlantic Coast.

Between 1988 and 1993, the northeastern beach tiger beetle was documented at 13 sites in Calvert County, Maryland (U.S. Fish and Wildlife Service, 1994). In 1998 and 1999, the Service funded comprehensive larval and adult tiger beetle surveys along the majority of the shoreline of the Chesapeake Bay in Virginia. Knisley and Hill (1998) found 27,099 adult tiger beetles at 62 sites on the western shoreline of the Bay in Virginia. Knisley and Hill (1998) discovered 23 new sites but determined that nine sites had apparently been extirpated since Roble's (1996) survey. Knisley and Hill (1999) found 32,167 adult tiger beetles at 35 sites on the Virginia Eastern Shore, though larval numbers were inexplicably low. Ten new sites were discovered during the 1999 surveys. Because storms and other natural and man-made factors can rapidly alter beach habitat, determining exactly how many sites exist at a given time is difficult.

4. Continuing Threats

a. Predation

Primary natural enemies of adult tiger beetles are wolf spiders (*Arctosa littoralis*), asilid flies (*Dasypogon diadema*), and birds (U.S. Fish and Wildlife Service, 1994). Larvae are probably more vulnerable to habitat disruption than adults (Knisley *et al.*, 1987) and, as with other tiger beetle species, larval survival is low due to natural enemies and other limiting factors. Only 5 percent of the first instar larvae of several Arizona tiger beetle species reached adulthood (Knisley, 1987b). Habitat disturbances could further reduce survival (Knisley *et al.*, 1987) by eliminating suitable habitat, and when combined with natural mortality factors, populations could be reduced to the point of extinction (Knisley, 1987b). The primary natural larval enemy is a small, parasitic wasp (*Methocha* sp.) that enters the larval burrow, paralyzes the larvae with a

sting, and lays an egg on the larvae. The egg hatches, and as it develops, the larval wasp consumes the larval tiger beetle. Mites have also been found on larvae at Martha's Vineyard, but their effect, if any, is unknown (U.S. Fish and Wildlife Service, 1994).

b. Habitat Loss, Degradation, and Disturbance

Natural limiting factors include winter storms, beach erosion, flood tides, hurricanes (Stamatov, 1972), and natural enemies. The extirpation of the tiger beetle from most of its range has been attributed primarily to destruction and disturbance of natural beach habitat, shoreline development, beach stabilization, off-road vehicular traffic, and high levels of recreational use (Knisley *et al.*, 1987; Knisley and Hill, 1989; Knisley and Hill, 1990; Hill and Knisley, 1994a; U.S. Fish and Wildlife Service, 1994). Oil spills and use of pesticides for mosquito control may have also contributed to the decline of this species (Stamatov, 1972). Most of the large northeastern beach tiger beetle populations in Maryland and many of those in Virginia are threatened by activities associated with the increasing human population (U.S. Fish and Wildlife, Service 1994). Adult foraging, mating, and ovipositioning can be disrupted by human activity (Knisley *et al.*, 1987). However, larvae are probably more affected because they spend most of their time at the tops of their burrows waiting for prey, and thus are disturbed by even the slightest activities such as vibrations, movement, and shadows (Knisley *et al*., 1987).

Knisley and Hill (1990) examined the effects of visitor use on the tiger beetle at Flag Ponds, a public beach in Maryland. As human use continued to increase, no reduction in the population of adult tiger beetles was found. However, human impact appeared to diminish the number of newly emerged adults. Larval survival was significantly lower on the beach area with the greatest amount of human use. In areas that were firmly stomped to simulate increased foot traffic, there was a 50 to 100 percent reduction in numbers of active larvae (Knisley and Hill, 1989). In addition, 25 percent of the burrows did not reopen within 10 days of stomping; this suggests that the stomping may have killed the larvae (Knisley and Hill, 1989). Negative effects of foot traffic apparently involve compaction, disruption of burrows, or direct injury to larvae. Because larvae occur in the intertidal zone, burrows can easily be compacted or dislodged either by vehicles or by high levels of human activity (Knisley *et al.*, 1987).

Beach erosion, resulting from natural events or anthropogenic beach modifications, may also have serious effects on tiger beetles and their habitat. Erosion within the beach habitat is a natural phenomenon resulting from rising sea levels and prevailing winds. However, this process has been exacerbated by beach development that interferes with the natural beach dynamics. Beach stabilization structures such as groins, jetties, rip-rap revetments, and bulkheads, are designed to reduce erosion. This interrupts and captures sand from longshore movement, building up the beach around the stabilization structure and robbing sand from the down-drift shoreline. Bulkheads and rip-rap typically result in reflection of wave energy, which ultimately removes the sand and steepens the beach profile. Changes in the beach profile can take from 1 to 30 years. Beach stabilization structures also prevent the back beach from supplying sand to the forebeach, concentrating wave energy at the ends of the bulkhead or revetment and resulting in erosion (Knisley and Hill, 1994). Beaches 1 to 3 meters wide, which support adult beetle populations, typically have few or no larvae. Larval beetles seem to be

limited to areas where beaches are at least 8 m wide with sand within and above the intertidal zone (Knisley *et al.*, 1987; U.S. Fish and Wildlife Service, 1994). Although larvae are more sensitive to erosion and beach impacts than adults, adults are also less abundant in these narrow sections.

Along a given length of shoreline, the first shoreline stabilization structure installed often has an adverse impact on the neighboring shoreline (usually downstream of a longshore current), this results in a sequence of other shoreline modifications. Eventually, as shoreline modifications and the amount of modified shoreline increases in number, the sand 'bank' is further depleted, due to the halt of erosion and the movement of sand offshore into deeper channels. The long-term (50+ years) impacts of this scenario are unknown, but may eventually lead to a collapse of the natural beach habitat (Hill and Knisley, 1995).

Knisley (1997b) conducted a 3-year study on the effects of shoreline stabilization structures on the distribution and abundance of the tiger beetles in Virginia. A total of 24 sites (51 site sections) were surveyed for adult and larval beetles. The sites were placed into one of the following categories: natural beach (14 sections), narrow beach (6 sections), groins (13 sections), groins/bulkheads (10 sections), and revetment (7 sections). The mean fall beach width was measured from the most recent high tide to the end of the back beach. The results of this research (Knisley, 1997b) are summarized in Table 1.

Distribution patterns among these types of sites were similar for both adults and larvae; however, larvae were clearly more selective and limited in distribution than the adults. While the difference in adult abundance was less than 2-fold between natural and groin sites, the differences for larvae were more than 4-fold. Natural beaches and those with sand deposition supported the greatest number of larval and adult tiger beetles (Knisley, 1997b). Bulkheads and revetments had the greatest negative impact on tiger beetles. Although larvae were found at some bulkhead sites and at other modified or narrow sites, they probably have higher winter mortality than those at natural beaches. Due to the 2-year life cycle, larvae are more likely to survive two seasons of erosion and beach narrowing when more beach width is available (Knisley, 1997b).

Table 1. Distribution and Abundance of Tiger Beetles Found in Various Shoreline Conditions

Parameter Measured	Shoreline Type				
	Natural Beach	**Narrow Beach**	**Groin**	**Groin / Bulkhead**	**Revetment**
Mean Number of Adults per 100 Meter Plot	90	13	56	13	0.1
Mean Number of Larvae per 2 Meter Plot	7.6	1.6	1.6	1.0	0
Mean Fall Beach Width in Meters	7.6	1.5	3.6	1.4	0.2

5. Vulnerability to Extinction

Recovery of the northeastern beach tiger beetle will depend largely on re-establishing populations within the species' former range along the Atlantic Coast and protecting the Chesapeake Bay region (U.S. Fish and Wildlife Service, 1994). Developmental pressures and the associated heavy foot and off-road vehicle traffic are thought to have caused the extirpation of the northeastern beach tiger beetle in New Jersey (Hill and Knisley, 1994a). Existing development and high recreational use along much of the species historic Atlantic coastal range have severely degraded or eliminated previously occupied northeastern beach tiger beetle habitat. The low number and considerable distance between available suitable habitats reduces the likelihood that recolonization will occur through natural dispersal alone. Isolated populations, whether naturally occurring or repatriated, will remain vulnerable to local extirpations by stochastic events.

The current stronghold of tiger beetle distribution is in the Chesapeake Bay. The higher survival of this species in the Bay as opposed to the Atlantic Coast may be due to historically lower levels of human activity on Bay beaches and less natural mortality from winter storms and erosion (U.S. Fish and Wildlife Service, 1994). Since 1996, more than 30 non-jeopardy biological opinions anticipating take of northeastern beach tiger beetles have been completed on the effects of shoreline stabilization activities in Virginia alone. This alteration of tiger beetle habitat shows no sign of slowing, threatening tiger beetle populations in Maryland and Virginia as activities associated with human populations increase. Furthermore, unpermitted activities may be contributing to the reduction of tiger beetle habitat in Virginia.

V. ENVIRONMENTAL BASELINE

A. STATUS OF THE SPECIES WITHIN THE ACTION AREA

1. Piping Plover

Piping plovers nest within eight areas at Sandy Hook as shown on Figure 2. Six of these nesting areas are within portions of the park designated as protected areas by NPS: North Beach; North Gunnison; South Gunnison; Critical Zone, Hidden Beach; and Fee Beach. One nesting area, South Fee Beach, is outside of a designated protected area but is provided protection during the nesting season. An eighth area, USCG Beach, is on USCG property but is managed by the NPS as a protected area under an agreement with USCG. The earliest recorded arrival date for piping plovers at Sandy Hook is March 10. The birds normally depart in early September, although plovers have been observed as late as September 25 (National Park Service, 2004).

A summary of piping plover nesting activity and productivity at Sandy Hook over the past 10 years is provided in Table 2 (McArthur, 1997; Jenkins *et al*., 1995; 1998; Jenkins and Pover, 2001a; 2003; Jenkins *et al*., 2004; McArthur-Heuser *et al*., 2004; Lane pers. comm., 2005). The number of piping plover pairs nesting at Sandy Hook during this period has ranged from a high of 43 pairs in 1995 to a low of 29 pairs in 1998 through 2000. The dramatic decline from 42 nesting pairs in 1997 to 29 pairs in 1998 is attributed largely to predation and harassment from foxes, resulting in nest abandonment.

Productivity needed to maintain a stable population for Atlantic coast piping plovers is estimated at 1.24 fledged chicks per nesting pair (Melvin and Gibbs, 1994). Small populations may be highly vulnerable to extinction due to variability in productivity and survival rates; therefore, the average productivity for a stationary population may be insufficient to assure a high probability of species survival. To compensate for small populations, the recovery plan for the Atlantic coast population of the piping plover establishes a productivity goal of 1.50 chicks fledged per nesting pair in each of the four Atlantic coast recovery units (U.S. Fish and Wildlife Service, 1996).

Productivity on piping plover nesting beaches at Sandy Hook has reached the Atlantic coast population recovery goal of 1.50 fledged chicks per pair in only four of the last 10 nesting seasons (Figure 3), and has averaged only 1.21 chicks fledged per nesting pair over the 10-year period of 1995 to 2004 (Table 2). Overall productivity at Sandy Hook has, however, reached the level needed to maintain a stable population in six of the last 10 nesting seasons (Figure 3). In the breeding seasons when productivity was below that needed to maintain a stable population, predation has been reported as the major factor in loss of nests or chicks. Isolated flooding has also been a factor, but to a lesser degree (National Park Service, 2003; McArthur-Heuser, 2004; Lane, pers. comm., 2004).

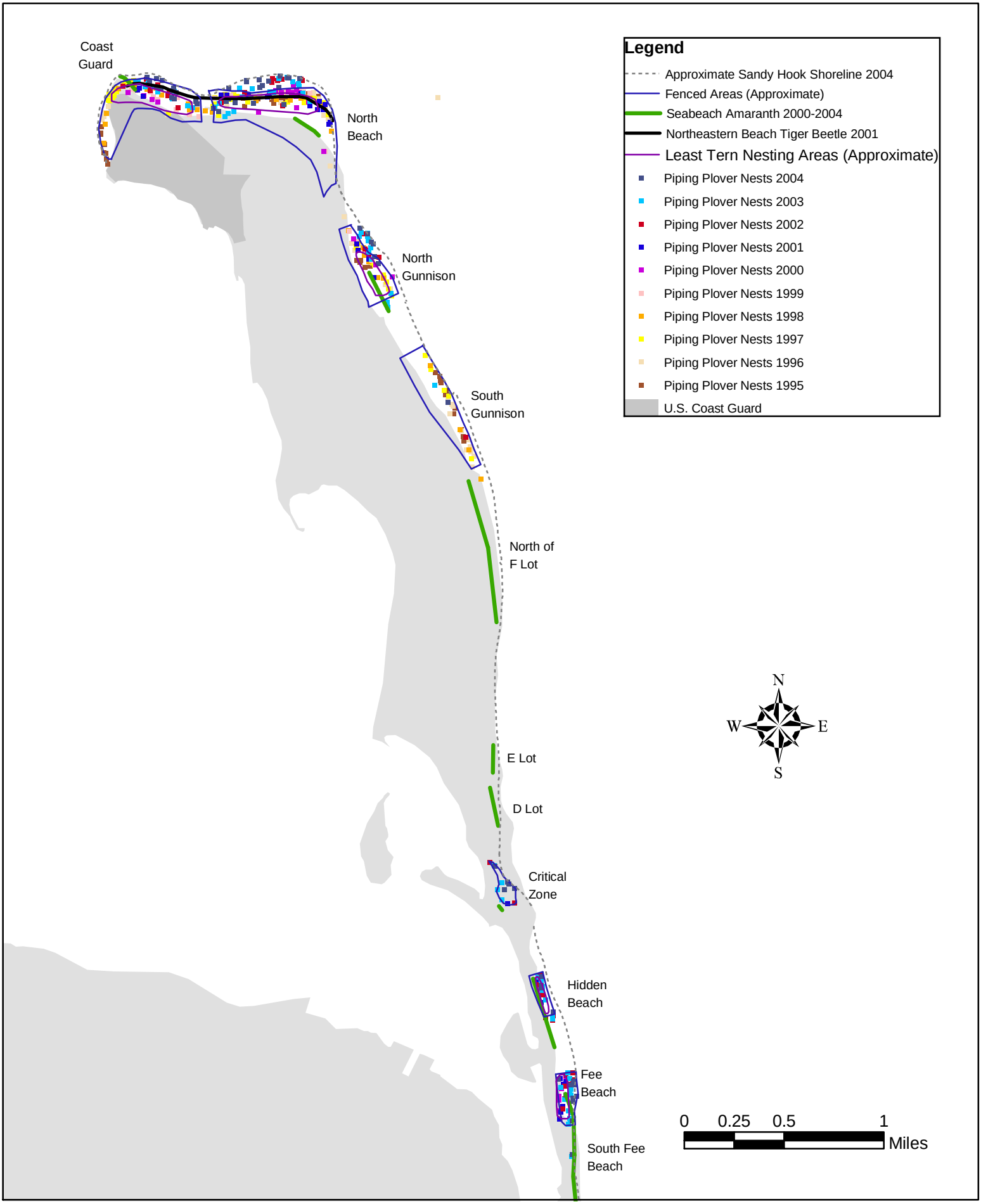


Figure 2. Distribution of Federally and State-Listed Species at Sandy Hook, New Jersey

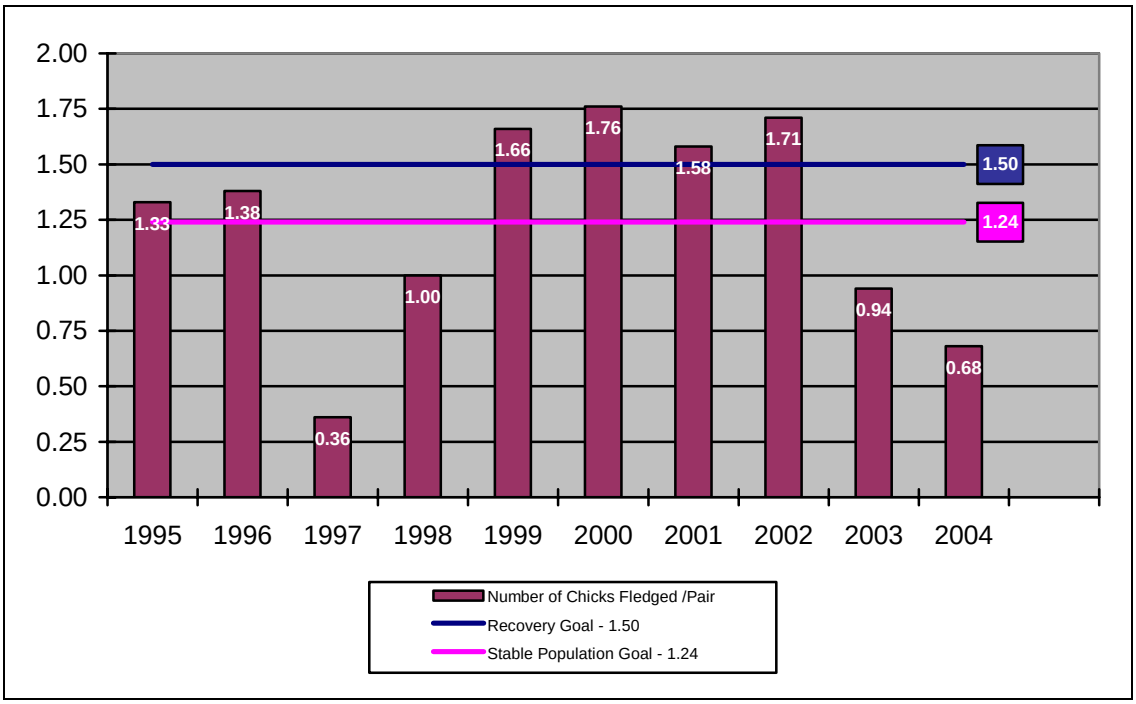
Table 2. Sandy Hook Piping Plover Nesting and Productivity Summary, 1995-2004

Location	Year	Number of Breeding Pairs	Number of Pairs with Nests Hatched	Number of Chicks Fledged	Number of Chicks Fledged/Pair (Productivity)
Coast Guard Beach	1995	10	9	15	1.50
	1996	10	10	23	2.30
	1997	11	1	0	0.00
	1998	7	3	7	1.00
	1999	9	6	14	1.50
	2000	5	4	7	1.40
	2001	6	6	11	1.80
	2002	7	7	8	1.14
	2003	8	6	13	1.63
	2004	6	1	2	0.33
North Beach	1995	12	11	26	2.17
	1996	14	8	16	1.14
	1997	13	4	1	0.08
	1998	10	6	11	1.10
	1999	11	10	24	2.18
	2000	12	11	23	1.92
	2001	11	10	20	1.82
	2002	9	9	17	1.89
	2003	9	4	11	1.22
	2004	10	4	7	0.70
North Gunnison	1995	4	*	4	1.00
	1996	7	*	7	1.00
	1997	8	1	2	0.25
	1998	4	*	7	1.75
	1999	3	2	4	1.30
	2000	3	3	4	1.30
	2001	3	2	3	1.00
	2002	4	4	11	2.75
	2003	5	2	0	0.00
	2004	3	0	0	0.00
South Gunnison	1995	11	*	9	0.81
	1996	7	*	9	1.29
	1997	4	1	0	0.00
	1998	3	*	1	0.33
	1999	0	-	-	-
	2000	0	-	-	-
	2001	0	-	-	-
	2002	1	1	0	0.00
	2003	1	0	0	0.00
	2004	1	0	0	0.00
Critical Zone	1995	6	3	3	0.50
	1996	2	0	0	0.00
	1997	0	-	-	-
	1998	0	-	-	-
	1999	0	-	-	-
	2000	0	-	-	-
	2001	1	1	1	1.00
	2002	2	2	3	1.50
	2003	4	1	2	0.50
	2004	3	2	2	0.67

Location	Year	Number of Breeding Pairs	Number of Pairs with Nests Hatched	Number of Chicks Fledged	Number of Chicks Fledged/Pair (Productivity)
Hidden Beach	1995	0	-	-	-
	1996	0	-	-	-
	1997	6	4	12	2.00
	1998	4	1	3	0.75
	1999	4	2	2	0.50
	2000	3	3	10	3.30
	2001	3	2	6	2.00
	2002	5	5	10	2.00
	2003	4	2	3	0.75
	2004	3	1	3	1.00
Fee Beach	1995	0	-	-	-
	1996	0	-	-	-
	1997	0	-	-	-
	1998	1	0	0	0.00
	1999	2	2	4	2.00
	2000	6	6	7	1.17
	2001	7	5	8	1.14
	2002	7	7	11	1.57
	2003	6	2	5	0.83
	2004	4	2	5	1.25
South Fee Beach	1995	0	-	-	-
	1996	0	-	-	-
	1997	0	-	-	-
	1998	0	-	-	-
	1999	0	-	-	-
	2000	0	-	-	-
	2001	0	-	-	-
	2002	0	-	-	-
	2003	1	1	2	2.00
	2004	1	1	2	2.00
Total – Sandy Hook	**1995**	**43**	**31**	**57**	**1.33**
	1996	**40**	**25**	**55**	**1.38**
	1997	**42**	**11**	**15**	**0.36**
	1998	**29**	**13**	**29**	**1.00**
	1999	**29**	**22**	**48**	**1.66**
	2000	**29**	**27**	**51**	**1.76**
	2001	**31**	**26**	**49**	**1.58**
	2002	**35**	**35**	**60**	**1.71**
	2003	**38**	**18**	**36**	**0.94**
	2004	**31**	**11**	**21**	**0.68**
	10-year average	**34.7**	**21.9**	**42.1**	**1.21**

* The number of piping plovers with successfully hatched nests at North Gunnison and South Gunnison was not available for the 1995, 1996, and 1998 breeding seasons.

Figure 3. Piping Plover Productivity at Sandy Hook, 1995-2004



The contribution of Sandy Hook to overall piping plover nesting and productivity within New Jersey is significant. As shown in Table 3, over the last 10 years Sandy Hook has provided an average of 23.6 percent of the active nesting areas within the state. From 1995 to 2004, an average of 28.4 percent of the known New Jersey piping plover breeding pairs nested at Sandy Hook. The percentage of New Jersey piping plovers nesting at Sandy Hook has ranged from a high of 36.8 percent in 1997 to a low of 23.0 percent in 2004.

For the 10-year period of 1995 to 2004, Sandy Hook produced 34.3 percent of the total chicks fledged in New Jersey. In 1995, Sandy Hook produced nearly half (47.5 percent) of the chicks fledged within the State. However, in 2004 the number of successfully fledged chicks declined dramatically with only 25.6 percent of the chicks fledged in New Jersey coming from Sandy Hook sites. Nonetheless, over the last 10 years productivity at Sandy Hook averaged 1.21 chicks fledged per pair, well above the statewide average for this same period of only 1.00 chicks fledged per pair, but still below the level needed to maintain a stable population. Productivity at Sandy Hook has exceeded the statewide average in 8 of the last 10 nesting season.

With Sandy Hook supporting such a large percentage of nesting pairs, success or failure of breeding at Sandy Hook greatly influences Statewide piping plover breeding success and, consequently, impacts whether or not annual recovery goals for the New York – New Jersey recovery unit are met.

Table 3. Piping Plover Nesting and Productivity at Sandy Hook as Compared to New Jersey Statewide Totals

Location	Year	Number of Breeding Pairs	Number of Active Nesting Areas	Number of Chicks Fledged	Number of Chicks Fledged/Pair (Productivity)
Sandy Hook – All Areas	1995	43	5	57	1.33
	1996	40	5	55	1.38
	1997	42	6	15	0.36
	1998	29	6	29	1.00
	1999	29	5	48	1.66
	2000	29	5	51	1.76
	2001	31	6	49	1.58
	2002	35	7	60	1.71
	2003	38	8	36	0.94
	2004	31	8	21	0.68
	10-year Average	**34.7**	**6.1**	**42.1**	**1.21**
New Jersey - Statewide	1995	132	27	120	0.91
	1996	127	26	127	1.00
	1997	114	25	45	0.39
	1998	93	21	101	1.09
	1999	107	22	143	1.34
	2000	112	23	157	1.40
	2001	122	26	157	1.29
	2002	138	28	161	1.17
	2003	144	30	133	0.92
	2004	135	31	82	0.61
	10-Year Average	**122.4**	**25.9**	**122.6**	**1.00**
Percent of Statewide Total Occurring at Sandy Hook	Year	Percent of Total Statewide Breeding Pairs	Percent of Total Statewide Active Nesting Areas	Percent of Total Chicks Fledged Statewide	Productivity Compared to Statewide Average (Above or Below State Average)
	1995	32.6%	18.5%	47.5%	Above
	1996	31.4%	19.2%	43.3%	Above
	1997	36.8%	24.0%	33.3%	Below
	1998	31.2%	28.6%	28.7%	Below
	1999	27.1%	22.7%	33.6%	Above
	2000	25.9%	21.7%	32.5%	Above
	2001	25.4%	23.1%	31.2%	Above
	2002	25.4%	25.0%	37.3%	Above
	2003	26.4%	26.7%	27.1%	Above
	2004	23.0%	25.8%	25.6%	Above
	10-Year Average	**28.4%**	**23.6%**	**34.3%**	**Above**

2. Seabeach Amaranth

In 2000, seabeach amaranth was documented in Monmouth County after being absent from New Jersey since 1913. Table 4 summarizes the results of surveys conducted since 2000 for seabeach amaranth by Service, NJDEP, and NPS biologists at Sandy Hook (U.S. Fish and Wildlife Service, 2004; Lane, pers. comm., 2005). As shown in Figure 2, seabeach amaranth occurs within five of the six protected areas at Sandy Hook. In general, fencing of these protected areas for piping plovers and other shorebirds has favored seabeach amaranth by reducing impacts from

pedestrians and staff off-road vehicles. As shown in Figure 2, occurrences of seabeach amaranth plants also extend beyond the traditionally fenced protected areas and have been found within additional beaches managed for human recreational use. Park staff protect plants in these areas through symbolic fencing during the amaranth growing season.

Table 4. Summary of Seabeach Amaranth Sites at Sandy Hook, 2000 - 2004

Site Name	Number of Plants					Average Since Discovery
	2000	2001	2002	2003	2004	
Coast Guard	0	1	5	1	0	1
North Beach	0	0	2	0	2	1
North Gunnison	6	0	11	2	0	4
South Gunnison	1	5	15	2	2	5
North of F Lot	8	25	12	0	8	53
Lot E	0	0	0	0	1	0
Lot D	0	0	0	0	181	36
Critical Zone	7	53	98	370	872	280
Hidden Beach	57	285	536	139	104	224
Fee Beach	41	192	225	128	77	133
South Fee Beach	0	0	0	225	420	129
Sandy Hook Total	**120**	**561**	**904**	**642**	**1667**	**779**

In 2003 to offset potential impacts to the species from the 2002 interim beach fill project, 400 seabeach amaranth plants were planted at the Critical Zone as a conservation measure to ensure the continued occurrence of the species at that location. Plant numbers at individual sites can vary widely from year to year depending on site conditions, site management, and growing conditions. Given the high fecundity of the species (thousands of seeds for a large plant) (Jolls and Sellars, 2000) and the available dispersal mechanisms of wind and wave action along the New Jersey coastline, it is reasonably certain that additional areas of suitable habitat will be colonized by the species over the life of the NPS project and that some populations occurring in areas with favorable habitat conditions will expand over present plant numbers. In general, seabeach amaranth numbers at Sandy Hook would be expected to increase over time in accreting areas or following beach fill events and to decrease over time in areas that are eroding.

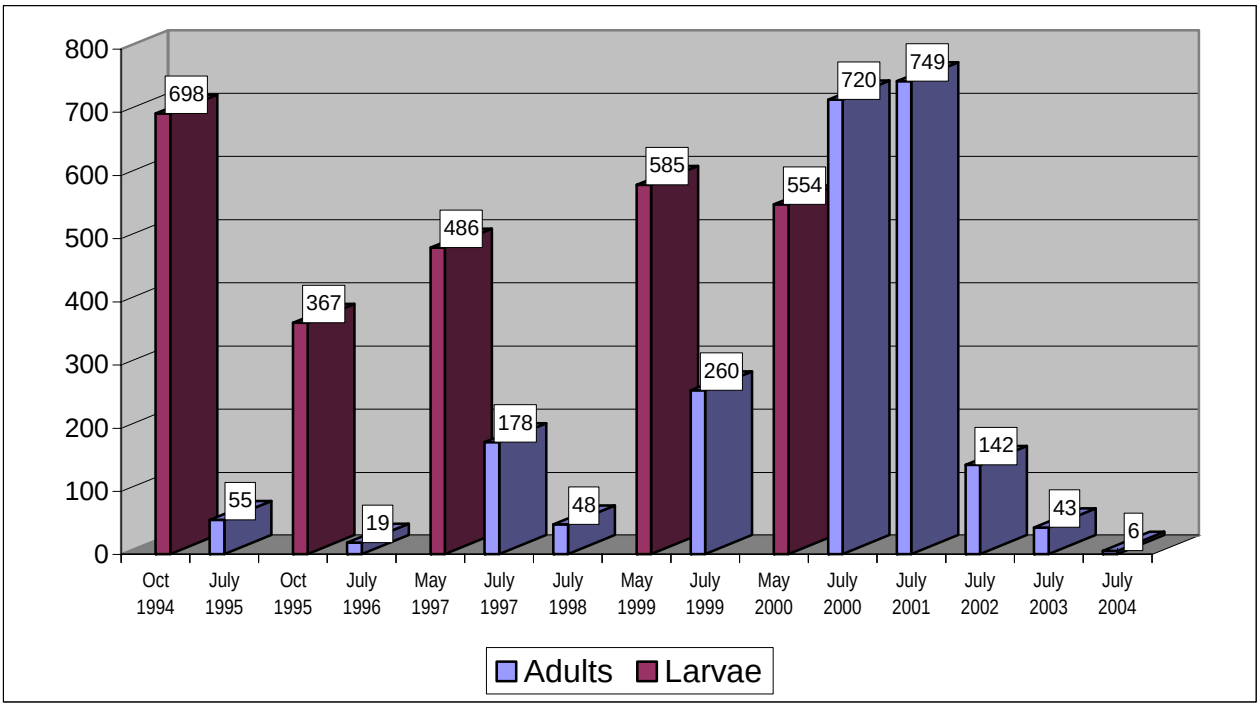
3. Northeastern Beach Tiger Beetle

Although the northeastern beach tiger beetle was once found in great swarms along the Atlantic coast from Massachusetts to central New Jersey, the species declined dramatically and by the late 1970s was gone from most of its historic range. The species was last observed in the vicinity of Sandy Hook in the late 1930's (Hill and Knisley, 1994a).

In 1994, in partnership with the Service, the NPS reintroduced the northeastern beach tiger beetle to its historic range at Sandy Hook. A summary of larval translocations and results of annual surveys for adult beetles are summarized in Figure 4 (Knisley and Hill, 2001; Scherer, pers. observ., 2002; 2003; Knisley *et al*., 2005 in press). During autumn 1994, a total of 698 larvae collected from Virginia and Maryland and larvae reared in a laboratory were released at North and Gunnison Beaches. In summer 1995, adults were documented at both sites; mating and

foraging were observed. In autumn 1995, 20 first instar larvae were found, providing evidence of natural reproduction by the reintroduced beetles (Scherer, pers. observ., 1995; Knisley et al., 2005 in press).

Figure 4. **Number of Northeastern Beach Tiger Beetle Larvae Translocated and Peak Adults Counted, 1994-2004, Gateway National Recreation Area, Sandy Hook Unit, New Jersey.**



During the winter of 1995/1996, due to severe coastal storms, portions of the Sandy Hook tiger beetle translocation sites were completely eroded. Little larval activity was documented during 1996. In 1997, 1999, and 2000 spring larval reintroductions were conducted in an attempt to establish a self-sustaining population at Sandy Hook. As a result of these reintroductions, the population continued to increase through 2001 when a peak count of 749 adult northeastern beach tiger beetles was recorded. Although the 2001 count did not coincide with the time of peak adult emergence, Knisley (pers. comm., 2003) estimated the population at over 2,000 beetles based on the assumption that only one-third of beetles present are actually observed during adult counts. In 2002, the number of adult northeastern beach tiger beetles observed declined dramatically with a peak count of only 142 beetles found. The decline was attributed to a large flock of over 1,000 great black-backed gulls (*Larus marinus*), laughing gulls (*Larus atricilla*), and herring gulls (*Larus argentatus*) observed roosting on the beach in the areas where tiger beetle had been observed in past years (Scherer, pers. observ., 2002). This flock may have keyed into the adult beetle emergence as a potential food source, or the presence of the gulls may have depressed adult activity or caused widespread adult dispersal. The downward trend continued in 2003 and 2004. Only 6 adult northeastern beach tiger beetles were found during adult surveys in 2004 (Knisley, pers. comm., 2004).

In 2002, the Service surveyed previously occupied and potentially suitable habitats at Sandy Hook for northeastern beach tiger beetles. Areas where beetles were observed included the USCG Beach, North Beach and North Gunnison. No northeastern beach tiger beetles were found at South Gunnison, Kingman/Mills Sandspit, Horseshoe Cove, Spermaceti Cove, or the Plum Island beach areas (Scherer, pers. observ., 2002). To date, no northeastern beach tiger beetles have been found at Sandy Hook outside of beaches where reintroduction efforts took place.

B. FACTORS AFFECTING SPECIES ENVIRONMENT WITHIN THE ACTION AREA

1. Habitat

Past stabilization projects along the New Jersey Atlantic coastline have fundamentally altered the naturally dynamic coastal processes that create and maintain beach strand habitats. Hard shoreline stabilization structures such as jetties and groin fields interrupt littoral drift, while seawalls, bulkheads, and artificially created dunes prevent overwash. These structures prevent natural shoreline migration. Such stabilization over the past century at Sandy Hook has encouraged residential and commercial development and associated infrastructure along otherwise ephemeral and / or flood-prone sites. This subsequent development has forestalled formation of highly productive overwash habitats for piping plover and eliminated connectivity of piping plover oceanfront and bayside nesting and foraging habitats. Development and recreational use at stable and / or accreting areas has eliminated or degraded many areas of otherwise suitable beach habitat for seabeach amaranth and northeastern beach tiger beetle.

The suitability of Sandy Hook's southern beaches as habitat for federally listed species is strongly affected by the existing hard stabilization structures and ongoing beach nourishment activities in the Critical Zone and on municipal beaches to the south of the park. Several factors make abandonment or removal of hard stabilization structures in the project area and adjacent municipalities to the south unlikely in the foreseeable future. Such structures provide flood and storm protection to extensively developed upland areas and infrastructure. The State of New Jersey has furnished financial and technical assistance for shoreline stabilization of shore towns for decades. The New Jersey Shore Protection Master Plan calls for the maintenance of existing functional hard structures throughout the State (New Jersey Department of Environmental Protection, 1981).

No piping plover nesting occurred at Hidden Beach or Fee Beach prior to 1997 because of the groin field, sea wall, and hard structures south of Sandy Hook. These areas were eroded back to the seawall, except for small sand fillets updrift of the groins. Colonization of these beaches by piping plovers in 1997 and seabeach amaranth in 2000 was made possible in part by the increased transport of sand into the area from a 1995-96 Corps beach fill in Sea Bright and Monmouth Beach Boroughs. Hidden Beach and Fee Beach have since accreted to a width of over 450 feet (U.S. Fish and Wildlife Service, 2002).

Despite the substantial amounts of sediment now moving past the seawall at the southern end of the park, a natural deflection point in the northbound littoral drift of sediments causes continually eroding conditions and a steep beach face slope at the Critical Zone. Barring a breach or overwash of the peninsula, without periodic beach fill erosion is likely to render the Critical Zone unsuitable as habitat for piping plovers or seabeach amaranth. Future colonization by northeastern beach tiger beetles would be unlikely.

The pattern of piping plover nesting at the Critical Zone during the 1990s and early 2000s clearly relates to the pattern of beach nourishment. After a 2-year absence, piping plovers returned to the Critical Zone in 1990 (Jenkins, 1990) following a large beach fill during the winter of 1989-90 that used sand from Sandy Hook Channel (National Park Service, 2004). Nesting continued in the Critical Zone until 1996, but ceased from 1997 to 2000 in response to narrowed, eroding beach conditions. The re-colonization of the Critical Zone by piping plovers in 2001 was due to beach fills in 1996-97 and 1997-98, followed by several years of significantly reduced erosion rates that allowed wider beach conditions to persist. Most recently, in November 2002 an additional 253,000 cy of sand was placed at the Critical Zone as an interim measure pending construction and implementation of the sand slurry pipeline project. Nesting at the critical zone once again increased in the 2003 breeding season as available habitat increased following the 2002 fill event.

Northern beaches at Sandy Hook are continuing to widen due to accretion from the northerly transport of sand. Monitoring of Sandy Hook shorelines over time indicates that volumetric sand losses at the Critical Zone are correlated with gains at Gunnison Beach with a lag time of 1 to 2 years. In addition, approximately 300,000 cy of sand passes through Gunnison Beach annually to accumulate either at North Beach, at the end of the Sandy Hook spit, or in the navigation channel just beyond the end of the Hook. Upper beach berm and dune habitats within the USCG Beach, North Beach, and North Gunnison protected areas become progressively more vegetated each year as the island migrates eastward and new lower and mid-beach berm areas form (Psuty, pers comm., 2002; National Park Service, 2004). The accreting conditions at northern Sandy Hook beaches provide substantial, high quality habitats for piping plovers, seabeach amaranth, and northeastern beach tiger beetles.

2. Beach Management and Recreational Use

Sandy Hook beaches are intensively used for recreation. The park receives approximately 2.5 million visitors per year, with 30 to 40 thousand guests per day on a typical summer weekend. Most recreational activity is clustered at six developed, staffed beach centers (National Park Service, 2004; Wells, pers. comm., 2005). To minimize disturbance of piping plovers from recreational activities, the NPS manages the birds in accordance with the Service's (1996) recovery plan and the NPS (1992) Sandy Hook Unit Piping Plover Management Plan. Seabeach amaranth receives incidental protection from beach closures enacted to protect piping plovers and other beach-nesting birds (National Park Service, 2004; Lane, pers. comm., 2005).

Current visitor use restrictions to protect endangered species include closure of fenced piping plover nesting areas from March 15 through Labor Day. The closure extends to include the

intertidal zone while chicks are present. Kite flying within 500 feet of posted nesting areas is prohibited. High-impact recreational activities are prohibited in the intertidal zones adjacent to nesting areas. These prohibited activities include: ball playing, jogging, picnicking, beaching of boats/jet skis, campfires, and sunbathing. Low impact activities such as walking, fishing, birding, and surfing are permitted until intertidal zones are closed. Off-road vehicle use is prohibited on Sandy Hook, and use of vehicles by NPS staff during the nesting season is limited to recreational beach centers, and one resource management vehicle to transport fencing supplies to nest sites. Park interpretation regarding beach-nesting birds includes Visitor Center displays and video, signs and waysides, brochures provided at information areas and by shorebird wardens, offsite programs to school and other groups, and orientation for park employees. Permanent and seasonal NPS staff and volunteers patrol and monitor nesting areas (National Park Service, 2004; Lane, pers. comm., 2005; Wells, pers. comm., 2005).

Activities occurring on NPS beaches managed for human recreational use reduce the suitability of those areas as potential habitat for federally listed species by destroying or degrading natural beach habitat characteristics for all three species. Such activities include beach grooming, dune stabilization, sand fencing, vegetation maintenance, and off-road vehicle use by lifeguards, park rangers, and maintenance staffs. Recreational use on the park's ocean beaches open to the public ranges from moderate to intense. This level of recreational use would preclude movement of piping plovers or northeastern beach tiger beetles onto areas managed for human use. While some seabeach amaranth plants have been found along the upper beach and dune toe on recreational beaches, seabeach amaranth seedlings in areas of high foot traffic would be unlikely to persist to an easily detectable size. With the exception of isolated plants or patches of seabeach amaranth, expansion of federally listed species onto recreational beaches at Sandy Hook is unlikely if current management practices remain status quo.

Recreational disturbance of nesting birds in the Critical Zone is likely higher than within other Sandy Hook nesting areas. Eddings *et al.* (1990) noted that public beaches immediately beyond the northern and southern boundaries of the Critical Zone produced a "steady daytime flow of pedestrian traffic throughout the week." The high potential for disturbance of nesting birds in the Critical Zone in 1990 was indicated by numbers of people counted in each park nesting area. For its size (only about 15 percent of the total length of shoreline used by piping plovers in 1990), the Critical Zone accounted for a disproportionate percent of mean total people counted within piping plover nesting areas in four out of six survey periods (morning, afternoon, and evening during both weekdays and weekends/holidays). On weekday afternoons, for example, the Critical Zone accounted for 57 percent of the mean number of people counted in all nesting areas, with a mean of 104 people (Eddings *et al.*, 1990). More recently, the Critical Zone continued to receive higher levels of recreational disturbance than in other nesting areas. A greater-than-average visitor use conflict arose at the Critical Zone in 2001 due to the proximity of the piping plover nest to Beach Area C. After 4 years without any nesting at the Critical Zone, park visitors were particularly uncooperative regarding the closure of this nesting area in 2001. Responding to frequent conflicts at the Critical Zone often diverted NPS staff from other nesting areas (McArthur, pers. comm., 2001).

3. Predation

Predation has been identified as a significant factor reducing piping plover productivity at Sandy Hook nesting areas. Predators encountered at Sandy Hook include foxes, raccoons, gulls, crows, ghost crabs (*Ocypode quadrata*), and feral or free-ranging domestic dogs and cats (National Park Service, 2004; McArther-Heuser, pers. comm., 2004). The red fox has been documented as the major predator of piping plover nests and chicks at Sandy Hook. In 1997, 42 pairs of breeding piping plovers at Sandy Hook made 63 known nesting attempts. Of these attempts, only 11 nests hatched at least one chick. Of the nests that were lost, red foxes were positively identified as the cause for 30 nest losses and likely played a factor in the abandonment of 5 additional nests and 17 nests where the cause of the nest lost could not be definitively determined. In 1997, foxes took 96 piping plover eggs. Areas hardest hit were the USCG Beach, North Beach, and North and South Gunnison Beaches (McArthur, 1997). The dramatic decline from 42 nesting pairs of piping plovers in 1997 to only 29 pairs in 1998 can be attributed to predation and harassment from foxes, resulting in plovers abandoning the affected nesting areas.

Similar heavy fox predation was documented in 2004 when 31 pairs of plovers made 61 known nesting attempts, of which only 12 hatched at least 1 chick. Fox predation accounted for 66 percent of nest failures in 2004. Out of 207 known piping plover eggs laid, foxes were documented as the cause of 76 percent of eggs lost. Table 5 shows the number of known eggs laid and the number of eggs lost to predators (foxes, raccoons, crows, and gulls) and humans over the 10 year period of 1995 to 2004 (McArthur-Heuser *et al*., 2004). This table includes *only* known eggs that were found by NPS staff and volunteers and does not include eggs that may have been lost to predators before discovery.

Table 5. Piping Plover Eggs Losses at Sandy Hook, 1995-2004

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total number of eggs laid	193	200	195	145	107	124	140	137	226	207
Number of eggs predated	32	64	118	96	8	8	0	0	53	133
Percent of eggs lost to predators	17	32	61	66	7	6	0	0	23	64

To reduce nest losses from predation, NPS staff erect predator exclosures around nests where circumstances warrant. Exclosures can be ineffective in circumstances where a "smart predator" learns how to enter the exclosure or to wait for the adults to exit. The predator subsequently keys into the exclosed nests as a food source. To reduce nest losses from "smart" foxes at Sandy Hook, the NPS has used electrified fences as a deterrent. Thirteen electrified exclosures were used at Sandy Hook in 2004. While foxes did predate three of these electrified exclosures, this management technique was successful in reducing total nest losses. Sixty two percent of nests with electrified exclosures successfully hatched in 2004 as compared to success rates of only 5 percent of non-electrified exclosures and 10 percent of unexclosed nests (McArthur-Heuser *et al*., 2004).

While predator exclosures are somewhat effective in reducing nest losses, they do not offer protection to chicks. The precocial chicks leave the nest site within hours of hatching, becoming vulnerable to a variety of predators (U.S. Fish and Wildlife Service, 1996). Because piping plover chicks are highly mobile, the exact cause of chick losses is often very difficult to determine. The percent of hatched chicks surviving to fledgling stage at Sandy Hook over the period from 1995 to 2004 ranged from a low of 49 percent to high of 63 percent (McArthur-Heuser *et al*., 2004).

To reduce losses of piping plover nests and young from predators, the NPS has conducted periodic predator management, including live-trapping and removal of foxes. Both hatching success and chick survival appear to have increased significantly following trapping of foxes within northern nesting areas in 1998 and 1999 (National Park Service, 2004; Lane, pers. comm., 2005). Fox predation over the last two nesting season (2003 and 2004) resulted in high rates of both nest predation and nest abandonment at Sandy Hook. The 2004 nesting season was one of the poorest years of productivity on record for Sandy Hook with only 0.66 chicks fledged per nesting pair (Jenkins *et al*., 2004). To reduce predation of piping plovers, the NPS intensified fox trapping efforts in early 2005. As of mid-April 2005, 2 adults and 3 fox kits were live-trapped and removed from Sandy Hook to locations approved by the NJDEP (Lane, pers. comm., 2005; McArthur-Heuser, pers. comm, 2005).

The NPS prohibits pets on ocean beaches; however, pets are permitted on bayside beaches during nesting season. Bayside sand and mudflats provide high quality foraging habitats for piping plovers. Leashed and unleashed dogs in these preferred habitats may harass foraging birds or may preclude birds from foraging altogether. Dogs on beaches during the nesting season can present a greater threat than pedestrians (Jenkins and Pover, 2001b) as the birds perceive dogs as predators.

No evidence of herbivory of seabeach amaranth has been reported from Sandy Hook to date. However, evidence of minor insect herbivory has been observed in the adjacent municipalities of Sea Bright and Monmouth Beach, where isolated occurrences of chewed leaves, insect webs, and a few feeding larval insects have been noted. To date, these insect species have not been identified, and damage has appeared minimal. Low-level herbivory most likely occurs on Sandy Hook as well, and may increase in coming years. As plant populations expand, insect and mammalian herbivores may increasingly exploit this new food source (U.S. Fish and Wildlife Service, 2002).

Natural predators of northeastern beach tiger beetles include robber flies (Asilidae), birds, and spiders. Larvae are preyed upon by parasitic wasps (*Methocha* sp.) (U.S. Fish and Wildlife Service, 1994). Such predators are likely present at tiger beetle sites at Sandy Hook. While the cause of the decline of the reintroduced population of northeastern beach tiger beetle at Sandy Hook is not known, flocks of gulls loafing at North Beach may have been a factor. The gulls may have preyed upon tiger beetle adults, may have disrupted normal tiger beetle foraging and mating activities, or caused the beetles to disburse to other less suitable areas.

4. Other Beach Nesting Birds

Piping plovers often nest in association with least tern (*Sterna antillarum*) colonies, presumably benefiting from the aggressive behaviors of terns in driving away predators (Burger, 1987). Total least tern numbers within colonies at Sandy Hook 2000-2004 are shown in Table 6 (National Park Service, 2000; 2001; 2002; 2003; McArthur-Heuser *et al.*, 2004). Burger (1987) found that piping plovers in New Jersey derived anti-predator benefits from nesting near terns, and plovers nesting in tern colonies often had higher success than those nesting outside of tern colonies. Productivity of least terns in the past two nesting season has also been poor and can be attributed largely to predation. No least tern young survived to fledgling stage in 2004 (McArthur-Heuser *et al*., 2004).

Seabeach amaranth also benefits from the presence of least tern colonies, since restrictions on public access in the nesting areas provide protected areas where plants can become established (Weakley and Bucher, 1992). Northeastern beach tiger beetles would also likely benefit from reduced disturbance in areas closed to public access to protect least tern colonies. Least terns are listed as endangered by the State of New Jersey.

Table 6. Adult Least Terns and Young at Sandy Hook Nesting Sites, 2000-2004

SITE	2000		2001		2002		2003		2004	
	Adults	Young	Adults	Young	Adults	Young	Adults	Young	Adults	Young
Coast Guard	20	0	36	5	77	0	26	1	0	0
North Beach	46	10	51	10	23	12	4	0	5	0
North Gunnison	22	0	14	2	17	0	2	0	28	0
South Gunnison	0	0	0	0	0	0	0	0	0	0
Critical Zone	0	0	0	0	0	0	66	2	77	0
Hidden Beach	35	0	109	12	145	16	8	0	16	0
Fee Beach	195	47	178	45	182	24	28	5	12	0
South Fee Beach	0	0	0	0	0	0	9	1	0	0
Total	**318**	**57**	**388**	**74**	**444**	**52**	**143**	**9**	**138**	**0**

Common terns (*Sterna hirundo*) and oystercatchers (*Haematopus palliatus*) also nest on Sandy Hook. As with plovers and least terns, the nesting success of these birds has also been poor in recent years (Table 7), with neither species fledging young in the past two breeding seasons (National Park Service, 2000; 2001; 2002; 2003; McArthur-Heuser *et al*., 2004). Fencing to protect these species would benefit seabeach amaranth and northeastern beach tiger beetles, and common terns lend additional predator defense to piping plovers on the northern beaches.

Table 7. Common Terns and Oystercatchers at Sandy Hook, 2000-2004

SPECIES	2000		2001		2002		2003		2004	
	Adults	Young	Adults	Young	Adults	Young	Adults	Young	Adults	Young
Common Tern	36	11	20	9	124	31	8	0	8	0
Oystercatcher	8	3	12	7	18	2	18	0	12	0

VI. EFFECTS OF THE ACTION

In evaluating the effects of the federal action under consideration in this consultation, 50 CFR 402.2 and 402.14(g)(3) require the Service to evaluate both the direct and indirect effects of the action on the species, together with the effects of other activities that are interrelated or interdependent with the action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for project justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The NPS sand slurry pipeline project will have some beneficial effects at piping plover and seabeach amaranth areas prone to erosion in the southern portion of the park. However, the project will also cause direct and indirect adverse effects on piping plovers, seabeach amaranth, and northeastern beach tiger beetle as discussed below.

The sand slurry pipeline project is proposed as a long-term solution for periodic beach renourishment by "recycling" sand transported from south to north in the littoral drift. For the purpose of evaluating the effects of the action, the Service considered the effects over the anticipated 30-year life of the project.

At the Gunnison Beach borrow site, the linear distance of intertidal area shoreline to be impacted annually by sand removal will range from approximately 500 feet to a maximum of 1,000 feet. At the Critical Zone deposition area, the linear distance of intertidal shoreline that may be targeted to receive fill over the life of the project is approximately 3,000 feet in length. However, annual operation of the pipeline will deposit the sand slurry at a stationary location through pipes extending into the intertidal zone area. The sand will then be subsequently transported and distributed downdrift by ambient waves and currents. Therefore, the area to be adversely impacted at the borrow site will be confined to the vicinity of the discharge pipe and is anticipated to be no more than 500 linear feet of intertidal shoreline per year.

In addition, annual operation of heavy machinery and project-related motorized vehicles will occur on beach habitats to support activities associated with operation of the sand slurry pipeline system. The area to be affected annually is estimated by the NPS as 2 acres at Gunnison Beach and 3 acres at the Critical Zone for a total of approximately 5 acres.

A. BENEFICIAL EFFECTS

1. Habitat Creation Incidental to Beach Nourishment

Prior to recent beach nourishment events carried out at both Sandy Hook and the adjacent municipalities to the south, some sites within the southern portion of the park had become unsuitable for piping plovers and seabeach amaranth due to previous shoreline stabilization efforts. Sandy beach habitats had eroded and new habitats were precluded from forming by the effects of the existing hard stabilization structures. Past nourishment of oceanfront beaches at the Critical Zone and increased sand accumulation resulting from Corps nourishment activities in

Sea Bright and Monmouth Beach created "new" nesting habitat for piping plovers and suitable sites for seabeach amaranth colonization along Sandy Hook's southern oceanfront beaches. Specifically, formation of listed species habitat at the Critical Zone, Hidden Beach, Fee Beach and South Fee Beach can be attributed to the aforementioned past renourishment events.

In the absence of the renourishment, erosion of the Critical Zone beach would be expected to continue, and the area would eventually become too narrow and scarped to support nesting piping plovers or seabeach amaranth. Such unsuitable habitat conditions would persist until overwashing or breaching of the peninsula occurred. More likely, once the area eroded, the NPS would act to prevent or repair overwash or breaching through alternate means such as periodic large-scale renourishment using sediment dredged from off-shore sources or construction of hard structures to protect Hartshorne Drive and other park facilities and infrastructure. Therefore, the proposed Sandy Slurry pipeline project will benefit piping plovers and seabeach amaranth by maintaining habitat over the 30-year life of the project. In past years when suitable habitat was present for plovers at the Critical Zone, the site supported from one to six breeding pairs. However, the benefits to piping plovers of maintained habitat at the Critical Zone will be negated if proposed conservation measures to prevent reproductive losses are not aggressively implemented at the site. Reproductive success at the site since 1995 has averaged only 0.61 chicks fledged per nesting pair. Past reproductive data (see Table 2) suggest that, in all but one past nesting season, the Critical Zone has constituted a population sink in which reproductive success was drastically below that needed to maintain a stable piping plover population. It should also be noted that, although the NPS sand slurry pipeline project will create sandy beach habitat that may attract piping plovers, the habitat created can be expected to be of lesser quality (*i.e.*, lower carrying capacity, lower productivity potential, higher disturbance from recreational use conflicts, reduced escape cover from predators, and limited alternate foraging habitat for chicks) than habitat that is formed through natural coastal processes such as overwash.

Maintenance of sandy beach habitat in the Critical Zone is expected to benefit seabeach amaranth. With favorable growing conditions (including the perpetuation of greater beach widths) and the NPS's proposed conservation measure to restore plants following project implementation, seabeach amaranth can be expected to remain stable or increase at the Critical Zone and adjacent targeted fill areas over the 30-year project life.

Maintenance of sandy beach habitat in the Critical Zone via the sand slurry pipeline may create suitable habitat for future colonization by northeastern beach tiger beetles. Mark-recapture studies have shown that northeastern beach tiger beetles are capable of traveling 5 to 12 miles from their original capture sites (Knisley and Hill, 1989); some individuals may disperse up to 15 miles (Knisley, 1997b). Therefore, beetles from the northern Sandy Hook reintroduction site may disperse to suitable habitats at the Critical Zone.

2. Endangered Species Monitoring and Management Program

To offset potential impacts to federally listed species at the sand slurry pipeline borrow and deposition sites and other indirect effects of the action, the NPS will hire additional staff to monitor and manage federally listed species throughout the Sandy Hook Action Area.

Monitoring and management activities that have been ongoing or that have been included as conservation measures for this project (see Project Description above) will be conducted on both the nourished and unnourished portions of Sandy Hook.

Current NPS staff assigned to implementation of federally listed species monitoring and management actions at Sandy Hook includes 2 full-time permanent resource management positions in the Park Ranger job series, and 4 seasonal positions in the Biological Technician job series or through the Student Conservation Assistant volunteer program. In addition, 13 permanent law enforcement employees, supplemented by varying numbers of seasonal law enforcement positions, provide support in enforcing park regulations and preventing unauthorized access into areas closed to protect federally listed species (Lane, pers. comm., 2005). Two additional seasonal Biological Technicians will be hired annually beginning with the initiation of sand slurry pipeline construction activities and continuing for the 30-year life of the project (National Park Service, 2004; Lane, pers. comm., 2005).

Impacts to piping plover nests and broods from recreational users at Sandy Hook would be substantial without management actions carried out by the NPS staff. The NPS has committed to continuing and expanding its piping plover monitoring and management activities and to expanding its natural resource monitoring and management program to include annual surveys for and protection of seabeach amaranth and northeastern beach tiger beetle. These conservation actions can be expected to benefit piping plovers and other beachnesting birds by reducing disturbance to nesting birds and to protect seabeach amaranth plants and northeastern beach tiger beetle larvae from destruction by pedestrians and vehicles. In addition, annual surveys and management will promote recovery of these species.

B. DIRECT ADVERSE EFFECTS

1. Sand Slurry Pipeline Construction and Operation

Sand slurry pipeline project activities occurring on or adjacent to sites currently occupied by federally listed species could have direct adverse effects. Cyclic beach nourishment will involve operation of a sand excavator with educator nozzle to dredge a sand slurry that will then be pumped through a pipeline for deposition onto the targeted beach. Heavy machinery will be used on the beach to place temporary pipe and associated equipment at both the borrow and deposition beaches and, when necessary, earth-moving equipment will be used to contour pumped sand at the deposition area. Even in areas where sand will be placed only seaward of the present high-tide line, disturbance of the upper beach from equipment and construction crews can be expected.

Sand slurry pipeline construction and operational activities will take place outside of the piping plover nesting season (March 15 to August 15); therefore, no direct adverse effects to piping plovers are anticipated. However, seabeach amaranth and northeastern beach tiger beetle may be directly impacted by the project.

Efforts will be made to locate, fence, and, where possible, avoid seabeach amaranth plants. However, the NPS anticipates that some plants may occur in areas that will be impacted by construction-related activities. These plants would likely be damaged or destroyed by construction-related equipment and / or the plants and their seed would be buried by fill material. Since the project will not commence until October of each year, most seabeach amaranth plants would have produced some seed by that date. For an annual plant, the effects of direct plant mortality are less important than the effects of reduced seed production, which impairs the species ability to persist into successive growing seasons. The NPS proposes to offset anticipated destruction of plants and seed by relocating plants that would be destroyed and by collecting seed for distribution back at the affected site in the following growing season. A similar effort conducted by the NPS following the Interim Beach Fill Project in 2002 was successful in maintaining a seabeach amaranth population at the Critical Zone. The annual operation of the sand slurry pipeline will reduce the amount of sand placed at the deposition area during each fill event and the amount of mechanical contouring required as compared to past large-scale renourishment events. Therefore, the Service anticipates that approximately 10 percent of seabeach amaranth plants and 10 percent of total seed produced at the affected sites in a given year will be destroyed or buried. This adverse affect is anticipated to continue annually within approximately 5 acres of beach habitat in each year of the 30-year project.

As previously discussed, although no northeastern beach tiger beetles have been documented at either the borrow or deposition areas, colonization over the 30-year life of the project can reasonably be expected to occur if the reintroduced population at Sandy Hook is successful and expands. Northeastern beach tiger beetle adults would not be active during the period of construction or operation; therefore, no direct adverse impacts to adult tiger beetles are anticipated. The NPS proposes to survey the Gunnison Beach borrow and Critical Zone deposition areas for the presence of adult beetle in the summer prior to each fill event to determine if larval beetles would likely be present. If so, a survey for larval beetles would be conducted. If evidence of northeastern beach tiger beetles is found within the borrow or deposition areas, the NPS proposes to reinitiate consultation to determine appropriate minimization or avoidance measures. Due to their small size, it is unlikely that the burrows of first instar larval beetles within the borrow or deposition areas would be detected if present in low densities. Therefore, the Service anticipates that any undetected larvae within the footprint of borrow and deposition area construction activities would likely be adversely impacted. Heavy machinery operation would probably crush larvae. While most larvae would occur in the vicinity of the wrack line or landward, some larvae could occur in the intertidal area. Larvae incidentally taken in the sand slurry by the educator nozzle intact or buried by sediments at the deposition site would likely not survive. The NPS estimates that the amount of northeastern beach tiger beetle potential habitat to be impacted annually is approximately 5 acres.

2. Shoreline and Beach Profile Surveys

Periodic beach profile surveys are a maintenance component associated with the proposed project. Surveys will be conducted using a vehicle-mounted GPS for development of a digital atlas of the Sandy Hook shoreline to assess sand conditions at the project borrow and deposition sites and at areas downdrift of the project. Surveys will be conducted monthly at the Critical

Zone, quarterly at Gunnison beach, and annually in sensitive beach areas with occurrence of federally listed species.

Beach profile surveys will be scheduled to avoid or minimize impacts to nesting piping plovers. However, since beach profile surveys will be conducted monthly at the Critical Zone, motorized vehicles will be operated on the beach at this site during the nesting season. The operation of motorized vehicles conducting beach profile surveys will not likely result in physical injury or death of adult birds. However, even a single temporary disturbance can result in disruption of courtship activities, preclusion of nest initiation, interference with foraging or roosting, abandonment of nests or chicks, or stress to adults and chicks that may result in chick mortality. Operation of motorized vehicles within piping plover nesting areas could cause death or injury to piping plover eggs or young.

Both seabeach amaranth and northeastern beach tiger beetles may be adversely impacted by motorized vehicles used to conduct quarterly beach profile surveys at Gunnison Beach and annual beach profile surveys of the Sandy Hook shoreline. Seabeach amaranth plants or northeastern beach tiger beetle larvae within the path of the vehicle may be crushed, resulting in death or injury of plants or beetle larvae.

C. INDIRECT ADVERSE EFFECTS

1. Preclusion of Natural Habitat Formation

Stabilized beach strands are generally less productive habitats and have lower carrying capacity for piping plovers, seabeach amaranth, and northeastern beach tiger beetles than more dynamic, naturally functioning beaches. The NPS sand slurry project will adversely affect piping plovers, seabeach amaranth, and northeastern beach tiger beetle by contributing to the perpetuation of a highly stabilized coastline at Sandy Hook. The project affords protection to upland development by buffering these structures from storm tides and wave attack and thus continues a program of shoreline stabilization that has essentially stopped the natural process of periodic erosion and accretion typical of barrier islands and barrier spits. Consequently, the project prevents natural formation of optimal habitats for piping plovers, seabeach amaranth, and northeastern beach tiger beetles.

The adverse effects of a stabilized shoreline within the Action Area on numbers of individuals of piping plovers, seabeach amaranth, and northeastern beach tiger beetles are difficult to quantify since such a quantification would depend on where (in addition to the predicted periodic overwash or breach at the Critical Zone), when, and how new habitats would form if stabilization efforts were halted, and to what degree these habitats would permit expansion of current populations. Given the past history of coastal stabilization and intense coastal development that has previously occurred within the Action Area, it is also not possible to quantify the amount of "naturally" created habitat that would provide optimal conditions as opposed to marginal or unsuitable conditions for plovers and amaranth should no further stabilization occur. It is possible, however, to determine the linear distance of beach habitats that will be artificially stabilized through the NPS project. Natural coastal processes that create, enhance, and

perpetuate piping plover, seabeach amaranth, and northeastern beach tiger beetle habitat will be directly curtailed along approximately 4,000 feet of coastline for the 30-year life of the project. Additionally, the project will interfere with "natural" sand volumes transported along approximately 5.5 miles of the Sandy Hook coastline from the Critical Zone north by annually recycling up to 100,000 cy of sand per year. Recycling of sand may reduce or delay accretion along that portion of the Sandy Hook coastline lying to the north of Gunnison Beach (National Park Service, 2004); however, the areal extent of this anticipated impact has not been quantified.

The NPS proposes to monitor beach profile and shoreline changes within areas supporting federally listed species. If monitoring shows that sand recycling diminishes the amount of listed species habitat, the NPS will implement habitat management or restoration efforts to offset project-related losses. Potential management or restoration actions include, but are not limited to vegetation management and adjusting rate of sand removed from the Gunnison Beach borrow area (Foley, pers. comm., 2005; Lane, pers. comm.. 2005; Wells, pers. comm., 2005).

2. Creation of Sub-Optimal Beach and Dune Habitats

The NPS project will perpetuate the artificial creation and maintenance of suboptimal beach and dune habitats. Stabilization of beach and dune habitats is likely to accelerate growth of native and non-native vegetation that will out-compete seabeach amaranth and further reduce habitat suitability for nesting and foraging plovers and for northeastern beach tiger beetle larvae.

Periodic nourishment within the Critical Zone will attract plovers to artificially stabilized beach areas and perpetuate nesting activity in areas where harassment from human disturbance is likely to occur.

3. Burial of Piping Plover Prey Base

Piping plovers feed on invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks (Bent, 1929; Cairns, 1977; Nicholls, 1989). Prey can generally be divided into two categories: terrestrial invertebrates (chiefly flies and other insects, including diurnally burrowing Talitrid amphipods (Amphipoda) (Gibbs, 1986)), and benthic intertidal infaunal invertebrates.

On oceanfront habitats, terrestrial invertebrates tend to be concentrated in the wrack line (Loegering and Fraser, 1995; Hoopes *et al.*, 1992), a favored piping plover foraging area, particularly for chicks (Goldin, 1993; Hoopes, 1993; Hoopes *et al.*, 1992). Availability of wrack is especially important at sites where ephemeral pool and bayside foraging areas are not available. Impacts to the wrack line from the NPS sand slurry pipeline project are anticipated to be insignificant.

Although the exact composition of the benthic invertebrate community at the borrow and deposition area beaches is not known, many studies have investigated plover use of this prey resource on other Atlantic coastal beaches. On three southern New Jersey beaches, Staine and Burger (1994) found that polycheate (*Scolelepis* spp.) abundance is highest in piping plover foraging areas, and concluded that polychaetes (especially *Scolelepis squamata*) are the plovers'

main source of food in these locations. Hoopes *et al.* (1992), Gibbs (1986), and Cairns (1977) also documented that piping plovers feed on polychaetes. Loegering (1992) found amphipods and mole crabs (*Emerita talpoida*) abundant in the saturated intertidal zone of the ocean beach on Assateague Island National Seashore in Maryland, with amphipods comprising approximately 95 percent of samples from these areas. Loegering (1992) and Loegering and Fraser (1995) observed that older chicks and adults often feed in this saturated zone, suggesting that amphipods constitute a prey resource. In an evaluation of benthic prey resources conducted by the Corps in Ocean City, Cape May County, New Jersey, dominant taxa included amphipods and other Haustoridae, coquina clams (*Donax* spp.), and polychaetes (Scott, 2002).

Beach nourishment affects the species' richness, abundance, and biomass at the sand placement area in the short term following the nourishment (U.S. Army Corps of Engineers, 1999). The Service expects that 100 percent of the intertidal infaunal prey base will be covered by sand placement at the deposition pipe outfall site and immediate vicinity. Recovery times are dependent on compatibility of sediments between the existing beach and the fill material, as well as the time of year in which nourishment takes place. For oceanside beach nourishment, the intertidal zone fauna is most affected by nourishment activities (Lynch, 1994). Studies conducted in Florida, North Carolina, and South Carolina show that recolonization rates by benthic invertebrates are variable and somewhat dependent on the time of year in which the nourishment occurs, beginning within days and taking up to 1 year for full recovery of some species (Reilly and Bellis, 1983; Bacca and Lankford, 1988; Lynch, 1994). The macrofaunal community after recolonization may differ considerably from the original community. Once established, it may be difficult for species of the original community to displace the new colonizers (Hurme and Pullen, 1988).

In a study of the effects of beach nourishment on oceanside intertidal benthos conducted by the Corps (1999) in Monmouth County, New Jersey, recovery time of the intertidal infaunal community was as short as 2.0 months following renourishment carried out between early August and early October. Recovery time following renourishment in mid- to late-October is expected to fall within the range of 2.0 to 6.5 months. Renourishment between November and January would coincide with the period of sharp seasonal decline in abundance, and the infaunal community would not be expected to recover for at least 6.5 months.

Impacts to benthic invertebrates at the Gunnison Beach borrow area would be confined to approximately 1,000 feet of intertidal shoreline at the public bathing portion of Gunnison beach, an area not typically used by piping plovers for foraging. Additionally, no impacts to piping plover prey resources are anticipated at the adjacent North and South Gunnison nesting areas. The volume of sand to be deposited annually at the Critical Zone via the proposed sand slurry pipeline project will be 100,000 cy or less. This sand will be deposited in small quantities (up to 2,000 cy per day) into the intertidal zone over approximately 50 pumping days. Invertebrates within the intertidal zone deposition site at the Critical Zone would likely be buried, resulting in elevated mortality. Additionally the NPS estimates that increased suspension of sediments and turbidity will occur adjacent to the borrow and deposition sites (up to 3 acres total). This turbidity may negatively impact benthic prey resources adjacent to and downdrift of the deposition pipe. Operation of the pipeline will deposit the sand slurry at a stationary location

through pipes extending into the intertidal zone area. Sand will subsequently be transported and distributed downdrift by ambient waves and currents. The area to be adversely impacted at the borrow site will be confined to the vicinity of the discharge pipe and the intertidal zone downdrift, anticipated to be no more than 500 linear feet of intertidal shoreline per year (National Park Service, 2004; Lane, pers. comm., 2005). Therefore, the Service anticipates a reduction of benthic invertebrate prey resources for piping plovers will occur along approximately 500 linear feet of shoreline at or adjacent to the Critical Zone nesting on an annual basis.

Each individual annual fill event is expected to bury and cause mortality of invertebrate organisms that serve as food resources for piping plovers, thereby depressing food resources. The long-term impacts to prey resources from this repeated cycle are not fully understood and may be impossible to determine because there is no baseline for comparison. Areas adjacent to the impacted deposition area should serve as reservoirs of source populations of benthic invertebrates. Recovery of prey resources can be expected to start immediately after fill placement and to continue as the piping plover breeding season commences; however, since the sand slurry pipeline may continue to operate until March 1, full recovery of the site may be delayed until after or late in the breeding season. Additionally, prey species abundance and composition may change as a result of annual impacts at the deposition site over the 30-year length of the NPS project. The effects of such a change in prey species resources on piping plover survival and reproductive success are not fully understood.

4. Recreational Activities

By maintaining habitat at the Critical Zone, the sand slurry pipeline project will continue the current exposure of piping plovers at the site to high levels of disturbance from recreational users over the 30-year life of the project. Combined with other factors occurring at the site, this level of disturbance is likely to perpetuate a piping plover population sink in the Critical Zone (see below Population Sink section). Studies have found a negative correlation between the number of people present within 50 meters of piping plovers and time spent foraging (Burger, 1991). Plovers may spend only 50 percent of their foraging time actually feeding in habitats with many people present, compared to 90 percent in less disturbed areas (Burger, 1994). Flemming *et al.* (1988) found productivity correlated to level of disturbance, with 1.8 chicks per pair in areas of low disturbance compared to 0.5 chicks per pair in areas of high disturbance. However, Hoopes *et al.* (1992) found no correlation between rates of disturbance and productivity rates, and attributed this to intensive management of recreation within his study area, including restrictions on dogs and off-road vehicles and use of symbolic fences to protect nests and provide refuge areas for chicks. To reduce impacts from recreational activities at the Critical Zone, the NPS proposes to manage and enforce a beach closure around piping plover nesting areas. The closed area will include all areas within 100 meters from any nest site. The intertidal zone will be closed once nests hatch and will remain closed until all chicks at the site have fledged. Trained personnel will be stationed at the end of the protected area at the Critical Zone to enforce protective measures.

Perpetuation of recreational activities at the Critical Zone beach would impact seabeach amaranth by exposing the plants to high density foot traffic over the 30-year life of the project.

To reduce trampling, NPS staff will erect symbolic fencing to protect plants in the Critical Zone and other areas open to beach-goers. Impacts to seabeach amaranth in the Critical Zone will be further minimized by fencing and beach closures to protect piping plovers.

Northeastern beach tiger beetles may colonize the Critical Zone over the 30-year life of the project if the reintroduced population at Sandy Hook is successful and expands. Adult tiger beetles have a tendency to avoid areas with high human use. Since the period when adult tiger beetles would disperse into new areas coincides with the period of high recreational use, the Service does not anticipate that beetles would move onto recreational beaches at the Critical Zone. Rather, the beetles would be most likely to colonize areas closed to protect piping plover or seabeach amaranth. Therefore, perpetuating recreational use at the Critical Zone would limit the amount of habitat available for expansion of the northeastern beach tiger beetle. Impacts from recreational activities on tiger beetle adults and larvae would be minimized within areas fenced and closed to the public to protect piping plovers and seabeach amaranth.

By forestalling a breach at the Critical Zone and preserving vehicle access onto the Sandy Hook barrier spit, the sand slurry pipeline project will permit the continuation of existing levels of disturbance to federally listed species from recreational activities throughout the park. With the exception of the Critical Zone, Hidden Beach, and Fee Beach, current levels of disturbance from recreational activities to piping plovers, seabeach amaranth, and northeastern beach tiger beetles on Sandy Hook are considered low and can be attributed to the strong protections and intense management efforts provided by NPS staff. Recreational disturbance of federally listed species throughout the park is expected to increase over the 30-year life of the project. To offset any increased disturbance from the proposed project, the NPS will hire two additional seasonal Biological Technicians to monitor and manage federally listed species and to implement conservation measures. At the northern nesting areas, the Service does not anticipate a significant increase in disturbance from recreational activities above existing baseline conditions. Human disturbance at the Critical Zone, Hidden Beach, Fee Beach and South Fee Beach is high; however, since these areas are within reasonable walking distance from the southern park boundary, absent the proposed project these beaches would be expected to receive the same or, in the case of a breach, a substantially higher amount of visitation over the current baseline.

5. Predation

The proposed project will preserve vehicle access and perpetuate recreational use on Sandy Hook. As noted in the piping plover recovery plan (U.S. Fish and Wildlife Service, 1996) substantial evidence exists that human activities are exacerbating natural predation on piping plovers, their eggs, and chicks. Beach recreationists often feed wildlife or leave trash that attracts species that prey on piping plovers. Such activities occurring on Sandy Hook's public beaches could result in losses of plover adults, nests, or young. Documented predators of piping plovers at Sandy Hook include foxes, raccoons, gulls, crows, and feral or free-ranging domestic dogs and cats (National Park Service, 2004; McArther-Heuser, pers. comm., 2004).

In the artificially stabilized system at the Sandy Hook Unit, piping plovers are provided protection within areas specifically zoned and managed as nesting areas, while other Park areas

are managed for public use. Areas managed for natural resource protection comprise almost 50 percent of the Sandy Hook shoreline (National Park Service, 2004). While this strategy strives to provide a secure nesting area for plovers where disturbance from recreational users can be avoided, a disadvantage of this management strategy is that once predators key into the nesting areas, the birds are unable to move to new suitable nesting areas such as those that would be formed at accreting areas within beaches currently managed for public use. In a natural coastal barrier island and spit system, plover habitat would be expected to wax and wane and change spatially as geomorphologic changes occur at Sandy Hook (Psuty, undated), providing the birds with alternate suitable nesting sites to avoid these predators. The proposed cyclic renourishment project will artificially stabilize Sandy Hook further and will preclude future formation of an inlet or overwash zone at the Critical Zone that would provide new highly suitable habitat for plovers. Even with formation of plover habitat at an inlet or overwash at the Critical Zone, over time predators, such as foxes, raccoons, gulls, and crows, would be expected to discover the new nesting area.

Some circumstantial evidence exists that predators are more efficient on linear beaches where nest locations are in a highly predictable line along the foot of the dune (Hecht, pers. comm., 2004). On Long Island south shore barrier beaches, red foxes use dunes as denning sites. By confining piping plover breeding areas to these narrow predictable bands of linear oceanside habitat, efficiency of red fox and other predators may be increased as compared to sites with wider, irregular barrier island features that may allow piping plovers to be more efficient in eluding predators (U.S. Fish and Wildlife Service, 2003). By preventing overwash or inlet formation at the Critical Zone and perpetuating a narrow, linear beach, the proposed action may increase vulnerability of nests and chicks to predators at the Critical Zone nesting area and nearby Hidden and Fee Beaches. Also, preventing a breach at the Critical Zone maintains connectivity with the mainland that may facilitate movement of mammalian predators onto Sandy Hook.

Piping plovers will abandon traditional nesting areas if adult birds are subjected to significant disturbance or if nesting success is consistently poor, as evidenced by the dramatic decline in pairs of nesting plovers following the 1997 nesting season when heavy losses of eggs and chicks to fox predation were documented at Sandy Hook. In the absence of the formation or creation of suitable nesting habitat in alternate locations, plovers can be expected to abandon nesting areas at Sandy Hook in favor of less suitable areas off-site, or birds will continue to use traditional nesting areas with sustained poor success.

Piping plovers within the Action Area are currently protected from avian and mammalian predation through management actions undertaken by NPS. As described in more detail within the Environmental Baseline section of this Biological Opinion, NPS predator management in nesting areas includes use of predator exclosures around plover nests, close monitoring, and, where necessary, predator removal. Use of predator exclosures have been used with demonstrated success to reduce predation on piping plover eggs (Melvin *et al.*, 1992; Rimmer and Deblinger, 1990). However, these same devices have also been associated with serious problems including entanglements of birds in the exclosure netting and attraction of “smart” predators that have “learned” there is potential prey inside. The downside risks may include not

only predation or nest abandonment, sometimes at rates exceeding those that might occur without exclosures, but also induced mortality of adult birds. Exclosures provide no protection for mobile plover chicks, which generally leave the exclosure within 1 day of hatching and move extensively along the beach to feed.

At Sandy Hook, use of exclosures made important contributions to productivity between 1990 to 1996. However, heavy predation on both exclosed and unexclosed nests was the major cause of a precipitous drop in productivity from 1.49 chicks per pair (1990-1996 average) to 0.36 chicks per pair in 1997 (McArthur, 1997). Electrification of exclosures at Sandy Hook increases nest hatching success substantially; however, even with electrification, nest losses to foxes can occur, especially when equipment failure occurs (McArthur-Heuser pers. comm., 2004).

As a conservation measure to offset losses of piping plovers from the sand slurry pipeline project, the NPS will conduct a predator monitoring and management program. In areas where exclosures or other deterrents are not successful in abating losses of nests and chicks, the NPS will continue to live trap and relocate mammalian predators as the NPS did in 1998, 1999, and 2005. In addition, feral cats will be trapped and taken to an animal care facility. Such a trapping program should help to reduce losses from predation. To date, most trapping has been with the use of box traps. However, since, as with exclosures, foxes can become "smart" and learn to avoid box traps, alternate methods of live trapping may need to be employed, such as the use of snares.

Live-trapping will, in particular, target areas with "smart-fox" individuals that have learned to circumvent predator exclosures. Under the NJDEP permit for predator control the NPS has the option of trapping and relocating or euthanizing foxes. While the NPS is required to release any lactating female to prevent starvation of kits, the NPS has the option of euthanizing the kits if the den can be located. In spring 2005, rather than euthanizing unweaned fox kits, the NPS preferred to release trapped lactating female foxes unharmed back into the nesting area from which they had been captured (Jenkins, pers. comm., 2005). Such animals are likely to become "trap-wise" and difficult to re-capture using the same trapping technique. The Service anticipates that such animals will continue to prey on piping plover nests and young. Therefore, the NPS-proposed predator management program may, on occasion, create a situation where "smart" and "trap-wise" foxes will continue to adversely affect piping plover nesting success either by preying directly on eggs and young, or by harassing adult plovers causing abandonment of nests or broods.

The NPS's ability to exercise the option of live trapping and relocating individuals is dependent upon the availability of NJDEP-approved release locations. The number of available NJDEP-approved predator release locations are limited and one can anticipate that previously used predator release sites will eventually reach carrying capacity. Therefore, the NJDEP may be unable to provide the NPS with approved release locations in some years over the 30-year life of the project. If such a situation arises, or if trap-wise animals learn to avoid live traps, the NPS's proposed predator management program may become ineffective in reducing predation of piping plover eggs and young.

While the reasons for the dramatic decline of northeastern beach tiger beetles at the North Beach reintroduction site are not known, large numbers of gulls have been documented at the site since 2001, coinciding with the period when adult tiger beetles would emerge and be active at the site. Gulls have been documented as a major predator of other species of tiger beetles (Knisley, pers. comm., 2004). Continued presence of the gulls at the site is likely to suppress or eliminate beetles at the site, possibly precluding successful establishment of a reintroduced population of the northeastern beach tiger beetle at Sandy Hook. As described above, the proposed project will perpetuate recreational access to Sandy Hook and the NPS will continue to stabilize ocean beach areas and manage those areas for recreational use. As with plovers, absent the proposed project, northeastern beach tiger beetle habitat would be expected to wax and wane and change spatially as geomorphologic changes occur at Sandy Hook, providing the beetles with alternate sites to colonize. The proposed project will perpetuate a situation where the beetles are confined to designated areas where they may become increasingly susceptible to losses from predation.

6. Perpetuation of a Piping Plover Population Sink

The maintenance of existing habitat is not necessarily a purely beneficial effect of beach nourishment for piping plovers. Continued plover use of an area may actually be detrimental if indirect adverse effects are sufficient to result in reproductive rates below those needed for stable or recovering populations. Habitat that is physically suitable may create a "population sink" by recruiting individuals to the area each season, only to yield reproduction below replacement levels. This may particularly affect piping plovers on sites close to more productive habitats. Potential exists for the stabilized beach created by the sand slurry pipeline project to lure piping plovers into the Critical Zone, although the birds would have nested more successfully elsewhere on Sandy Hook.

A comparison of piping plover productivity for the Critical Zone with Sandy Hook as a whole (Jenkins, 1990; Jenkins and Pover, 2001a; Jenkins *et al*., 1995; 1998; National Park Service, 2000; 2001; 2002; 2003; Lane, pers. comm., 2005) suggests that past fills may have created a population sink at the Critical Zone (Table 8). Situated between South Beach Areas C and D, and subject to constant erosion, the Critical Zone may offer the least suitable habitat, and the highest levels of disturbance, of any Sandy Hook nesting area. Piping plovers nested unsuccessfully in the Critical Zone in 1990, following the large 1989-90 beach fill. In that year, Eddings *et al.* (1990) noted that public beaches immediately beyond the northern and southern boundaries of the Critical Zone produced a "steady daytime flow of pedestrian traffic throughout the week," and found that mean numbers of people counted in the Critical Zone were higher than in other Sandy Hook nesting areas during afternoon and evening survey periods. Eddings *et al.* (1990) also observed a 0.5 to 1.0-m-high sand scarp in the berm of the Critical Zone that interfered with the access of unfledged chicks to intertidal and wrack foraging habitats. Higher-than-average recreational conflicts were also reported in 2001, when plovers re-colonized the Critical Zone following the 1997-98 fill (MacArthur, pers. comm., 2001).

Table 8. Comparison of Piping Plover Productivity in the Critical Zone versus Sandy Hook Total, 1990-2004

YEAR	SANDY HOOK	CRITICAL ZONE
1990	1.17	0.00
1991	1.15	0.50
1992	1.70	1.20
1993	1.80	0.60
1994	1.94	1.60
1995	1.33	0.50
1996	1.38	0.00
1997	0.36	*
1998	1.00	*
1999	1.66	*
2000	1.76	*
2001	1.58	1.00
2002	1.71	1.50
2003	0.94	0.50
2004	0.66	0.67

* No nesting occurred at the Critical Zone from 1997 to 2000

Piping plover productivity in the Critical Zone over the last 15 years has consistently lagged behind the average productivity for all Sandy Hook nesting areas, despite high levels of protection and management provided by the NPS. This low reproductive success is probably due to the combined effects of human disturbance, predation, erosion (*i.e.*, scarping, flooding, and narrowed beaches) and periodic depletion or alteration of prey resources following large-scale fill events resulting in a lesser quantity and quality of available intertidal feeding areas and nesting and foraging habitats with greater exposure to human disturbance and predation. Productivity in the Critical Zone was below the level needed for a stable population (1.24 chicks fledged per pair) in 9 of the 11 years the area has been occupied since 1990. These data suggest that the area may, in fact, be a piping plover population sink. The sand slurry pipeline project will adversely affect this species by perpetuating this situation for up to 30 years.

D. CUMULATIVE EFFECTS

Cumulative effects include the impacts of future State, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future federal actions that are unrelated to the proposed action are not addressed here because they require separate consultation pursuant to Section 7 of the ESA. Within the New York-New Jersey piping plover Recovery Unit, the entire range of seabeach amaranth, and northeastern beach tiger beetle Geographic Recovery Area 4, shoreline stabilization and development are considered the most significant threats to these species.

New Jersey has the highest degree of shoreline stabilization of any State. As measured by the amount of shoreline in the totally stabilized category (90 to 100 percent “walled”), New Jersey, America’s oldest developed shoreline, is 43 percent hard-stabilized (Pilkey and Wright, 1988). Although construction of new hard stabilization structures has slowed, the New Jersey Shore

Protection Master Plan (New Jersey Department of Environmental Protection, 1981) documents the State's intent to maintain existing functional structures in many parts of New Jersey. Sandy Hook represents one of the few relatively natural beach ecosystems in New Jersey, and the only one in Monmouth County. By maintaining existing hard structures, and through implementation of the long-term sand slurry pipeline beach nourishment, the NPS is opting to forego the return of Sandy Hook's southern beaches to the natural coastal processes that sustain federally listed and other rare beach strand species. Very
few locations along the New Jersey shoreline offer similar restoration opportunities due to the presence of far more extensive commercial and residential development than that which occurs in the vicinity of the Critical Zone.

In addition, almost the entire ocean-front coastline of New Jersey is scheduled for beach nourishment through federal, State, or local programs over the next 5 to 10 years, further contributing to shoreline stabilization, and further exposing beach strand species to the kinds of direct and indirect effects discussed above. Together, these proposed beach nourishment programs may also increase the risk of species declines or extirpation in New Jersey by rendering significant proportions of habitat temporarily unsuitable at any given time (*i.e.*, through construction effects on both species and their habitats). These widespread, simultaneous habitat disturbances limit the ability of these species to disperse and recover from declines in productivity or catastrophic events.

VII. CONCLUSION

After reviewing the current status of the species, the environmental baseline for the action area, the effects of the NPS-proposed project activities, and cumulative effects, the Service's Biological Opinion is that the NPS project is not likely to jeopardize the continued existence of the piping plover, seabeach amaranth, or northeastern beach tiger beetle. No Critical Habitat has been designated for these species; therefore, no Critical Habitat will be affected.

"Jeopardize the continued existence" of a species means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery in the wild by reducing the reproduction, numbers, and distribution of that species" (50 CFR 402.02). The NPS project contributes, both directly and indirectly, to the vulnerability of the Atlantic Coast piping plover population and the New York - New Jersey Recovery Unit in particular.

Numbers of piping plovers are limited by the carrying capacity of habitat, as well as the availability of birds to fill it. The NPS project perpetuates the long-standing sequence of shoreline stabilization events and coastal development that preclude natural coastal processes from creating optimal piping plover habitats at Sandy Hook. A complex history of past inlet stabilization and beach nourishment projects and the effects that may accrue to habitat updrift and downdrift make it difficult to correlate stabilization activities with carrying capacity very closely. The situation is also confounded by probable under-utilization of habitats due to low productivity and harassment from predators. Conservation measures included in the project

description to reduce the direct effects of beach nourishment (*e.g.*, avoidance of nesting areas during the breeding season) are also very important in maintaining habitat carrying capacity for piping plovers. Numbers of piping plovers are also very sensitive to changes in adult and juvenile survival rates. It is very difficult to apportion and quantify specific impacts of factors affecting survival rates, but effects of the project that detract from fitness (*e.g.*, recreational disturbance, reduced prey) or minimize these effects are likely to affect piping plover numbers.

Implementation and success of conservation measures designed to minimize the indirect and/or cumulative effects due to human disturbance and predation are crucial to consistent attainment of productivity rates necessary to sustain a persistent piping plover population. In light of the low density of breeding piping plovers in stabilized areas, extending recreation and predator management to the entire Action Area as proposed is necessary. Management must be consistently implemented to foster high productivity and avoid, to the maximum extent possible, periods of substandard productivity to which small populations are particularly vulnerable. Because Atlantic Coast piping plovers have high rates of fidelity to their natal region, productivity is also closely tied to numbers of breeding pairs in subsequent years.

The Service's evaluation of the effects of the NPS project on federally listed species was based largely on a project description that includes an extensive set of conservation measures to avoid or minimize most significant direct and indirect effects to piping plovers, seabeach amaranth, and northeastern beach tiger beetles. The NPS proposes to include these conservation measures as part of its agency action; therefore, they were considered as an integral part of the project and are nondiscretionary.

VIII. INCIDENTAL TAKE STATEMENT

A. DEFINITION OF INCIDENTAL TAKE

Section 9 of the ESA and the federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. *Take* is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. *Harm* is further defined by the Service to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing essential behavioral patterns such as breeding, feeding, or sheltering. *Harass* is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. *Incidental take* is defined as take that is incidental to, and not the purpose of carrying out an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to, and not intended as part of, the agency action is not considered a prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

B. EXTENT OF ANTICIPATED TAKE

Sections 7(b)(4) and 7(o)(2) of the ESA do not apply to the incidental take of federally listed plant species; therefore, no incidental take statement, and subsequently no reasonable and prudent measures nor terms and conditions, are provided within this Biological Opinion for seabeach amaranth.

1. Anticipated Take from Direct Effects

a. Piping Plover

Sand slurry pipeline construction and operation will take place outside of the piping plover nesting season (March 15 to August 15); therefore, no take of piping plover adults, eggs or young is anticipated from the pipeline construction or operation.

Beach profile surveys using a vehicle-mounted GPS will be conducted monthly at the Critical Zone piping plover nesting area. The beach profile surveys are likely to result in up to six events per year that may incur incidental take (up to one per month in the months of March, April, May, June, July, and August). Take would be in the form of harassment of up to 6 pairs of piping plovers from disruption of courtship activities, preclusion of nest initiation, interference of foraging or brooding, abandonment of nests and young, and / or stress to adults and chicks. The intensity of the harassment is anticipated to be relative to the proximity of the vehicle to individual nesting territories, nests, and broods; therefore, not all pairs would be expected to receive the same level of harassment. The Service anticipates that harassment from beach profile survey activities at the Critical Zone will result in a reduction in the site-wide productivity in the amount of no more than one fledgling every 2 to 3 years.

Additionally, piping plover nests and young are well camouflaged and difficult to detect by operators of motorized vehicles. Operation of motorized vehicles for beach profile surveys in piping plover nesting areas can result in injury or mortality of piping plover nests and chicks. Even with monitoring, instances of take of undetected plover nests or mobile chicks by motorized vehicles have occurred (Melvin *et al.*, 1994; Pover, pers. comm., 2002). The Service anticipates that operation of motorized vehicles for beach profile surveys in the Critical Zone will result in incidental take in the form of harm to one nest or one unfledged piping plover chick approximately once every 15 years for a total of up to two instances of take of nests or chicks over the life of the project.

b. Northeastern Beach Tiger Beetle

While no northeastern beach tiger beetles are currently known to occupy the Gunnison sand removal area or the Critical Zone deposition area, it is likely that beetles may expand their current range at Sandy Hook and colonize one or both of these sites over the 30-year life of the project. Additionally, annual operation of motorized vehicles for beach profile surveys will occur in areas currently occupied by the northeastern beach tiger beetle. Since sand slurry pipeline construction and operation will not occur during the period when adult beetles would be active (late June to early August), no take of adult beetles is anticipated from the pipeline construction or operation and is unlikely to occur from operation of motorized vehicles conducting beach profile surveys. However, incidental take of larval beetles may occur within beach habitats impacted by pipeline construction and operation, and equipment and motorized vehicle operation related to sand cycling and beach and shoreline profile survey actvities. Incidental take in the form of harm would occur as a result of death or injury to larvae from crushing by heavy equipment or motorized vehicles. Additionally, any larvae present within the sand slurry intake zone would be unlikely to survive transport through the pipeline to the deposition area. Larvae present at the deposition area would likely experience elevated mortality from burial by sand slurry sediments.

The Service anticipates that take of individual northeastern beach tiger beetle larvae will be difficult to quantify and detect because larvae that are killed or injured are unlikely to be observed or located due to their coloring and small body size and the tendency for larvae to remain beneath the beach surface. However, the level of take of this species can be anticipated by the areal extent of the habitat affected. Death or injury of tiger beetle larvae will occur in up to 5 acres of beach habitat (2 acres at Gunnison Beach and 3 acres at the Critical Zone) annually over the 30-year life of the project from construction and operation of the sand slurry pipeline project and from operation of motorized vehicles for beach profile surveys at Gunnison Beach and the Critical Zone. In addition, death or injury of northeastern beach tiger beetle larvae from crushing will occur where present within up to an approximately 6 to 10-foot-wide pathway along the entire length of the Sandy Hook oceanfront shoreline (approximately 7 miles) from operation of motorized vehicles for the annual beach profile survey.

2. Anticipated Take from Indirect Effects

a. Piping Plover

The Service anticipates that the indirect effects of the action will also result in incidental take of piping plovers. Such incidental take of piping plovers will occur in the form of harm from adverse habitat alteration and diminished prey resources, harassment from disturbance by beach recreation, and harm and / or harassment from predation.

The NPS sand slurry pipeline project will result in incidental take through habitat alteration by curtailing natural coastal processes that revitalize or create optimal piping plover nesting and foraging habitats such as overwash zones, tidal pools, natural dunes, and newly forming inlets at the Critical Zone and adjacent beaches. By precluding formation of these preferred habitats, the NPS project reduces the amount and quality of available piping plover nesting and foraging habitat within the Critical Zone and adjacent beaches. In addition, by annually recycling sand from Gunnison to the Critical Zone, the project will alter sand transport along the Sandy Hook shoreline and reduce or delay accretion at areas managed for threatened and endangered species north of Gunnison Beach. The Service cannot quantify the loss of productivity or impact to the number of piping plover individuals specifically attributed to such habitat alteration. Therefore, incidental take attributed to harm from adverse habitat modification is quantified as the amount of potentially suitable habitat to be affected. The Service anticipates that the NPS project may forestall natural coastal processes and perpetuate artificial stabilization along 4,000 feet of coastline at the Critical Zone and adjacent beaches and may reduce sand accretion and subsequently reduce maintenance or expansion of piping plover nesting and foraging habitat along approximately an additional 2.5 miles of coastline north of Gunnison Beach for the 30-year life of the project.

Additionally, impacts to benthic intertidal prey resources are anticipated from the proposed project. Each individual nourishment cycle is expected to bury and cause mortality of invertebrate organisms that serve as prey for piping plovers, thereby depressing food resources for up to one nesting season following each nourishment cycle. While some evaluation of the impacts from single beach fill events has been made, the effect of recurrent annual deposition of sand, as would occur through implementation of the sand slurry pipeline, on the abundance and species composition of benthic intertidal invertebrates is not known. Without further information on how the project might alter prey availability over the long-term 30-year life of the project, the Service cannot quantify the loss of productivity or impact to the number of piping plover individuals specifically attributed to impacts to prey resources. Incidental take attributed to harm from adverse habitat modification through a reduction in benthic invertebrate prey resources along approximately 500 linear feet of shoreline at the Critical Zone is expected to occur annually over the 30-year project life. This affected area overlaps with the area described above where curtailment of natural coastal processes will occur. Therefore, the reduction in prey resources will compound anticipated adverse habitat alteration along a 500-foot area of shoreline on an annual basis.

Annual nourishment of the Critical Zone will continue to attract plovers to a sub-optimal, artificially stabilized beach and will perpetuate nesting activity in an area where harassment from human disturbance is highly likely to occur. Conservation measures proposed by the NPS will minimize the severity of human disturbance; however, take in the form of harassment can be anticipated from disruption of nesting, brood rearing, and foraging activities. Additionally, by perpetuating stabilization of the Critical Zone, piping plovers will be confined to a linear band of beach where they are likely to be vulnerable to harm or harassment from predators. Although conservation measures proposed by the NPS will serve to reduce predation, the proximity of the Critical Zone to recreational beaches makes it likely that predators will continue to be attracted to the area or will traverse the area when moving between recreational beaches. As with

curtailment of coastal processes and impacts to prey resources, it is not possible to quantify with any accuracy the amount of take specifically attributed to human disturbance or predation at the Critical Zone. The Service anticipates that all piping plovers nesting at the Critical Zone over the 30-year life of the project will be exposed to human disturbance and be vulnerable to increased predation.

The Service anticipates that the combined indirect effects associated with the NPS sand slurry pipeline project (*i.e.*, curtailment of coastal process, impacts to prey resources, human disturbance, and increased vulnerability to predation) will perpetuate, over the 30-year life of the project, the past poor productivity that has been observed at the Critical Zone. Further stabilization may increase the number of piping plovers that are drawn to the Critical Zone to as many as 8 pairs. However, especially given the many disturbance factors that birds nesting at the Critical Zone are subjected to, the number of pairs nesting at the site can be anticipated to fluctuate from year to year. The Service estimates that with annual nourishment, an average of 4 pairs per year will nest at the Critical Zone over the life of the project. The average productivity within the Critical Zone over the past 10 years (1995-2004) was 0.61 chicks fledged per nesting pair as compared to 1.25 chicks fledged per pair at all other Sandy Hook nesting sites combined. As shown in Table 9, productivity at the Critical Zone over the past 10 years has been less than half, or an average of approximately 0.64 chicks per nesting pair, lower than on all other Sandy Hook nesting sites. While many natural factors, such as weather and flooding, will affect actual productivity on nesting beaches, a similar depression in productivity at the Critical Zone would be expected throughout the 30-year life of the sand slurry pipeline project as compared to other available nesting sites at Sandy Hook. However, the Service anticipates that the conservation measures proposed by the NPS will approximately halve losses in productivity at the Critical Zone. Therefore, incidental take attributed to the combined indirect effects of the project in the form of reduced productivity will result in the loss of 38.4 fledged chicks over the life of the project (a reduction of 0.64 chicks per pair X an average of 4 pairs per year X 30 years X 50 percent of previous losses due to conservation measures).

By forestalling a breach at the Critical Zone, the sand slurry pipeline project will preserve vehicle access and continue the current management strategy of zoning approximately 50 percent of Sandy Hook's coastal beaches for natural resource protection while providing access for moderate to high levels of recreational use on the remaining 50 percent of ocean beaches. Sandy Hook has a history of periodic high predation rates, especially by red fox, on piping plover nesting beaches. Actions by visitors, such as leaving trash or feeding wildlife may attract predator species. Maintaining connectivity with the mainland may facilitate movement of mammalian predators onto Sandy Hook. The proposed project and the perpetuation of zoning natural resource areas vs. recreational use areas will continue to prevent piping plovers from relocating nesting areas to escape areas of high predation. To minimize losses to predators, the NPS proposes to implement a predator management program that includes use of standard and electrified predator exclosures, and live trapping and removing problem individuals.

Table 9. Comparison of Piping Plover Nesting at the Critical Zone to Other Sandy Hook Nesting Areas and New Jersey Statewide, 1995 to 2004

Location	Year	Number of Breeding Pairs	Number of Chicks Fledged	Number of Chicks Fledged/Pair (Productivity)
Critical Zone	1995	6	3	0.50
	1996	2	0	0.00
	1997	0	-	-
	1998	0	-	-
	1999	0	-	-
	2000	0	-	-
	2001	1	1	1.00
	2002	2	3	1.50
	2003	4	2	0.50
	2004	3	2	0.67
	10-year Average	**1.8**	**1.1**	**0.61**
Sandy Hook – All Areas Except Critical Zone	1995	37	54	1.46
	1996	38	55	1.45
	1997	42	15	0.36
	1998	29	29	1.00
	1999	29	48	1.66
	2000	29	51	1.76
	2001	30	48	1.60
	2002	33	57	1.73
	2003	34	34	1.00
	2004	28	19	0.68
	10-year Average	**32.9**	**41.0**	**1.25**
Sandy Hook – All Areas	1995	43	57	1.33
	1996	40	55	1.38
	1997	42	15	0.36
	1998	29	29	1.00
	1999	29	48	1.66
	2000	29	51	1.76
	2001	31	49	1.58
	2002	35	60	1.71
	2003	38	36	0.94
	2004	31	21	0.68
	10-year Average	**34.7**	**42.1**	**1.21**
New Jersey - Statewide	1995	132	120	0.91
	1996	127	127	1.00
	1997	114	45	0.39
	1998	93	101	1.09
	1999	107	143	1.34
	2000	112	157	1.40
	2001	122	157	1.29
	2002	138	161	1.17
	2003	144	133	0.92
	2004	135	82	0.61
	10-Year Average	**122.4**	**122.6**	**1.00**

As previously discussed, the NPS program will reduce piping plover losses from predation over levels recently documented at Sandy Hook. However, the NPS program may periodically create a "smart" fox situation whereby trap-wise foxes continue to take piping plovers either by preying directly on eggs and young or by harassing adult plovers causing abandonment of nests or

broods. Further, the NJDEP may not be able to provide an approved site to accommodate the NPS's preference for relocating rather than euthanizing trapped individuals. On the basis of past incidences of predation events at Sandy Hook, the Service anticipates that above average predation will occur cyclically approximately every 6 years, or 5 times over the 30-year life of the project. In the past, nearly all Sandy Hook nesting sites were affected by cyclic predation events causing reduced productivity. The Service estimates that, due to the NPS's proposed conservation measure for predator control, only 25 percent of Sandy Hook's nesting pairs will be affected by a smart predator situation. However, since a single smart predator can have a drastic effect on reproductive success, the predation event would result in up to a 50 percent reduction in productivity at the affected sites. Therefore, the Service anticipates that the NPS's proposed project will perpetuate a situation where higher than average losses of piping plover nests and young to predation occurs, resulting in the loss of 5 fledglings approximately every 6 years (10-year average of 35 pairs X 25 percent of pairs affected X average productivity of 1.21 chicks fledged per pair X 50 percent reduction in nesting success) for a total of 30 lost fledglings over the 30-year life of the project.

b. Northeastern Beach Tiger Beetle

By annually recycling sand from Gunnison to the Critical Zone, the NPS project will perpetuate artificial stabilization at the Critical Zone and adjacent beaches, alter sand transport along the Sandy Hook shoreline, and reduce or delay accretion at areas managed for threatened and endangered species north of Gunnison Beach. The Service cannot quantify the impact to number of northeastern beach tiger beetle individuals specifically attributed to such habitat alteration. Therefore, incidental take attributed to harm from adverse habitat modification is quantified as the amount of potentially suitable habitat to be affected. The Service anticipates that the NPS project may forestall natural coastal processes and perpetuate artificial stabilization along 4,000 feet of coastline at the Critical Zone and adjacent beaches and may reduce sand accretion and subsequently reduce maintenance or expansion of northeastern beach tiger beetle habitat along approximately an additional 2.5 miles of coastline north of Gunnison Beach for the 30-year life of the project.

C. EFFECT OF THE TAKE

The Service has determined that the level of take anticipated, as described above, from the NPS sand slurry pipeline project is not likely to result in jeopardy to the species or destruction or adverse modification of Critical Habitat.

D. REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

Reasonable and prudent measures (RPMs) are measures considered necessary or appropriate to minimize the amount or extent of anticipated incidental take of federally listed species. The Service has concluded that the below RPMs are necessary and appropriate to minimize take of piping plovers and northeastern beach tiger beetles. In order to be exempt from the prohibitions of Section 9 of the ESA, the NPS and its contractors, cooperators, and / or permittees must comply with the below terms and conditions, which implement the RPMs and outline

reporting/monitoring requirements. The RPMs and terms and conditions are nondiscretionary, and must be implemented by the NPS. Each RPM is listed in italics, followed by the numbered terms and conditions that implement each RPM.

The NPS has a continuing duty to regulate the activity covered by this incidental take statement. If the NPS: (1) fails to demonstrate clear compliance with the RPMs and their implementing terms and conditions in this Biological Opinion; or (2) fails to require NPS staff, contractors, cooperators, and / or permittees to adhere to the terms and conditions of the incidental take statement; and/or (3) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

RPM 1: *Conduct all activities associated with beach profile and shoreline surveys in a manner that will avoid or minimize loss or disturbance of piping plover adults, nests, and young and northeastern beach tiger beetle adults and larvae.*

RPM 1: Terms and Conditions

1.1 Provide all NPS staff, contractors, cooperators, and / or permittees involved with construction and operation of the pipeline with a written summary of all relevant conservation measures contained within the project description, RPMs, and terms and conditions of this Biological Opinion.

1.2 Provide all personnel involved in collection of beach profile and shoreline surveys with current maps of piping plover nesting areas and northeastern beach tiger beetle areas and update maps as necessary prior to each scheduled survey.

1.3 Ensure that any potentially affected piping plover or northeastern beach tiger beetle habitat area is clearly delineated in the field with signs and / or symbolic fencing, prior to each scheduled beach profile or shoreline survey, to warn personnel of the location of sensitive habitats.

1.4 Conduct beach profile and shoreline surveys on foot, with use of a light-weight open vehicle such as a 4-wheel all-terrain vehicle (ATV), or with a non-motorized all terrain bicycle as applicable to minimize disturbance as much as possible.

1.5 Use the following precautions when conducting beach profile or shoreline survey activities using motorized vehicles within 600 feet of piping plover nesting areas, or via foot or bicycle within 150 feet of known nests:

1.5.a Ensure that at least one NPS natural resource staff member routinely responsible for piping plover monitoring is present and has verified the locations of all piping plover nests and chicks.

1.5.b Provide a natural resource staff member to walk in front of the surveyor to guide the surveyor through the nesting area and to ensure that no previously undetected nests or flightless chicks are present within the path of the surveyor.

1.5.c Ensure that all motorized vehicles conducting beach profile surveys remain at least 300 feet from nests or chicks and that non-motorized vehicles or pedestrians remain at least 50 feet from nests or chicks.

1.5.d Restrict speed of motorized vehicles to no more than 5 miles per hour and operation to daylight hours only.

1.6 Use the following precautions when operating motorized vehicles within 100 feet of northeastern beach tiger beetle areas to conduct beach profile and shoreline surveys[2]:

1.6.a Ensure that at least one NPS natural resource staff member familiar with northeastern beach tiger beetle areas is present and available to guide the surveyor through the beetle habitat.

1.6.b Schedule surveys through tiger beetle areas during low tide to the maximum extent possible.

1.6.c Operate vehicles in the intertidal area and away from areas where tiger beetle larvae are most likely to occur (*i.e.*, route vehicles as far as possible away from the wrack line / recent high tide line).

1.7 Hold a pre-survey meeting, prior to each scheduled beach profile or shoreline survey, with appropriate NPS staff, contractors, and cooperators to review known piping plover nesting locations, northeastern beach tiger beetle areas, and appropriate procedures to avoid disturbance to birds and beetles.

RPM 2: *Evaluate any changes in the quantity and quality of available piping plover and northeastern beach tiger beetle habitat at beaches north of the Gunnison borrow area and ensure that forestalling or reducing accretion through annual operation of the sand slurry pipeline does not diminish the quantity or degrade the quality of available habitats.*

RPM 2: Terms and Conditions

2.1 Calculate a baseline pre-project acreage of available suitable piping plover and northeastern beach tiger beetle habitat at beaches north of the Gunnison beach borrow area.

[2] Collection of beach profile and shoreline surveys within northeastern beach tiger beetle areas by foot or non-motorized lightweight vehicle are unlikely to result in take of larvae and need not be escorted by NPS natural resource staff.

2.2 Continue efforts to remove invasive species of vegetation that would diminish or degrade piping plover and northeastern beach tiger beetle habitat.

2.3 Retain tidal pools and upper beach wet swales throughout Sandy Hook and especially within piping plover nesting and foraging areas, and in northeastern beach tiger beetle areas, except where conditions would present a public health or safety hazard.

2.4 Take action to restore or improve suitability of habitats (*i.e.*, removal of dense or woody vegetation, creation of tidal pools to serve as alternate foraging areas), if quantity of available high to moderate quality habitat is reduced by greater than 10 percent.

RPM 3: *Evaluate the short and long-term impact to piping plover prey resources from annual deposition of sediments at the Critical Zone and, to the maximum extent possible, adapt pipeline operation to minimize any observed impacts.*

RPM 3: Terms and Conditions

3.1 Perform the following in addition to the proposed monitoring of invertebrates (sampling of transects downdrift, within, and updrift of the sand borrow and discharge areas for the first 2 to 3 years of slurry pipeline operation) to evaluate potential project-related impacts to piping plover prey resources:

3.1.a Collect at least 1 year (2 years if project construction schedule is delayed) of baseline invertebrate data prior to pipeline operation.

3.1.b Ensure that data collected in the baseline and future invertebrate monitoring are representative of the prey base that would be present during the period when piping plovers would be foraging (March 15 through August 15).

3.1.c Repeat sampling transects (downdrift, within, and updrift of the sand borrow and discharge areas) in years 10, 20, and 30 following pipeline construction and evaluate any long-term changes in prey species composition, size, or abundance.

3.2 Provide an analysis of the results of the piping plover prey resource monitoring to the Service following each sampling event. If significant (greater than 10 percent) change is observed in prey species composition, size, or abundance, evaluate pipeline operation and determine if adaptations can be made that would reduce impacts to invertebrate populations.

RPM 4: *Ensure that the NPS predator management program at Sandy Hook (included as a project conservation measure) does not result in trap-wise "smart" predators and is adaptable to counter losses from other predator species that may become a threat to piping plovers over the life of the project.*

RPM 4: Terms and Conditions

4.1 Conduct live-trapping efforts in a manner that will avoid the need to release predatory species back into piping plover nesting areas.[3]

4.1.a Conduct live-trapping efforts targeting foxes or other mammals during the period prior to the animals giving birth or after young are weaned to avoid capture of lactating females.

or

4.1.b Undertake reasonable efforts to locate the den / nest and humanely euthanize unweaned young, if lactating female mammals are trapped. If successful, relocate the lactating female. If unsuccessful, comply with NJDEP requirement that lactating females with unweaned young be released.

4.2 Seek additional methods or alternatives for effective predator control (*i.e.*, contract trapper; assistance from U.S. Department of Agriculture, Animal & Plant Inspection Service, Wildlife Services; implement humane lethal removal), if new predator species or issues are encountered that are not addressed by the current program, or if the current predator management program is unsuccessful in countering losses to piping plover eggs, young, or adults (as measured by losses of 15 percent or more of nesting attempts or of hatched chicks to predation) immediately (within 7 days).

RPM 5: *Practice adaptive management of the sand slurry pipeline project and adjust protective measures as needed or as new information becomes available.*

RPM 5: Terms and Conditions

5.1 Conduct a review of the project conservation measures and the status of federally listed species at Sandy Hook at least every 5 years; adapt conservation measures as needed in coordination with the Service and the ENSP.

[3] The NJDEP Special Wildlife Permit requires that any lactating female be released to avoid starvation of unweaned young, unless the den can be located and young can be humanly euthanized.

5.2 Evaluate the piping plover monitoring and management program at least biannually, and, with Service and ENSP input, adapt the program and program staffing as needed to minimize disturbance from recreational and NPS activities occurring at Sandy Hook. As species distributions and / or threats may change, different levels and / or methods of species management may be necessary to maintain sufficient levels of protection.

RPM 6: *Report on the progress of the action and its impact on the species, as required pursuant to 50 CFR 402.14(i)(3).*

RPM 6: Terms and Conditions

6.1 Continue the current ongoing monitoring and reporting to the Service and / or ENSP by NPS natural resource staff unless otherwise notified, and begin monitoring and reporting on the progress of the action and any project-related impacts or threat abatement activities, as proposed within the project conservation measures.

6.2 Monitor piping plover nesting and factors affecting nesting activity or reproductive success (*i.e.*, human disturbance, predation, flooding) at least three times per week until May 1 and daily thereafter during the nesting season at the Critical Zone and any other sites within 300 feet of high recreational use areas. Monitor all other Sandy Hook nesting sites at least twice per week until May 1 and at least three times per week thereafter.

6.2.a Document locations of territorial or courting plovers, nest locations, and areas used by adults and chicks for foraging.

6.2.b Record observations of any reactions of incubating birds to pedestrian or vehicular disturbance and any evidence of human disturbance or predation.

6.3 Provide the Service with a brief monthly summary during the nesting season of piping plover nesting activity and observed threats or causes of nest or chick losses or abandonment.

6.3.a Provide at a minimum for each piping plover nesting area, a summary to include the number of nesting pairs, number of nests, number of renests, number of chicks observed hatched, number of chicks fledged, number of nests or chicks lost, and reason for losses if discernable.

6.3.b Provide the monthly summary by the 5th day of the following calendar month.

6.4 Monitor and report on the status of northeastern beach tiger beetles at Sandy Hook; take management actions as necessary to abate observed threats to the species.

6.4.a Conduct surveys for adult beetles at known northeastern beach tiger beetle sites at Sandy Hook at least once in late June and at least twice in July each year on an annual basis and following established survey protocols.

6.4.b Conduct surveys for the presence or absence of adult northeastern beach tiger beetles at least once every 5 years within all potentially suitable habitat at Sandy Hook. The survey period should coincide with the anticipated period of peak adult activity as determined by seasonal conditions during the survey year (usually early to mid-July).

6.4.c Provide a summary of the results of adult northeastern beach tiger beetle surveys to the Service by August 15 of each year. The summary should include the areas surveyed, date and time of surveys, weather conditions, number of adult beetles found per site, and any threats to the species observed (*i.e.*, predators, presence of oil or pollutants, erosion of previously used areas).

6.5 Monitor predator activity and impacts to federally listed species at Sandy Hook and provide the Service with monthly summaries of management activities undertaken to reduce losses of federally listed species.

6.5.a Include in the summary date(s) of predator management actions, predator species targeted, estimated number of problem predator individuals present in listed species area, number and type of traps deployed, number of staff hours expended, number of trapped individuals removed, and areas where trapped individuals are released (both on and off-site).

6.5.b Provide the monthly summary by the 5th day of the calendar month following trapping or predator control activities.

6.6 Provide the Service with an annual report, by October 1 of each year, summarizing the results of piping plover, northeastern beach tiger beetle, and predator monitoring and management activities at Sandy Hook. The report should, at a minimum, include information outlined in 7.1 through 7. 5 above and include maps showing the locations of federally listed species habitat areas protected, locations of individual piping plover nests and indicating type of predator exclosure used (if any), extent of areas with presence of northeastern beach tiger adults, and areas where predator control activities were undertaken.

6.7 Exercise care in handling any specimens of dead piping plover adults, young, or non-viable eggs, or northeastern beach tiger beetle adults or larvae, to preserve biological material in the best possible state. In conjunction with the preservation of any specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead or non-viable specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective.

Report the discovery of a dead piping plover (except where death as a result of predation or flooding is completely certain) to the following Service Law Enforcement office:

Senior Resident Agent
U.S. Fish and Wildlife Service
Division of Law Enforcement
Sea Land Building, 2nd Floor
1210 Corbin Street
Elizabeth, New Jersey 07201
(908) 787-1321

Report the discovery of a dead piping plover from all causes and of an abandoned nest or non-viable egg specimen to the following Service office:

Supervisor
U.S. Fish and Wildlife Service
New Jersey Field Office
927 N. Main Street, Bldg. D
Pleasantville, New Jersey 08232
(609) 646-9310

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the aforementioned level of incidental take is exceeded, such incidental take would represent new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The NPS must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures. The Service will not refer incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712) if such take is in compliance with the terms and conditions specified herein.

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or Critical Habitat, to help implement recovery plans, or to develop information. The Service has identified the following actions that, if undertaken by the NPS, would further the conservation and assist in the recovery of the piping plover and seabeach amaranth.

(1) Ensure that at NPS staff, contractors, cooperators, and / or permittees are aware that construction and operation of the sand slurry pipeline is prohibited from March 15 to August 15 each year.

(2) Monitor piping plover use within the Gunnison borrow and Critical Zone deposition areas. If unfledged chicks are still present after August 15, ensure that all appropriate staff and contractors are notified and continue to implement all appropriate protection and disturbance-avoidance measures until the chicks are verified to be capable of sustained flight. If early season territorial or courtship behaviors are observed at either site prior to March 15, coordinate with the Service to determine if an adjustment in the planned dates of pipeline operation is necessary.

(3) Clearly delineate the known and likely areas of occurrence and avoid project-related activities that would crush or otherwise impact larval beetles if, following the NPS's planned annual surveys, northeastern beach tiger beetle larvae are found at the Gunnison or Critical Zone beach areas. Coordinate with the Service to determine if reinitiation of consultation is necessary.

(4) Ensure that impacts to State-listed endangered (*i.e*, least tern and black skimmer) and other beachnesting birds (*i.e.*, common tern and American oystercatcher) from project-related activities are minimized. In addition to the positive benefits to these species that would result from such protection, piping plovers nesting within or adjacent to tern colonies may benefit from the defensive behaviors against avian predators that is typical of this colonial species.

(5) Schedule and implement project activities to avoid construction within 300 feet of least tern and/or black skimmer colonies during the nesting season. The least tern nesting season is generally late May to late August; the black skimmer nesting season is generally early June through September.

(6) Prohibit sand fencing or dense planting of vegetation that would adversely alter potentially suitable seabeach amaranth habitat.

(7) Fence areas (as proposed within the conservation measures) and prohibit mechanical beach raking and sand scraping within 10 meters of any seabeach amaranth plants found. Restrict operation of NPS staff, contractor, cooperator, or permittee vehicles in seabeach amaranth areas.

(8) Monitor the effectiveness of any conservation measures implemented to offset losses of seabeach amaranth. In particular, if implemented, monitor the effectiveness of transplantation, and seed collection and re-seeding.

X. REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the effects of the proposed sand slurry pipeline project at the Sandy Hook Unit of Gateway National Recreation Area. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or Critical Habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or Critical Habitat that was not considered in this opinion; or, (4) a new species is listed or Critical Habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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C. PERSONAL OBSERVATIONS

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