November 1999

FIRE ISLAND INLET TO MONTAUK POINT, LONG ISLAND, NEW YORK

REACH 1

FIRE ISLAND INLET TO MORICHES INLET

DRAFT DECISION DOCUMENT
AN EVALUATION OF AN INTERIM PLAN FOR STORM DAMAGE PROTECTION

VOLUME I

MAIN REPORT
AND
DRAFT ENVIRONMENTAL IMPACT STATEMENT

US Army Corps of Engineers
New York District

FIRE ISLAND INLET TO MONTAUK POINT, LONG ISLAND, NEW YORK

REACH 1

FIRE ISLAND INLET TO MORICHES INLET

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EVALUATION OF AN INTERIM PLAN FOR STORM DAMAGE REDUCTION

MAIN REPORT

U.S. Army Corps of Engineers

New York District

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SYLLABUS

This report, titled "Fire Island Inlet to Montauk Point, Long Island, New York; Fire Island Inlet to Moriches Inlet Reach - Interim Plan for Storm Damage Reduction," presents the results of an investigation to determine the Federal interest in providing interim storm damage protection for Reach 1 (Fire Island Inlet to Moriches Inlet) of the authorized Federal Beach Erosion and Hurricane Protection Project for Fire Island Inlet to Montauk Point, New York. This report provides supporting technical documentation for this project which is intended to be an interim measure to provide protection until the overall reformulation of the authorized Fire Island Inlet to Montauk Point project is complete, and the results potentially implemented. This report includes an evaluation of an interim protective plan for providing storm damage reduction to the Fire Island Inlet to Moriches Inlet Reach of the project, much of which is within the legislative boundaries of the Fire Island National Seashore. The evaluation includes an analysis of the associated costs, benefits, and environmental impacts for the various alternatives presented. The selected Interim Plan provides net annual benefits in excess of costs. All of the benefits considered are derived from storm damage reduction, recreation, and reduced Breach Contingency Plan costs. The project is justified based upon the benefits derived from storm damage protection alone. Approximately 80 percent of the benefits are derived from protection provided to the mainland areas adjacent to the Great South Bay.

The overall Fire Island Inlet to Montauk Point project was originally authorized by the River and Harbor Act of 14 July 1960 in accordance with the reports printed in House Document No. 425, 86th Congress, 2nd Session. The originally authorized project for the Fire Island Inlet to Moriches Inlet Reach included a beach berm at an elevation of +14 feet NGVD, backed by a dune system with a crest elevation of +20 feet. The authorized project for this reach was not constructed.

The Interim Plan consists of sections of beach berm at elevation +9.5 feet NGVD with a dune elevation of +15 feet NGVD for a length of 15,000 feet, sections of beach berm at elevation +11.5 feet NGVD with a dune elevation of +18 feet NGVD for a length of 16,750 feet, and sections of beach berm with no dune fill for a length of 28,200 feet. Sand beach fill would be placed on 11.3 miles of the Fire Island Atlantic shoreline, which is approximately 38% of the length of the island. Sand dune fill would be placed on 6.0 miles of the shoreline, approximately 20% of the island length.

The Interim Plan was evaluated for consistency with Federal design standards including the National Park Service Special Use Permit requirements. The plan was compared to a Modified Authorized Plan (a higher level of protection than the Interim Plan). The results of the analyses indicate that the Interim Plan is economically feasible and is smaller in scope than a potential National Economic Development Plan. The annual cost for this plan is estimated to be $17,040,000, with annual benefits of $21,685,000. The benefit to cost ratio (BCR) was calculated to be 1.3.

The estimated initial cost of the recommended Interim Plan is $52,887,000. The Federal portion of the initial cost is $34,377,000 and the non-Federal cost is $18,510,000. Material for initial construction and periodic nourishment would be obtained from an offshore borrow area.

Although the plan recommended in this document provides positive net benefits, the recommended plan is still an interim plan, and should not be construed to be the final National Economic Development (NED) plan. An evaluation was performed to compare the recommended plan and the Modified Authorized Plan's higher level of protection. The evaluation shows that the recommended plan provides net benefits which are less than the Modified Authorized Plan. The recommended Interim Plan is not the final NED plan, which will be developed in the Reformulation Study of the authorized project from Fire Island Inlet to Montauk Point.

This report includes a Draft Environmental Impact Statement.

The project sponsor, the New York State Department of Environmental Conservation, has indicated its support for this project in a letter dated November 30, 1999.

PERTINENT DATA

Description

The recommended plan is to provide storm damage protection until a more permanent solution becomes available. The proposed project provides for a protective beach berm and dune.

Beach Fill Length	59,900ft
Volume of Initial Fill	7,747,000 cy
Width of Design Beach Berm	Varies between 40 or 90 feet
Elevations	
Dune Crest	Varies between +15 or +18 ft NGVD
Beach Berm	Varies between +9.5 or +11.5 ft NGVD
Slopes	
Dune (landward)	1V to 5H
(seaward)	1V to 5H
Beach (onshore)	1V to 15H (to -2 ft NGVD)
(offshore)	1V to 30H
Nourishment Fill Volume	2,709,000 cy
Project Cost	
Initial	$52,887,000
Annual (Discounted at 6-7/8%)	$17,040,000
Average Annual Benefits	
Reduced Damages	$19,665,000
Increased Recreation Value	$936,000
Reduced Breach Contingency Plan Cost	$1,084,000
Total Benefit	$21,685,000
Benefit Cost Ratio	1.3
Net Annual Benefits	$4,645,000
Cost Apportionment (First Cost)	
Federal (65%)	$34,377,000
Non-Federal (35%)	$18,510,000

NOTE: NGVD is the National Geodetic Vertical Datum.

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EVALUATION OF AN INTERIM PLAN FOR STORM DAMAGE REDUCTION

BEACH EROSION CONTROL AND HURRICANE PROTECTION PROJECT

Fire Island Inlet to Montauk Point, Long Island, New York

Fire Island Inlet to Moriches Inlet Reach

DRAFT DECISION DOCUMENT FOR AN INTERIM PROJECT

INTRODUCTION

Purpose

1. The Fire Island Inlet to Montauk Point, New York project is a Federal project authorized by Congress in 1960, which was intended to provide beach erosion control and hurricane protection for approximately 83 miles of the Atlantic Coast of Long Island, from Fire Island Inlet to Montauk Point. This document considers the unconstructed Fire Island Inlet to Moriches Inlet Reach, otherwise referred to as Fire Island. The majority of Fire Island lies within the legislative boundaries of the Fire Island National Seashore. The Atlantic shore of Fire Island has become increasingly susceptible to storm damages. The Corps of Engineers has been requested by State and Congressional representatives to evaluate the feasibility of an interim storm damage reduction project. Therefore, the purpose of this report is to evaluate the feasibility of Federal participation in an interim plan along Fire Island, to reduce storm damages along the mainland shore areas protected by Fire Island, until a more permanent solution can be evaluated, and possibly implemented, as a result of the Reformulation Study of the Fire Island Inlet to Montauk Point project. This report will confirm that the selected plan is an interim, or subset to a potential reformulated plan of protection, and consistent with the requirements for interim measures. This document is prepared in accordance with ER 1105-2- 100 (Planning Guidance), ER 1110-2-1150 (Engineering & Design for Civil Works Projects), and ER 1165-2-130 (Federal Participation in Shore Protection). The evaluation of plans for this study included environmental and social impacts, local and interagency concerns. Particular attention was given to ensuring compatibility with the National Park Service Management Objectives for the Fire Island National Seashore (FIIS).

Location

2. The authorized project area extends from Fire Island Inlet eastward to Montauk Point along the Atlantic Coast of Suffolk County, is about 83 miles long and comprises about 70 percent of the total ocean frontage of Long Island. Fire Island Inlet is located about 50 miles by water east of the Battery, New York City. The other inlets located along the project area are Moriches Inlet and Shinnecock Inlet, 30 and 45 miles east of Fire Island Inlet, respectively.

3. The Fire Island Interim Project is located within Reach 1 of the authorized project, which extends from Fire Island Inlet to Moriches Inlet. The interim project area is bounded by the two inlets and includes the Fire Island National Seashore (FIIS), populated communities within the Seashore, Robert Moses State Park, and Smith Point County Park. The island is approximately 31 miles in length, with a width that generally varies between 800 and 2,500 feet. Fire Island is separated from the mainland of Long Island by the Great South Bay and Moriches Bay. The study area includes the shoreline, barrier beaches, bay areas and mainland areas. Although the study area includes the entire barrier island coastline, the project will specifically target selected sections of the island which currently provide limited levels of protection against overwash and breaching.

Project Authorization and History

4. The Fire Island Inlet to Montauk Point, New York, Combined Beach Erosion Control and Hurricane Protection Project was authorized by the River and Harbor Act of 14 July 1960, and subsequently modified in accordance with Section 103 of the River and Harbor Act of 12 October 1962. The project authorization was modified again by Section 31 of the Water Resources Development Act (WRDA) of 1974. The authorization was further modified by section 502 of the WRDA of 1986 (P.L. 99-662). For portions of Fire Island to Montauk Point, other than the portion from Moriches Inlet to Shinnecock Inlet, Section 103 of the WRDA of 1986 (P.L. 99-662) defined the cost sharing of the first cost to be 65% Federal. In addition, Section 156 of the WRDA of 1976, as modified by Section 934 of the WRDA 1986, provides for continued renourishment not to exceed 50 years from initiation of construction of each of these reaches. Copies and a more detailed explanation of the authorizing documents are contained in Appendix B.

5. The authorized project recommends beach erosion control and hurricane protection along five reaches of the Atlantic Coast of New York from Fire Island Inlet to Montauk Point by widening the beaches along the developed areas to a minimum width of 100 feet, with an elevation of 14 feet above NGVD, and by raising dunes to an elevation of 20 feet above NGVD, from Fire Island Inlet to Hither Hills State Park, at Montauk and opposite Lake Montauk Harbor. This construction would be supplemented by grass planting on the dunes, by interior drainage structures and the possible construction of 50 groins, and by providing for subsequent beach nourishment (Figure 1). The five reaches of the authorized project are as follows:

Reach 1 - Fire Island Inlet to Moriches Inlet

Reach 2 - Moriches Inlet to Shinnecock Inlet

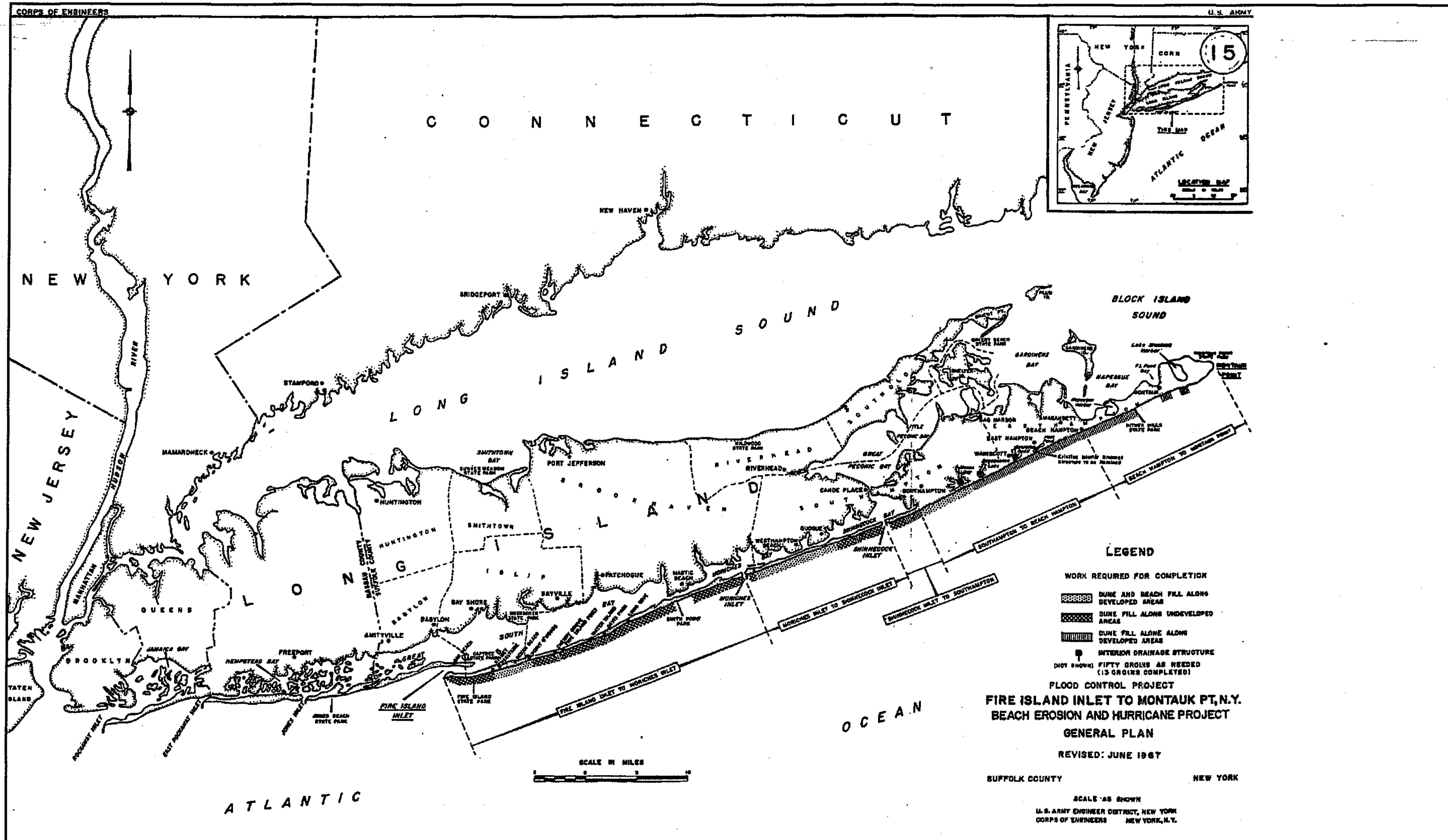
Reach 3 - Shinnecock Inlet to Southampton

Reach 4 - Southampton to Beach Hampton

Reach 5 - Beach Hampton to Montauk Point

6. In the Fire Island Inlet to Montauk Point study area, most work performed since the 1960's has occurred along Reach 2, from Moriches Inlet to Shinnecock Inlet. For this area, a General Design Memorandum (GDM) was prepared in 1963 which recommended the construction of groins and the placement of beach fill. Construction of 11 groins was completed in 1965. In the late 1960's, four additional groins were constructed, bringing the total number of groins in Reach 2 up to 15. Two additional groins at Georgica Pond were constructed in Reach 4. Construction was halted in 1972, when the State of New York withdrew support for its capital projects funding.

7. Due to renewed non-Federal interest, an Environmental Impact Statement (EIS) was prepared in 1978 for the Fire Island to Montauk Point study area. Upon review by the Department of the Interior and the U.S. Environmental Protection Agency, the EIS was referred to the Council on Environmental Quality (CEQ) as unacceptable to those agencies. The CEQ indicated that the plan formulation did not address all alternatives or adequately assess their impact. CEQ further indicated that the entire study area should be treated as a system. The Corps of Engineers concurred and directed a project reformulation. In 1980 a plan of study for project reformulation was approved by the Chief of Engineers and initiated shortly thereafter. The study was halted in 1984 when it was identified that non-Federal interests would be



AUTHORIZED PROJECT - FIGURE 1

responsible for 94% of renourishment costs. The New York State Department of Environmental Conservation withdrew its support for the project until a Congressional change was made to the authorization regarding periodic renourishment.

8. The cost sharing issue, including periodic renourishment, was resolved with the WRDA of 1986, in which cost sharing provisions calling for 70 percent Federal funding were applied to periodic nourishment of continuing construction at Westhampton for a period of 20 years. With this resolution, the State was willing to participate in a plan for Reach 2 (Westhampton). In light of New York State's willingness to participate in a plan for this reach, the most critically eroded of the overall project area, the New York District resumed the efforts of the Reformulation Study in FY 1994. The Reformulation Study is an extended effort, which will leave the barrier islands and affected mainland communities vulnerable to storm damages in the intervening years. Therefore, the New York District, as requested by New York State and Congressional and local interests, was charged to evaluate the feasibility of interim projects, which could be implemented pending completion of the Reformulation Study. The interim projects were intended to provide a lesser degree of protection than may be afforded by the reformulated National Economic Development (NED) plan. The areas considered for actions include: the Westhampton barrier from within the existing groin field to a point within Cupsogue County Park (Westhampton Interim Project), Fire Island from Fire Island Inlet to Moriches Inlet (Fire Island Interim Project), the area west of Shinnecock Inlet near the commercial fishing docks (West of Shinnecock Interim Project), and for all the critical barrier island areas from Fire Island Inlet to Montauk Point a Breach Contingency Plan (BCP) designed to achieve breach closure within 3 months.

9. For the Westhampton Interim Project, a conceptual plan was developed by the State, modified by the District to comply with Corps policy, and approved in concept by all involved Federal and non-Federal agencies. The District prepared a technical support document in order to demonstrate the feasibility of this interim project by comparing it to the authorized plan to determine if the construction of a larger (potentially NED) plan would provide greater net excess benefits than the proposed Interim Plan. The Interim Plan was determined to be in the Federal interest to provide protection until the findings of the reformulation effort are available. Initial construction of the interim project was substantively complete in December 1997.

10. In 1996 HQUSACE approved a Breach Contingency Plan (BCP), which provides a rapid response to close breaches along the barrier islands within the authorized project area. However, this is only a response action which, in the event of a breach, will restore the barrier island to an

elevation of +9 ft NGVD in order to provide a limited level of protection. A barrier island where the BCP has been implemented is characterized by low-lying areas likely to be overwashed and subsequently breached again during relatively minor events. The design is similar to the breach closure undertaken at Westhampton as a result of the December 11, 1992 northeaster.

Format of the Report

11. This Draft Decision Document (DDD) is accompanied by a Draft Environmental Impact Statement (DEIS). Appendix A - ***Pertinent Correspondence***, Appendix B - ***Authorizing Documents***, and Appendix H - ***Public Access Plan***, are also included in this Volume. The Draft Decision Document summarizes various detailed technical investigations. Technical Appendices were prepared to describe these investigations and were used in the quality control and quality assurance reviews. The following technical appendices are available for review at local document repositories or at the office of the District Engineer:

- C: Engineering Appendix
- D: Benefits Appendix
- E: Cost Appendix, MCACES
- F: Borrow Area Appendix
- G: Real Estate Plan

12. The initial four sections of the document provide background information on the study area conditions. These are the ***Study Area***, which provides a general discussion of the geographic study limits, followed by a review of the ***Study Area History*** and a description of both the ***Existing Conditions*** and the ***Without Project Future Conditions.*** The remaining sections of this document detail the development and analysis of the Interim Plan and provide an overview of the steps required for implementation.

13. The planning framework is described though the ***Problem Identification*** section and the discussion of planning ***Needs, Objectives and Constraints***. After establishing the planning framework, the development of the Interim Plan is described in the ***Plan Formulation*** section of the document. This section describes the evaluation of alternatives in relation to the planning

framework and summarizes the technical development of the Interim Plan design. The impacts of the project are then presented in the ***Project Impacts*** section. This includes a brief overview of the findings of the DEIS, an assessment of the project relative to the institutional constraints, and a discussion of both the project costs and benefits. The section titled ***Proposed Interim Project*** provides a summary of the Interim Plan and important implementation requirements such as real estate, public access and monitoring. This is followed by brief discussions of the Interim Plan's ***Relationship to Other Plans*** and ***Project Coordination.*** The discussion of ***Local Cooperation*** details the responsibilities of the non-Federal sponsor. Following the ***Conclusions*** and ***Recommendations*** are the ***DEIS***, Appendix A - ***Pertinent Correspondence***, Appendix B - ***Authorizing Documents,*** and Appendix H - ***Public Access Plan.***

14. In an effort to maintain the continuity of the report, the plates depicting the project layout are included after the DDD text. Photographs and illustrative figures are included within the text to supplement written descriptions.

STUDY AREA

Description of Study Area and Vicinity

Barrier Island

15. Fire Island is a barrier island approximately 31 miles long, located on the south shore of Long Island, within Suffolk County, New York (Figure 2A and 2B). Fire Island is bounded by the Atlantic Ocean to the South, Fire Island Inlet to the west, Moriches Inlet to the east, and the Great South and Moriches Bays to the north. Fire Island consists of a mixture of parks and residential communities. Parks include Robert Moses State Park, Fire Island National Seashore, Smith Point County Park and a few smaller, municipal park segments, which together make up approximately 80 percent of the island's Atlantic shoreline. The residential communities consist of mostly summer cottages, with some full time residents.

16. The Fire Island National Seashore extends from the eastern boundary of Robert Moses State Park to Moriches Inlet. Not all properties within the legislative boundaries of Fire Island National Seashore are owned by the United States Government. The federally owned properties are considered as either major or non-major federal tracts of land. Depending upon this

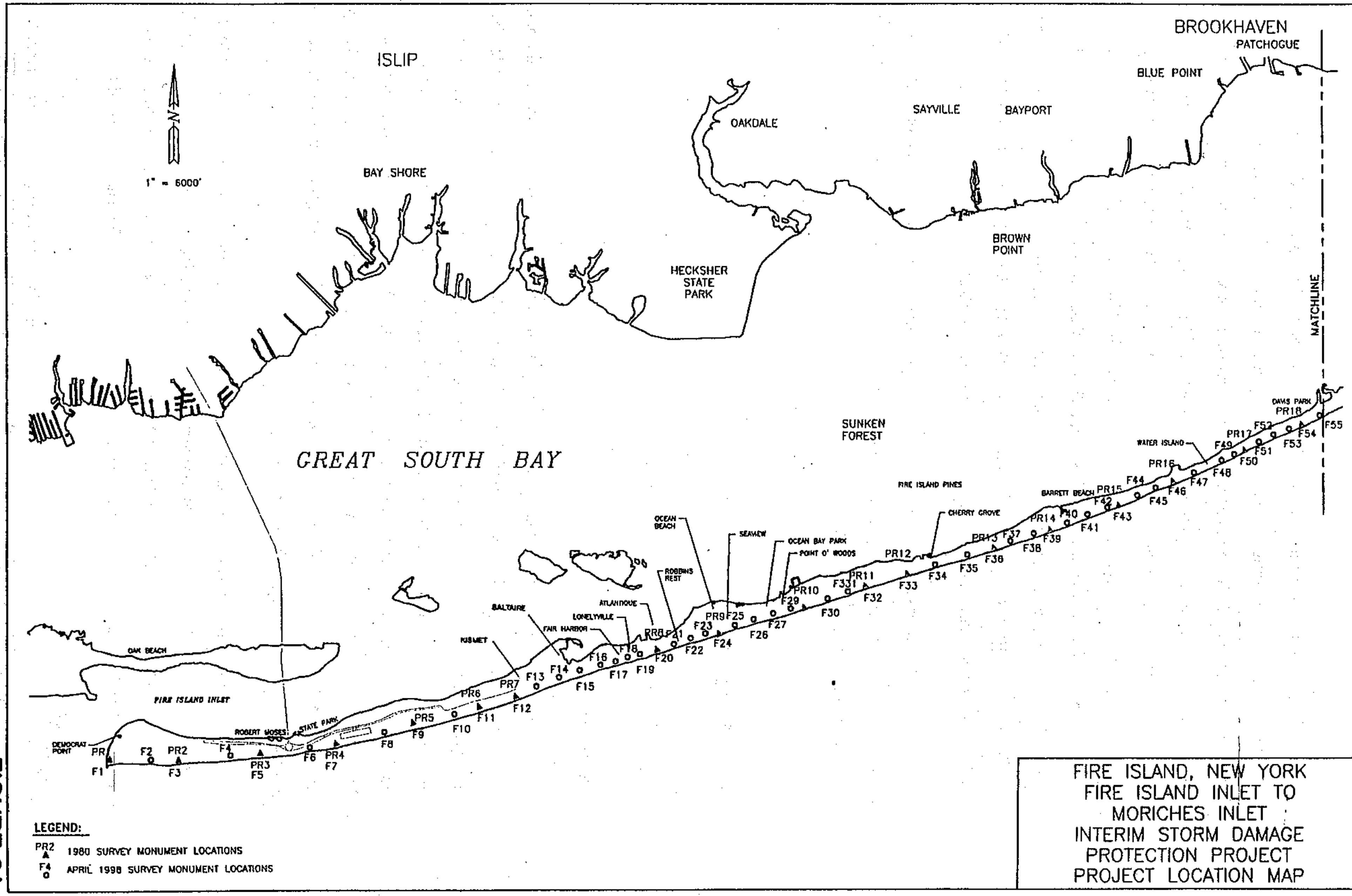

BROOKHAVEN
PATCHOGUE
BLUE POINT
SAYVILLE
BAYPORT
OAKDALE
ISLIP
BAY SHORE
HECKSHER STATE PARK
BROWN POINT
SUNKEN FOREST
GREAT SOUTH BAY
MATCHLINE
1" = 6000'
OAK BEACH
FIRE ISLAND INLET
DEMOCRAT POINT
ROBERT MOSES STATE PARK
KISMET
SALTAIRE
FAIR HARBOR
LONELYVILLE
ATLANTIQUE
ROBBINS REST
OCEAN BEACH
SEAVIEW
OCEAN BAY PARK
POINT O' WOODS
CHERRY GROVE
FIRE ISLAND PINES
BARRETT BEACH
WATER ISLAND
DAVIS PARK
LEGEND:
PR2 1980 SURVEY MONUMENT LOCATIONS
F4 APRIL 1998 SURVEY MONUMENT LOCATIONS
FIRE ISLAND, NEW YORK
FIRE ISLAND INLET TO
MORICHES INLET
INTERIM STORM DAMAGE
PROTECTION PROJECT
PROJECT LOCATION MAP

FIGURE 2A

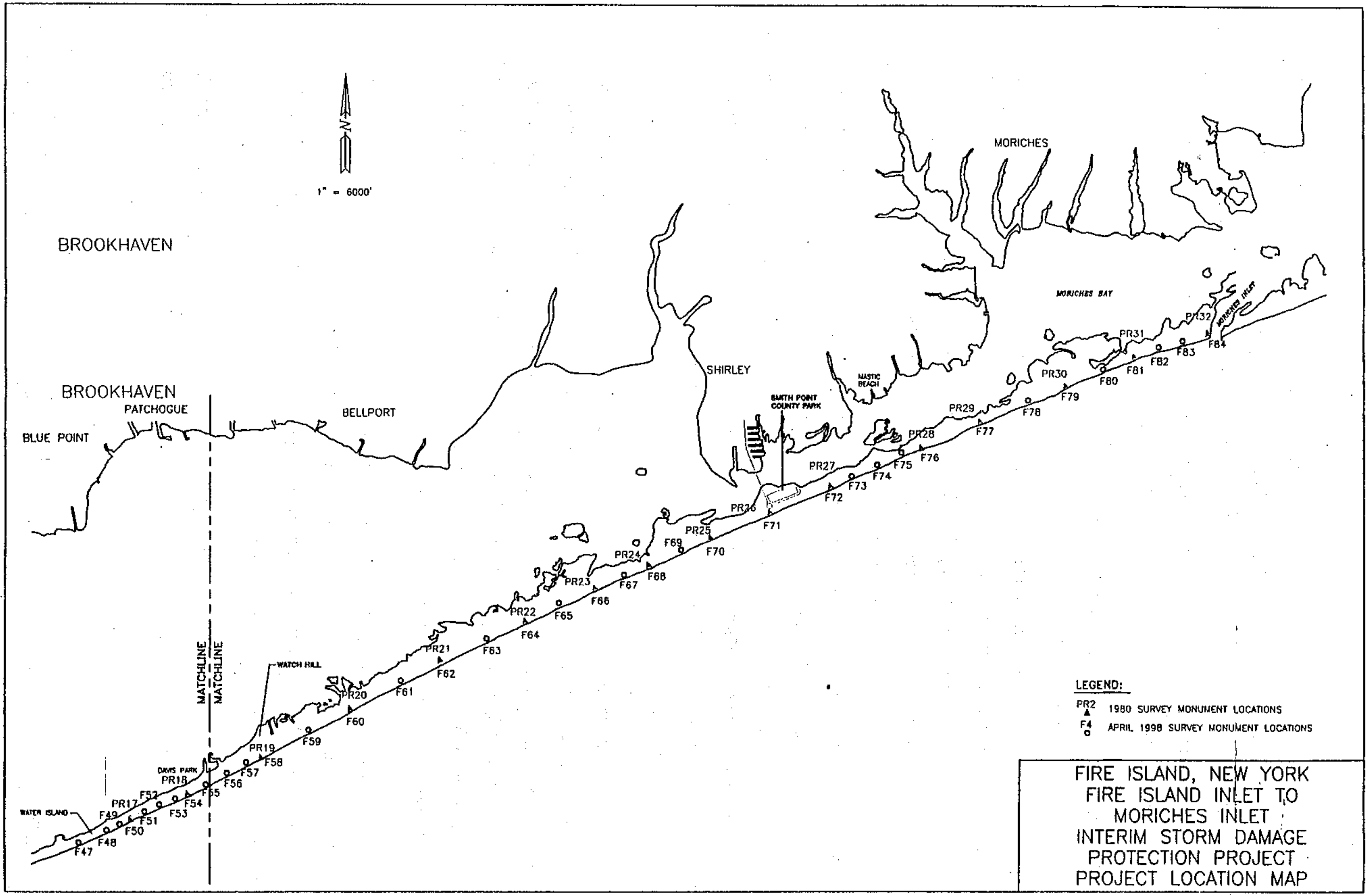

N
1" = 6000'
BROOKHAVEN
BROOKHAVEN
PATCHOGUE
BLUE POINT
BELLPORT
SHIRLEY
SMITH POINT COUNTY PARK
MASTIC BEACH
MORICHES
MORICHES BAY
MORICHES INLET
WATCH HILL
DAVIS PARK
WATER ISLAND
MATCHLINE
MATCHLINE
PR17 PR18 PR19 PR20 PR21 PR22 PR23 PR24 PR25 PR26 PR27 PR28 PR29 PR30 PR31 PR32
F47 F48 F49 F50 F51 F52 F53 F54 F55 F56 F57 F58 F59 F60 F61 F62 F63 F64 F65 F66 F67 F68 F69 F70 F71 F72 F73 F74 F75 F76 F77 F78 F79 F80 F81 F82 F83 F84
LEGEND:
PR2 1980 SURVEY MONUMENT LOCATIONS
F4 APRIL 1998 SURVEY MONUMENT LOCATIONS
FIRE ISLAND, NEW YORK
FIRE ISLAND INLET TO
MORICHES INLET
INTERIM STORM DAMAGE
PROTECTION PROJECT
PROJECT LOCATION MAP

FIGURE 2B

characterization, there are different policies governing work within their boundaries. The major federal tracts of land include: the Lighthouse Tract, Sunken Forest and Sailors Haven, Talisman, Blue Point Beach, Watch Hill, and the Otis G. Pike Wilderness Area. The remainder of the federally held properties are interspersed among the communities and are not considered major Federal land holdings.

17. The General Management Plan for the Fire Island National Seashore describes the Park Service lands as follows: *In February 1977, the National Park Service managed 5,943 acres within the seashore boundaries, of which 2,792 acres were owned in fee and 3,151 acres were controlled through an easement granted by New York State (from the mean high waterline seaward 1,000 feet). The lands managed by the Park Service represent about 31 percent of the total acreage of land and water (19,356 acres) within the boundaries. Most federally owned lands were acquired during a 6-year period following passage of the enabling act in 1964. At present, Park Service holdings on Fire Island consist of four large bay-to-ocean strips totaling 1,639 acres and six smaller bay-to-ocean strips totaling 183 acres. All of East Fire Island and its satellite islands (156 acres), as well as most of West Fire Island (102 acres), are also federal lands. In addition to these lands, which were included within the original boundary, Congress added in 1965 the 612-acre William Floyd Estate, a historic mainland property north of Moriches Bay near the eastern end of Fire Island.*

18. Communities on Fire Island are located between Robert Moses State Park and the Otis G. Pike Wilderness Area. The communities in the western half of the developed area include Kismet, Saltaire, Fair Harbor, Dunewood, Lonelyville, Atlantique, Robbins Rest, Ocean Beach, Seaview, Ocean Bay Park and Point O'Woods. Communities in the eastern half of the developed area, between Sailors Haven and Watch Hill Visitors Center include Cherry Grove, Fire Island Pines, Water Island, Davis Park and Watch Hill.

19. Robert Moses State Park forms the western limit of the barrier island. The park extends from Fire Island Inlet to the Lighthouse Area, approximately 28,000 feet to the east. Development in the park is limited to several large parking fields, the water tower at the park's entrance, and several administrative and recreational buildings.

20. Smith Point County Park forms the eastern limit of the barrier island. The park extends from Moriches Inlet to the Otis G. Pike Wilderness Area, approximately 32,000 feet to the west.

Smith Point County Park is also within the jurisdictional boundaries of the Fire Island National Seashore. Development in the park consists of parking areas and recreational facilities.

Mainland Communities

21. The three Towns comprising the mainland portion of the study area are Babylon, Islip, and Brookhaven. Portions of these towns are low lying, with existing development vulnerable to tidal inundation. The communities within these Towns are susceptible to inundation damages when storm tides enter the bays through Fire Island Inlet and Moriches Inlet. The damage levels can be significantly worse due to increased water elevations on the bay, when a greater than normal volume of water enters the bay as a result of breaching and overwash of the barrier island. This large expanse of existing, high density development in an area of low topographic relief results in an existing infrastructure vulnerable to even small changes in storm water levels. There is a potential for significant storm damages which far surpasses the potential damage on the barrier island. A general description of each Town is provided below.

22. Babylon: With 53.5 square miles of land area, Babylon is the smallest of the Towns in Suffolk County. The study area within Babylon is primarily residential. The 1990 average population density of 3,790 persons/sq. mile is substantially higher than the overall Suffolk County average density of 1,464 persons/sq. mile. Coastal areas in the Town of Babylon are heavily developed, with an estimated 6,800 buildings in the 100-year floodplain in the Town. Communities in this area include Bayside Park, Copiague, and the incorporated Villages of Lindenhurst, Amityville, and Babylon.

23. Islip: The study area within Islip is primarily residential, with open space uses throughout the Town and commercial development concentrated along Montauk Highway. Communities in this area include West Bayshore and Bayshore, the Village of Brightwaters, Islip and East Islip, Great River, Oakdale, West Sayville and Sayville, and Bayport. Residential development consists largely of medium-density detached homes on lots ranging from ½ to 1/4 acre. Somewhat higher-density developments are found in West Bay Shore just south of Montauk Highway, in West Sayville near the county park, and in other scattered pockets throughout the Town. The 1990 average population density was 2,828 persons/sq. mile.

24. Brookhaven: With 253 square miles of land area, Brookhaven is the largest Town on Long Island. Within the study area in Brookhaven, development is generally less concentrated

than that found in Islip (with a notable exception being the area that includes Shirley and Mastic) with a number of undeveloped parcels. The 1990 average population density was 1,613 persons/sq. mile. Communities in this area include Blue Point, the Village of Patchogue, Bellport, Brookhaven, Shirley, Mastic, Mastic Beach, Center Moriches, and East Moriches. Residential development is predominantly medium-density.

STUDY AREA HISTORY

25. The study area has been shaped by a number of natural processes and human activities. This section includes a discussion of these actions, in order to provide a framework for considering the existing conditions, expected future conditions, as well as the problems, needs and constraints for any proposed measures within this area. The topics discussed include coastal and geomorphic processes, historic development patterns on the island, establishment of Fire Island National Seashore, historic storm events, and the range of human management measures undertaken on the island.

Barrier Island Processes

26. The Fire Island barrier island system has formed over time through the complex interaction of several distinct geomorphic processes. The eastern portion of the system has been subject to geologic processes known as rollover and overwash, the central portion has been relatively stable, and the western portion formed as a prograding or growing spit fed from littoral material moving from East to West.

27. Intensive investigations being undertaken cooperatively by the U.S. Army Corps of Engineers and the United States Geological Survey (USGS) have helped to clarify the physical conditions contributing to the unique morphology of Fire Island. The presence of "relict" or residual flood-tidal deltas east of Watch Hill, as well as outcrops of tidal-marsh sediments on the upper shoreface provide geomorphic evidence of landward migration of this portion of the barrier-island system (Leatherman and Allen, 1985). In contrast, over the past approximately 1,000 years, most of Fire Island west of Watch Hill has experienced in-place submergence (Sanders and Kumar, 1975; Leatherman and Allen, 1985). For the bulk of the period from 1830 to 1930, the Fire Island barrier-island system, from Shinnecock Bay west to Fire Island Inlet, remained a single spit. A strong storm in 1931 opened Moriches Inlet, and the "great" hurricane of 1938 opened Shinnecock Inlet and 11 other smaller inlets between Shinnecock and Moriches

Inlets (Howard, 1939). All of these inlets were subsequently closed except Shinnecock Inlet, which was initially stabilized in 1939 and subsequently stabilized by local interests with jetties in 1954. Fire Island Inlet was stabilized with a jetty in 1940.

28. The oldest (approximately 750-1,300 years) and most stable part of the barrier-island system is the area between Watch Hill and Point O'Woods (Leatherman and Allen, 1985). Recent investigations by the USGS (Schwab, et al. 1999) concluded that an onshore sediment flux from the sand ridges west of Watch Hill historically provided, and continues to provide, sediment to the downdrift beaches west of Watch Hill.

29. Geomorphic evidence and vibracore data suggest that the barrier-island segment west of Point O'Woods formed as a prograding spit (Leatherman and Allen, 1985). Until Fire Island Inlet was stabilized in 1940, the process of spit progradation occurred for 300-500 years (Leatherman and Allen, 1985). The sediment volume required to develop the prograding spit seems to exceed the volume being introduced from the east. It is possible that an onshore sediment flux introduces sediment into the littoral system to account for spit growth. A Waterways Experiment Station (WES) analysis of the 1870 and 1979 shorelines shows that between 60-70% of the barrier island east of Watch Hill experienced drowning in place, and approximately 16-18% experienced barrier island rollover. For example, the barrier island in the vicinity of Moriches Inlet, which opened in 1931, has transgressed half of its 300-meter width since 1870. In comparison, there has been no inlet breach west of Watch Hill in historic time; in this area, the barrier island has basically drowned in place and aggraded vertically (Leatherman and Allen, 1985).

Study Area Development Patterns

30. Fire Island was not used for intensive human habitation until the second half of the 19th century. However, Fire Island was used to access various important natural resources of the time, prior to general settlement. Whaling was commonly done from the beach until about 1750 when whales were no longer found near the beach. Salt hay from the marshes was harvested for mulch and insulation. Horseshoe crabs were gathered as fertilizer by farmers. The beach of Fire Island was considered to be dangerous and inhabited by pirates. Shipwrecks were common along Fire Island during this time. From 1787 to 1890, New York State law allowed wreck masters to salvage cargo and parts from grounded ships. To reduce the number of groundings and shipwrecks, the Federal Government began to build lighthouses for safe navigation. The first

lighthouse was built at Fire Island Inlet in 1825. The second lighthouse was built in 1858 at Shinnecock Inlet. However, the perception of Fire Island as home to pirates and shipwrecks remained into the last half of the 19th century.

31. Governor Dongan's Patent of 1686, which conveyed lands and lands under water to the Towns, did not include lands south of the bay shore such as Fire Island. Because of this oversight, William Tangier Smith claimed ownership of Fire Island, Great South Bay, and Moriches Bay in 1693. The lands passed through various heirs and legal proceedings. In 1845, David Sammis purchased land in order to build a hotel. Ownership of the land was disputed and led to lawsuits that continued into the 1920s. The Great Partition of 1878 is the basis of the final settlement of the lawsuits and ownership of the land. The Great Partition allowed development of lots for summer homes. David Sammis' Surf Hotel became a resort center in the second half of the 19th century. The Chautauqua movement of self-improvement blossomed in the 1890s, and Chautauqua Assemblies became common on Fire Island at that time. These assemblies, active primarily during the summer months, introduced Fire Island to a large number of people who lived in tents and bungalows. To accommodate these visitors, regular ferry service from the bay shore to Fire Island began.

32. With the Great Partition of 1878 allowing secure purchase and ownership of land and the Chautauqua Assemblies bringing people to Fire Island, communities were settled. The first of these, the Point O'Woods Association, began in 1898. Other communities quickly followed, although the youngest community, Dunewood, was not formed until 1958. Each of the communities developed its own distinctive personality. The summer population began to grow. According to an analysis of aerial photographs, approximately 950 structures were found on Fire Island in 1928. The number grew slowly to 1,260 in 1955, and the number of structures doubled to approximately 2,400 in 1962. The number of structures reached about 3,500 in the 1970s and has remained fairly constant, except for the structures removed from what is now the Otis G. Pike Wilderness Area after the formation of the Fire Island National Seashore. Currently, there are approximately 4,100 structures on Fire Island.

33. In contrast to the rather forbidding environment of Fire Island, the bay shore attracted people from the start. Native Americans were drawn to the unique freshwater rivers and the brackish environment of the bay shores for the abundant shellfish and other fish life and for the hay from the salt marsh meadows. The relatively protected shores allowed these peoples to protect their boats, which they used for fishing and whaling.

34. Although much of Long Island was attractive to European settlers for farming, the shoreline developed first around marine industries. Shellfishing, whaling, and eventually boat building and related industries (rope works, cooperages, etc.) were core industries. However, farmers soon discovered the value of the meadowlands for salt hay and began to acquire property on and near the shore. As the New York City region began to grow and railroads came to Long Island, these two basic industries – marine and agriculture – intensified. With the railroads, Long Island became important as a source of fresh produce for the city. In 1873, nine ducks, descended from the imperial flocks of China, were imported, starting the "Long Island duckling" industry. Several major duck farms were located in the study area.

35. In the late 19th century the railroad also spurred a new development trend, suburban communities oriented to employment centers in the city. This development form did not at first affect the bay shore, which at 50 to 80 miles was rather far from Manhattan. However, as time went on and closer in areas began to fill up, the Towns of Babylon, Islip and Brookhaven began to feel development pressure from commuters. Their zoning resolutions passed in 1938 clearly show a concern for this type of development.

36. A post-World War II building boom took place on Long Island prior to the enactment of any National Flood Insurance Program (NFIP) restrictions on floodplain development. Consequently, much of the development on the mainland shore occurred in locations that were subsequently mapped as flood hazard areas. The population of Suffolk County and the study area communities increased rapidly between 1940 and 1970, with population increases of 471% and 577%, respectively. The period from 1970 to 1990 has seen much more modest population increases for the County and the study area, with respective increases of 17% and 25%. Population levels have generally stabilized in the western portion of the study area; e.g., the population levels in the towns of Islip and Babylon have changed less than 1% since 1980. The eastern portion of the study area has experienced growth during this period, as reflected by the Town of Brookhaven.

Fire Island National Seashore (FIIS)

37. FIIS was established by Public Law 88-587 on September 11, 1964, and placed under the jurisdiction of the U.S. Department of the Interior, National Park Service (NPS). FIIS encompasses much of Fire Island, with only Robert Moses State Park on the far western end of the barrier island excluded. The boundaries of the seashore extend 1,000 feet into the Atlantic

Ocean and 4,000 feet into the Great South and Moriches Bays. The islands and marshlands adjacent to Fire Island are also included in FIIS. Since its establishment, NPS has prepared a number of documents that set the policies and management policies for the FIIS. A General Management Plan and the Final Environmental Impact Statement on the General Management Plan were accepted in 1978. FIIS' Statement For Management was last revised in 1979. NPS established Management Policies in December 1988. A Resource Management Plan was approved August 9, 1993.

38. The FIIS enabling legislation gives the following directive for the organization: "for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York, which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population." NPS has followed that charge in developing its practices and management procedures for the operation of the FIIS. This has involved a careful balance of making federal lands available and usable to the public while protecting and perpetuating the environmental features and values of those lands. Another factor to be balanced is that much of Fire Island is privately owned and has been developed. The property rights of the owners have to be respected, and access to the barrier island be provided and maintained for the public and property owners.

39. The General Management Plan (GMP) for the Fire Island National Seashore, dated March 1978, recognizes that not all areas on Fire Island are natural and that there are populated areas with established stable communities. One of the planning premises is "Fire Island is a culturally manipulated barrier island system, and it cannot be managed as if natural processes had been totally unimpeded." NPS policies generally allow for manipulation of the existing environment : 1) when directed by Congress, 2) in some emergencies when human life and property are at stake, or 3) to restore native ecosystem functioning that has been disrupted by past or ongoing human activities (NPS, 1988).

40. To meet the mandate of its policies and responsibilities, NPS has established three districts within its boundary. These are the: 1) Community Development District; 2) Seashore District; and 3) Dune District. The Community Development District encompasses the existing communities and Villages. In the Community Development District existing uses and development of single-family houses are allowed. The Seashore District includes all land in FIIS that is not in the Community District. No new development is allowed in the Seashore District,

but existing structures may remain. The Dune District extends from Mean High Water (MHW) to 40 feet landward of the primary natural high dune crest which has been mapped by NPS. The Dune District was last mapped in 1980. This district overlaps the other two districts. Like the Seashore District, existing legal structures may remain and be repaired and maintained. NPS developed Federal zoning standards that became effective in 1980 and were revised September 30, 1991 under 36 CFR Part 28. These are standards that local zoning must meet in order to be exempt from the condemnation authority of the Secretary of Interior.

41. The Wilderness Act, which was passed by Congress on September 3, 1964, established the National Wilderness Preservation System. The Otis G. Pike Wilderness Area was established on December 20, 1980 under Public Law 95-585 and comprises 1,360 acres of the FIIS, the only federal wilderness area in New York State. The Otis G. Pike Wilderness Area encompasses the 6 miles of alongshore distance immediately west of Smith Point County Park. The cross-shore extent of wilderness boundaries extend from the seaward toe of the dune to the bay shoreline. The Wilderness Management Plan for FIIS was accepted by the Secretary of the Interior in November 1983 and governs activities in the Otis G. Pike Wilderness Area.

Storm History

42. The south shore of Long Island has repeatedly suffered devastating impacts from storms of both extra-tropical (northeasters) and tropical origin, including major northeasters in 1950, 1962, 1979, 1984, 1991, 1992 and 1993. Hurricanes resulting in significant damage include the great unnamed storm of 1938, Carol in 1954, Donna in 1960, Gloria in 1985, and Bob in 1991. Most recently, a series of storms in 1995 and 1996 continued the damage trends. The best illustration of a major storm's impact are the 1938, 1962, 1992 storms and the recent series of storms which are discussed below. The description of the 1938, 1962 and 1992 storms were taken from the Governor's Coastal Erosion Task Force Final Report (September 1994) prepared by the State of New York, unless otherwise indicated.

43. **Hurricane of September 21, 1938**. The hurricane was detected about 300 miles northeast of Puerto Rico on September 18, 1938. The center of the storm skirted the east coast of New Jersey and struck the south shore of Long Island near Moriches Inlet on the afternoon of September 21. Maximum wind speeds for this class 3 hurricane exceeded 111 mph immediately to the right of the eye. Storm surge recorded at Willets Point was 9.5 ft, resulting in a 13.7 ft NGVD water elevation, the highest ever recorded at that station. The storm surge along the

Atlantic shoreline of Fire Island was estimated at 10.0 feet NGVD. Waves heights averaged between 10 to 12 ft along the south shore.

44. As a result of the 1938 hurricane, 45 lives were lost in Nassau and Suffolk counties. Two deaths occurred in Saltaire, and two on the Great South Bay shoreline. Between Fire Island Inlet and Montauk Point, large areas were inundated, causing extensive damage. One thousand homes on Fire Island were damaged, of which approximately 265 were destroyed. Saltaire, Fair Harbor and Point O'Woods suffered greater damage than other communities due to insufficient sand dune protection. Extensive damage at Saltaire has been attributable to "the decision to level the dunes to provide more building lots." (Milner, 1998) Total physical damage along the south shore, from Jones Inlet to Montauk Point was estimated at more than $6 million (1938 dollars). Twelve new inlets, including Shinnecock Inlet, were formed along the south shore barrier beaches and numerous smaller breakthroughs occurred. All but Shinnecock were filled with wrecked cars, broken trees, structural debris and millions of tons of sand. (Long Island Express, 1998)

45. When storm tides overtopped Fire Island the resulting flooding along the mainland was severe. During the 1938 hurricane 20 square miles of the mainland were flooded (Coastal Science and Engineering, 1994). This storm was most severe toward the eastern end of the study area where mainland flood marks were typically 9 ft. NGVD or higher, consistently exceeding the regulated 100 year flood levels. The low density of development at the time, minimized damages. Based on the current density of development, a recurrence of these flood stages would inundate approximately 8,500 mainland structures at depths of up to 6 ft above grade. Under current conditions this would result in mainland inundation damage of over $70,000,000.

46. **Extratropical Storm of March 6, 1962**. This northeaster began on March 4, 1962 as two weak storms in the Atlantic Ocean east of Florida and in the Mississippi Valley (USACE, 1963a). By March 6th the storm area encompassed the eastern third of the United States and a large part of the western North Atlantic. The main center of the storm stopped its northward movement and became stationary off the Delmarva coast. There, it developed a complex pattern of multiple pressure centers and moved eastward out into the Atlantic on March 7-9.

47. Ocean waves were estimated at 20 to 30 ft. Northeast winds of gale force with velocities up to 50 mph were reported at Westhampton Beach. The maximum water levels were 7.7. ft NGVD at the Battery, and 9.2 ft NGVD at Willets Point. Damage incurred by private and public

properties from Jones Inlet to Montauk Point was estimated at over $16,500,000. A total of 50 washovers, and one inlet at Westhampton Beach (approx. 1200 ft wide), were created by the storm. On Fire Island, a total of 47 homes were destroyed and 75 damaged. Fire Island Pines suffered severe damage with 32 homes destroyed (USACE, February 1963).

48. Unlike the 1938 hurricane, which was most severe closer to Moriches Bay, the 1962 northeaster caused the most severe flooding toward the western portions of Great South Bay, inundating nearly 12 square miles of the mainland. While flood depths along the eastern portion of the bay were reported to be up to 4 ft. lower than during the 1938 hurricane, flood depths in western areas such as Lindenhurst were nearly equal to conditions in 1938. A recurrence of the reported flood stages today would inundate nearly 4,500 mainland structures.

49. **Extratropical Storm of December 11, 1992**. In early December 1992, a major storm moved across the south to Virginia. After reforming in the vicinity of Chesapeake Bay, it moved slowly up the East Coast in a typical northeaster pattern. On December 11 and 12, the storm hit southeastern New York State.

50. Along the portions of the south shore of Long Island, the northeaster generated wind velocities that exceeded hurricane force (74 miles per hour). These strong northeasterly winds pushed ocean waters toward the Long Island shoreline through 4 tide cycles. The National Weather Service estimated 15 to 25 foot seas on the ocean and the tide gauge at the Battery on the southern tip of Manhattan recorded a maximum water level of approximately 8.3 ft NGVD, its fifth highest recording.

51. The storm caused widespread erosion the entire length of Fire Island. Severe beach erosion occurred from Kismet to Davis Park, at Long Cove and at Old Inlet. Smith Point County Park also had severe beach erosion and dune scarping. Most of the Fire Island communities suffered widespread dune scarping, and many experienced washovers. Kismet, Fair Harbor, Dunewood, Lonelyville, Robbins Rest, and Atlantique were particularly hard hit. Two homes in Saltaire were destroyed, and portions of Village boardwalks and beach stairways were damaged. In the Village of Ocean Beach, several oceanfront homes were destroyed. Also, the Village marina and the Fire Island Ferry dock were damaged. The Town of Islip's Bayside Marina in Atlantique also suffered damage. Washovers in Atlantique, within the Otis G. Pike Wilderness Area, and in Smith Point County Park have rendered these locations highly susceptible to overtopping or breaching.

52. Robert Moses State Park, Smith Point County Park and communities from Kismet to Davis Park experienced significant reductions in beach width and dune height due to the December storm. Overwashes of the barrier island were more severe during the March 13-14, 1993 blizzard because the protective features had been diminished by the December storm. Additional erosion occurred and houses were destroyed with the March 1993 northeaster. As of early June 1993, 86 houses were reported to have collapsed or been severely damaged.

53. On the mainland bay shoreline in the Town of Islip, the lower Browns River Road in Sayville and access to the Bay Shore Marine were flooded. Significant flooding was also reported in the Town of Babylon.

54. In response to the storm, Governor Cuomo declared a State of Disaster Emergency which went into effect on December 11, 1992. Based on initial assessment of the physical damage and associated economic injury to individuals, business, and governments, the Governor wrote to the President on December 12, 1992, requesting a determination of eligibility for Federal disaster assistance for Suffolk, Nassau, Rockland and Westchester counties, the City of New York, and their contiguous areas.

55. President Bush responded to the Governor's request and declared New York State eligible for federal assistance under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, on December 21, 1992.

56. **Storms of 1995-96**. Between the summer of 1995 and the winter of 1995-96, storms have continued to take their toll on Fire Island. Hurricanes Felix and Luis, the November 14-15 northeaster and the blizzard of 1996 have all contributed to continuing damages. A comparison of April 1995 aerial photographs to conditions in February 1996 showed that ten houses had been removed from their coastal lots, most of these destroyed by one of the above storms. Fire Island Pines has lost 6 houses, while other structures were lost in Davis Park and near Ocean Beach. At Smith Point County Park, a very popular recreation area, over 200 feet of beach was lost in the blizzard, exposing the infrastructure to future storms.

Related Development Actions

57. Numerous actions have been undertaken which have influenced the existing barrier island condition. These actions include those directly affecting the shore front area including inlet stabilization, shore protection projects, and development on the dune. In addition, the

cultural manipulation of the barrier island is demonstrated by other activities including bulkheading of the bay shoreline, dredging to improve accessibility to the island via ferry, and mosquito ditching, undertaken in the majority of the park area. These prior actions highlight the human commitment to manage the study area and further highlight how these management decisions have influenced the present condition of the island. The discussion included herein is not intended to provide a quantifiable separation of impacts due to human and natural causes, but rather is intended to provide a qualitative discussion of human influence on the systems so that these factors can then be considered in evaluating the feasibility of any proposed measures.

58. Tuthill (1944) describes actions which were undertaken in response to the hurricane of 1938, that demonstrate an early commitment to restore the integrity of the barrier island:

"Essential things were done - namely, closing the breaches or inlets that occurred in the barrier beach. These constituted an ever growing menace that gained with time. Work was carried on in the dead of winter; there was no let-up; there could not be. Success depended upon continuity of action. There were many setbacks, many times the heavy seas tore out what had been done. All final closings were timed to a zero hour that was limited from five to ten minutes at the most on the turn of the tide. It may have been coincidental, but there were no misses. This accomplished, our attention was directed to bolstering the long line of beach from further inroads of the sea, which persisted in slopping over ... Thus, sand trap barriers were erected along the beach, many miles of it, to assist in building back the loss. This system of sand traps generally served its purpose well ... In areas where dunes were completely destroyed, artificial dunes were built of material dredged from the bay and beach grass planted to hold them."

59. Following the hurricane of 1938, there is a consistent record of beach nourishment activities undertaken in response to storm events. Following the 1962 storm, for example, the Corps of Engineers contracted the placement of 9,529 linear feet of dune and 37,000 linear feet of berm between Fire Island Inlet and Moriches Inlet as part of the Disaster Recovery Operation (USACE 1963b). Local efforts were also undertaken at Point of Woods, Cherry Grove and the Village of Ocean Beach. These efforts included placement of a dune 20 ft. above MLW at Point of Woods. Table 1 shows the distribution of fill placement, by decade, by reach. Generally, the volumes of material presented below come from volume computations contained within historic sediment budgets of the area, which although representative of the size of the operation, do not capture the configuration of the placement operation. Based upon anecdotal evidence, these fill

TABLE 1
HISTORICAL FILL VOLUMES FOR FIRE ISLAND
1955 TO 1994

BEACH SEGMENT	SHORE LENGTH (FT.)	FILL VOLUME (CY) 1955 1959	1960 1964	1965 1969	1970 1974	1975 1979	1980 1984	1985 1989	1990 1994	1955 1979	1980 1994	TOTAL
Robert Moses Park to Kismet	27,227	0	242,222	0	249,982	2,724	8,036	0	719,168	494,928	727,203	1,222,131
Kismet to Point O' Woods	24,299	207,230	172,309	145,925	0	7,276	21,464	0	527,481	532,739	548,946	1,081,685
Point O' Woods to Bayberry Dunes	43,227	240,113	275,420	475,710	0	0	18,399	0	329,819	991,243	348,218	1,339,460
FIIS Wilderness Area to Smith Point Park	68,305	404,520	963,726	1,159,190	187,720	0	0	0	56,900	2,715,155	56,900	2,772,055
TOTAL	163,057	851,863	1,653,677	1,780,824	437,702	9,999	47,899	0	1,633,368	4,734,066	1,681,267	6,415,333

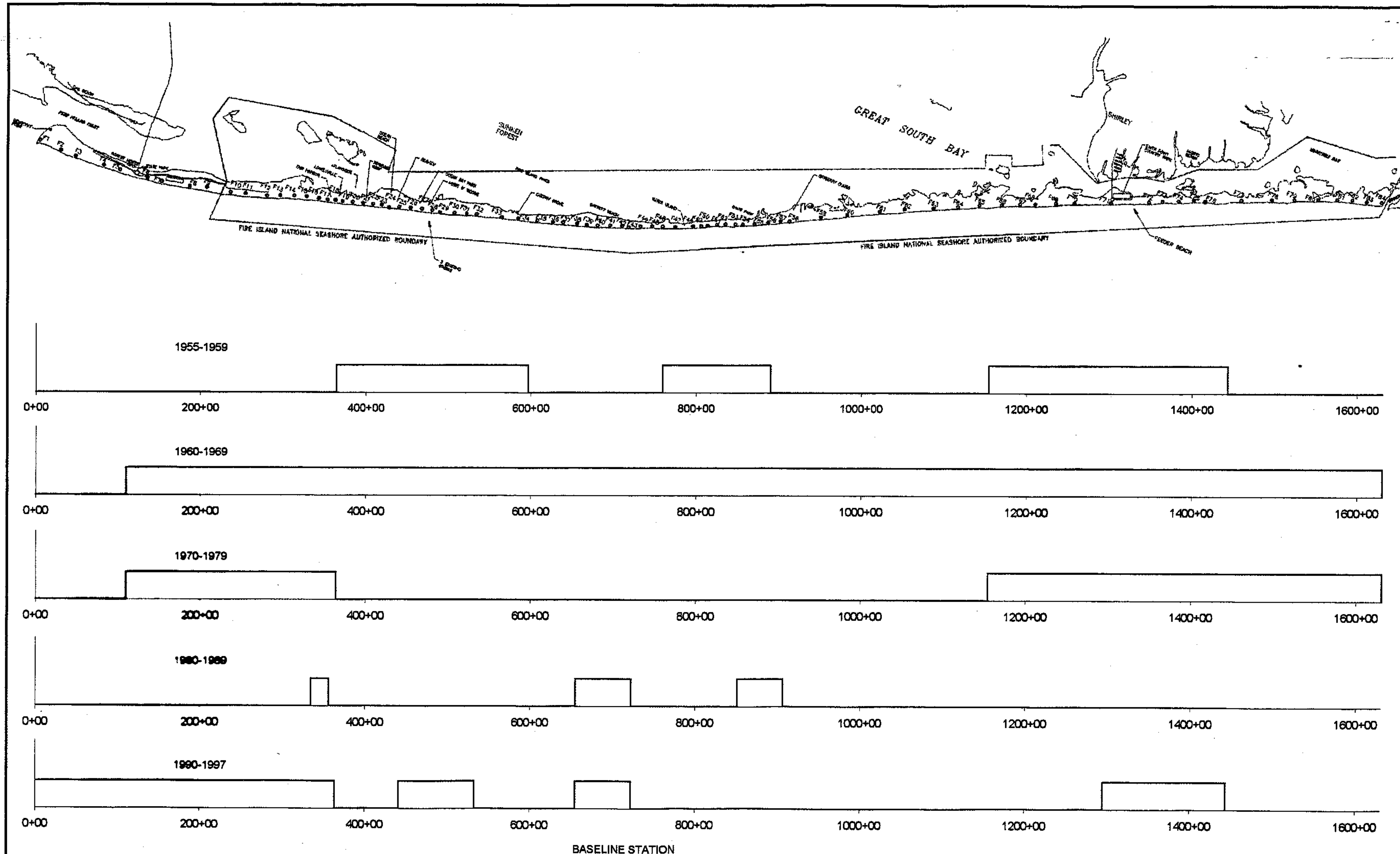
Reference: Kana & Krishnamohan (1994) for 1955 to 1989.

volumes were generally placed in an emergency response to a storm event. As such, material was frequently placed in a dune configuration to rebuild the dune lost during the storm event. Based upon the spatial and temporal distribution of the 6,400,000 cy of material placed on Fire Island displayed in Figure 3, it is likely that the location of much of the dune line existing on Fire Island today has been affected by past fill placement operations.

60. After emergency efforts to rebuild the dunes, such as occurred in 1938 and 1962, it is likely that rebuilding of structures took place on the dune. Although the details of historic operations are not available, recently undertaken fill projects have resulted in structures built on or within the primary dune. In most emergency conditions, dune placement practices have been to place the dune as far landward as possible, often with existing structures located on, or immediately adjacent to the newly constructed dune. Once houses are located on the dune, building restrictions have historically been ineffective in preventing the "infilling" development of lots adjacent to existing structures, which ultimately resulted in additional construction on the dune. As a result of a combination of emergency fill actions and subsequent development, there are approximately 310 structures currently within the existing primary dune. Research undertaken by McCluskey and Nordstrom (1985), indicate that the presence of houses and sand fences on dunes along Fire Island reduces the amount of windblown sand transported to landward side of the dune.

61. Inlet Stabilization. The dynamic nature of inlet formation and migration along Fire Island has been influenced by the stabilization of both Moriches Inlet, and Fire Island Inlet. Moriches Inlet, which originally opened in 1931 was originally stabilized by local interests for improvements in water quality, and navigation. Subsequent efforts have been undertaken, including a Federal navigation project constructed in the early 1980's. Fire Island Inlet, which establishes the western boundary of Fire Island, has changed significantly over time, migrating west to its present location (a total distance of about 5 miles) between 1825 and 1940.

62. Navigation Channel Maintenance Dredging. Presently both Moriches Inlet and Fire Island Inlet are routinely dredged to maintain navigability in the inlets. Sand from each inlet is bypassed to the westerly beaches. The present inlet configurations, as established through periodic dredging provide greater tidal exchanges in the back bays than had historically existed in the unstabilized condition. In addition to these two inlets, numerous bay channels maintained



LOCATION OF HISTORICAL FILL VOLUMES, 1955 - 1997, FIRE ISLAND, NY

FIGURE 3

Sources: (1) CPE, (1995) (2) LAND USE ENV, (1995) (3) USACE, NYD, (1995) (4) ROBERT MOSES PARK, (1995) (5) BAKER (1995) (6) KANA (1985)

by federal, state, and local governments have also altered bay bottom topography and water circulation patterns.

63. Bayshore Changes to Fire Island. The bayside shore of Fire Island has been dramatically altered by measures to improve access and living conditions, associated with the development of the barrier island. In addition to shore normal channels which have been dredged to allow ferry access, the majority of the shoreline within the developed communities has been stabilized, primarily with bulkheading. In areas where existing salt marshes remain, they have been largely impacted by efforts to create and maintain mosquito ditching. Much of the existing salt marsh on Fire Island presently remains impacted by these past practices.

Considerations in the Development of the Fire Island Interim Plan

64. The plan formulation strategy for the Fire Island Interim Project was a course of action where a plan within the limits of the authorized plan was developed by the Corps of Engineers and coordinated with federal, state, and local government agencies, in order to ensure consistency with identified objectives and constraints. The components of the interim study include those necessary to determine the feasibility of the project by means of: benefit cost analysis, environmental analysis pursuant to the National Environmental Policy Act (NEPA), and coastal engineering analysis and design. The objective of this study is to design and analyze an interim project which is feasible, cost effective, and meets criteria for local sponsor participation and the National Park Service Special Use Permit. Since a full optimization of alternatives is not being undertaken, a comparison of the Interim Plan with a larger plan is undertaken to determine if the construction of a larger (potentially NED) plan provides greater net excess benefits. In light of the unique nature of both the study area environment, and the study being undertaken, the following additional factors needed to be taken into consideration in the development of the interim project: 1) consistency with NPS General Management Plan and Park Service Policies, 2) consistency with a Partnership Agreement entered into between the U.S. Army and the Department of the Interior on June 1, 1999, and 3) consistency with NEPA policies regarding interim measures.

65. The NPS General Management Plan (GMP) recognizes that "Fire Island, functions to some degree as a barrier, shielding the urbanized communities along the south shore of Long Island from the damaging impact of hurricanes and extratropical storms", and considered this in developing management proposals for the island. The authorizing legislation for Fire Island

National Seashore recognized the potential need for shore protection efforts and the duty of the Corps of Engineers to meet that need. The statue states that "The Authority of the Chief of Engineers, Department of the Army, to undertake or contribute to shore erosion control or beach protection measures on lands within Fire Island National Seashore shall be exercised in accordance with a plan that is mutually acceptable to the Secretary of the Army and the Secretary of the Interior and that is consistent with the purposes of this act."

66. The GMP recognizes the need to maintain existing dune systems, stating that "ocean-facing dunes will be repaired or restored as needed. Planting with native, perennial dune-stabilizing species to encourage revegetation will be initiated throughout the seashore. Dune blowouts and other naturally occurring bare-sand areas will be repaired or replanted in the seashore district when compelling considerations – such as threat to major developments – dictate such action (the seashore district includes all federal and non-federal public recreational lands outside the exempted communities.) In the development district, dune blowouts that endanger homes during extreme high tides or moderate-intensity storms may be filled and replanted, following evaluation of the need for such action. Such measures will be undertaken by affected communities."

67. The General Management Plan recommends "Following the completion of current studies by the Corps of Engineers and their consultants, National Park Service managers and planners will determine the feasibility of sand nourishment. If sand nourishment is begun, the large Federal tract east of Watch Hill would not be included in the project area. Adequate time would be necessary for the Park Service to determine results and impacts. All sand nourishment activities would be closely monitored by the Park Service and Corps of Engineers. Also, sand nourishment projects would not be permitted until the Moriches Inlet and Shinnecock Inlet sand-bypassing systems are operational." The Environmental Impact Statement, in support of the GMP, further states that "if beach nourishment appears economically and environmentally feasible, work will be limited to beach areas west of Watch Hill. Major Federal tracts will not be included in the sand nourishment program."

68. Fire Island National Seashore is also responsible for issuance of a Special Use Permit for actions which are proposed to be undertaken within the boundaries of the Fire Island National Seashore. Issuance of the Special Use Permit requires that the proposed action be consistent with the GMP. If the proposed action is inconsistent with the GMP, sufficient justification must be provided for the deviation. National Park Service policies generally allow for manipulation of

the existing environment when: 1) directed by Congress, 2) in some emergencies when human life and property are at stake, or 3) to restore native ecosystem functioning that has been disrupted by past or ongoing human activities. Depending upon the magnitude of the proposed action, the rationale, and the extent of deviation, issuance of the Special Use Permit could be done within the discretionary authority of the Park Superintendent, or could necessitate a change in the GMP, which would require an accompanying EIS to be prepared by the National Park Service. The EIS accompanying this report has been prepared in cooperation with the Department of the Interior, and was intended to satisfy National Park Service NEPA requirements for issuance of a Special Use Permit.

69. The Department of the Army and the Department of the Interior (DOI) have entered into a partnership agreement on 1 June 1999, which establishes baseline conditions for the development of an interim project of Fire Island. The agreement, which is included in the pertinent correspondence section, is summarized below.

(1) The Corps will recommend a project which consists of initial construction and one nourishment, with a duration not to exceed six years.

(2) The scheduled nourishment would not occur unless the EIS for the Reformulation Study is completed and renourishment is consistent with the preferred alternative. Recognition is given to the need for unscheduled nourishment as a result of a storm or series of storms.

(3) The Corps will support and facilitate discussions between the NPS and NYSDEC to address concerns regarding expansion of development or new development that is not in conformance with New York State's Coastal Erosion Hazard Areas Act, or National Park Service policy.

(4) The DOI and Army agree that two full field seasons of baseline data will be collected for the Reformulation EIS, prior to implementing the interim project.

(5) The Army and DOI agree to continue to meet and cooperatively frame issues, identify and evaluate impacts, and make preliminary recommendations on how to address issues as they relate to work within federal lands.

(6) The Army and DOI agree to work together in the development of the draft documents, to meet regularly, and to develop a process for dispute resolution.

(7) Nothing in this agreement supercedes the responsibilities of the Army and DOI under applicable federal law by precluding the need for an additional EIS to be prepared by the NPS.

70. NEPA Requirements. NEPA regulations regarding the implementation of interim projects are found under 40 CFR 1506.1(a) and (c). These subparts specify conditions which must be met if an agency is to undertake an action related to a proposal for which the Record of Decision has not been issued. These paragraphs are transcribed below. Together, they describe the relationship between the Reformulation Study and the interim project.

Until an agency issues a record of decision as provided in 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:

(1) Have an adverse environmental impact; or

(2) Limit the choice of reasonable alternatives.

c) While work on the required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:

(1) Is justified independently of the program;

(2) Is itself accompanied by an adequate environmental impact statement; and

(3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.

EXISTING CONDITIONS

Physical Conditions

71. **Astronomical Tides**. Astronomical tides on the south shore of Long Island are semi-diurnal. The mean tidal range for Moriches Inlet is 3.3 feet and the spring tidal range is 4.0 feet. At Fire Island Inlet the mean tide range is 4.1 feet and the spring tide range is 5.0 feet. In Great South Bay at Point O'Woods, the mean tide range is 0.7 feet while the spring tide range is 0.8 feet.

72. **Storm Surge**. Design water levels in the study area are dominated by storm effects (i.e. storm surge and wave setup) in combination with astronomical tide. Storm surge is a temporary rise in water level generated during the passage of major storms. The rise in water level results from wind action and the low pressure of the storm disturbance. Wave setup is a term used to describe the rise in water level which attends wave breaking.

73. Storm surge and wave setup in the study area can be generated either by hurricanes or by large-scale extra-tropical storms known as northeasters. A comprehensive evaluation of storm-induced water levels has been conducted by the U.S. Army Corps of Engineers, Coastal Engineering Research Center, 1996. As a result of this evaluation, stage-frequency curves were developed for various return periods. These curves indicate that the 100-year water level for the Atlantic Ocean at Westhampton Beach is 9.5 feet NGVD and 11.5 feet NGVD without and with the wave setup component, respectively. The 100-year water level for the Atlantic Ocean at Great South Beach is 11.6 feet NGVD and 14.1 feet NGVD without and with the wave setup component, respectively.

74. **Sea Level Rise**. Variations in sea level are affected by global, regional, and local factors. A study of tidal records at the Battery in New York City and Montauk Point, New York indicated average rates of sea level rise of 0.009 and 0.006 feet per year, respectively. Sea level rise for the study area was estimated at 0.01 feet per year or 1 foot per century. Estimates of future sea level rise range from a "Low" value of 0.009 feet per year to a "High" value of 0.026 feet per year (0.9 feet to 2.6 feet per century).

75. **Currents**. Most of the barrier island is sufficiently distant from Fire Island Inlet and Moriches Inlet to be free of tidally generated currents under normal conditions. A number of

potential breach locations exist on Fire Island. Once a breach has occurred, the beach area adjacent to the breach is exposed to tidal currents. These tidal currents generally dominate the morphological development of the breach.

76. **Waves**. Waves breaking at an angle to a beach generate longshore currents which are the primary mechanism responsible for longshore transport of beach sediments under normal conditions. The U.S. Army Corps of Engineers, Coastal Hydraulics Lab (CHL) has performed a hindcast of waves generated by extra-tropical weather conditions for the period 1956 thru 1975, for the entire East Coast. The Wave Information Study (WIS) hindcast station nearest to the Fire Island project site is Station 76, located about 12 miles from the project site in a water depth of 102 feet. The mean spectral wave height is 3.6 feet and the mean peak wave period is 6.4 seconds. In addition to the extra-tropical storm wave hindcasts, CHL has developed design wave heights on the basis of hurricane wave hindcasts for the period 1956 thru 1975 (Abel et al, 1989). The hurricane hindcast for Station 24 is located directly south of Fire Island in a water depth of 167 feet.

77. Deepwater waves were transformed to nearshore conditions using the Regional Coastal Processes Wave Model (RCPWAVE) utilizing NOAA bathymetric data supplemented with 1995 beach profile data. WIS waves were transformed from offshore depths to the -6 meter depth contour for use as input to the shoreline change simulation model (see Appendix C for details).

78. **Beach and Dune Characteristics**. The existing beach and dune characteristics are highly variable along the length of Fire Island. The beaches of Fire Island are typically low with moderate width, backed by fairly high dune elevations. The existing berm width for Fire Island averages 55 feet, but is particularly variable. Berm width represents the distance from the seaward berm crest to the seaward dune toe. Berm widths within the western half of Fire Island are measured as great as 115 feet, yet other sections of the beach have no measurable berm.

79. The average berm elevation for Fire Island is 9.0 feet NGVD, varying between 4.2 and 16.7 feet. Lower berms prevail in western portions of the island. Dune elevations vary between 12.2 and 35.5 feet NGVD, with a mean elevation of 21.8 feet. The area between Kismet and Point O'Woods features the lowest dunes, which to a large degree have been artificially constructed.

80. The level of protection offered by the existing beach and dune against storm events varies greatly. Breaching susceptibility along Fire Island during a given storm is high if the rate

of overtopping exceeds 1.7 ft^3/ft/sec (763 gal/ft/min) [USACE 1995]. This rate is based on an analysis of the Westhampton beach formation in 1992. The overtopping rate criteria utilized storm stage, wave heights and profile characteristics such as slopes and elevation. Other pertinent factors such as island width, backbay depth, and tide phase differences were also considered. Based on the overtopping criteria and existing dune dimensions, the entire study area features at least a four year level of protection, while 83% of the island has at least a 10-year level of protection and 77% has at least a 30-year level of protection. About 56% of the study area features at least a 39 year level of protection. It should be noted that a 10-year level of protection does not mean that protection will last for 10 years, but that there is a 1 in 10 chance of exceeding the level of protection in any year. Further details on the existing condition level of protection investigation are presented in Appendix C.

81. Beach slopes are relatively steep onshore and flat offshore. Onshore slopes were measured from approximate elevations of +5 to -3 feet, indicating an average value for the island of 1V on 13.7H. These slopes are generally milder near the island's ends and consistent in the central reaches. Nearshore slopes landward of the bar typically range from 1V:10H to 1V:50H, with an average of 1V:34H. Offshore slopes are relatively flat , typically ranging from 1V:65H to 1V:120H, averaging 1V:92H. Beach and nearshore slopes are highly variable because of the presence and mobility of a large bar-trough system fronting Fire Island. The bar changes wave refraction patterns, which results in variations in alongshore wave energy (Allen and Psuty, 1987 and Gravens, 1999).

82. **Inlets**. Fire Island is bracketed by Fire Island Inlet and Moriches Inlet. Both inlets are stabilized with jetties on their east and west sides. The maximum average tidal velocities in the inlets on both the ebb and flood tide are very similar, averaging 2.4 kts (4.1 fps), although Fire Island Inlet has approximately three times the cross-sectional area of Moriches Inlet.

83. Fire Island Inlet provides a connection between the Atlantic Ocean and the Great South Bay. Maintenance dredging has removed an average of 371,000 cy/yr from the inlet between 1955 and 1994 in 35 dredging operations. Most of the dredged material was placed on the beach west of the inlet. Moriches Inlet connects to the Great South Bay through Moriches Bay and the narrows, at Smith Point. Thirteen maintenance dredging operations removed an average of 74,000 cy/yr between 1953 and 1996. A majority of this material was placed on the beach west of the inlet. A detailed listing of dredge quantities at both inlets is presented in Appendix C.

Socio-Economic Conditions

84. **Development**. The study considers development extending from the Nassau/Suffolk County border, east to Smith Point, and includes development on both Fire Island and the mainland shore to elevation 16 feet NGVD. The area is primarily residential in nature with pockets of commercial development, as well as open space areas. The barrier island is undeveloped from Davis Park to Moriches Inlet but is heavily developed in the more western areas on Fire Island. Table 2 provides a summary of the number and value of structures located in the study area.

TABLE 2

Summary of Mainland and Barrier Island Development

Location	Number of Structures		Structure Value (Thousands of Dollars)		Total Structure Value (Thousands of Dollars)
	Residential	Non-Residential	Residential	Non-Residential	
Mainland - Great South Bay	27,486	2,570	5,081,000	2,042,000	$7,123,000
Fire Island - Non-Shorefront	3,122	222	553,000	98,000	$ 651,000
Fire Island - Shorefront	765	23	165,000	13,000	$ 178,000
Total	31,373	2,815	5,794,000	2,153,000	$7,952,000

85. A post-World War II building boom took place on Long Island prior to the enactment of any National Flood Insurance Program (NFIP) restrictions on floodplain development. Consequently, much of the development in the study area occurred in locations which were subsequently mapped as flood hazard areas. Although new structures meet NFIP regulations, there is the possibility of damage due to nonconformance to building regulations or due to floods exceeding the 100 year storm.

86. In the existing condition, the regulations governing development on Fire Island are primarily municipal zoning standards. Although Federal zoning regulations are in place, they are

limited as the only available option for refusal to issue a permit is condemnation, for which no funds have been available. New York State has identified the entire Atlantic Ocean shoreline of Fire Island as a coastal erosion hazard area. The entire beach and nearshore area, and the primary dune to a point 25 feet landward of the landward toe of the dune, are designated as natural protective features. New construction is not permitted in these areas and pre-existing development is strictly limited to only a 25% increase in ground area coverage. Due to the amount and location of existing development, coupled with recent court rulings, existing regulatory authorities are limited in preventing new development from infilling adjacent lots on the existing dune since denial of a permit has been determined to be a regulatory "taking". New development and reconstruction of homes on the existing dune has historically occurred, and is ongoing. A comparison between existing structures within the primary dune (as defined by the Coastal Erosion Hazard Areas Act) in 1980 versus the present condition indicates that along the length of Fire Island 1.6 houses have been constructed annually that could be considered to be in a hazard area. Based upon past actions, there presently exist approximately 250 structures that are located within the boundary of the existing primary dune. Within this area there are up to 50 empty lots, which could be developed under the existing regulatory framework.

87. **Population**. The population of Suffolk County increased by approximately 18% between 1980 and 1990. This growth rate exceeded the growth for New York State and the population at the eastern end of Long Island is projected to undergo continued growth. The population of the towns of Islip and Babylon increased by 300% or more between 1950 and 1970. Since 1970, the population of Islip and Babylon has remained fairly stable , while the population of Brookhaven has continued to increase.

88. **Income**. There is significant variation in the per capita income between the various study area communities. Per capita income in the incorporated portions of Brookhaven is generally above the County average, while per capita incomes in Islip and Babylon are below the County average.

89. **Economy**. The largest segment of the population is employed in service industries with tourism a significant part of the local economy. The study area is especially affected by the influx of seasonal residents from May to September. In addition to service industries, retail trade, manufacturing and government also provide employment for significant portions of the population.

90. **Transportation**. The study area is convenient to major population centers through a network of modern highways and railroads. It is accessible by major highways, the Long Island Expressway (I-495), the Sunrise Highway (Rte. 27), the Sagtikos State Parkway, and the William Floyd Parkway (Rte. 46). The Sagtikos Parkway provides access to Robert Moses State Park on Fire Island via the Robert Moses Causeway. The William Floyd Parkway provides access to Smith Point Park on Fire Island. In addition, passenger ferries from Bayshore, Sayville, and Patchogue carry over 1,000,000 passengers per year to communities on Fire Island.

Environmental Resources

91. The project area extends from the Atlantic nearshore region south of Fire Island to the mainland Long Island shoreline along the Great South Bay. An extensive discussion of the existing environmental resources is provided in the DEIS Chapter 3. The following sections provide a brief overview of the existing conditions.

92. Several ecological communities occupy the barrier island and the adjacent open water habitat. The most southern community is usually under water, and is referred to as the nearshore/littoral community. The ocean beach community contains the geologic zones of intertidal, berm, open beach, foredune, and primary dune. Behind the beach/dune system there is often found a dune/swale community of grasses and rushes. Interspersed throughout the interior of the barrier island are maritime forest communities. These may be bordered to the north by saltmarsh community. Often extending out from the island's northern boundary to 4,000 feet offshore, is the bayside estuary community. There is little variation in topography in these ecological communities. The Otis G. Pike Wilderness Area, located in the eastern eight miles of FIIS, contains the best examples of these communities in a relatively natural and undisturbed state. The stability of these communities is sensitive to specific types of disturbance (i.e., tidal action, wave action, human development, wind activity, storms, and other natural processes).

93. On the mainland, the Connetquot River and Carmans River empty into the Great South Bay. The Carmans River is part of the Wertheim National Wildlife Refuge. The Refuge is about 2,500 acres in area, and contains a diversity of habitats including freshwater wetlands, saltmarshes, an impoundment pond, upland forests, and old fields. The river is one of only four relatively large, undisturbed riverine systems on Long Island.

94. The project area is within the Atlantic Migratory Flyway for many migratory birds (i.e., geese, hawks, and neotropical species).

95. **Great South Bay**. Great South Bay contains eleven Significant Coastal Fish and Wildlife Habitats as designated by the New York State Department of State including Great South Bay East, Great South Bay West, Beaverdam Creek, Swan River, Carmans River, Connetquot River, Champlin Creek, Orowoc Creek, Cedar Beach, Gilgo Beach, and Sore Thumb. The bay has also been recognized by the U.S. Fish and Wildlife Service as a significant fish and wildlife habitat.

96. The vast salt marshes, intertidal flats, and shallows in the Great South Bay provide valuable nesting and feeding areas for migratory birds throughout the year, including large populations of shorebirds. Several heron rookeries have been located on the wetland islands within Great South Bay. From November to March the bay provides wintering habitat for brant (*Branta bernicula*), greater scaup (*Aythya Marila*), lesser scaup (*Aythya Affins*), black duck (*Anas rubripes*), Canada geese (*Branta canadensis*), mallard (*Anas platyrhynchos*), bufflehead (*Bucephala albeola*) and red-breasted merganser (*Mergus serrator*). Generally, the birds feed in open water areas through mid-winter; prior to migration (early spring), the birds feed widely in the surrounding salt marshes.

97. Great South Bay is a productive area for marine finfish and shellfish, and other marine wildlife. The bay serves as a feeding and nursery area from April to November for bluefish (*Pomatomus saltatrix*), winter flounder (*Pleuronectes americanus*), summer flounder (*Paralichthys dentatus*), kingfish (*Memticurrhus saxatilis*), tautog (*Tautoga onitis*), scup (*Stenotomus chrysops*), and blue crab (*Callinectes sapidus*). Forage fish species that utilize the bay include Atlantic silverside (*Menidia meridia*), mummichog (*Fundulus heteroclitus*), striped killifish (*Fundulus majalis*), sticklebacks (*Apeltes quadracus*) and northern pipefish (*Syngnathus fuscus*). The bay is inhabited by hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), bay scallops (*Aequipecten irradians*) and mussels (*Mytilus edulis*). Portions of the bay are open for commercial shellfishing.

98. **Moriches Bay Area**. The barrier beach/dune system is the most dominant physical topographic feature fronting Moriches Bay. Extensive wetlands fringe the southern edge of Moriches Bay, and a few tidal wetland islands are located within the bay. The mainland, behind the northern boundary of the bay, provides numerous stream corridors associated with freshwater

and tidal wetlands. The Moriches Bay area contains five New York State Designated Significant Fish and Wildlife Habitats. They include Moriches Bay, Smith Point County Park, Cupsogue County Park, and a portion of Quantuck Creek and Quogue Refuge. Moriches Bay has also been identified as a significant fish and wildlife habitat by the USFWS (1995).

99. The salt marshes, intertidal flats, and shallows in Moriches Bay provide valuable nesting and feeding areas for migratory birds and shorebirds throughout the year. Moriches Bay is also one of the most important waterfowl wintering areas (November to March) on Long Island containing populations of brant, scaup, black ducks, Canadian geese, mallards, buffleheads, and canvasbacks (*Aythya valisineria*). Winter waterfowl use of the bay is due to the limited amount of ice cover (NYSDOS, 1987) each year. Waterfowl species feed in open water areas through midwinter. Prior to migration in early spring, the birds feed widely in the surrounding salt marshes.

100. Moriches Bay is a productive area for marine finfish, shellfish and other wildlife. From April to November, the bay serves as a feeding and nursery area for bluefish, winter flounder, summer flounder, American eel (*Anguilla rostrata*), tautog, scup, and blue crab. Forage fish species that utilize the bay include Atlantic silverside, mummichog, striped killifish, and northern pipefish. Hard clams, soft clams, bay scallops and mussels are some of the macroinvertebrates which are found in the bay. The area is open for commercial shellfishing.

101. **Barrier Island**. The eastern barrier island segment is undeveloped and exhibits extensive beach, dune, tidal wetlands along the back-bay area, and tidal wetland islands scattered within the bay. This area includes both County owned land at Smith Point County Park, and the Otis G. Pike Wilderness Area within the FIIS.

102. Residential areas are located in the western half of the island. The undeveloped areas provide activities such as swimming, recreational boating, nature walks, and fishing. The jetties at Fire Island Inlet and Moriches Inlet serve to stabilize the navigation channels from the ocean to the inner bays, and also provide an additional benefit in terms of recreational fishing use.

103. The barrier beach and associated bayside wetlands provide nesting and wintering habitats for migratory shorebirds and waterfowl. Permanent avian species for the surrounding area include various species of gulls, crows, pigeons, and sparrows, normally associated with

residential communities. The species of shorebirds which nest along the shorefront include plovers, terns, oystercatchers (*Haematopus palliatus*), and sandpipers.

104. **Federally and State Listed Marine Species**: No State or Federally listed endangered or threatened marine species are known to breed within the proposed interim project area. During the summer and early fall months, the threatened loggerhead (*Caretta caretta*) and endangered Kemp's ridley (*Lepidochelys kempi*), leatherback (*Dermochelys coriacea*), and green (*Chelonia mydas*) sea turtles, as well as the endangered fin (*Balaenoptera physalus*), humpback (*Megaptera novaeangliae*), and right (*Eubalena glacialis*) whales may be present in New York coastal waters (National Marine Fisheries Service, 1993). While sea turtles have been seen in this region, nesting has been documented only as far north as New Jersey (NRC, 1990). Although there is a possibility that the Kemp's ridley, loggerhead, and green sea turtles feed in Moriches Bay or Great South Bay, no substantiating data is available.

105. **Federally and State Listed Plant and Shorebird Species**: The Federally-listed threatened piping plover (*Charadrius melodus*), and the State-listed threatened common tern (*Sterna hirundo*) and endangered least tern (*Sterna albifrons*) are found within the proposed interim project area. These species utilize sand or sand/cobble beaches along ocean shores, bays, and inlets between the high tide line and the area of dune formation. They usually nest at sites which are sparsely vegetated.

106. Piping plovers and least terns have been observed utilizing the habitat found at the Fire Island Interim project study site. However, nesting has not occurred successfully in the last three years and productivity can be assumed low. In 1998, one piping plover nest consisting of four eggs has been identified near the Old Inlet area. In 1999, there were nine piping plover nests on Fire Island. They were observed at the following locations: one pair at Water Island (brood subsequently moved to Long Cove) one pair at Old Inlet; and six pairs at Smith Point (in front of Pottersquash Island). Approximately 12 least tern nests were identified, but due to disturbance, none of the nests hatched. To create more favorable conditions within the Fire Island National Seashore, the FIIS has implemented the Endangered Species Habitat Management Plan that restricted beach driving from April 1 - July 15, 1998, and extended the restrictions to March 1-July 15, and March 1 - September 1, in 1999 and 2000 respectively (NPS, 1998).

107. The Federally-listed threatened plant species, seabeach amaranth (*Amaranthus pumilus*) has also been observed at several sites throughout the project area. Another New York

State-listed species which may occur is: the threatened Eastern Mud Turtle (*Kinosternon subrubrum*), found in forests, marsh, swale, estuary communities.

108. **Offshore**. Any project which is undertaken would utilize sand from the offshore area. A sand borrow site has been identified offshore of Cherry Grove. A benthic survey of the offshore borrow area has been ongoing since 1996 to characterize the benthic environment in the borrow area, and update data presented by Cerrato (1983), who performed borrow area investigations along the south shore of Long Island. Benthic invertebrate communities in the borrow area include mollusks, crustaceans, marine worms, amphipods, sea stars, and urchins.

Cultural Resources

109. **General:** Detailed assessments of cultural resources are provided in the attached DEIS. The following sections provide a brief overview of the findings.

110. **Terrestrial Cultural Resources:** A review of the site files of the New York State Museum and the New York State Office of Parks, Recreation and Historic Preservation identified a great number of archaeological sites in the vicinity of the study area. Thirteen historic period sites have been identified along the Fire Island barrier island. These sites include the remains of life saving stations, refuse middens and stratified deposits, a farm boundary and the remains of recreational facilities and residences. Of these, only two are located along the ocean side of the barrier island; the remainder are located on the bay side (JMA, 1998).

111. The Fire Island Light Station is the only property within the bounds of the study area that is listed on the National Register of Historic Places. The light station was established in 1827 and the current brick light tower was built in 1858. The Fire Island Lighthouse was important in guiding trans-Atlantic steamers to New York Harbor and as a departure point for those vessels on their European runs. The lighthouse was deactivated in 1973. It is situated within the bounds of the Fire Island National Seashore and is owned by the National Park Service, who leases it to the Fire Island Lighthouse Preservation Society. Archaeological investigations within the bounds of the light station have identified the remains of the original light tower (JMA, 1998; National Park Service, 1994; Holland 1989).

112. **Drowned Terrestrial Archaeological Sites:** Recent studies (JMA, 1998; Pickman, 1993, 1994) indicate that as a result of coastline changes and sea level rise, the current dunes and

beaches lie on top of surfaces that were once interior, non-coastal, and not subjected to coastal erosion. As sea level rose, these surfaces, which may have been occupied by prehistoric peoples prior to inundation, are likely to have been buried intact. If identified, they may be able to provide evidence of early coastal adaptations dating to the Paleo-Indian and Early and Middle Archaic periods (12,000 - 4000 years ago) (JMA, 1998).

113. **Maritime Resources:** Submerged wrecks associated with the historical development of the Port of New York are located in the waters along the entire length of Long Island's Atlantic Coast. Research has documented more than 450 shipwreck losses and accidents since the 16th century and a number of wrecks have been identified along the south shore of Long Island in both the near shore and offshore areas (Moeller, 1978; Berg, 1992; Reiss, 1993). Although many wrecks have not been located or identified, the periodic appearance of timbers exposed or washed up on the beach indicates wrecks located along the Fire Island coast.

114. **Architectural Resources:** A reconnaissance survey of architectural resources within the study area resulted in the identification of a number of structures that are associated with either the resort/vacation or maritime contexts of the study area. For the purpose of this survey, potentially affected architectural properties were considered to be those visible from the beach. It was not the purpose of the initial survey to provide site-specific research or conclusive recommendations concerning the National Register eligibility of resources within or in the vicinity of the study area. Visual inspection of the study area indicates that a number of properties, each more than 50 years of age, may possess the requisite integrity to be eligible for the National Register.

WITHOUT PROJECT FUTURE CONDITIONS

115. The without project condition is a scenario which is developed as the baseline from which to evaluate alternative measures. This scenario generally projects future activities based upon historic events, unless there is definitive evidence of new actions or policies which are scheduled to be implemented. For the project area, the without project condition is identified as a continuation of the historic long-term trends, including beach erosion with an attendant reduction of the protective level of the existing beach and dune system. The without project condition considers the impact of shoreline change and sea level rise on future barrier island conditions.

116. There are a number of federal, state, and local actions which are likely to continue or be implemented in the without project condition, independent of the outcome of the interim project evaluation. At the federal level, these measures include actions undertaken by the U.S. Army Corps of Engineers, Federal Emergency Management Agency (FEMA), and National Park Service. In the without project condition, the USACE would continue to close breaches under the authority of the Breach Contingency Plan, the details of which are described below. The Corps of Engineers will also continue to maintain the navigation channels, including Moriches Inlet, Fire Island and the Intercoastal Waterways, as discussed below.

117. Programs administered by FEMA include the Hazard Mitigation Grant Program (HMGP) and the National Flood Insurance Program (NFIP). All of the study area communities participate in the NFIP, which provides Federally backed flood insurance to communities that adopt and enforce floodplain management regulations. FEMA also administers the Flood Mitigation Assistance (FMA) program, which provides grants to communities for projects that reduce the risk of flood damage to structures that have flood insurance coverage. This funding is available for mitigation planning and the implementation of mitigation measures.

118. FMA-funded mitigation plans identify actions, such as floodproofing or buyouts, to be taken to mitigate future storm damages. A community must receive approval for its mitigation plan to be eligible for FMA project grant monies. On the barrier island, the Village of Ocean Beach has recently received FEMA approval for its mitigation plan, while the Village of Saltaire is currently in the plan development process. On the mainland, the Villages of Amityville and Lindenhurst have received approval for their mitigation plans. Due to limited program funding

for mitigation projects, it is not anticipated that FMA projects will result in substantial damage reduction over a 6 year interim project life.

119. Actions which could be undertaken by the National Park Service include exercising their regulatory authority for condemning structures which are inconsistent with federal zoning standards. The National Park Service has indicated a desire to maintain the dune and beach in a natural condition including consideration of: life-tenancy until 50% or more of home is destroyed by flooding or storm; trade for NPS lots inside communities and in "strips"; transfer from State after Article 34 designation makes sites unbuildable, transfer from Suffolk County for unpaid taxes, or continued private ownership in a natural condition; condemnation and purchase of developed and undeveloped tracts; and, purchase from willing seller. In recent years, however, the National Park Service has not been funded to acquire structures. It is not expected that the Park Service would be funded in the future to implement the aforementioned alternatives.

120. The USACE has permitting responsibility for work in navigable waters and in wetlands, and all local and state actions in navigable waters and wetlands require USACE permits. The 91 permits granted by the New York District along the Atlantic Coast east of Fire Island Inlet from 1991 to mid-1999 encompass a variety of activities from decks and pilings for individual structures to major transatlantic submarine cables. About a quarter of these permits were for activities located wholly or partially in the study area and 20 of these were for storm damage protection. Most actions involved beach renourishment and fill. Some, however, were for structural features such as breakwaters and revetments. It is anticipated that in the future baseline conditions, the NYD will continue to grant permits for actions that meet the requirements of the permit program.

121. At the state level, it is anticipated that the NYSDEC will continue to administer and enforce the Coastal Erosion Hazard Areas (CEHA) law along the entirety of Fire Island's ocean shoreline. At the present time, four of the five municipalities with land use jurisdiction on Fire Island (Towns of Babylon and Brookhaven, and Villages of Saltaire and Ocean Beach) are administering, or are in the process of adopting, local coastal erosion hazard area management programs. The NYSDEC is administering the regulatory program within unincorporated areas in the Town of Islip. State law provides for the NYSDEC to revoke certification of local CEHA management programs if local administration is not consistent with statewide minimum standards, and to assert regulatory jurisdiction over these areas. Thus, continuous future

enforcement of New York's CEHA law and regulations is assured for Fire Island's ocean shoreline. At the municipal level, past actions indicate a strong likelihood of a continuation of local measures to be undertaken to either provide remedial protection (through beach nourishment, or beach scraping), or to individually protect existing structures by relocation, or by reinforcing the existing pilings. These actions are also discussed below.

122. Over the years, continued erosion has reduced the ability of the barrier beach and dune to absorb the impact of storm waves. Under without project conditions, it is anticipated that the pattern of highly variable shoreline change will continue, with both spatial and temporal cycles of erosion and accretion. If no efforts are taken to protect vulnerable areas, these changes in shoreline position will periodically expose back shore areas to storm waves and overwash, and will increase potential breach formation. Since the most prominent feature of shoreline change has been variability rather than a uniform erosion trend, the location, size, and hydraulic impacts of future overwash areas are difficult to estimate. While there is reasonable evidence that continued erosion of Fire Island may increase future flood stages in Great South Bay, both the likelihood and magnitude of such change is highly uncertain. Therefore, except for the hydraulic impact of future barrier island breaches, this analysis conservatively assumes that future without project conditions (i.e., changes in dune height and beach width) on Fire Island will not alter the backbay flood stage vs. frequency relationships beyond the confidence limits of the existing condition hydraulic models described in Appendix C.

123. The current highly eroded condition of Fire Island has increased the probability of a future breach in the barrier, with an estimated 20% probability of at least one breach forming in any future year. Given this high probability of disrupting the littoral system and exposing Great South Bay to changes in storm levels, a cooperative response plan has been developed by local, state and federal agencies. In the case of any breach in the barrier system, it is assumed that this Breach Contingency Plan (BCP) will be implemented and that closure of the breach will be accomplished within 3 months. Between breach formation and closure, it is expected that the breach will initially grow at a rapid rate, then at a reduced rate until closure is achieved. The breach area will be closed to an elevation of +9 ft NGVD as called for in the approved BCP, which would result in the area remaining susceptible to future breaches and overwash. Upon completion of the closure, however, it is assumed that the extent of overwash and the probability of a subsequent breach will be equal to existing conditions. This approach may understate future

damages and provide a conservative estimate of project benefits and implicitly assumes that local efforts will be undertaken to restore critically eroded areas.

124. Without Federal involvement, local efforts will likely continue, including localized "soft" protection measures including, beach scraping, and beach restoration projects such as the recent ones at Saltaire, Fair Harbor and Dunewood, and at Fire Island Pines. These projects typically do not restrict new development on the reconstructed dunes. Subsequent to construction, the area may then be subject to development with residential structures located closer to the newly constructed dune line.

125. The without project future condition also anticipates that inlets and back bay navigation channels in the area will be maintained through either periodic dredging or bypassing and that these ongoing efforts will not measurably alter the existing hydraulics of Great South Bay. The Corps of Engineers and New York State periodically dredge Moriches Inlet and Fire Island Inlet and place the dredged material in the intertidal zone of the downdrift beaches.

126. Along the barrier it is likely that intermittent storms of varying intensity will result in the periodic collapse of shorefront and nearshore structures. While several homeowners have responded to erosion threats by relocating structures to a more landward position, the intensive nature of development in most communities will preclude relocation for the majority of structures. The current analysis assumes that as erosion approaches additional structures, efforts will be taken to deepen the piles of any shallow foundations. This deepening is commonly performed by inserting a 'sister' pile next to the existing pile, with the overlapping piles bolted together. The analysis of future building stability assumes that pile tips will be at elevation -10ft. NGVD. Despite these efforts to protect and stabilize individual structures, future storms will almost certainly result in the collapse of buildings exposed to erosion and direct wave impacts. The current analysis conservatively assumes that such structures will be rebuilt in accordance with FEMA standards to minimize damage up to a 100-year storm, and that damage due to structural failure is a non-recurring event. This assumption is considered reasonable, though conservative, for the relatively short period of analysis being considered.

127. Due to the intensive existing development on Fire Island, significant future additional development of the barrier island will be limited. Within the existing primary dune (the area regulated by the CEHA law), there are over 300 structures and approximately 35 vacant lots among these structures. A review of historic building trends indicates an average rate of 1.6 new

structures per year in this area. Based on this trend, it is estimated that 15 out of 35 properties will be developed between now and the end of the project life. Continued population growth in Suffolk County, however, is likely to result in additional development of mainland areas. For the current analysis it has been assumed that the Breach Contingency Plan and adherence to floodplain development regulations will combine to prevent any substantial increase in future damages along the mainland. While this assumption is considered valid for design levels such as the Interim Plan, larger alternatives, such as the authorized plan, may provide significant flood damage reduction benefits to structures built at or above the regulatory 100 year Base Flood Elevation. Similarly, if rapid breach closure were not considered a part of the without project conditions, the presence of a breach or new inlet would expose both existing and future development to storm damage even though they were built in compliance with the existing flood hazard maps and regulations.

128. The without-project future condition recognizes that New York's CEHA law will remain in place to limit new development, and redevelopment following coastal-storm related losses, within the primary dune area. Program regulations define the primary dune to include the entire body of the dune from its seaward toe to a point 25 feet landward of the landward toe. The adjacent beach and nearshore areas are similarly regulated. The capacity to enforce these restrictions is somewhat limited by the presence of pre-existing, nonconforming structures within the existing primary dune. In its present alignment, there are approximately 308 structures within the primary dune and existing hazard area. Similar to local zoning limitations, the permitting agency is limited in its capacity to preclude new development, which is considered "infilling" even if the property is located within the designated hazard area. The intent of restricting new development is to avoid human impacts on the natural processes. It is difficult to demonstrate an adverse impact on the existing condition, when the proposed development is flanked by existing structures.

PROBLEM IDENTIFICATION

General

129. Northeasters and hurricanes periodically impact the southern shores of Fire Island and the shoreline of the Great South Bay. These storms produce tides and waves that cause extensive flooding and erosion to the study area. Flooding in the Great South Bay is intensified when Fire Island is overwashed.

130. While long-term erosion and large storms have posed a significant threat to the project area for many years, a series of recent storms has created a potentially imminent hazard of widespread overtopping of the island. Previous investigations indicate that at several locations, overtopping may erode the barrier to the point where a breach, or new inlet could be formed. As seen in photos 1 and 2, severe erosion of the protective dunes has left numerous barrier island structures exposed to even minor storms. The lack of dry beach seaward of some dunes also impedes vehicular access by residents, Park Service, and emergency personnel. This creates a potential safety hazard by limiting options for emergency response and evacuation. For discussion purposes, problems are presented as a sequence of the following three closely related components: erosion of the barrier beach and dune, leading to storm overwash and/or breaching of the barrier, resulting in widespread flooding along the shore of Great South Bay, such as was the case in the December 1992 northeaster, as seen in Photos 3 and 4.

131. **Beach and Dune Change**. Coastal erosion of the Fire Island shoreline increases the barrier island's susceptibility to breaching. Between 1979 and 1998, the total net volumetric loss of sand was 3,095,000 cubic yards between the dune and -6 ft NGVD depth contour. This does not include 2,870,000 cubic yards of beach fill placed over this time. This sand loss increases the exposure of structures to wave damage and allows increased overwash from the ocean to Great South Bay.

Photo 1. Fire Island shoreline during the December 1992 storm.

(note lack of protective dune)

Photo 2. Fire Island shoreline during the December 1992 storm.

(note absence of dune)

Photo 3. Community north of Great South Bay flooded during December 13, 1992 storm.

Photo 4. Flooding north of Great South Bay during December 13, 1992 storm.

132. The Atlantic Ocean at Fire Island is very energetic, causing large seasonal as well as long-term variations in the shoreline location. An analysis of 1979 and 1995 surveys shows the average shoreline change rate to be 0.4 foot/year, but the standard deviation of change over this time period is over 102 feet. This large shoreline variation is primarily caused by the curved shoreline features, often referred to as erosion "hot-spots," or undulations formed by the energetic wave climate. Spacing of the undulations are approximately 0.5 to 2.0 miles. These undulations can increase the potential of storm damage and breaching at their maximum landward extent.

133. In many areas, particularly within the developed communities, erosion of the beach has translated into lowering and narrowing of the primary dune. Between 1980 and 1998, the dune is on average three feet lower than the 1980 condition. According to previous studies, the presence of houses and sand fences on dunes along Fire Island reduces the amount of windblown sand transported to landward side of the dune. The combination of sand fencing and elevated housing at a density considered typical of the developed communities on Fire Island reduces the rate of onshore sand transport across the dune crest.

134. This combined effect of erosion of the seaward dune face and impediments to landward dune migration has contributed to the formation of a narrow primary dune system without sufficient volume or secondary dunes to absorb storm impacts. These remaining dunes are more easily eroded during storms, exposing low lying landward areas to potential breach and overwash.

135. **Breach and Overwash Impacts**. Breaches and overtopping of the barrier island occur periodically in conjunction with larger storms. During the 1992-93 series of storms, two breaches occurred between the Westhampton groins and Moriches Inlet. During the December 1992 storm, overwash occurred at Atlantique, Old Inlet and Smith Point County Park, making these areas highly susceptible to breaching (New York State, 1995). A significant overtopping of the dune occurred between Kismet and Saltaire. In addition, breaches occurred in the Westhampton and Moriches Inlet region in 1962 and 1980. In *A History of Fire Island* (Johnson, 1983), the 1962 Ash Wednesday northeaster is reported to have "cut 50 sluices through the beach" on Fire Island.

136. The physical impacts of a breach or severe overwash at Great South Bay identified in the Breach Contingency Plan include:

a. Increase in bay tide levels

b. Increase in bay storm tide levels

c. Changes in bay circulation patterns, residence times, and salinity.

d. Increase in sediment shoaling in navigation channels and shellfish areas.

e. Increased transport and deposition of sediment to Great South Bay including creations of overwash corridors.

137. Barrier island breaching often results in the formation of flood tidal deltas on the bay side of the barrier. These are likely to provide suitable substrate for future SAV growth or the development of emergent tidal marshes, if the elevation is sufficient. These flood tidal deltas typically benefit a variety of wildlife species, especially shorebirds, by increasing the available foraging and loafing area, and potential nesting sites. Flood tidal deltas and the dynamic sand spits associated with bay inlets also provide optimal habitat for the rare plants, seabeach amaranth and seabeach knotweed.

138. **Tidal Flooding Problem**. The rapid post World War II population growth in Suffolk County has led to intensive development of low lying areas around Great South Bay. The waterfront and nearshore areas are estimated to have over 100,000 residents, many of whom are attracted by the inexpensive housing opportunities, excellent access to boating, fishing and other recreational opportunities. The inventory of buildings has identified over 30,000 structures potentially subject to flood damage, with a total structure value of $7.9 billion.

139. During most tidal storms the presence of the barrier island limits widespread inundation of these low lying areas. Both Fire Island Inlet and Narrow Bay act both as hydraulic conveyances and hydraulic constrictions which severely limit the storm surge volume entering Great South Bay. As the tidal surge spreads out away from the inlets, the corresponding flood stage decreases. Accordingly, the lowest surge elevations in Great South Bay are located near Brown Point, approximately midway between Fire Island Inlet and Narrow Bay. On the ocean side of Fire Island, the 2 year storm tide (a common storm expected to be exceeded in ½ of the years analyzed) is at elevation 5.2 ft. NGVD excluding any wave impacts. At Brown Point, this same frequency event would result in a surge elevation of 2.5 ft. NGVD, 2.7 feet below the ocean surge. This attenuation of ocean surges becomes less pronounced for larger events which

overtop the barrier island. The 20 year ocean surge of 6.8 ft. NGVD, for example, would overwash portions of Fire Island resulting in a stage of approximately 5.5 ft. NGVD at Brown Point, a reduction of only 1.3 feet from the ocean stage. If overwash were prevented, the 20 year stage at Brown Point could be reduced to 3.4 ft. NGVD. This indicates how strongly the flood problem along the mainland is linked to the condition of the barrier systems, and that severe mainland flooding is unlikely to occur without substantial overtopping of Fire Island. The extent of inundation is discussed in further detail in the Coastal Engineering and Design Section and in Appendix C.

STORM DAMAGE ANALYSIS

140. **General**. The analysis of storm damage considered inundation, wave and erosion impacts to structures, and emergency restoration costs. The basic procedure used to calculate potential storm damages was to first inventory the type and value of structures subject to damage. Damage to each structure was then estimated for each storm surge and erosion distance. Storm frequency relationships were then used to simulate the possible sequence of storms and the associated damages were determined. The simulations were repeated numerous times and the results collected and analyzed. The resulting mean value of damages then represents the expected average annual damage amount.

141. As part of the Fire Island Inlet to Montauk Point (FIMP) Study, a complete inventory of structures on the mainland and barrier island was performed. Critical cost parameters (size, occupancy, basement, the number of stories, garages and construction material) were identified and analyzed for current conditions during a "sample survey" of floodprone study area structures. This sample survey, using standard estimating guides and interviews with the residents, was used to determine current replacement costs. Assessments of structure condition were used as a surrogate for the effective age/remaining life to determine the depreciated costs.

142. **Non-Shorefront Damages**. Damages at various elevations were estimated by applying generalized flood damage relationships to each individual building. As part of the FIMP Study conducted in 1982, over 1500 detailed damage surveys were performed. These surveys evaluated physical damage to the structures, content and property, as well as non-physical costs

such as cleanup and temporary housing expenses. Stage vs. damage functions were created for different structure types.

143. The current analysis used Flood Insurance Administration (FIA) rate review data to calculate structure and content damage to standard one and two story residential structure configurations. These include colonial, cape cod, ranch, bungalow, two-family, duplex and multifamily style structures. Evacuations and other non-physical costs were calculated using the FIMP emergency cost damage functions.

144. Damages to the remaining residential categories (split level, bi-level, raised ranch, custom, mobile home, garden apartment, and mansions) were evaluated using the FIMP damage functions. The FIA data were not utilized for these structures due to inconsistencies between the structure inventory and FIA definition of first floor, and the unique value and configuration of some building categories. The FIMP damage functions were also applied to nonresidential structures.

145. In order to maintain consistent damage reporting categories, the FIA functions for structure and content damage were combined to create a physical damage function. The combined structure and content damage function represented physical damage as a percent of depreciated structure replacement value (based on a content value to structure value ratio of 50%) at varying flood levels.

146. Using structure and ground elevation data, depth vs. damage relationships were converted to corresponding stage (NGVD) vs. damage relationships. Damages for individual structures at various stages were aggregated to develop composite stage vs. damage curves.

147. **Shorefront Damages**. For structures located along the Fire Island shorefront, wave attack and erosion combine to create frequent structural failures. The stability of these structures was analyzed to relate the wave forces at any depth of storm surge to the required pile embedment depth. The pile embedment depth at each structure was determined using the final scoured ground elevation, including vertical erosion from storm-induced or long-term erosion and local scour around the piles.

148. Stage vs. damage curves were determined for a variety of erosion distances, ranging from 0 to over 500 ft. For each erosion distance, the calculated pile embedment depth at every building was compared to the embedment depth required for stability against various storm surge

levels. If the pile embedment depth is insufficient for structural stability, damage was set equal to the structure value plus a 50% allowance for contents. This procedure develops a family of stage vs. damage curves, each representing a different erosion distance.

149. **Damage Simulations**. As previously described, the project area is potentially subject to a variety of storm conditions. Uncertainty and variability in shoreline change, storm erosion, and flood stage, combine with the inherently random nature of storm events to produce a wide range of potential damages. The current analysis uses Monte Carlo simulation techniques to allow these uncertainties to interact independently. As described in draft guidance on risk-based techniques, there are three basic components to such an analysis.

150. The first component is the storm event, categorized as the "source" of damage. Each simulation has used a life-cycle approach in which the severity of a storm in any analysis period is selected using a randomly generated exceedance probability. Each iteration of the simulation alters the timing and severity of storms, allowing the analysis to reflect complex interactions such as rebuilding limitations or breach formation.

151. For every storm event, the analysis then evaluates the second analysis component, the "exposure" of property to damage from inundation or storm attack. The general technique applied to each simulation is that a "look-up function" identifies the mean erosion and/or flood stage associated with the "source" storm. Adjustments are then made to reflect both uncertainty in mean values and life-cycle impacts such as shoreline change, sea level rise, or the presence of an open breach.

152. The third component of the simulation is to determine the "response" of buildings to flooding or erosion. The technique utilizes stage damage curves to relate "exposure," measured as flood stage or erosion distance, to the expected damage. Uncertainty in damage elevations is incorporated by allowing variation in the zero damage elevation. Life-cycle adjustments are then applied to reflect limitations in rebuilding after prior events and economic discounting to base year conditions.

153. Two general simulation models have been developed for this project. The shorefront model evaluates structural response for exposure to shoreline change, storm erosion, sea level rise and storm surge/wave impacts. The non-shorefront model evaluates inundation damages in response to sea level rise and storm surges in Great South Bay. The possibility of increased

exposure due to the presence of a breach in the barrier island required the non-shorefront model to consider short time periods, with simulation of monthly intervals. Average annual damages are repetitively calculated and the results are collected and analyzed with the mean result representing the expected average annual damage.

154. **Summary of Damage**. Both existing and future years average annual damage were calculated using stage vs. frequency relationships developed for eight representative locations within Great South Bay as well as the Fire Island shorefront. Table 3 provides a summary of the average value of expected damages.

Table 3
Without Project Damages
(6 Year Project Life, 6.875% Discount Rate)

Model	Expected Annual Damages
Non-Oceanfront	
Station 16 - Strong's Point	$4,265,000
Station 17 - Sampawams Point	13,240,000
Station 19 - Coast Guard Station	27,000
Station 20 - Heckscher State Park	6,666,000
Station 21 - Brown Point	6,265,000
Station 22 - Barrier/Bay Side	3,598,000
Station 24 - Howells Point	3,852,000
Station 25 - Smith Point	860,700
Subtotal	$38,773,000
Oceanfront	
Station 23 - Barrier Shores	2,309,000
TOTAL	**$41,083,000**

NEEDS, OBJECTIVES AND CONSTRAINTS

Current Needs

155. The Fire Island barrier island, as the name suggests, acts as a barrier, preventing ocean waters from encroaching into the bay and therefore reducing the impact of storms. As discussed in the Problem Identification section of this report, erosion of this barrier island has resulted in a reduction in the beach and dune, height and width. A comparison of profiles between 1979 and present indicates an average dune lowering of 3 ft. This lowering of the dune is apparent, even though a number of actions have been undertaken to mitigate the impacts of storms in the early 90's, which included the placement of 1,600,000 cy of sand. This reduction increases the vulnerability of the island to overwashing and breaching, which makes the mainland areas increasingly susceptible to storm damages. For example, as a result of the December 1992 storm event, "communities from Kismet to Davis Park experienced significant reductions in beach width and dune height. Overwashes in this part of the barrier island were more severe during the March blizzard, because the natural protective features had been diminished by the December storm" (New York State, 1994). Continuation of this historic trend will increase the potential for economic losses and the threat to human life and safety.

156. The purpose of the interim project is to provide sufficient protection to the mainland and barrier island, by reducing the potential for breaching and overwash of the barrier island until the completion and possible implementation of the Reformulation Study. This purpose provides the basis for the interim project period of analysis, which is discussed in the Plan Formulation Section of the report.

Planning Objectives

157. Planning objectives were identified based on the problems, needs and opportunities as well as existing physical and environmental conditions in the project area.

158. In general, the prime Federal objective is to contribute to the National Economic Development (NED) account consistent with protecting the Nation's environment, pursuant to

national environmental statutes, applicable executive orders and other Federal planning requirements. Accordingly, the following objectives have been identified.

a. The plan must reduce the imminent threat of damages to buildings and infrastructure due to the effects of storms, with an emphasis on tidal flooding and breaching.

b. In accordance with the limits of institutional participation, plan components may not exceed levels which reasonably maximize NED benefits.

Planning Constraints

159. Planning constraints are technical, environmental, economic, regional, social and institutional considerations that act as impediments to successful response to the planning objectives or reduce the theater of possible solutions.

160. **Technical Constraints**

a. Plans must represent sound, safe, acceptable engineering solutions.

b. Plans must be in compliance with Corps engineering regulations.

c. Plans must be realistic and state-of-the-art. They must not rely on future research and development of key components.

d. Plans must provide storm damage and flooding protection.

161. **Economic Constraints**

a. Plans must be efficient. They must represent optimal use of resources in an overall sense, limited by institutional acceptance.

b. Accomplishment of one economic purpose cannot unreasonably impact another economic system.

c. The economic justification of the proposed project must be determined by comparing the average annual tangible economic benefits with the average annual costs. The average annual benefits must equal or exceed the annual costs. The economic justification of the proposed project must demonstrate that the interim project is justified independent of the outcome of the Reformulation Study.

162. **Environmental Constraints**

a. Plans must seek to avoid or minimize impacts on environmental resources.

b. Where an adverse potential impact is established plans must consider mitigation or replacement and should adopt such measures, if justified.

163. **Regional and Social Constraints**

a. No favoritism can be shown; all reasonable opportunities for development within the study scope must be weighed one against the other and state and local public interests views must be solicited.

b. The needs of other regions must be considered and one area cannot be favored to the unacceptable detriment of another.

c. Public access plans must be obtained where sand is placed in the coastal zone creating new beaches, unless such placement is purely incidental to project function or for cost savings to the Government.

164. **Institutional Constraints**

a. Federal and State participation must be contracted for the authorized period, since no assurances can be made that future Federal budgets will be able to accommodate funding against competing needs.

b. Plans must be consistent with existing Federal, State, and local laws, including Executive Order 11988, Flood Plain Management.

c. An interim plan will be acceptable only if it conforms with laws, regulations, and general policies of the National Park Service.

d. The plan must be compatible with the goals and objectives of the Fire Island National Seashore as documented in the General Management Plan.

e. The plan must be consistent with the Partnership Agreement entered into between the Department of the Army and the Department of the Interior on 1 June 1999.

f. Plans must meet the NEPA requirements for Interim Actions found under 40 CFR 1506.1 (a) and (c). As such, the Interim Plan must:

1) Be justified independently of the reformulation

2) Be accompanied by an adequate Environmental Impact Statement

3) Not prejudice the ultimate decision on the reformulation program. The Interim action prejudices this ultimate decision when it tends to determine subsequent development or limit alternatives.

g. Measures must be "interim" with the capability to be reversed, modified or expanded pending the completion of a Reformulation Study for a permanent solution.

h. Plans must be locally supported to the extent that non-federal interests must, in a signed cooperation agreement, guarantee all items of local cooperation, including cost sharing.

i. All of the interim plans evaluated must incorporate a 25 foot buffer zone landward of the landward toe of the constructed or restored dune. This area must be included, together with the dune, within a permanent conservation area easement to ensure that no development can occur within it. This is consistent with Coastal Erosion Management Regulations (6NYCRR Part 505) of the NYSDEC which define the primary dune as having a landward limit extending 25 feet landward of its landward toe. While the previously identified CEHA landward boundary will not be shifted seaward to conform to the location of any constructed dune, as a consequence of the limited duration of the interim project, the 25 foot buffer will still be required to allow natural dune growth as well as to facilitate dune maintenance and restoration activities.

j. Policies of the New York State Coastal Erosion Management Regulations also require that beach erosion projects must have a reasonable probability of controlling erosion for at least 30 years and that such projects must be maintained at the level of protection for a minimum period of 30 years. While the 30 year design level can be provided within planning constraints, the interim nature of the project precludes the assurance of maintenance for 30 years. As a variance cannot be granted for such a wide departure from the state's minimum standards for an erosion protection project within an identified coastal erosion hazard area, the project will be considered as the beneficial deposition of material obtained from excavation or dredging, as permitted under the Coastal Erosion Management Regulations.

k. To the maximum extent practicable, plans must be consistent with New York State's Coastal Management Program.

165. The applicability of the institutional constraints relative to work within the boundaries of the Fire Island National Seashore, and also relative to interim project requirements, are discussed previously in the section titled "Interim Project Considerations."

PLAN FORMULATION

166. **General**. The development of alternative plans, including the screening of individual measures and alternatives, must be within the context of an appropriate set of formulation criteria. The *Principles and Guidelines* require the application of four major evaluation criteria.

167. The *completeness* of a plan is determined by analyzing whether all necessary investments or other actions necessary to assure full attainment of the plan have been incorporated. The *effectiveness* of a plan is determined by analyzing the technical performance of a plan and its contributions to the planning objectives and to the System of Accounts. The *efficiency* of a plan is determined by analyzing its ability to achieve the planning objectives and the National Economic Development (NED) and Environmental Quality (EQ) outputs in the least cost way. The *acceptability* of a plan is determined by analyzing its acceptance by concerned parties. A plan is acceptable if it is, or likely will be, supported by some significant segment of the public. During reiteration of the planning tasks, every attempt was made to eliminate, to the extent possible, proposals unacceptable to any significant segment of the public.

168. The formulation strategy for this interim plan differs from interim projects that are typically conducted for a feasibility-level study because this project does not seek a complete long-term solution for a part of the study area. This project is also interim in scale, or level of protection, as well as duration. Since this is a study of an interim plan, being conducted concurrently with the Reformulation Study for the entire Fire Island Inlet to Montauk Point project area, the study must show that the Interim Plan is economically feasible, yet smaller in scope than a potential NED (National Economic Development) Plan, the upper limit for federal participation. The Interim Plan must be economically compared to the Authorized Project (or a variation of the plan) to ensure it has not exceeded NED criteria. The Interim Plan is designed and evaluated so it could be abandoned, modified, or incorporated into the results of the Reformulation Study. To accomplish the objectives of the interim project, the project formulation considers the project costs and benefits associated with a minimum duration until the results of the Reformulation Study are available, and the potential results implemented.

Description of Preliminary Alternatives

169. **Introduction**. In evaluating alternative interim plans, several alternatives were initially considered. After initial consideration, only those alternatives which were determined to meet the objectives of providing interim protection against storm damages were considered for further evaluation. Possible solutions considered in the initial step of plan formulation are listed below:

a. No action
b. Buy-out Plan
c. Floodproofing/Retrofit
d. Dune District Management Plan
e. Upland Sand Management
f. Sand Bypassing
g. Beach Nourishment
h. Revetments
i. Revetments and beach restoration
j. Breakwaters
k. Breakwaters with beach restoration
l. Seawalls
m. Seawalls with beach restoration
n. Groins
o. Groins with beach restoration

170. The following paragraphs briefly describe the objective and the evaluation of each alternative.

171. **No Action**: This alternative, simply, means that no additional measures beyond those currently approved or planned, such as the BCP, would be taken to provide for storm damage protection of the barrier island or mainland property along the Great South Bay. This plan fails to meet any of the objectives or needs for the project. While this plan was not considered for further development, it does provide the basis from which the with project benefits are measured.

172. **Buy-Out Plan**: Permanent evacuation of existing areas subject to erosion or inundation involves the acquisition of this land and its structures either by purchase or by exercising the powers of eminent domain. Following this action, all development in these areas is either

demolished or relocated. The structure value of affected mainland structures alone could reach $4.7 billion, and Fire Island structural values exceed $640,000,000. Considering the amount of development, both commercial and residential, along the ocean front and bay side of the barrier and all of the affected properties on the mainland, this plan is both prohibitively expensive and socially unacceptable and was dropped from consideration as a stand-alone option. The plan is not readily reversible and will not be considered further, as an interim measure.

173. **Floodproofing/Retrofit**: A nonstructural plan consisting of a combination of floodproofing, structure raising, ring walls, and buyouts was considered to protect structures on both the mainland and the barrier. The screening analysis identified nonstructural measures to provide a 44-year frequency level of protection. This would require floodproofing over 9,500 buildings, raising over 3,600 buildings, and providing ring walls for approximately 150 buildings. The preliminary initial cost estimates ranged between $400,000,000 and $500,000,000. This plan was eliminated from consideration as an interim measure due to the high cost, the long period required for implementation, and because it is not readily reversible.

174. **Dune District Management Plan**: The premise of this alternative is that removing development within the primary dune (Dune District) will eliminate any obstacles to dune growth and migration. Over time, dune growth may provide an increased level of protection. Some possible property acquisition methods suggested by the Department of the Interior are:

- Life-tenancy until 50% or more of home is destroyed by flooding or storm;
- Trade for National Park Service lots located inside communities or in "strips" of non-major federal tracts of land, with payments for difference in values;
- Transfer ownership if erosion makes sites unbuildable; transfer from Suffolk County for unpaid taxes; or continued private ownership in a natural condition;
- Condemnation and purchase of developed and undeveloped tracts;
- Purchase from willing seller.

It is assumed that this alternative would require acquisition of the estimated 380 properties located within the State's Coastal Erosion Hazard Areas. The NPS has identified this plan as their long-term plan; however, it is not readily implementable as an interim measure. It also does not meet the storm damage reduction objectives or reversibility constraints for interim protection.

175. **Upland Sand Management**: Upland sand management consists of regrading of existing material at the project site to optimize the configuration of the existing material to provide an additional degree of protection. In many areas along the south shore of Long Island, local communities participate in beach scraping projects, where material is removed from the top of a beach berm having sufficient height and width, and is placed in a dune configuration to reduce the possibility of dune overtopping. These measures typically move material in the cross-shore direction, and do not redistribute material in the alongshore direction. This alternative is minimally effective as there is no net increase in the volume of sand, and only may be considered a viable option where the existing beach berm is both high and wide. Many areas of Fire Island do not currently have a sufficient amount of material fronting the beach to provide a source of material for upland sand management operations to be successful. Upland sand management can be a component of any alternative which includes periodic beach renourishment to reduce the quantity of beach fill that is required as advance fill or renourishment. In a renourished beach scenario sufficient quantities of material are usually present in the area to allow for redistribution of material and to ensure the project design is maintained. This redistribution of material would typically include the transport of sand alongshore and would move material from an accretional area to an erosional area. While upland sand management is not recommended for further consideration as a stand-alone alternative, it will be considered as a component for alternatives that include beach nourishment in order to minimize renourishment requirements and to offset the difficulties in addressing erosion undulations along the shoreline.

176. **Sand Bypassing**: Sand bypassing involves placement of material, which is presently trapped within an inlet system, to areas to the downdrift side, to reintroduce material into the littoral system, in order to offset the impacts of an inlet as a sediment trap. At Moriches Inlet, sand that accumulates in the navigation channel is routinely placed on the downdrift shoreline when it is removed for maintenance of the Moriches Inlet Navigation Project. It should be noted, however, that this procedure does not bypass all the sand trapped by the inlet system, only that portion which is deposited within the navigation channel and associated deposition areas. Such bypassing, while critical to helping mitigate the impact of the inlet, is not sufficient to be considered a stand-alone option for providing storm damage protection to the Fire Island barrier.

177. The existing longshore transport rate deficit caused by Moriches Inlet is 130,000 cy/yr. Even if a majority of this material could be bypassed to Fire Island, its contribution to the maintenance of the project would be limited during the six year project life. Shoreline change model results also indicate that fill bypassed to Fire Island would not migrate sufficiently west to have a major impact on the project area beaches.

178. **Beach Nourishment**: Beach nourishment involves placement of sand directly on an eroding shoreline to restore its form and subsequently maintain an adequate beach width by means of periodic renourishment fill. Beach nourishment would include a berm backed by a dune to reduce the storm damage potential to the barrier island and mainland areas. A sand fill only plan was considered a viable alternative interim plan because it would tend to restore natural protective features using material similar to native shorefront materials. Beach nourishment will tend to revert to conditions similar to existing conditions upon cessation of nourishment. This alternative will be analyzed in greater detail.

179. **Revetments**: Revetments are a facing of resistant material such as rock built to protect shorelines from erosion and storm damage. They consist of an armor layer of rock placed over a dune or berm in the back portion of the beach. Revetments are designed to protect the land immediately behind them. Erosion will continue adjacent and in front of the revetment. Because of this, the revetment must have a substantial toe foundation to prevent undermining of the structure. This alternative fails to check erosion, and does not significantly increase storm inundation protection and was not considered for further development.

180. **Revetments with Beach Restoration**: Beach restoration combined with revetments will provide added storm protection and will act to protect the revetment from undermining. The beach restoration will also prevent erosion and provide recreational beach area. This alternative was eliminated from further development due to extremely high costs. The alternative is not readily reversible and will not be considered further.

181. **Breakwaters**: Breakwaters are structures which protect beaches from wave action by dissipating wave energy before it reaches the beach. A decrease in wave energy will reduce sediment transport thus reducing the erosion rate. The breakwater does not, however, provide protection from tidal surges and therefore this alternative was eliminated from further development.

182. **Breakwaters with Beach Restoration**: To minimize the effect of breakwaters on downdrift beaches they should be constructed in conjunction with beach restoration. This alternative would effectively check erosion and also create a wider beach berm and dune system to provide storm damage reduction. This alternative was eliminated due to the associated high costs and because the alternative is not reversible as an interim plan, but will be considered further during the reformulation effort.

183. **Seawalls**: Seawalls provide upland erosion protection and are usually employed to protect upland structures from erosion and flooding damage. Seawalls provide some storm protection for the backshore areas. Many seawalls cause scour problems in the beaches fronting them, which could become a potential safety hazard. This alternative is not reversible as an interim plan and fails to check erosion of existing beaches, and therefore was eliminated from further consideration.

184. **Seawalls with Beach Restoration**: With this option, seawalls would provide upland storm protection, while beach restoration would check erosion along the shoreline. Beach restoration would also provide an extra buffer for storm protection. This alternative is an irretrievable commitment of resources for interim protection, but will be further examined during the reformulation effort. The cost of a seawall is likely to exceed benefits for these areas.

185. **Groins**: Groins are coastal structures which are normally constructed perpendicular to the shoreline. They extend from the back beach area into the water and are designed to retard erosion. Properly designed groins will reduce erosion. This alternative fails to meet all of the objectives since the groin alternative fails to provide adequate storm protection and is not readily reversible as an interim feature.

186. **Groins with Beach Restoration**: Groins alone, as described above, would not widen the existing beach because of a severe deficiency of sand. Beach restoration would provide a wider dry beach area while still benefitting from the erosion reduction by the groins. While groins with beach restoration may be beneficial at some locations on Fire Island, such an alternative is not readily reversible, but will be considered further during the reformulation effort.

Interim Plan Development

187. **General.** Based on a comparison of the storm damage protection alternatives considered, only beach restoration meets the planning objectives and thus was carried forward for more detailed analyses. The no action alternative is carried throughout the plan formulation for consideration and comparison as the without project condition. All the hard structural alternates are an irretrievable commitment of resources and costly; therefore they are unsuitable as cost effective interim measures. This selection for an interim project does not preclude the consideration of structures in the Reformulation Study.

188. **Period of Analysis.** To develop an interim project to address the time period prior to completion and potential implementation of the Fire Island Inlet to Montauk Point, NY Reformulation Study, the interim project includes a period of time for which the interim project would be maintained, consistent with the schedule for the Reformulation Study. The Reformulation Study final report with Environmental Impact Statement is scheduled to be completed in 2002, with a Record of Decision anticipated in 2003. The Record of Decision serves as the mechanism for rendering the decision of the study. Currently the outcome of the Reformulation Study is unknown, as is the actual completion date for potential implementation. At a minimum, the steps required to overtake or replace the interim project, based upon analyses contained in the Reformulation Study, include the need for a new Project Cooperation Agreement, all permits to proceed with the action, and construction bid documents. At a minimum, several years are required to allow these actions to occur. These steps therefore, necessitate an interim project which is in place for a period of six years. Based upon the schedule for initial construction and renourishment, this duration requirement can be met with initial construction and one renourishment cycle, which is estimated to provide six years of protection. To meet the objectives of the interim project, the recommended duration for this interim project is 6 years.

189. **Design Level**. In order to limit the level of environmental impact and the amount of financial investment, the Interim Plan uses the minimum design sections necessary to satisfy technical and institutional constraints. Primary among such criteria is the need for the design to

be economically feasible and provide a reasonable chance of surviving storm recession and dune overtopping.

190. The design parameters of the considered interim protection alternatives were guided by the overriding plan formulation criteria that an economically feasible and environmentally acceptable plan be readily reversible and be of a scale or size such that it would likely be within or less than the scale of a potential National Economic Development Plan, which would provide the highest net economic benefits. More specifically, the project design considered a combination of New York State Law and Federal Regulations, which establish criteria for beach nourishment projects. The New York State Coastal Erosion Management Regulations require artificial beach nourishment projects to have a reasonable probability of providing 30 years of erosion protection and that they be maintained for a minimum period of 30 years (see DEIS Appendix D). In light of the very short project duration of only 6 years, the project will be considered as the beneficial deposition of dredged material, as explained above, for regulatory purposes. Accordingly, New York State will not revise the existing coastal erosion hazard area delineation to conform to the physical location of a constructed dune with only a 6 year design life. However, since the intent of the law is to ensure that adequately sized protection measures are implemented, the basis for design considers the protective capacity consistent with state requirements for a project of thirty years. In addition to the State design requirements, current regulation ER 1110-2-1407 "Hydraulic Design for Coastal Shore Protection Projects", requires that a life cycle period of evaluation be performed in order to account for the unpredictability of occurrences of future storm events. Satisfactory performance of all elements was considered in the design for storm events up to and including the annual exceedance frequency which has no greater than a 50 percent risk of being exceeded during the design life of the element. Using these criteria (30 year probability and 50% survivability requirements) results in a design return period of 44 years.

191. Since the current analysis considers a project life of 6 years, a lower design level might not create an unacceptable risk to the project, although it would be contrary to New York State requirements. A plan with a design return period of 25 years was considered a reasonable comparison for a lower level of design consistent with a short term solution.

Reduced Protection Plan

192. The design of protection against a storm with a return interval of 25-~~years was~~ developed for comparison based upon the existing conditions storm recession analysis and performance analysis of preliminary alternatives. The storm overtopping discharges indicates that in Reach 2 the dune height may be set to +15 feet NGVD if the berm width is set to 90 feet at +9.5 feet NGVD; in Reach 3, the dune height may be set to +13 feet NGVD with a 70 foot wide berm at +9.5 feet NGVD. Advance fill requirements would be reduced as the total length of fill placement is reduced. The volume differences between these two designs are approximately 1,679,000 cy, with an annualized cost savings of $2,050,000 for the 25 year design level. Analysis of design reliability indicates that the 44 year level of protection has a 13 % chance of exceedance in a 6 year period while the 25 year level of protection has a 22% chance (a 70% increase in risk). Since the proportional reduction in volumetric requirements and the associated costs between each scale project are small (13%) relative to the proportional increase in risk (70%), it is concluded that the project design be developed with a 44 year level of protection. This conclusion further considers that a larger volume also provides greater assurances to address the high variability in long-term erosion and fill loss in response to storm events. The larger project would also require less frequent major rehabilitation efforts in the instance where a storm exceeds the project design.

193. **Design Requirements**. The existing beach and dune conditions along the island were reviewed to identify the specific design requirements. Beachfill and dune requirements were developed for the four design reaches described in the subsequent paragraphs. With the exception of the Old Inlet area, one of the four design sections is applicable to any of the project areas. Although the Old Inlet area is subject to frequent overwash and clearly does not meet the technical design requirements, the fill placement at this location has been eliminated in recognition of Department of the Interior management practices within the Otis G. Pike Wilderness Area. A stockpile sited at Smith Point Park will be utilized to provide fill material to quickly respond to a breach.

194. It is expected that the highly variable shoreline change patterns will continue to affect the project area after project construction. Rather than placing a greater amount of advance fill to account for shoreline undulations, an additional monitoring and nourishment component, to occur between renourishment cycles, is included to address areas of high erosion. This operation

could consist of trucking sand from stockpiles, or rehandling accretional material to areas of erosion through backpassing operations.

195. The requirements for placement of fill were based upon the existing dune and beach characteristics. In areas where the existing dune and berm meet the design requirements, no fill is required. Additionally, consideration has been given to areas where the volumetric requirements for the minimum survivability may be provided by the volume of sand within the existing primary and secondary dunes in the instance where the fronting berm is insufficient. Due to the presence of secondary dunes within much of the undeveloped areas, consideration of this second criteria was used to minimize the need for fill placement in much of the areas within the major federal tracts of land.

Plan Layout

196. **Reaches**. The Fire Island shoreline was divided into four representative reaches (Figure 4A and 4B). The reaches are defined in order to best represent areas of similar beach characteristics, volumetric and linear changes, shorefront development, and design requirements.

197. Reach 1 extends approximately 26,700 feet from Fire Island Inlet to nearly the west limit of Kismet to survey profile F11. The reach consists primarily of Robert Moses State Park, and the FIIS Lighthouse Tract. The location of the reach and survey profile lines is shown in Figure 4A and 4B.

198. Reach 2 consists of the adjacent 24,700 feet of shoreline to the east of Reach 1. Reach 2 includes the communities of Kismet through Point O'Woods, profiles F12 to F30 (Figure 4). The shoreline of this reach is almost completely developed, but is interspersed with small, non-major federal tracts of land.

199. Reach 3 extends from profile F31 for a distance of 42,800 feet to profile F59 at Watch Hill. The reach also includes the communities of Cherry Grove, Fire Island Pines, Barrett Beach, Water Island and Davis Park. This reach consists of a mixture of developed and undeveloped shoreline, including the major federal land holdings of Sunken Forest, Sailor's Haven, Talisman, Blue Point Beach, and Watch Hill.

fig 4A
11X17
COLOR

2 pages

200. Reach 4 includes the Otis G. Pike Wilderness Area and Smith Point County Park. Development along the reach is sparse and limited to FIIS and Smith Point County Park facilities.

201. Along the length of the barrier island, consideration was given to the existing barrier island conditions, and the required cross-section topography which is needed to provide the requisite protection. As a result of the analysis there are four typical design cross-sections, described below.

202. **Design Section 1**. The first design section is applicable to areas in which there is currently sufficient back shore dune elevation and island width to prevent frequent overtopping or breach formation, but have eroded beach berm conditions which are inadequate to protect the existing dunes. Localized areas of inadequate beach width threaten emergency access, and a continuation of the erosion trends could cause future violations of the overtopping design requirements.

203. Fill placement in these areas will create a minimum beach berm width of 90 ft. at elevation +9.5 NGVD fronting the existing dune. Design beach slopes are 1 vertical to 15 horizontal onshore to -2 ft. NGVD and 1V to 30H offshore (Figure 5). This design section will be used for a length of approximately 1.0 miles. Located eastward from the center of Robert Moses State Park, the region of fill placement has been affected by large waves of erosion. The fill alignment has been selected to provide smooth transitions and to facilitate more uniform littoral transport, reducing the potential for severe erosion of the beaches and dunes to the west. An additional 23 feet of beach fill width will be provided as advance fill and periodic renourishment to maintain the design section.

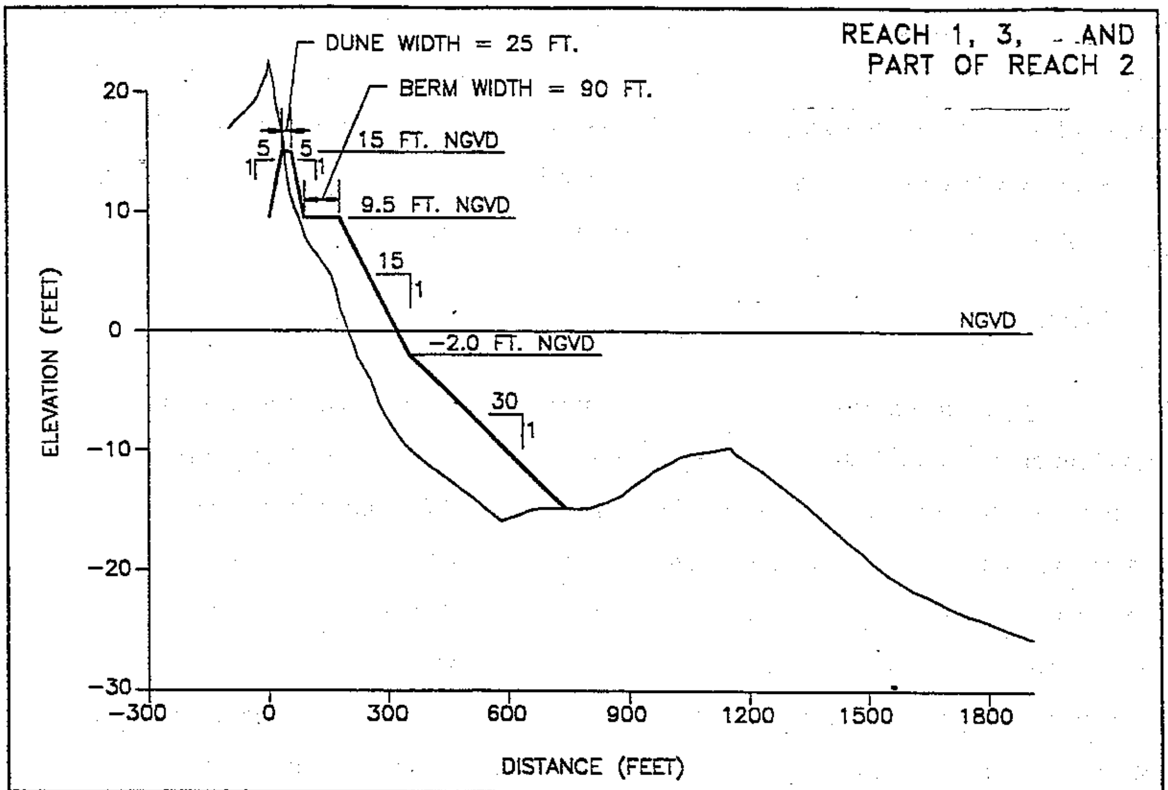
204. **Design Section 2**. The second design section is applicable to areas in which there are no secondary dunes and the primary dune is backed by low lying areas with typical elevations of 5 to 6 feet NGVD. Locations in which the existing beach and dune have eroded are subject to frequent wave overwash, but can not readily reform landward due to the presence of developed communities. These dunes may erode rapidly during a storm, creating a potential path of breach formation over the low barrier island topography.

205. The design section in these locations will create a minimum beach berm of 40 ft. at elevation +11.5 NGVD, fronting a dune with a crest width of 25 ft. at an elevation of +18 ft.

NGVD (Figure 5). This design section will be used as needed along approximately 15,400 ft. of the Reach 2 coastline between Kismet and Point O' Woods at any location where the existing beach or dune does not meet these minimum dimensions and where landward areas are low-lying. For approximately 6,650 feet of Reach 2, design section 3 utilizing a +15 foot NGVD dune with a 90 foot width at +9.5 feet NGVD will be used, as described in the paragraphs to follow. Since the primary dune provides the only barrier to overwash, it is necessary to ensure that the design beach and dune have not been severely eroded prior to a storm occurrence. An additional beach fill averaging 23 feet, acting as advanced nourishment against erosion, and to be provided as periodic renourishment, will provide reasonable assurance that the dunes will maintain their design stability prior to renourishment. Design section plots for each individual profile are presented in Appendix C.

206. **Design Section 3**. The third design section also incorporates beach and dune elements to minimize the impacts of overtopping in areas of eroded beaches and dunes. Because of differences in topography, such as a primary dune backed by landward elevations of 11 to 12 feet, the majority of the design beach and dune elevations are not required to be as high as for design section 2.

207. Fill placement for design section 3 will create a minimum berm width of 90 ft. at elevation +9.5 ft. NGVD, fronting a dune with a crest width of 25 ft. at elevation +15 ft. NGVD. This design section will be used intermittently over a 20,800 foot length of coastline between Kismet and Point O' Woods, and between Cherry Grove eastward to Davis Park. Limited sections of shoreline near Davis Park will have a 40 ft. wide berm at elevation +11.5 ft. NGVD, with a dune crest 25 feet wide at elevation +18 ft. NGVD. Of the 23,931 ft. Reach 3 length, 8,300 ft. has a proposed +15 ft. NGVD dune, and 1,350 ft. has a proposed +18 ft. NGVD dune. As described for section 2, this section also relies on the design dune to reduce the chance of overwash of the island. Accordingly, the plan also incorporates a 23 feet wide advance nourishment feature and periodic re-nourishment.



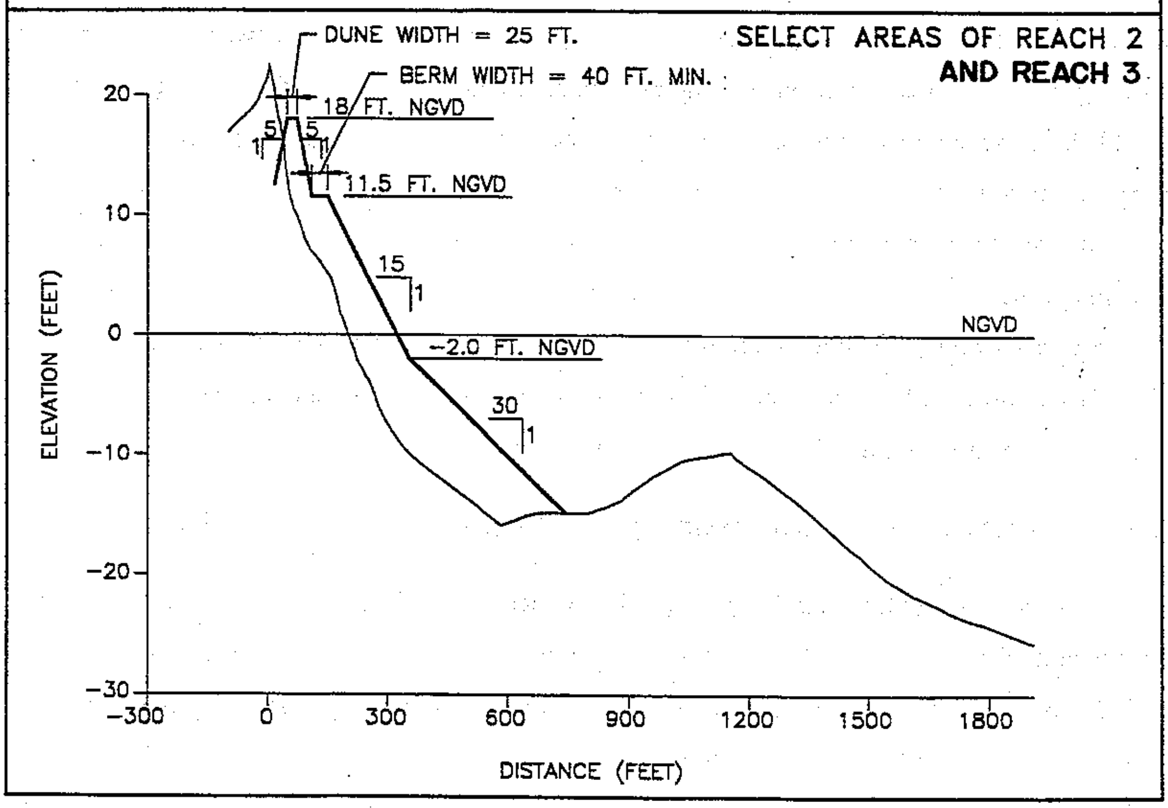


FIGURE 5

FIRE ISLAND
INTERIM BEACH IMPROVEMENT DESIGN

208. **Design Section 4**. This design section is applicable to areas in which the primary and/or secondary dunes are sufficient to prevent significant overtopping, but have eroded beach berm conditions which are inadequate to protect the dunes. This design section includes a 90-foot berm width at elevation 9.5 ft. NGVD and will be utilized east of the other fill areas, providing an additional source of material to reduce the extensive sediment deficit.

Fill Alignment

209. General. In general, the cross-shore location of the dune and berm is based upon a consideration of several factors including the quantity of material required, and costs required for real estate acquisition. The intent is to select a dune alignment which is as far landward as possible, and ties into the existing dune line, thus minimizing the volume of material required. Due to real estate requirements, a dune cannot be constructed under an existing structure. In many instances, structures located on the remnants of existing, eroded dunes require that consideration be given to the most cost-effective design, which requires a balance of real estate and sand placement costs. The options available for project design, to account for structures, include: relocation of existing structures, realignment of the dune further seaward, acceptance of structures as pre-existing nonconforming, or acquisition and demolition of the structures. In establishing the landward-most position of the dune, there are several considerations. For purposes of construction, and access for maintenance of the dune, an easement of 25 feet is generally required landward of the landward toe of the dune. Additionally, the state Coastal Erosion Management Program Regulations prohibit any new construction or other development on the primary dune, which incorporates the area 25 feet landward of the landward toe of the dune. To conform to both state and federal requirements, the dune alignment was generally selected to ensure that this 25 foot wide buffer is maintained.

210. The options considered in developing the fill alignment are described below.

211. Relocation of Existing Structures. The relocation of existing structures consists of the movement of the structure within the same parcel, or to adjacent, empty parcels. Due to the existing development density, there are limited opportunities for relocation to adjacent parcels, which are located further landward. In addition, there are limited areas along Fire Island, where existing lot depths allow for relocation within the parcel. Relocation, however, was considered a viable option in several site-specific areas, where limited structures were located on the existing

dune. Relocation costs within existing or adjacent lots would typically range in cost from $35,000 to $50,000.

212. In addition to the relocation of structures within a lot, it is possible to consider relocation of structures currently within the primary dune to areas outside the primary dune either to undeveloped lots or non-major federal tracts of land. There are presently limited numbers that are undeveloped, and FIIS has yet to undertake the necessary steps for relocation of structures to federal land. Historically, house relocations on Fire Island have consisted of moving structures a limited distance, often within the same lot, and retaining the same utility hook-ups and septic system. Relocating a structure a considerable distance to adjacent federal properties requires additional considerations, including: 1) logistical limitations, 2) costs associated with new services, 3) costs associated with differences in land value, 4) increased costs for the transportation of the structure over increased distances, and 5) existing authorities to accomplish relocations. In addition, the house would require new pilings, electric and water service, and septic system. The costs associated with relocation must also consider the difference between the values of oceanfront and non-oceanfront property, which could be owed to a homeowner following relocation. Taking these factors into account, the cost for relocating a structure could range from $150,000 to $300,000. At present, there are limited opportunities for relocation of structures to adjacent lots outside the primary dune.

213. Realignment of the Dune. The realignment of the dune to a location further seaward, considers the costs associated with the increased volumetric requirements associated with locating the entire cross-section seaward. Application of this alternative also recognizes that the fill alignment needs to be maintained in a configuration which is generally straight, and considers the overall alignment of the dune relative to the existing protective features. Relocating the cross-section seaward, on average requires 71,000 cy of sand per mile, per 10 ft., which correlates to roughly $450,000 per mile. While relocating the dune further seaward increases the volume of sand required, this alternative may be more cost-effective in areas where multiple structures would need to be relocated or acquired in a more landward alignment.

214. The dune alignment developed for this study was based on existing beach profiles spaced approximately 1,200 feet apart. As such, the alignment shown on the plans is generally linear between profile locations and does not necessarily follow the alignment of the existing dunes. Dune alignment will be re-evaluated during the development of detailed project plans, with the

intent of locating the design dune as far landward as possible while maintaining the 25 feet buffer zone landward of the dune.

215. Acceptance of Structures as Pre-Existing, Non-Conforming. Generally, the existence of pre-existing, non-conforming structures within the dune easement, establishes a precedent for development in adjacent lots. The presence of structures within the easement generally limits the permitting agency's capability to enforce the building restrictions, and also limits the access necessary for maintenance of the dune. In several locations, if individual buildings protrude less than 10 feet into the required 25 foot construction and maintenance easement, and are not of a number or spacing to influence enforcement of rebuilding restrictions, the structures were considered acceptable as pre-existing, non-conforming. Applying this option allows the dune to be located further landward, thus minimizing volumetric requirements.

216. Selected Fill Alignment. The selected fill alignment represents a tradeoff of real estate costs, fill costs and encroachments on the desired dune easements. The plan includes the acquisition of one structure and will allow 21 structures to encroach on the dune easement. The current layout utilizes dune realignments where necessary to minimize costs. At the current feasibility level of study, the realignments are assumed to be linear, generally paralleling the with project shoreline. The dune alignments will be refined to the most landward possible position during development of detailed plans.

217. Acquisition and Demolition of Structures. The acquisition, and subsequent demolition of structures is a mechanism to eliminate structures which would be located in the dune or easement. Generally, this alternative is the most expensive, with costs ranging from $250,000 to over $1,000,000, and is considered only in limited cases when singular structures are located significantly further seaward than adjacent structures, rendering a realignment of the fill project not cost effective.

Modified Authorized Plan (Higher Level of Protection)

218. General. As a basis for comparison, a design is presented consistent with the protection afforded by the authorized project. The basis for design in developing the authorized project was reevaluated in order that the interim and authorized project were considered using the same criterion for design. Also to provide a consistent comparison with the interim project, no hard structures were included. Based upon the changed parameters, the Modified Authorized Plan

consists of widening the beaches along the project area to a minimum of 100 ft with an elevation of +11 ft NGVD (as compared to the authorized 14 foot NGVD elevation), and by raising dunes to an elevation of +20 ft NGVD, with a minimum dune crest width of 25 feet at the adjacent reaches. A berm elevation of +13 ft NGVD was required for Design Reach 2, due to extremely low elevations landward of the dune. The proposed dune slopes are 1V:5H, and the design beach slopes are to be 1V:15H to MLW (-2.25 ft NGVD), and 1V:30H below MLW. The Modified Authorized Plan cross-section is shown in Figure 6.

219. Modified Authorized Plan Layout. It is anticipated that berm fill to varying heights and widths would be required for all of the reaches between Robert Moses State Park and Smith Point County Park. Berm fill (100 ft wide at +13 ft NGVD) is required for the area extending from Kismet to Point O' Woods. For the remaining areas, a berm at +11 ft NGVD is necessary to provide a similar level of protection. Dune fill is recommended (as in the authorizing document) for Design Reaches 2 through 4 to provide continuity of +20 ft NGVD dune height. Existing conditions in Design Reach 1 do not require dune fill for the requirements of the Modified Authorized Plan, and therefore, fill was not included. In addition, to match the existing beach slopes, the design beach slope has been revised to 1V:15H, from 1V:20H.

Coastal Engineering and Design

220. **Introduction**. The basis for the project designs, the design performance and the adjustment of the plans based upon with-project simulation, are included in this section. Coastal processes are the natural processes which affect oceanfront shorelines. The major objective of plans of improvement is to reduce the damages caused by these processes. The coastal processes affecting Fire Island include breaching, inundation, long-term erosion, short-term erosion, storm-induced recession, wave attack and wave runup. More detailed discussion of the models and results are provided in Appendix C.

221. **Storm-Induced Erosion Modeling**. Storm-induced erosion modeling was performed as part of an overall effort to examine the levels of protection offered under existing and improved conditions against storm-induced erosion at Fire Island. Specifically, cross-shore beach and dune response to storms were evaluated using the Coastal Engineering Research Center's (CERC's) Storm-Induced BEAch CHange model (SBEACH) (Larson and Kraus 1989a; Larson, Kraus, and Byrnes 1990; Rosati et al. 1993). Three (3) basic beach configurations were

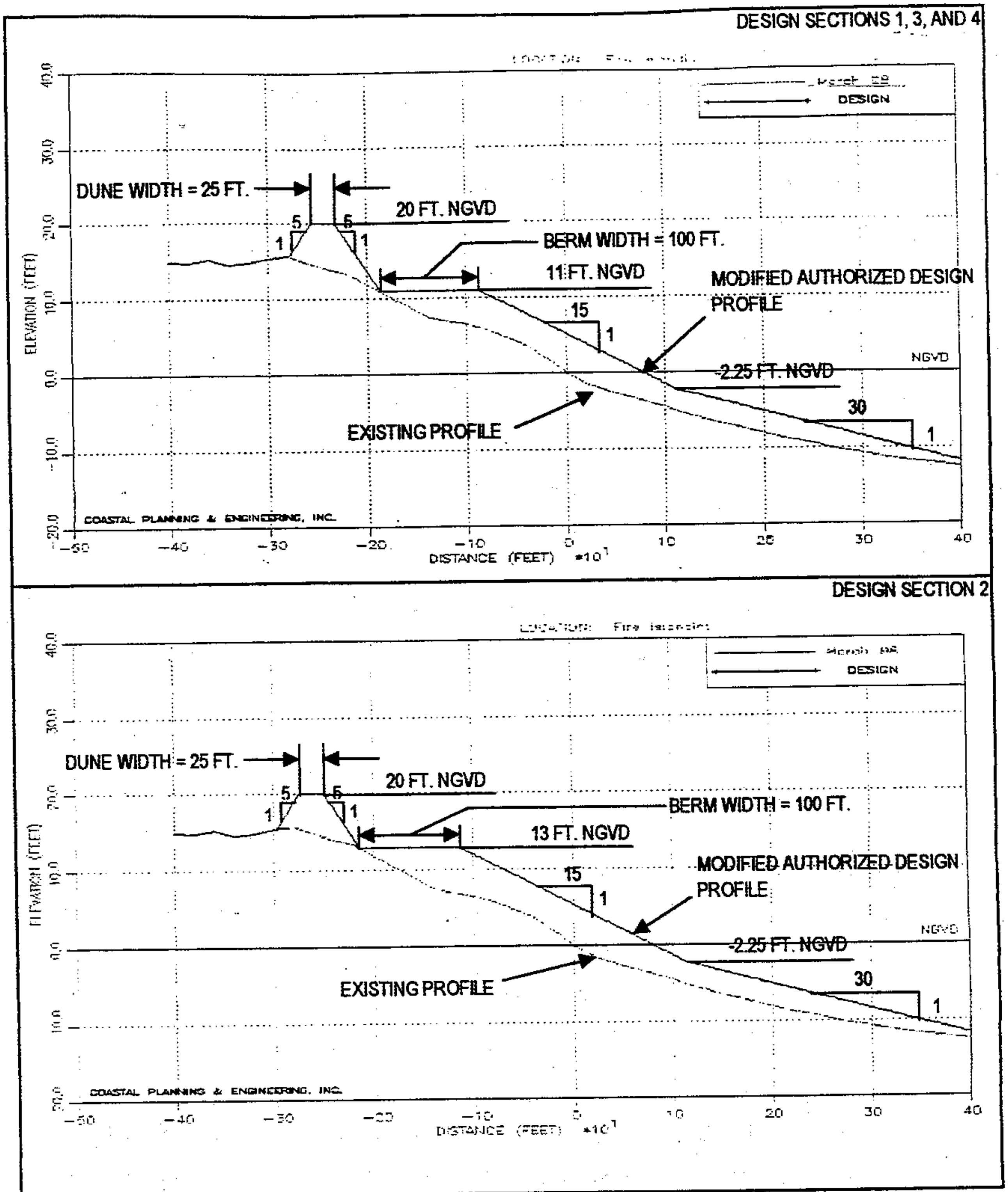


FIGURE 6

Fire Island Modified Authorized Design

examined: (1) existing conditions (i.e. without project), (2) interim beach nourishment plan, and (3) modified authorized beach nourishment plan. The storm recession model study of the improved conditions was extended to predict storm impacts of the improved conditions profiles after the project nourishment is terminated, and the cessation of renourishment activity makes a violation of the design profile likely. For this, the improved conditions profiles were modified to represent their likely shape following shoreline recessions of 20, 40, and 60 feet, based upon the profile being subjected to erosion, as a result of shoreline undulations (with accompanying dune recession). The storm adjusted, existing, improved, and post-project profiles were then used as input into wave overtopping evaluations to determine the level of protection offered by each of these scenarios, in order to evaluate the residual protection afforded by the project features after cessation of renourishment operations.

222. Application of SBEACH requires the specification of the following input: water levels, wave characteristics, beach profile geometry, grain size, and calibration parameters. Twenty northeaster and twenty hurricane storm wave and water level data sets were developed for use with SBEACH. Of the northeaster events, five (5) storms represented each of the following return frequencies: 2-year, 10-year, 25-year, and 50-year. The 20 hurricane events overlap these storm return frequencies, with five (5) storms representing each of the following return intervals: 25-year, 50-year, 100-year, and 200-year. SBEACH modeling was conducted at a representative profile for each design reach.

223. In many of the SBEACH model events, the existing primary dune was either minimally affected or almost completely destroyed. In either event, the most important of the SBEACH output variables in terms of level of protection is the landwardmost point of 0.5 ft vertical erosion. This variable is useful in establishing the landward limit of erosion which may damage nearshore structures.

224. In the remainder of the SBEACH model events, the existing dune configuration was significantly shifted landward. In this case, the location of the relocated dune crest is the most important output variable. The level of protection is determined by establishing this crest location as the landward limit of erosion which may damage nearshore structures. It is noted for these cases, that the position of the landward most point of 0.5-ft vertical erosion is farther seaward for the Interim Plan than for existing conditions.

225. **Wave Runup and Overtopping.** Wave runup and overtopping analyses are needed in concert with corresponding storm-induced erosion computations for coastal protection evaluation and the economic analysis of the study area's damages and benefits for both the with and without project conditions. The level of protection is segregated into two basic categories: (1) storm recession protection, and (2) inundation protection, which includes the effects of island breaching.

226. Economic benefits are computed by comparing the with and without project condition values of recession damage on Fire Island and inundation damage on the mainland of Long Island. The computations of wave runup and overtopping are used to estimate the increase in flood levels in the Great South Bay under storm conditions. In addition, the wave overtopping computations provide a rational means for evaluating the relative risk of island breaching.

227. A mean wave runup analysis was performed using the FEMA runup model based on the 1984 Shore Protection Manual (SPM) Slope Composite Method. The post-storm profiles following a 44-year event were analyzed for the without and with project conditions for Reach 3 (the reach with the lowest existing dune height). The predicted mean wave runup for the without project condition is 3.6 ft, which, when superimposed on the 44-year stage of +7.9 ft NGVD (without wave setup), gives predicted mean wave runup elevation of +11.5 ft NGVD.

228. Based on analysis of the Westhampton breach site (USACE 1995), dune breaching susceptibility is high during a given storm when overtopping exceeds a critical value of 1.7 ft^3/ft/sec (763 gal/ft/min). Other factors include a low or narrow island cross-section. An analysis was performed to evaluate the level of protection afforded by existing dunes along the project area. Overtopping evaluations were performed on the storm adjusted existing conditions profiles and the design condition profiles, to determine levels of protection. Results indicate a significant threat along the Fire Island shoreline. Many existing dunes would be overtopped by a 44-year storm event, while others are low enough to be insufficient to contain a 2-year storm event. The with-project conditions would feature reduced overtopping volumes due to greater volume of sand in the dune. Thus, dune damage would be reduced, reducing the likelihood of island breaching. The existing conditions level of protection indicated that the entire study area features at least a four year level of protection, while 83% of the island has at least a 10-year level of protection and 77% has at least a 30-year level of protection. About 56% of the study area features at least a 39- year level of protection. Further details on the existing, improved, and

post-nourishment conditions level of protection investigation are presented in Appendix C, which show decreasing protection with increased recession assumed in the post-cessation improved conditions.

Hydrodynamics and Island Breaching

229. General. The evaluation of island breaching likelihood and severity is critical to the study of Fire Island because of the potential impact of water level changes within Great South Bay as a result of the increased flow. Breaching can be initiated when the storm surge water level exceeds the ground elevation, or at a lower water level, as a result of wave overtopping, allowing ocean/bay interchange throughout the tidal cycle. Wave overtopping and the corresponding currents may erode the ground elevation, allowing tidal flow through the eroded area, forming a breach. This appears to have been the case in the December 1992 breach which occurred east of Moriches Inlet.

230. Island Breaching. An approximate evaluation of the conditions leading to the breach which occurred in December, 1992 has been used to establish the critical value of overtopping discharge which might have initiated such a breaching. High water marks recorded by New York District officials in the vicinity of the study area indicate that storm tides during the December, 1992 storm were about 4.9 feet above NGVD. Analysis of the 1992 Westhampton Breach site indicated that breaching could occur with an island width less than about 500 feet and an overtopping rate exceeding a critical value of 1.7 $ft^3/ft/sec$ (USACE, 1995). The susceptibility of the Long Island Atlantic barrier island to breaching was identified, (USACE, 1995) and the annual probability of initiating breach formation on Fire Island appears in Table 4. It should be acknowledged that the levels of protection presented do not indicate the storm level at which overwash begins or at which a complete breach would be expected, but rather at a point where sufficient dune lowering may occur to result in a breach. The actual probability of a breach occurring at these locations is somewhat less, due to other physical factors such as shallow water in Great South Bay or increased barrier width.

TABLE 4 Annual Probability of Initiating Breaches - Existing Conditions (USACE, 1995)			
Name	**Location**	**Exceedance Frequency for Critical Overtopping (Year)**	**Annual Probability (%)**
Smith Point	Moriches Inlet to Smith Point Park	5	20
Old Inlet	Smith Point Park to Watch Hill	5	20
Barrett Beach	Watch Hill to Sailor's Haven	18	6
Atlantique	Fair Harbor to 1.4 miles w of Kismet	5	20
Robert Moses	1.4 miles w of Kismet to Democrat Pt.	53	2

231. Numerical Modeling of Hydrodynamics and Stage Frequency Analysis. As part of this interim study, a numerical hydrodynamic modeling effort was conducted for the project area, which includes Fire Island, Fire Island Inlet, Great South Bay, Moriches Inlet and Moriches Bay. The purpose of the modeling was to develop ocean-side criteria for the design of storm damage reduction projects and to determine the reduced inundation in Great South Bay during storm events resulting from the plan of improvement. Four site conditions were modeled: without-project conditions (existing condition), with-project condition (Interim Plan), Modified Authorized Plan, and a condition with the barrier island breached.

232. The hydrodynamic model applied in this study included the capability to simulate barrier island overwash and breaching. Bathymetric data and tidal forcing data were processed and a numerical hydrodynamic grid network was established. Surge computations were made using the Finite Element (FE) hydrodynamic model ADCIRC (ADvanced CIRCulation model). The model was calibrated using historical tide elevation data. The data base used for the Empirical Simulation Technique (EST) is constructed from historical tropical and extratropical events.

Post processing of the multiple repetitions of life cycle simulations of storm activity are used to generate surge value frequency relationships. The peak water levels were recorded at nine locations around the Great South Bay and at one location along the coastline (Table 5).

233. Table 6 presents the ocean stage frequency relationship at Cherry Grove which was assumed to be representative of the entire study area ocean coastline. These water levels were used as the basis of berm and dune design for the Interim Plan.

234. After analyzing the hurricane and northeaster stage-frequency curves for each condition, the individual stage-frequency curves for each location were joined to form a combined stage-frequency curve for each location. Figure 7 shows sample combined frequency curves for three locations, Sampawams Point, Brown Point and the Atlantic Ocean. These curves demonstrate that the area of Brown Point has lower flood stages than Sampawams Point, which is located closer to Fire Island Inlet. Flood stages at Brown Point are also reduced more by the considered alternatives. Because of the high density of development and flat topography, even small changes in flood stages impact a large number of structures. The results of the Stage-Frequency Analysis were used in the economic evaluation of the project.

TABLE 5

Stage Frequency Curve Locations

Node No.	Location Description
16	Strongs Point
17	Sampawams Pt.
18	Mouth of Fire Island Inlet
19	Fire Island CGS
20	Heckscher Sate Park
21	Brown Point
22	Bayside, Great South Bay
23	Ocean Side, Great South Beach
24	Howells Point
25	Smith Point

TABLE 6

Hurricane and Northeaster Ocean Water Levels for Selected Return Periods

Ocean Side, Great South Beach, Node 23

Return Period (yrs)	Hurricanes (ft NGVD)	Northeasters (ft NGVD)	Combined (ft NGVD)	Combined w/Setup (ft NGVD)
2	-	5.2	5.2	6.4
10	-	5.7	6.1	7.5
25	7.2	6.2	7.2	8.7
44	8.9	6.4	8.9	10.8
50	9.2	6.5	9.2	11.2
100	11.6	6.7	11.6	14.1
200	14.1	6.8	14.1	17.2

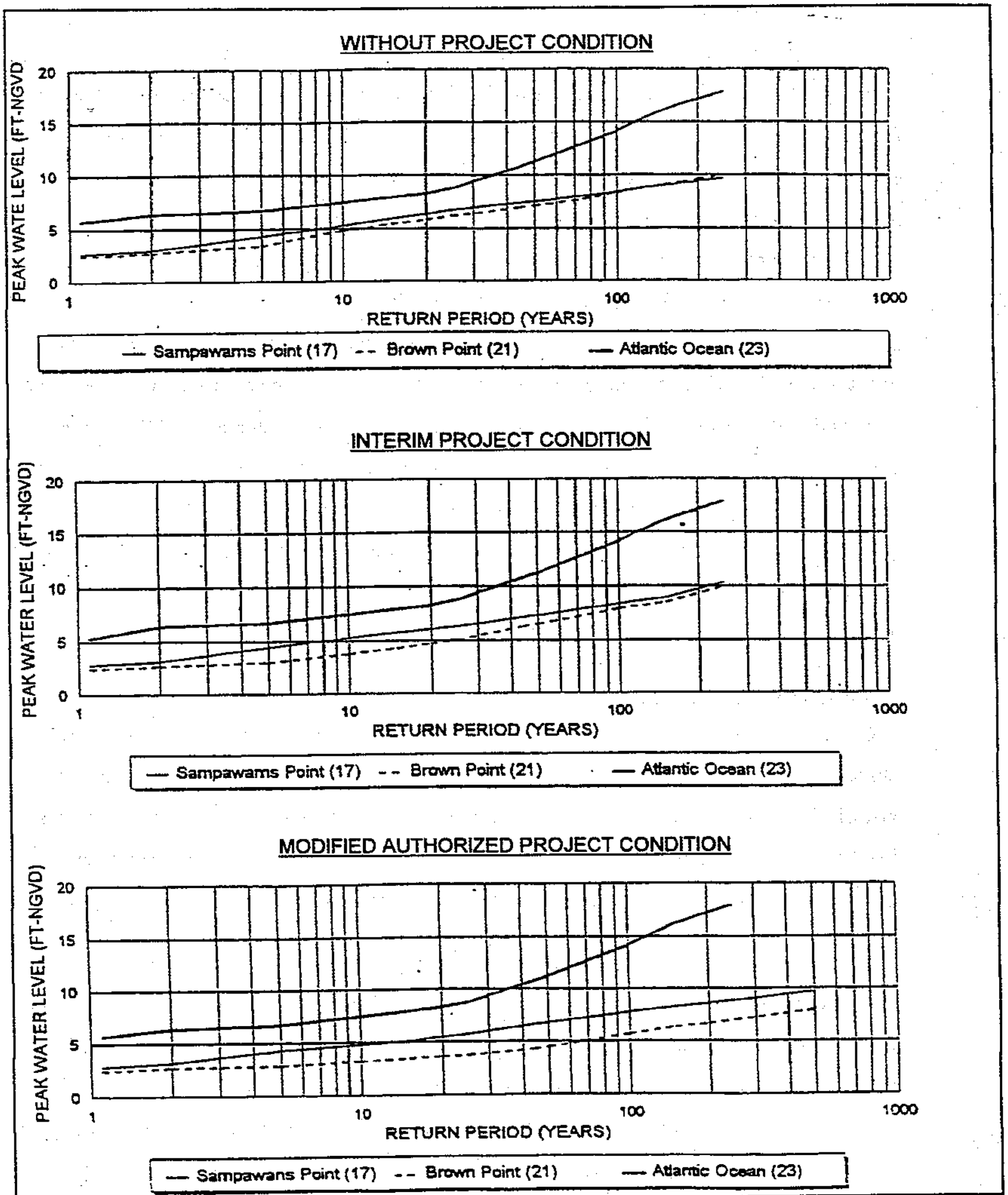


FIGURE 7

Combined Stage Frequency with Setup

Shoreline Change

235. General. The coast of Fire Island is a dynamic environment with frequent changes in shape and location of the shoreline. Analysis of changes in the 0' NGVD contour measurements for profiles surveyed in both 1979 and 1995 indicates extreme variability in the amount of erosion. Although the average erosion rate over the entire shoreline indicated by the surveys was 0.4 ft/yr, the extreme variability suggests that shorter term erosion processes are dominant. Short-term storm-induced erosive cuspate features have been observed to severely impact the shorefront structures on Fire Island. In order to simulate the extreme variability in erosion, a statistical analysis was performed. The results of the statistical simulation of a mean erosion rate of 0.4 ft/yr and a standard deviation of 102 ft were found to reproduce the variability between the 1979 and 1995 erosion fairly well. For design purposes, the consistent areas of erosion were isolated from areas of accretion for analysis to determine a more conservative (higher) erosion rate representative of the average long-term rate for areas of erosion. Based on this analysis (data between 1979 and 1995), an average long-term erosion rate of 6 ft/yr was determined for erosive areas of Fire Island. Use of this rate in estimating renourishment requirements will help avoid the potential to underestimate future costs.

Sediment Budget Analysis

236. A sediment budget was prepared for Fire Island through an analysis of (1) volumetric changes from surveyed profiles, (2) estimates of longshore and onshore transport, and (3) historic fill volumes. The 1979 to 1998 period is representative of recent coastal processes on Fire Island. The sediment budget analyzes the project area in the four design reaches and two offshore lenses, and shows all values as annual averages, including fill volumes. (Figure 8)

237. Overall, the Fire Island littoral cell was erosional between 1979 and 1998. The westward alongshore drift increases from a rate of 300,000 cy/yr at Moriches Inlet to 531,400 cy/yr at Fire Island Inlet. This natural littoral drift gradient is a significant cause of erosion on the island. The measured beach accretion was 25,200 cy/yr. There was an estimated influx of 97,000 cy of sand from the offshore region. The net erosion, subtracting the mechanically placed beach fill quantity (159,000 cy/yr), was 134,000 cy/yr. Additional sediment budget details are presented in Appendix C.

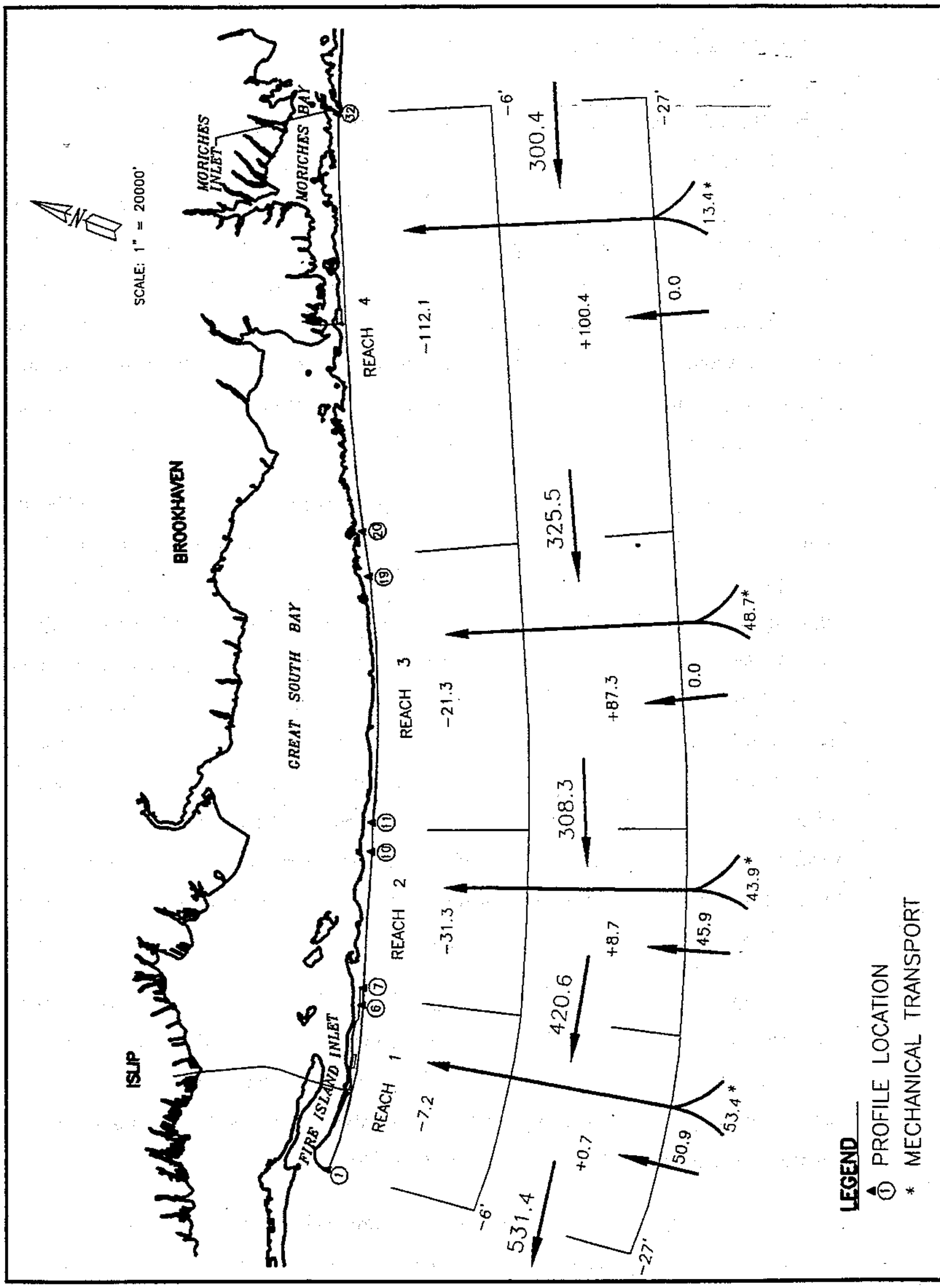


FIGURE 8

FIRE ISLAND SEDIMENT BUDGET
1979–1998
(1000 CY/YR)

Numerical Modeling of Shoreline Change

238. A numerical shoreline change model was used to evaluate expected changes in Fire Island with and without a project. The GENESIS shoreline change model was utilized for simulation of longshore sand transport processes and long-term shoreline changes along the project area. The GENESIS shoreline model is a generalized system of numerical models and computer sub-routines which allow simulation of long-term shoreline change under a wide variety of user-specified conditions. The model did not consider the nearshore bathymetry landward of the -6 meter depth contour. While this is not representative of the nearshore bar system and shoreline undulations, this model limitation is not critical to the design since model results were only used to evaluate general trends in longshore transport rate changes attributable to the design. This trend data assisted in the estimation of beachfill renourishment requirements.

239. Without Project Future Condition Simulation. The initial purpose of the GENESIS model effort was to simulate the without project future conditions shoreline position. This was accomplished by utilizing the surveyed April 1995 mean high water shoreline position and allowing the GENESIS model to simulate changes over a 3-year time period in the absence of any fill placement. The 3-year time period was selected since it corresponds to the proposed renourishment project cycle for the interim project. In general, the model tends to smooth irregularities in the shoreline. Areas which extend seaward of the average shoreline position are typically eroded, whereas shorelines which are located landward of the average shoreline orientation tend to accrete in the model runs. This trend was also found in the calibration and verification runs. The areas of most significant shoreline retreat under this scenario are west of Davis Park at profile 17, near Cherry Grove at profile 12, at Fair Harbor near profile 8, and at Robert Moses State Park in the vicinity of profile 3.

240. Interim Project Fill Plan Performance. The GENESIS model was also used to simulate the performance of the interim fill plan. Since the purpose of the GENESIS model study was to determine the performance of the advance fill over the renourishment cycle and its ability to protect the design fill, the interim project fill plan simulation included the shoreline widening caused by a combination of the design fill and the advance fill.

241. In general, the model predicts that fill volume will be transported from the areas where it is placed and spread into areas adjacent to the fill placement. Areas that receive a wide design shoreline will tend to erode more than areas receiving narrower design fill cross-section. The

model predicts that a majority of the fill locations will perform well over the 3-year nourishment cycle. The fill to be placed at Robert Moses State Park between profiles 3 and 4 is predicted to have the greatest loss rate. However, this area is expected to benefit from downdrift movement of fill placed in Reaches 2 and 3. For more description of GENESIS refer to Appendix C.

Interim Project Design

242. Interim Project Plan Description. The interim project design fill was calculated using the design profile (Figure 5) as a template. The template was oriented based on a project baseline which was generally set at the seaward toe of the existing dunes. The template was oriented to the baseline by setting the landward limit of the design berm coincident with the baseline. Some locations require fill landward of the baseline due to low existing elevations. Design Reaches 2 and 3 feature dune reinforcement landward of the baseline. The baseline was adjusted seaward in some locations to allow for a setback between structures and the landward toe of dune.

243. The dimensions of the Fire Island interim beach and dune fill design profile include a berm height of +9.5 NGVD with a 90 foot wide berm or height of 11.0 feet NGVD with a width of 40 feet. Based on the slope of the existing profile, design beach slopes are 1 vertical to 15 horizontal onshore, and 1V to 30H offshore. The beach berm is backed by a dune with crest width of 25 feet at a crest height of +15.0 feet NGVD for a length of 20,900 feet or +18.0 feet NGVD for a length of 18,200 feet. The seaward and landward dune slopes are 1V to 5H. The berm width is measured from the seaward toe of the dune, i.e., the baseline.

244. Due to the range of existing conditions, the required design beach and dune cross-sections vary along the Fire Island interim project area. Table 7 presents in detail the beach berm elevation and width, and dune elevations at each reach, community, and beach profile within the project area. Plates presented at the end of this text depict the fill layout on topographic maps.

245. Dune Crossings. Along the study area, there are 13 existing "dune cuts" which serve as vehicle accessways to the beach from the inland vehicle pathways. These existing dune cuts are generally perpendicular to the dune. The frequent use of these dune cuts by vehicular traffic has resulted in a lowering of the dune in these locations. The intent of the interim project is to

TABLE 7
FIRE ISLAND INTERIM PROJECT PLAN DESCRIPTION

Community Name	Profile Name	Starting Fill Station	Ending Fill Station	Dune Elev. (Ft, NGVD)	Berm Width (Feet)	Berm Elev. (Ft, NGVD)	Fill Volume (Cubic Yards)	Fill Length (Feet)
DESIGN REACH 1								
Robert Moses	F1			NA	NA	NA	0	0
Robert Moses	F2			NA	NA	NA	0	0
Robert Moses	F3			NA	NA	NA	0	0
Robert Moses	F4			NA	NA	NA	0	0
Robert Moses	F5	0091+10	0118+08	NA	90 / Taper	9.5	31,670	2,698
Robert Moses	F6	0118+08	0143+99	NA	90 / Taper	9.5	23,387	2,591
Robert Moses	F7			NA	NA	NA	0	0
Robert Moses	F8			NA	NA	NA	0	0
Robert Moses	F9			NA	NA	NA	0	0
U.S. Coast Guard	F10			NA	NA	NA	0	0
Robert Moses	F11			NA	NA	NA	0	0
Reach 1 Total							55,057	5,289
Community Name	**Profile Name**	**Starting Fill Station**	**Ending Fill Station**	**Dune Elev. (Ft, NGVD)**	**Berm Width (Feet)**	**Berm Elev. (Ft, NGVD)**	**Fill Volume (Cubic Yards)**	**Fill Length (Feet)**
DESIGN REACH 2								
Kismet	F12	0273+30	0292+16	18	40 / Taper	11.5	115,403	1,886
Kismet	F13	0292+16	0304+80	18	40	11.5	227,418	1,264
Saltaire	F14	0304+80	0317+93	18	40	11.5	183,274	1,313
Saltaire	F15	0317+93	0331+41	18	40	11.5	136,503	1,348
Fair Harbor	F16	0331+41	0344+79	15	90	9.5	108,413	1,338
Fair Harbor	F17	0344+79	0357+19	15	90	9.5	57,100	1,240
Lonelyville	F18	0357+19	0368+56	15	90	9.5	83,027	1,137
Lonelyville	F19	0368+56	0381+00	18	40	11.5	38,930	1,244
Atlantique	F20	0381+00	0393+00	18	40	11.5	187,448	1,200
Robbins Rest	F21	0393+00	0402+68	18	40	11.5	180,871	968
Ocean Beach	F22	0402+68	0413+49	18	40	11.5	216,643	1,081
Ocean Beach	F23	0413+49	0426+81	18	40	11.5	320,246	1,332
Ocean Beach	F24	0426+81	0441+17	15	90	9.5	155,243	1,436
Seaview	F25	0441+17	0454+27	15	90	9.5	121,706	1,310
Seaview	F26	0454+27	0466+29	18	40	11.5	164,691	1,202
Ocean Bay Park	F27	0466+29	0479+08	18	40	11.5	224,082	1,279
Ocean Bay Park	F28	0479+08	0490+09	18	40	11.5	228,422	1,101
Point O' Woods	F29	0490+09	0503+24	18	40	11.5	258,873	1,315
Point O' Woods	F30	0503+24	0519+89	15	90	9.5	134,778	1,665
Reach 2 Total							3,143,071	24,659

NOTES:

1. STATION 0+00 IS AT EAST JETTY OF FIRE ISLAND INLET FILL VOLUMES BASED ON SPRING 1998 SURVEY.
2. FILL STATIONS, FILL LENGTHS, AND FILL VOLUMES INCLUDE TAPERS.

TABLE 7 (CONTINUED)
FIRE ISLAND INTERIM PROJECT PLAN DESCRIPTION

Community Name	Profile Name	Starting Fill Station	Ending Fill Station	Dune Elev. (Ft, NGVD)	Berm Width (Feet)	Berm Elev. (Ft, NGVD)	Fill Volume (Cubic Yards)	Fill Length (Feet)
DESIGN REACH 3								
Point O' Woods	F31	0519+89	0528+00	NA	90	9.5	18,703	811
Fire Is. Nat. Seashore	F32	0528+00	0540+00	15	Taper	9.5	14,673	1,200
Fire Is. Nat. Seashore	F33			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F34			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F35			NA	NA	NA	0	0
Cherry Grove	F36	0620+00	0636+10	NA	90 / Taper	9.5	35,848	1,610
Fire Is. Nat. Seashore	F37	0636+10	0648+25	NA	90	9.5	42,841	1,215
Fire Is. Nat. Seashore	F38	0648+25	0661+52	NA	90	9.5	93,839	1,327
Fire Island Pines	F39	0661+52	0674+92	15	90	9.5	159,467	1,340
Fire Island Pines	F40	0674+92	0688+01	15	90	9.5	143,228	1,309
Fire Island Pines	F41	0688+01	0701+51	15	90	9.5	120,489	1,350
Fire Island Pines	F42	0701+51	0714+66	15	90	9.5	89,530	1,315
Fire Island Pines	F43	0714+66	0725+00	NA	90	9.5	30,058	1,034
Fire Is. Nat. Seashore	F44	0725+00	0735+00	NA	Taper	9.5	14,535	1,000
Fire Is. Nat. Seashore	F45			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F46			NA	NA	NA	0	0
Water Island	F47			NA	NA	NA	0	0
Water Island	F48A	0772+80	0784+00	18	40 / Taper	11.5	28,176	1,120
Water Island	F48	0784+00	0788+50	NA	40	11.5	14,796	450
Water Island	F48B	0788+50	0794+00	18	40	11.5	18,805	550
Water Island	F48C	0794+00	0796+56	NA	40	11.5	8,417	256
Fire Is. Nat. Seashore	F49	0796+56	0817+00	15	90 / Taper	9.5	25,428	2,044
Fire Is. Nat. Seashore	F50			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F51			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F52			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F53			NA	NA	NA	0	0
Davis Park	F54	0850+00	0866+72	NA	90 / Taper	9.5	9,943	1,672
Davis Park	F55	0866+72	0883+20	NA	90	9.5	145,105	1,648
Davis Park	F56	0883+20	0895+99	15	90	9.5	92,115	1,279
Davis Park	F57	0895+99	0900+00	15	90	9.5	14,667	401
Watch Hill	F58	0900+00	0910+00	NA	Taper	9.5	3,925	1,000
Watch Hill	F59			NA	NA	NA	0	0
Reach 3 Total							**1,124,588**	**23,931**

NOTES:
1. STATION 0+00 IS AT EAST JETTY OF FIRE ISLAND INLET FILL VOLUMES BASED ON SPRING 1998 SURVEY.
2. FILL STATIONS, FILL LENGTHS, AND FILL VOLUMES INCLUDE TAPERS.

TABLE 7 (CONTINUED)
FIRE ISLAND INTERIM PROJECT PLAN DESCRIPTION

Community Name	Profile Name	Starting Fill Station	Ending Fill Station	Dune Elev. (Ft. NGVD)	Berm Width (Feet)	Berm Elev. (Ft. NGVD)	Fill Volume (Cubic Yards)	Fill Length (Feet)
DESIGN REACH 4								
Fire Is. Nat. Seashore	F60			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F61			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F62			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F63			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F64			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F65			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F66			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F67			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F68			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F69			NA	NA	NA	0	0
Fire Is. Nat. Seashore	F70			NA	NA	NA	0	0
Smith Point Park	F71	1295+00	1317+89	NA	112 / taper	9.5	148,079	2,289
Smith Point Park	F72	1317+89	1355+00	NA	112 / taper	9.5	342,736	3,711
Smith Point Park	F73			NA	NA	NA	0	0
Reach 4 Total							**490,815**	**6,000**

NOTES:
1. STATION 0+00 IS AT EAST JETTY OF FIRE ISLAND INLET FILL VOLUMES BASED ON SPRING 1998 SURVEY.
2. FILL STATIONS, FILL LENGTHS, AND FILL VOLUMES INCLUDE TAPERS.

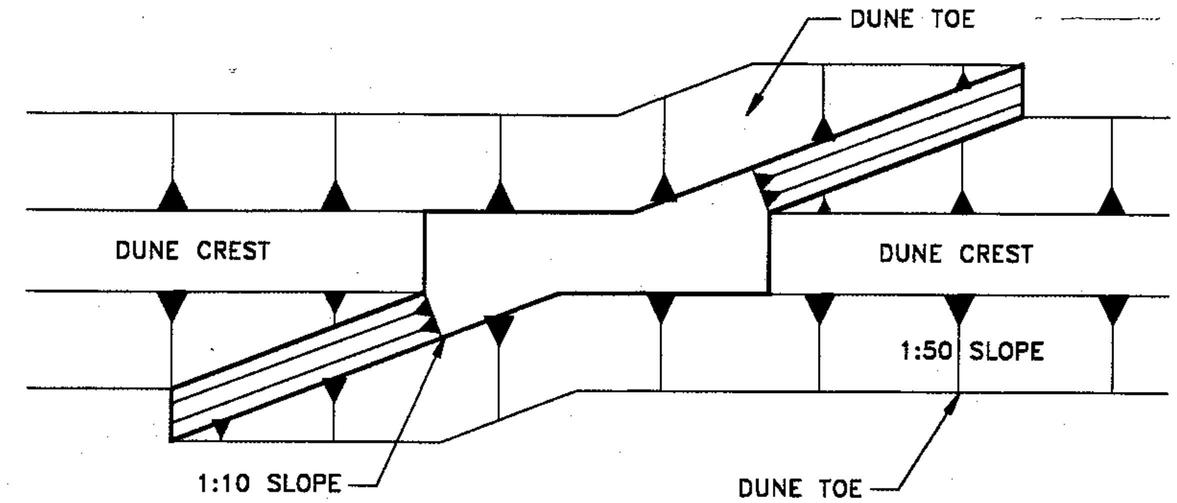
maintain existing vehicle flow, by maintaining the existing number and location of dune cuts. Five of the 13 existing cuts are affected by the proposed plan, where dune fill would be placed in the area of the existing crossing, thus necessitating a design to allow for vehicular access, which does not compromise project protection. Dune cuts are proposed to maintain a dune facing the ocean, but allow vehicle access using S-turns through the dune. The impacted dune crossings include the ones located at: 1) Lighthouse Tract, 2) Atlantique, 3) Ocean Beach, 4) Ocean Bay Park, and 5) West Fire Island Pines. The objective in developing dune crossing alternatives was to minimize the need for any structural component. Two alternatives, depicted in Figure 8A, were developed based upon the available space of each dune crossing. In Ocean Beach, sufficient space is available to allow for the alternative which includes overlapping dunes, with a connecting feature of a slope to allow vehicular access. In the remainder of the areas, an angled approach over the dune is proposed. In order to reduce dune lowering as a result of vehicular traffic, a geotextile material would be placed on the pathway.

246. In addition to vehicular dune crossings, some existing pedestrian overwalks will need to be modified. Existing overwalks are typically constructed of wood and are either privately or publicly owned. Construction of the new dune will impact some of the structures. Impacted overwalks will be identified and modifications to the walkways and stairways will be designed during the development of detailed project plans.

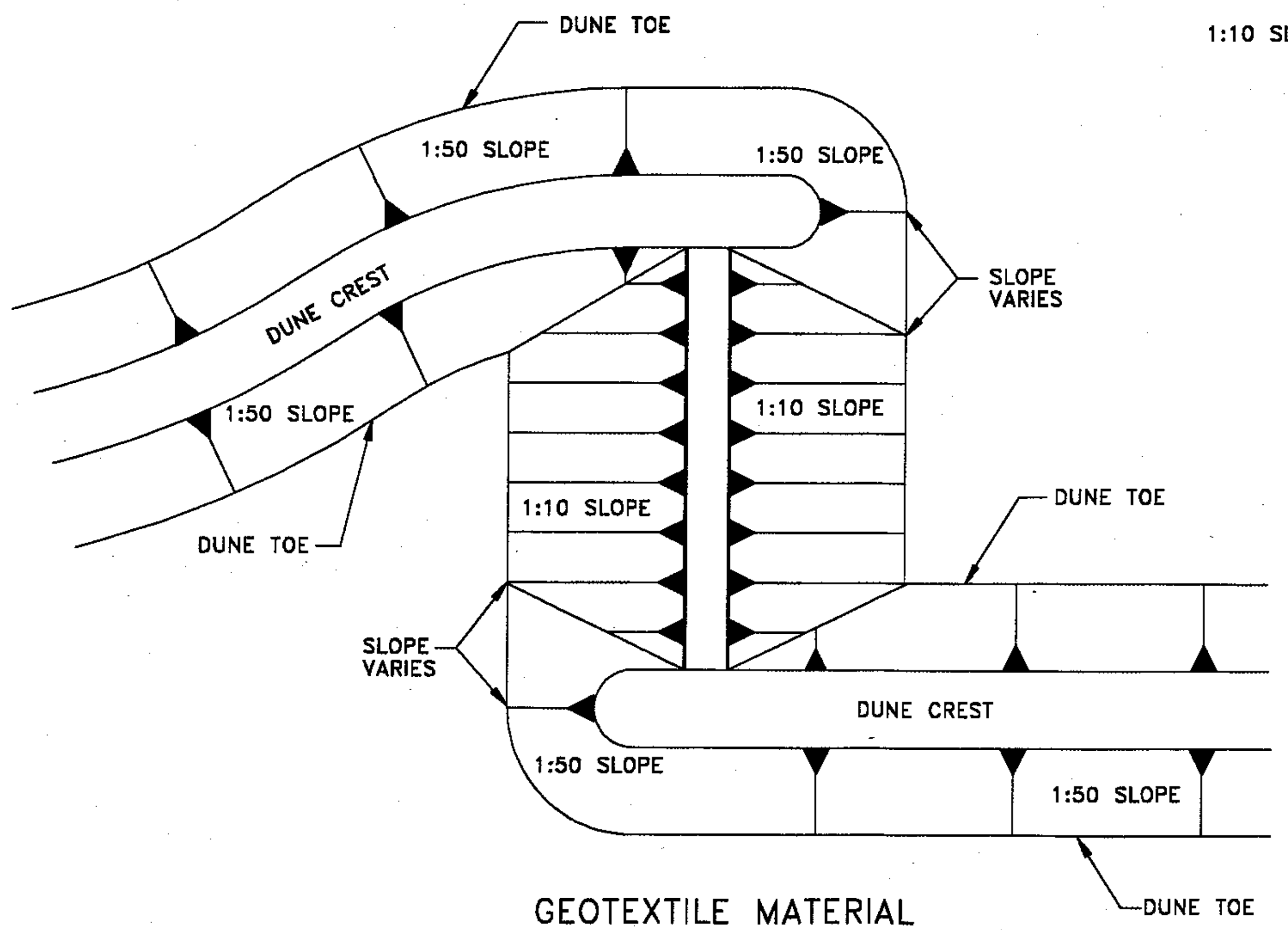
<u>Design Fill Volumes</u>

247. Design fill for the interim project is not continuous along the Fire Island shoreline. Fill is proposed where the natural dune and berm do not provide the design level of protection; such conditions are prevalent in the developed section of the shoreline. In addition, a berm is proposed at Smith Point County Park to provide protection to the facilities. (Figure 4). The design fill volume is estimated at 4,814,000 c.y. (Table 7). To the design fill, a tolerance fill volume is added to account for pay yardage fill beyond the design template due to construction tolerances.

248. <u>Advance Fill</u>. To ensure the integrity of the design fill cross-section throughout the project life, nourishment (advance and renourishment) fill will be placed along the proposed project shoreline. The advance (nourishment) fill quantity for initial construction as well as subsequent renourishment serve to maintain the design section. The advance fill is a sacrificial quantity of sand which acts as an erosional buffer against both the long-term and storm-induced shoreline recession. Insert fig 8a



GEOTEXTILE MATERIAL
STATIONS: 282+00, 377+00, 488+00, 677+00
NOT TO SCALE



GEOTEXTILE MATERIAL
STATIONS: 409+00
NOT TO SCALE

TYPICAL DUNE CROSSINGS

FIGURE 8A

The advance and total initial fill volumes for each reach are presented in Table 8.

249. An approximately 3-year nourishment interval was selected for the interim project due to the area's high erosion rate and variability. Due to the alternating patterns of erosion and accretion along the project shoreline, the advance fill volume was calculated to provide the average erosional losses along the shoreline. The average loss for eroding areas is approximately 6 feet per year. To provide sufficient renourishment fill, this volume will be extending seaward from the design berm crest. For portions of the project completed in the first year of construction, the advanced fill is designed to last 3.5 years, a width of approximately 27 feet. For areas completed in the second year of construction, the advanced fill requirement is reduced to approximately 19 feet. The future renourishment will include advanced fill sufficient for a four-year period. Nourishment fill will only be placed in areas of Design Reaches 1, 2 and 3, which receive design berm fill, and in Reach 4 to replenish the stockpile at Smith Point Park. Additional fill (0.2 cy/ft/yr) to compensate for the effects of sea level rise was included in the advance fill quantity.

250. Stockpiling and Backpassing Operations. It is expected that the highly variable shoreline change patterns will continue to affect the project area after project construction. As a result, it is expected that there will be locations along the project area where significant erosion may occur, resulting in erosion into the dimensions of the design profile. It is also expected that there will be areas that will accrete to dimensions greater than the design fill. Rather than placing a greater amount of advance fill to account for these shoreline undulations, an additional monitoring and nourishment component to take place between renourishment cycles is included to address areas of high erosion. This operation could consist of trucking sand from stockpiles, or rehandling accretional material to areas of erosion through backpassing operations.

251. As part of this project, monitoring will be undertaken in the spring and fall, consisting of profiles and aerial photography. Based upon the fall profile surveys, an assessment will be made of the existing conditions, and of the need to undertake localized measures to account for erosional areas. An assessment will be made of locations where the design section may be impinged upon, and a determination made as to the level of severity relative to a threat of dune survivability. If conditions are such that the dune would be vulnerable to being compromised, actions would be initiated to truck sand from a stockpile at Point O' Woods, or to backpass material from areas of accretion to areas of erosion. Depending upon the severity of conditions, trucking operations could be required to transport up to 40,000 cy, a year. Backpassing operations, accomplished by a small

TABLE 8
TOTAL INITIAL FILL VOLUME ESTIMATE
FIRE ISLAND INTERIM PROJECT

FILL LENGTH (FT.)	DESIGN FILL VOLUME (C.Y.)	ADVANCE FILL VOLUME (C.Y.)	STOCK-PILE FILL VOLUME (C.Y.)	15% TOLERANCE VOLUME (C.Y.)	SUB-TOTAL (C.Y.)	OVERFILL FACTOR	TOTAL FILL VOLUMES (C.Y.)
DESIGN REACH 1 5,289	55,057	195,058	0	37,517	287,633	1.00	287,633
DESIGN REACH 2 24,659	3,143,071	909,424	140,000	607,874	4,800,369	1.00	4,800,369
DESIGN REACH 3 23,931	1,124,588	653,292	0	266,682	2,044,563	1.00	2,044,563
DESIGN REACH 4 6,000	490,815	0	50,000	73,622	614,437	1.00	614,437
TOTAL 59,879	4,813,531	1,757,774	190,000	985,696	7,747,001		7,747,001

NOTES:
DESIGN FILL VOLUME INCLUDES BERM AND DUNE (DESIGN REACHES 2 AND 3)
ADVANCE FILL BASED ON 2.5 YEAR CYCLE (19.2 FT. (WIDTH) x 1.35 C.Y./FT.) = 26.42 C.Y. / FT.
REACH 2, CONSTRUCTED FIRST, INCLUDES ADVANCE FILL FOR 3.5 YEARS (36.88 C.Y./FT.)
PROFILE F31 THROUGH F35 ALSO INCLUDE ADVANCE FILL FOR 3.5 YEARS (36.88 C.Y./FT.)
ADVANCE FILL VOLUMES INCLUDE ADDITIONAL 0.2 C.Y./FT/YR FILL FOR SEA LEVEL RISE
STOCKPILE VOLUMES NOT INCLUDED IN TOLERANCE
VOLUMES BASED ON APRIL 1998 SURVEY

hydraulic dredge, could be undertaken every other year, in the amount of 70,000 cy. Work would be accomplished in the off-season, in the months of October through December.

252. As part of initial construction, 140,000 cy of sand will be placed in a stockpile east of Point O' Woods that will occupy a footprint of 650 feet by 520 feet, with a top elevation of +15 ft NGVD. A total of 160,000 cy of sand will be placed in the stockpile at the time of the renourishment. The top elevation is lower than the surrounding dunes. As needed, the stockpile will be transferred by front-end loaders into offroad dump trucks that would transverse the beach and deposit the material. The material which would be reconfigured at the site. These operations would be undertaken following fall monitoring surveys, and if needed would occur in the months of October and November. In addition to stockpile operations, an alternative method to address erosional areas consists of backpassing operations, which is the rehandling of material from area of accretion to areas of erosion. This would be undertaken via a small hydraulic dredge which would be operating on the beach, within a temporary work area 75 feet wide and 150 feet long, dredged to a depth of –2 feet NGVD. This work area would be open to the ocean to allow for a continual water depth within it. The dredge will be fed by trucks and front-end loaders, as needed, to rework sand into the work area. The dredge will pump sand up to a distance of 2 miles in either direction. It is expected that backpassing operations could be undertaken in areas of historical accretion, including in the vicinity of Cherry Grove and Water Island. These operations are expected to be undertaken every other year in the months of November and December.

253. Fill Volumes. The total initial project fill volume is the sum of the design fill, the advance fill and tolerance fill over the first nourishment cycle. The total fill requirement for the nourishment project is the sum of the above volumes plus the overfill. Total initial fill volumes for each design reach are presented in Table 9. The total initial fill volume for the Fire Island Interim Project is estimated as 7,747,000 cy.

254. Renourishment. Renourishment volumes were generally developed to account for long-term erosional, and storm-induced losses over an approximately 3 year cycle, due to the high erosion and variability. For the single renourishment operation, the volumetric requirements were adjusted to take place two years following the completion of the initial construction, consisting of 2,803,000 cy of renourishment fill. This quantity of fill is expected to last for four years. The fill performance will be monitored, and adjustments made in the planned renourishment cycle as needed, to account for the alongshore placement of fill. Based upon project monitoring, it is possible that

renourishment fill would be placed along any area within the Fire Island Inlet to Moriches Inlet project area, excluding the Otis G. Pike Wilderness Area. Such needs would continue to be coordinated with the involved agencies.

255. Modified Authorized Project. For comparison, the modified authorized fill volume of 18,452,000 cy is presented in Table 9. The methods of calculation are equivalent to the calculation for the interim design. The design fill volume value includes dune fill in Design Reaches 2 and 3. Advance fill is applied at all fill locations. Overfill is unchanged from the interim design. The total 3 year renourishment fill volume, including tolerance and overfill is 4,804,000 c.y.

256. Proposed Borrow Area Location. The required initial beachfill material for the project is proposed to be obtained from the borrow site offshore of central Fire Island previously identified in the 1983 borrow area investigation for the south shore of Long Island (Ocean Seismic Surveys, 1983) and re-investigated in 1996 (Ocean Surveys, Inc., 1996). This area lies offshore of Cherry Grove, and is shown in Figure 9. Sediment suitability analyses were performed in 1983 and 1996, and the texture of the material was found to be compatible with the native Fire Island sand. The grain size properties, i.e., phi-16, phi-84, mean phi, and the standard deviation, were determined from an investigation of borrow area cores (See Appendix F). No alternative sources of sand were identified.

257. Beach Sand Analysis. Beach sediment sampling was performed in 1996 in order to determine the textural characteristics of the native beach sand. Beach compatibility analyses with the borrow area material yielded a required beach overfill factor (Ra) of 1.0. The grain size properties of phi-16, phi-84, mean phi, and standard deviation were computed for each profile sampled. Additionally, a composite including all of the profile samples, a composite including all the profiles, and a total composite including all of the profile samples was computed. These along-island composites were computed by numerically averaging the grain size parameters of the applicable profiles. For further information refer to the Borrow Area Appendix F.

258. Sand taken from the borrow area would be extracted to a depth no greater than 20 feet below the existing bottom, in order to minimize impacts and avoid anoxic conditions. In addition, the depth of the borrow area will be limited where possible in order to minimize the potential for altering the bottom conditions within the pits. Assuming an average dredge depth of 15 feet below grade, with side slopes of 1:5, the estimated area of disturbance is approximately 390 acres for initial

TABLE 5 TOTAL INITIAL FILL VOLUME ESTIMATE FIRE ISLAND MODIFIED AUTHORIZED PLAN								
REACH NAME	FILL LENGTH (FT.)	DESIGN FILL VOLUME (C.Y.)	ADVANCE FILL VOLUME (C.Y.)	STOCKPILE FILL VOLUME (C.Y.)	15% TOLERANC VOLUME (C.Y.)	SUB-TOTAL (C.Y.)	OVERFILL FACTOR	TOTAL FILL VOLUMES (C.Y.)
DESIGN REACH 1	16,621	1,087,472	612,982	0	255,068	1,955,523	1.00	1,955,523
DESIGN REACH 2	24,659	4,512,652	909,424	300,000	813,311	6,535,387	1.00	6,535,387
DESIGN REACH 3	42,830	2,870,351	1,236,880	150,000	616,085	4,873,316	1.00	4,873,316
DESIGN REACH 4	39,284	3,281,849	1,037,883	120,000	647,960	5,087,692	1.00	5,087,692
TOTAL	123,394	11,752,324	3,797,170	570,000	2,332,424	18,451,918		18,451,918

NOTES:
DESIGN FILL VOLUME INCLUDES BERM AND DUNE (DESIGN REACHES 2 AND 3)
ADVANCE FILL BASED ON 2.5 YEAR CYCLE (19.2 FT. (WIDTH) x 1.35 C.Y./FT.) = 26.42 C.Y. / FT.
REACH 1 AND 2, CONSTRUCTED FIRST, INCLUDES ADVANCE FILL FOR 3.5 YEARS (36.88 C.Y./FT.)
PROFILE F31 THROUGH F35 ALSO INCLUDE ADVANCE FILL FOR 3.5 YEARS (36.88 C.Y./FT.)
ADVANCE FILL VOLUMES INCLUDE ADDITIONAL 0.2 C.Y./FT/YR FILL FOR SEA LEVEL RISE
STOCKPILE VOLUMES NOT INCLUDED IN TOLERANCE
VOLUMES BASED ON APRIL 1998 SURVEY

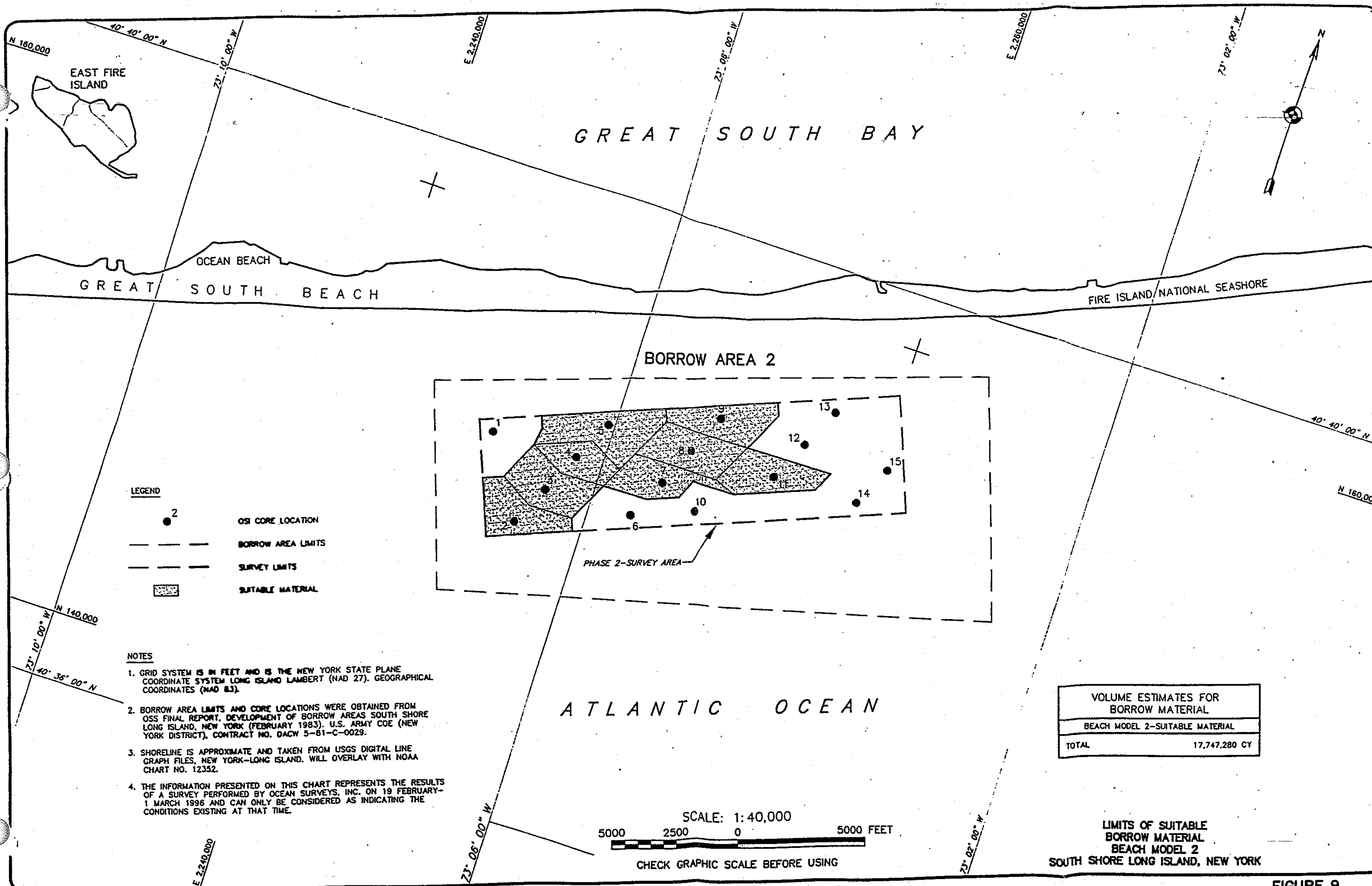

EAST FIRE ISLAND
GREAT SOUTH BAY
OCEAN BEACH
GREAT SOUTH BEACH
FIRE ISLAND NATIONAL SEASHORE
BORROW AREA 2
PHASE 2-SURVEY AREA
ATLANTIC OCEAN
N 160,000
N 140,000
E 2,240,000
E 2,260,000
40° 40' 00" N
40° 36' 00" N
73° 10' 00" W
73° 06' 00" W
73° 02' 00" W
N
LEGEND
OSI CORE LOCATION
BORROW AREA LIMITS
SURVEY LIMITS
SUITABLE MATERIAL
NOTES
1. GRID SYSTEM IS IN FEET AND IS THE NEW YORK STATE PLANE COORDINATE SYSTEM LONG ISLAND LAMBERT (NAD 27). GEOGRAPHICAL COORDINATES (NAD 83).
2. BORROW AREA LIMITS AND CORE LOCATIONS WERE OBTAINED FROM OSS FINAL REPORT, DEVELOPMENT OF BORROW AREAS SOUTH SHORE LONG ISLAND, NEW YORK (FEBRUARY 1983). U.S. ARMY COE (NEW YORK DISTRICT), CONTRACT NO. DACW 5-81-C-0029.
3. SHORELINE IS APPROXIMATE AND TAKEN FROM USGS DIGITAL LINE GRAPH FILES, NEW YORK-LONG ISLAND. WILL OVERLAY WITH NOAA CHART NO. 12352.
4. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 19 FEBRUARY-1 MARCH 1996 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME.
SCALE: 1: 40,000
5000 2500 0 5000 FEET
CHECK GRAPHIC SCALE BEFORE USING
VOLUME ESTIMATES FOR BORROW MATERIAL
BEACH MODEL 2-SUITABLE MATERIAL
TOTAL 17,747,280 CY
LIMITS OF SUITABLE
BORROW MATERIAL
BEACH MODEL 2
SOUTH SHORE LONG ISLAND, NEW YORK

FIGURE 9

construction and 110 acres for each nourishment operation. Further details are contained in the Appendix F-Borrow Area.

PROJECT IMPACTS

Environmental Impacts

259. The Interim Plan alternative involves the placement of sand, obtained from an offshore borrow site, directly onto the eroding shoreline to replace or reconstruct eroded dunes and berm areas. The following provides a summary discussion of impacts. A full impact analysis is contained in the DEIS accompanying this report.

260. **Environmental Resource Impacts**. Impacts associated with the placement of dredged material on the ocean beach are based on the abundance and kind of organisms present, the quantity and quality of material placed, the method used, and the time of year. Sessile organisms would experience the immediate impacts through direct deposition, lowered oxygen and light penetration, and/or disturbance during critical life cycle periods. Mobile species, bottom dwellers and free swimmers, can usually escape.

261. **Borrow Area Impacts**. The sand to be placed on the shore will be obtained from a borrow area offshore of Fire Island. The maximum depth to which the borrow area will be dredged is 20 feet below existing bottom.

The dredging of the borrow area may have generally two main adverse impacts:

a. The direct loss of benthic infauna within the dredged area. Mobile epibenthic forms such as fish and crustaceans would be expected to leave the area and should not be significantly impacted. Benthic recolonization would depend on the depth of the dredged area, sedimentation rate, and bottom substrate type. The depth of the borrow area will be limited where possible in order to minimize the potential for altering the bottom conditions within the pits.

b. An increase in turbidity levels. Due to the sandy substrate and location of the site, any plume will be restricted in size and duration and it is not anticipated that there would be any release of pollutants or significant lowering of dissolved oxygen levels resulting from the project. Surface sediments of the borrow area do possess a small percentage of silt which would be released into the water column. The dynamic wave and current conditions of the project area would rapidly dissipate the suspended solids.

While there will be short term impacts to the borrow area, no significant environmental impacts are anticipated because recolonization is expected in approximately 18-24 months. Dredging depths will be closely monitored so as to avoid the creation of potentially anoxic conditions. The District will implement a pre-construction, and post-construction monitoring survey to document the recovery of natural resources, generally consisting of benthic, surf clams, and finfish.

262. **Federally and State Listed Shorebird and Plant Species**. The creation of additional sandy beach may represent a positive impact for plovers and terns by providing greater potential areas for nesting. Creation of dune areas in conjunction with a widened and elevated berm may affect the development of ephemeral pools where the plovers tend to feed when available. The ocean wrack lines and intertidal zones which are also feeding areas will not be impacted since they will only move in relation to shoreline changes. As part of the NEPA process, the District is coordinating with the U.S. Fish and Wildlife Service regarding the potential impacts of this project to plover nesting areas, and is evaluating the need for mitigation and the means to mitigate for any potential disturbance to plover nesting, feeding and breeding habitat. These measures are currently being incorporated into the project description. Also considered will be the habitat of the State listed least and common tern. In addition, the District is also coordinating with the U.S. Fish and Wildlife Service regarding protection of the sea beach amaranth.

263. The increase in sandy beach area is not expected to significantly increase human use of the barrier island shore. In some areas, it may be possible to protect an area from human disturbance to favor sensitive shorebird and plant species. All practical protective measures will be investigated with the USFWS and NYSDEC to ensure the safety of the piping plover and least tern as well as seabeach amaranth. USFWS has prepared a Biological Assessment (see DEIS Appendix) that describes the potential direct and indirect impacts on the Atlantic Coast population as Piping Plover and Seabeach Amaranth.

264. **Threatened and Endangered Marine Species**. There is a potential for endangered Kemp's ridley, leatherback, and green sea turtles, as well as threatened loggerhead turtles to be present near

the vicinity of the project area (borrow area locations) during the summer and early fall months (NMFS, 1993). Coordination with NMFS on other similar projects within the District's boundary has resulted in agreement that if hopper dredges are utilized between mid-June and mid-November, a monitoring plan, that places NMFS- approved observers onboard to determine if impacts occur, will be implemented. Need for a similar plan can be expected and will be programmed into any work proposed in the borrow areas. The District would place special conditions into the Plans and Specifications for the project to comply with NMFS' determination.

Geomorphic Impacts

265. Given the intent of this project to reduce the frequency and volume of barrier overwash and to reduce the number of barrier breaches, there are potential geomorphic effects. For example, the reduction in surge volumes overtopping the island will also reduce the landward transport of sediment. It is important to reiterate that the western portion of Fire Island, where approximately 90% of the fill is proposed, has developed as a prograding spit from the westerly transport of sediment, as opposed to landward migration due to breaching and overwash, and that the central portion of the island has been stable for hundreds of years. Breaching and overwash are not the predominant geomorphic processes controlling barrier island shape and location in these areas. Overwash deposits, however, contribute to increasing the barrier island elevation and to creating washover corridors that link the ocean and bay habitats (USFWS, 1998). For some storm events, the presence of higher or wider dunes will reduce the extent of such washovers. It is likely, however, that if washovers occurred within a community district, the material would be removed, regraded or built upon, and that the overwash corridor would not remain. Since the vast majority of dune placement is within the community districts, potential impacts on washovers is limited. While the proposed project includes dune construction as well as beach nourishment, the project is more accurately characterized as beach nourishment, since approximately 95% of the fill is for beach nourishment. Leatherman and Allen recognize that beach nourishment is regarded as the most environmentally compatible means of shoreline engineering, since this technique can mimic the natural process of sand addition to the barrier chain (Leatherman, 1982). Introduction of new sand supplies, obtained from sources outside the nearshore sand-sharing system, provides the material for adjustment of the beach and shoreface according to the energy conditions and sea level position. It should be further acknowledged that the geomorphic impacts associated with a 6-year duration project are likely to be insignificant. The principal effect of beach nourishment would be the delay

in advent of the natural geomorphic processes involved in landward barrier migration (Leatherman and Allen, 1985).

266. Along the portions of Fire Island east of Watch Hill, breaching and overwash are more important geomorphic processes to a landward migration of the barrier system. Since the project fill placement in this area is limited to a beach berm at Smith Point County Park, no reduction in the frequency and magnitude of breaches and overwash is expected in this area. Under the Interim Plan, current conditions governing overwash frequency will be unaltered over the 75% of the length for which there is no dune alteration proposal.

Cultural Resource Impacts

267. The following sections provide a summary of the potential for cultural resource impacts. A full impact analysis is contained in the DEIS accompanying this report.

268. **Impacts to Terrestrial Cultural Resources:** Most of the documented archaeological sites located in the vicinity of Fire Island are situated in the back bay areas of Great South Bay or the interior uplands of the Long Island south shore. Two historic sites, an early 20th century recreational facility and the mid-19th century U.S. Coast Guard complex, are located on dunes bordering Great South Beach and are potentially eligible for listing on the National Register. The potential is low, however, for other preserved, good context archaeological deposits to be located within the beaches and dunes of Fire Island, as a result of the dynamics of beach and dune migration and the lack of stable surfaces (JMA, 1998). The placement of sand along the shoreline would not have an impact upon these existing resources. Any proposed construction activities will avoid the shoreline, and any proposed construction activities would not have an impact upon these existing conditions.

269. **Drowned Terrestrial Archaeological Sites:** Prehistoric archaeological sites dating to the initial occupation of the region are rare, however, they could be buried under the barrier beach, making them at risk of exposure to coastal erosion. The potential of these buried deposits along Fire Island is relatively high, particularly along former valley margins. These areas could only be defined with additional investigations consisting of mechanical coring and geomorphic analysis. Sand placement would not disturb the potential sites buried under the barrier island or the near shore

zone. The use of sand fill may help to protect these sites from being exposed and destroyed. No additional studies are required at this time (JMA, 1998).

270. **Maritime Resources:** Over 150 documented vessels were wrecked along the shoreline and just offshore of Fire Island. Many were later re-floated, removed by wreckers, destroyed by the surf, sunk or scuttled to serve as artificial reefs (Dolan Research, 1998). The placement of sand in the near shore tidal area has the potential to impact potentially significant submerged cultural resources located in this area. To locate these resources, a low water survey along the tidal zone utilizing a hand-held magnetometer and a near shore remote sensing survey using a side scan sonar and magnetometer is being undertaken (JMA,1998). Based upon the results of this survey, coordination with the NYSHPO and the FIIS will determine if sand placement will have an adverse impact to any identified potentially significant cultural resources, and if any additional studies are necessary.

271. A remote sensing survey of a proposed borrow site, utilizing a side scan sonar and magnetometer, identified seven potential cultural resources (PCRs). Current project plans include the avoidance of these PCRs, however, if these plans change or avoidance of one or any of the PCRs is not feasible, then any or all of the PCRs would be inspected and evaluated to determine what they are and if they are eligible for the National Register (Reiss, 1996).

272. **Architectural Resources**: The structures along Fire Island that may be potentially eligible for the National Register include the Robert Moses State Park Tower, approximately ten houses in the communities of Corneille Estates, Ocean Bay Park, Seaview, Cherry Grove and Fire Island Pines, the former Point O'Woods Life Saving Station, and the community of Point O'Woods (JMA, 1998). Further research is necessary to determine whether the properties possess significance under one of the defined contexts for the study area (JMA,1998). The placement of sand on the beach, however, would have no adverse effect on these properties, and no additional studies are necessary at this time.

Institutional Impacts

273. **General.** For the development of the interim project, several institutional constraints were identified as being required to be met. This section provides a summary of the consistency of the plan to these constraints. The institutional constraints include: 1) Reversibility, 2) consisting with WPS policies and FIIS GMP, 3) consistency with the Partnership Agreement entered into between the Department of the Army and the Department of the Interior, 4) consistency with NEPA

requirements for interim measures, and 5) consistency with State Coastal Zone Management and Coastal Erosion Management Regulations. A full discussion of compliance is included with the DEIS.

274. **Reversibility**. Because of the dynamic nature of the system, the with-project shoreline will be reshaped in response to wave climate and other forces. The length of time it will take to erode the Interim Project to a level of protection similar to current conditions will depend on future events, such as storm activity, that can not be predicted with certainty. The effects of long term erosion trends, short term shoreline undulations, and periodic storms will tend to redistribute the beach and dune fill. As erosion and shoreline undulations reduce the berm width protecting the dune, smaller storms will overwash the dunes and lower the crest elevation. These effects were evaluated using a statistical simulation technique to estimate future reductions in the protection and the associated storm damage reduction benefits provided by the proposed interim project. This assessment indicated that approximately five to six years after the project maintenance is discontinued, the effectiveness of the protection is reduced by 50%, and that after approximately ten years the project protection is reduced by approximately 80%.

275. **Consistency with National Park Service Requirements**. As discussed previously, Fire Island National Seashore has prepared a General Management Plan (GMP) based upon FIIS authorizing legislation, and NPS management policies and guidelines and also responsible for issuance of a Special Use Permit for actions which are proposed to be undertaken within the boundaries of the seashore. Issuance of the Special Use Permit requires that the proposed action be consistent with the GMP. If the proposal action is inconsistent with the GMP, sufficient justification must be provided for the deviation. Depending upon the magnitude of the proposed action and the rationale, including the extent of the deviation, issuance of the Special Use Permit could be done within the discretionary authority of the Park Superintendent, or could necessitate a change in the GMP, which would require an accompanying EIS. There are two issues related to consistency with the GMP, and issuance of a Special Use Permit. These are 1) work which is being done in the major federal tracts of land, and 2) the potential for increased development resulting from project construction.

276. The major federal tracts of land include the Lighthouse Tract, Sunken Forest/Sailors Haven, Talisman, Blue Point Beach, Watch Hill, and the Otis G. Pike Wilderness Area. The EIS in support of the GMP precludes fill within these areas. In order to meet the project objectives, to reduce the

potential for breaching and overwash, and provide protection to the mainland of Long Island, some sand placement is required within these areas. The extent of work and the associated volumes of fill are presented below in Table 10. There is approximately 8,490 linear feet of fill, and 197,000 cy of sand within these areas. The extent of fill and volume has been minimized to the extent possible without compromising project protection. With the exception of limited work in Talisman and Watch Hill, the remainder of the fill operations are tapers from the fill fronting the communities. Where possible, the extent of the taper has been limited to the extent possible. Further truncations of the tapers would result in too sharp of a contour change, resulting in increased fill losses. Work within the Talisman area is necessary to reduce the potential for breaching, and is recognized as one of the most critical areas. While these measures are inconsistent with the Park Service GMP, they have been minimized to the extent possible. Furthermore, these measures appear to be consistent with Park Service Management policies that allow for work to be undertaken where life and human property are at stake.

277. Development in a hazard area is inconsistent with the FIIS GMP. Future development, however, will largely be enforced by the State's Coastal Erosion Hazard Areas Act. NYSDEC representatives have confirmed by letter that they will not relocate the Coastal Erosion Hazard Areas Act line as a result of project construction. Accordingly, no lots that are presently unbuildable will become available for development. The only lots within the hazard area which may be built upon are those which are presently buildable, due to the realities of the regulatory framework. Development is presently occurring at a role of approximately 1.6 houses per year. It is likely that this will continue in the future, independent of the interim project being constructed. It is possible that the protection afforded by the interim project could be perceived by some landowners as an inducement to build within those lots. Discussions are underway between the Corps, the DOI and NYS to identify available mechanisms within the regulatory framework to address these concerns. For the purposes of regulatory consistency, it is recommended that the Federal Dune District be moved to be coterminous with the Coastal Erosion Hazard Area designation.

278. **Consistency with Partnership Agreement.** The Army and the Interior have entered into a partnership agreement to establish conditions for the development of an interim project. The proposed Interim Plan is in agreement with the seven points of the Partnership Agreement, as described below. The proposed plan is for initial construction, and one nourishment, consistent with point one. The one nourishment is scheduled to occur subsequent to the schedule for completing the

TABLE 10
LENGTH AND VOLUME OF FILL ALONG MAJOR FEDERAL TRACTS

Tract	Profile line	Starting station	Ending station	TRACT LENGTH (feet)	FILL LENGTH (feet)	APPROX. FILL VOLUME (cubic yards)	DESCRIPTION OF FILL
Lighthouse Tract	Total	0233+00	0287+00	5,400	Total: 1,370	Total: 83,829	
	F12	0273+30	0292+16		1,370	83,829	18' NGVD dune, 11.5' NGVD berm, width (feet) = 40 / Taper
Sunken Forest / Sailor's Haven		0531+00	0611+00	8,000	Total: 900	Total: 11,004	
	F32	0528+00	0540+00		900	11,004	15' NGVD dune, 9.5' NGVD berm, width (feet) = Taper
Talisman	Total	0720+00	0793+00	7,300	Total: 3,020	Total: 72,893	
	F44	0725+00	0735+00		1,000	14,535	No dune, 9.5' NGVD berm, width (feet) = Taper
	F45				No fill length	No fill volume	
	F46				No fill length	No fill volume	
	F47				No fill length	No fill volume	
	F48A	0772+80	0784+00		1,120	28,176	18' NGVD dune, 11.5' NGVD berm, width (feet) = 40 / Taper
	F48	0784+00	0788+50		450	14,796	No dune, 11.5' NGVD berm, width (feet) = 40
	F48B	0788+50	0794+00		450	15,386	18' NGVD dune, 11.5' NGVD berm, width (feet) = 40
Blue Point Beach	Total	0803+00	0857+00	5,400	Total: 2,100	Total: 21,579	
	F49	0796+56	0817+00		1,400	17,416	15' NGVD dune, 9.5' NGVD berm, width (feet) = 90 / Taper
	F50				No fill length	No fill volume	
	F51				No fill length	No fill volume	
	F52				No fill length	No fill volume	
	F53				No fill length	No fill volume	
	F54	0850+00	0866+72		700	4,163	No dune, 9.5' NGVD berm, width (feet) = 90 / Taper
Watch Hill	Total	0899+00	0937+00	3,800	Total: 1,100	Total: 7,583	
	F57	0895+99	0900+00		100	3,658	15' NGVD dune, 9.5' NGVD berm, width (feet) = 90
	F58	0900+00	0910+00		1,000	3,925	No dune, 9.5' NGVD berm, width (feet) = Taper
Wilderness		0937+00	1295+00	35,800	No fill length	No fill volume	
Total Fill Along Major Federal Tracts					8,490	196,888	
Approximate Total Length of Major Federal Tracts				65,700			

Reformulation EIS, consistent with point two. The Corps is currently supporting discussion relative to concerns regarding development, consistent with point three. The Corps is presently undertaking field sampling for the Reformulation Study, to collect information prior to implementing the interim project, which is consistent with point four. The Corps and the Department of the Interior have met on numerous occasions to develop the current plan with respect to work in the major federal tracts of land, consistent with point five. The Corps has solicited input from DOI in the development of this report, consistent with point six, and finally, the Corps recognizes that the proposed plan must be consistent with applicable federal laws.

279. **Consistency with NEPA Interim Constraints.** As presented previously, the specific requirements for an interim project, as they relate to NEPA Regulations (40 CFR 1506.1) have been met by the proposed plan. First, the proposed plan, presented herein demonstrates independent utility, as a stand-alone element, which is justified independent of the outcome of the Reformulation Study. Secondly, this draft decision document is accompanied by a Draft Environmental Impact Statement. Thirdly, the proposed interim project will not presuppose the outcome of the Reformulation Study. The proposed plan meets the requirements that it does not tend to determine future development or to limit alternatives for the Reformulation Study.

280. **Consistency with State Policies.** State policy and state law govern the development of shore protection projects: the state Coastal Program Management (CMP) policies and the Coastal Erosion Management Regulations, respectively. A CMP consistency determination accompanying the DEIS concludes that the proposed plan is consistent to the maximum extent practicable. The proposed project must meet the variance conditions within the Coastal Erosion Management Regulations because the interim plan does not include a maintenance component to ensure a minimum project life of 30 years. It is expected that this variance will be granted by the State.

281. **Environmental Features.** Concurrent with developing a plan for storm damage reduction, it is possible to include features within the plan specifically to promote the advancement of threatened and endangered species. These measures can be undertaken at incidental cost without negatively impacting project functioning, and are intended to improve the nesting and foraging habitat for key species. The exact nature, location and sizes of these measures are currently being coordinated with the USFWS through the biological opinion process, the National Park Service, the State, and the County. Possible measures could include actions to promote creation of ephemeral pools, optimizing vegetation coverage for endangered species use, removal or modification of

existing erosion control structures, as well as other management actions, or physical alterations to improve threatened and endangered species nesting and foraging habitats.

Project Benefits

282. **Introduction**. Potential project benefits were evaluated for the mainland and barrier island portions of the study area. The analysis of benefits along the mainland considered the area from the Nassau County/Suffolk County boarder, eastward to Smith Point. The analysis of benefits on the barrier island considered the area from Fire Island Inlet to Smith point County Park. All benefits have been evaluated in accordance with National Economic Development (NED) criteria and reflect the increase in economic value of goods and services.

283. The time period for economic analysis consists of the project life, during which the design level of protection will be maintained, and a post-renourishment period during which the impacts of shoreline change and storm erosion will reduce the effectiveness of the project. The project was also compared to a larger plan in an effort to ensure that the Interim Plan design level does not exceed the optimum level for a long term solution. The average annual benefits were calculated for the project life. The total present worth of post-renourishment benefits was also calculated, and then amortized over the appropriate project life. The total period of analysis was limited to 30 years after construction. Since the project's major benefit is reduced inundation damage to structures along Great South Bay, only these benefits are included in the analysis of post-renourishment impacts. Post-renourishment benefits result from diminishing storm damage protection afforded by the project after renourishment has ended and the advanced nourishment fill has eroded back to the basic project profile. This category of benefits is usually insignificant when considering projects having an economic life of 30 to 100 years. With a significantly shorter project life, however, the residual protection produces a more significant economic value relative to benefits accruing during the design project life.

284. Benefits were calculated by comparing future conditions with and without the alternatives considered. The specific categories of benefits considered in the analysis include:

- Reduced damage to structures and contents.
- Reduced Breach Contingency Plan costs

- Increased recreation values.

285. While the Interim Plan would essentially obviate the need for locally sponsored beachfills, the benefit of avoiding such actions has not been included in the current analysis. This avoids the possibility of double counting the cost and damage reduction of these efforts as project benefits.

286. The analysis of reduced damage to structures and contents considers the potential for temporary formation of a second inlet to Great South Bay resulting in a transitory increase in flood frequency in the bay. Based on the emergency breach closure procedures described in the BCP, it was assumed that the breach would remain open for a period of three months. Benefits have been calculated using a life cycle approach which incorporates risk and uncertainty analysis techniques.

287. For this analysis, reduced wave or erosion damage was only considered for shorefront or near shorefront structures. Damages to backshore and mainland structures were calculated based solely on tidal inundation. These structures were not analyzed for dynamic wave impacts, since these damages would be inconsequential.

288. Recreation benefits consider existing users only, due to uncertainties regarding the regional impact of usage transfers. Benefits in advance of base year have not been included. Additional information regarding the analysis of storm damage and benefits is presented in Appendix D.

Storm Damage Reduction Benefits

289. Shorefront Damage Reduction Benefits. The shorefront model evaluates structural response for exposure to shoreline change, storm erosion, sea level rise and storm surge/wave impacts, and simulates average annual damage reduction amounts over the without project condition. Shorefront storm damage reduction benefits are presented in Table 14.

290. Non-shorefront Damage Reduction Benefits. The non-shorefront model evaluates inundation damages in response to sea level rise and storm surges in Great South Bay. The average annual benefit is derived from the reduction in damages compared to the without project condition. The possibility of increased exposure due to the presence of a breach in the barrier island required the non-shorefront model to consider short time periods, with simulation of monthly intervals. The with project simulations have been performed using procedures directly analogous to the without project analysis. Non-shorefront storm damage reduction benefits are presented in Table 14.

291. Post-Renourishment Benefits. For most flood damage protection or storm damage reduction projects, the period of analysis used to evaluate costs and benefits has been selected to coincide with the expected duration of the Project Cooperation Agreement which generally defines maintenance and operations responsibilities. The use of an economic analysis period consistent with the duration of project maintenance provides assurance that project features will be in working condition and that the project will provide the expected benefits. Since most projects provide for a life of between 30 and 100 years, the discounted value of any residual benefits which may accrue after the project life are normally not important in the decision process. For shorter periods of analysis, such as the 6 year project life being considered for the current study, the current value of residual, or post-renourishment benefits could be substantial. For example, using a 6 year project life and an annual discount rate of 7%, $1,000,000 of benefits in the first year after the project life, year 7, would add $130,600 to the average annual benefits. In comparison, assuming a 50 year project life, the same $1,000,000 of benefits in year 51 would only add $1,700 to the average annual benefits.

292. Benefits were simulated for a total period of 30 years. This included the project life (6 years) and the post-renourishment period (24 years). In the post-renourishment period the progressive decline in the effectiveness of the design was estimated based on the long-term erosion rate, shoreline undulations, and the percentage of dunes destroyed in prior storms. The present worth of post-renourishment benefits was calculated and amortized over the project life.

293. In order to calculate post project benefits, SBEACH, a numerical simulation program described in the Engineering Appendix, was used to evaluate the survivability of the design dune. Output was used to relate beach and dune erosion to the residual level of protection for the reconstructed dune areas. Future levels of protection were adjusted for the average long term erosion rate by incrementally reducing the design width.

294. Variations in shoreline position, often referred to as undulations or erosion "hot spots", were evaluated using Global Positioning System (GPS) shoreline survey data. This data, collected as part of the National Park Service's ongoing monitoring efforts, was analyzed by the Coastal Hydraulic Lab (CHL) to establish "smoothed" shoreline positions and erosion or accretion offsets at 25-meter increments along the shoreline. The offsets were then ranked and cumulative erosion or accretion distributions developed. The average of these undulation values was used to establish what proportion of the shoreline would be eroded beyond a given distance.

295. Storm impacts were determined for randomly simulated events. The proportion of each design section that would be effective in any storm was determined, based on the combined effect of long-term erosion and undulations. The degradation of protection due to storms was considered to be cumulative, with no post storm restoration of the design protection.

296. During the post-renourishment period, flood depths during any storm were interpolated between the Interim Plan and the existing condition stage frequency curves. The effectiveness of the remaining beach and dune was based on the estimated proportion of the barrier which provides a level of protection (LOP) exceeding a given storm event. For example, assume that under existing conditions 50% of the barrier island provides a 25-year LOP, while under the Interim Project conditions, 90% of the barrier provides a 25-year LOP. If, at some post-renourishment condition, 70% of the barrier were estimated to provide a 25-year LOP, the residual beach and dune would be estimated to be ½ as effective as the Interim Project in reducing flood stages in Great South Bay during a 25-year storm. Benefits were simulated for a period of 30 years which included the project life and the post-renourishment period. In the post-renourishment period, the progressive decline in the effectiveness of the design and associated benefits is displayed in Figure 10.

297. Breach Contingency Plan Costs. In addition to damage to structures, there is also a strong potential for breaches to form in the barrier requiring closure. The cost of each breach closure under the Breach Contingency Plan (BCP) is currently estimated to be $6,400,000. As part of the BCP,

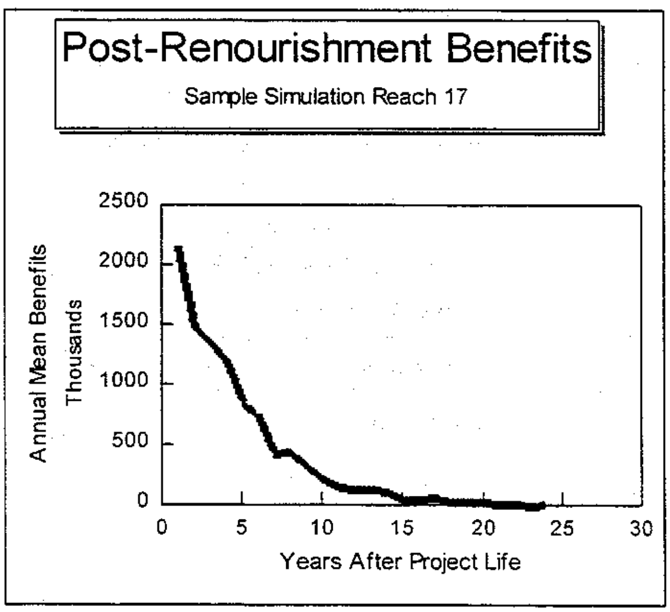


Figure 10

the probability of breach formation was evaluated for nine locations, four of which are within the limits of the current project. Although the BCP indicates annual probabilities of breach initiation as high as 20% in some locations, this analysis uses a maximum probability of breach formation of 10% to reflect the possibility of natural closure prior to implementing plans for closure. For areas with scheduled renourishment, a residual breach probability of 1.3% was used. In the Smith Point Park area sand stockpiles will be created for use at Old Inlet which will reduce closure costs by $2,900,000 due to the proximity of the stockpile. At other locations, breach closure savings will be negligible due to the larger magnitude of storm causing the breach and the possible need for stockpiled material in restoring design sections. Tables 11 and 12 provide summary calculations of the average annual cost of restoring barrier island breaches in accordance with procedures outlined in the BCP.

TABLE 11
Breach Contingency Plan
Average Annual Without Project Costs

Location	Cost/Closure	Annual Probability	Annual Cost
Old Inlet	$6,400,000	10%	$640,000
Water Island/Barrett Beach	$6,400,000	5%	320,000
Atlantique	$6,400,000	10%	640,000
Robert Moses	$6,400,000	2%	128,000
		Annual Cost Without Project	$1,728,000

TABLE 12
Breach Contingency Plan
Average Annual With Project Costs

Location	Cost/Closure	Annual Probability	Annual Cost
Old Inlet	$3,500,000	10%	350,000
Water Island/Barrett Beach	$6,400,000	1.3%	83,000
Atlantique	$6,400,000	1.3%	83,000
Robert Moses	$6,400,000	2%	128,000
		Annual Cost With Interim Plan	$644,000

298. **Recreation Benefits**. The plans were formulated based on storm damage reduction to the mainland structures. Storm damage reduction to the barrier island and recreation benefits are incidental, even though the beaches and environments of Fire Island provide an extraordinary range of living and recreation opportunities which are used by millions of visitors annually. These visitors are drawn to areas as diverse as the easily accessible Robert Moses State Park to wilderness areas of the Fire Island National Seashore.

299. The Unit Day Value (UDV) method has been used to determine a selected value under a with- and without-project scenario. With the use of guidelines established in ER 1105-2-100, (1990), points were assigned to various criteria. Once the total points for the with- and without-project condition were determined, the points were converted into dollar values in accordance with standard tables of general recreational values. The dollar values calculated for the with- and without-project condition are $5.96 and $5.57 per user day, respectively. Appendix D includes a more detailed description of the sources for these numbers. Given the travel cost associated with parking, ferry access and lodging, this procedure appears to provide a conservative estimate of the recreation unit value.

300. The dollar values determined in the UDV analysis were applied to annual use data under the with- and without-project scenario. The difference between the two estimated recreation values results in the recreation benefits for the project. Recreation benefits for the Interim Plan are based solely on visitors arriving aboard one of the public ferries and using beaches to be restored and nourished as part of the project. Under the without-project condition, the recreation value is estimated at 2,400,000 usage days at $5.57 per day, or $13,368,000. Under the with-project condition, the recreation experience is enhanced to $5.96 per day, which results in an annual recreation value of $14,304,000. Therefore, the recreation benefit resulting from implementation of the interim project is $936,000, the difference between the with- and without-project conditions.

301. **Summary of Damage and Benefits**. Based on the procedures described above, annual damages and benefits were calculated for conditions without-project; with the Interim Plan; and with the Modified Authorized Plan. A summary of the damages for the Interim Plan is shown in Table 13.

302. Project benefits were calculated based on comparison of annual damage and expenses under the with- and without-project conditions. Annual benefits are presented in Table 14.

TABLE 13 Fire Island Interim Protection Plan Summary of Annual Damages		
Damage Category	**Without Project Conditions**	**Interim Plan**
Damages		
Non-Shorefront Mainland Barrier	 $35,176,000 3,598,000	 $25,385,000 2,358,000
Shorefront	2,309,000	590,000
Subtotal	41,083,000	28,333,000
Breach Contingency Plan Costs	1,728,000	644,000
Total Damage	$42,811,000	$28,977,000

TABLE 14 Fire Island Interim Protection Plan Summary of Annual Benefits	
Damage Category	**Interim Plan Benefits**
Reduced Damages Over Project Life	
Non-Shorefront Mainland Barrier	$11,031,000 $9,791,000 $1,240,000
Shorefront	$1,719,000
Subtotal	$12,750,000
Increased Recreation Value	$936,000
Reduced BCP Costs	$1,084,000
Total Benefits During Project Life	$14,770,000
Post-Renourishment Benefits Amortized Over Project Life Mainland Barrier	 $6,122,000 $ 793,000
Total Benefits	$21,685,000

has been included to show that the benefits derived from the storm damage reduction to the barrier island are incidental for project justification.

Project Cost

303. **Introduction**. Cost estimates were developed for the selected Interim Plan alternative and the Modified Authorized Plan for economic comparison.

304. **Basis of Costs**. Cost estimates presented herein are based on February 1999 price levels. The unit prices were developed on the basis that construction procedures will be as follows.

305. Initial fill costs are based on the use of a medium size hopper dredge with pumpout capability (3,500 c.y. to 4,000 c.y. capacity) for placement of beach fill for the 17,000 LF western, and 7,000 LF eastern portions of the project area which are beyond the practical limitations of cutterhead dredge use, and on the use of a 30 inch hydraulic cutterhead dredge for the central 40,000 LF portion of the project placement within 3 miles of the borrow area to the west and within 4 miles of the borrow area to the east (with booster pump utilization). Renourishment fill costs for the Interim Plan are based on the use of only a medium size hopper dredge with a pumpout capability since nourishment placement quantities warrant only one plant. Included in the hopper dredge operation is a pumpout mooring barge located approximately 2,000 feet offshore. The location of the borrow area is shown on Figure 9. The required stockpiles will be constructed from hydraulically placed sand fill pumped directly to the stockpile sites. In order to develop detailed costs for the hydraulically placed sand, the shoreline length requiring improvement fill was segmented into 6 reaches to capture the cost differential of sand placement in the project area, based on dredge capability and pumping distance. Fill quantities are displayed in Tables 9 and 10.

306. **Real Estate Costs**. Real estate costs include the acquisition and relocation of one residential structure that is seaward of the improved dune line in addition to the administrative costs associated with obtaining easements.

307. **Estimated First Cost**. The estimated project first cost for the Interim and Modified Authorized Plans are $52,887,000 and $127,343,000, respectively, which include hydraulically placed design beach fill, advance nourishment fill, sand fence, dune grass, real estate, pertinent contingency, engineering and design, and construction management costs. Details of the first costs of the plan are shown in Table 15.

TABLE 15
TOTAL FIRST COST
FIRE ISLAND INTERIM STORM DAMAGE REDUCTION PROJECT
INTERIM PLAN (FEBRUARY 1999 PRICE LEVEL) - 6 YEARS

ACCOUNT CODE	DESCRIPTION	UANTITY	OM	UNIT PRICE	ESTIMATED AMOUNT	CONTINGENCY AMOUNT	CONTINGENCY PERCENT	TOTAL
01	Lands & Damages	1	LS		$422,600	$63,390	15%	$485,990
17	Beach Replenishment							
17.00.01	Mob./Demob.	1	LS		$1,394,070	$209,111	15%	$1,603,181
17.00.16	Pipeline Dredging							
17.00.16.01	Intrasite Mob./Demob.	1	LS		$452,729	$67,909	15%	$520,638
17.00.16.02	Hopper Dredge (Seg. 1)	287,633	CY	$5.85	$1,682,653	$252,398	15%	$1,935,051
17.00.16.03	Hopper Dredge (Seg. 2)	2,064,870	CY	$5.10	$10,530,837	$1,579,626	15%	$12,110,463
17.00.16.04	30" Hydraulic Dredge (Seg. 3)	2,859,172	CY	$3.93	$11,236,546	$1,685,482	15%	$12,922,028
17.00.16.05	30" Hydraulic Dredge (Seg. 4)	1,341,628	CY	$3.95	$5,299,431	$794,915	15%	$6,094,345
17.00.16.07	30" Hydraulic Dredge (Seg. 5)	579,262	CY	$4.94	$2,861,554	$429,233	15%	$3,290,787
17.00.16.08	Hopper Dredge (Seg. 6)	614,437	CY	$6.89	$4,233,471	$635,021	15%	$4,868,492
	Total	7,747,002	CY					
17.00.99	Associated General Items							
17.00.99.02	Dune Grass	39	ACR	$6,110.51	$238,310	$35,746	15%	$274,056
17.00.99.03	Sand fence	49,000	LF	$7.04	$345,075	$51,761	15%	$396,836
17.00.99.04	Environmental Features	1	LS		$600,000	incl		$600,000
30	Engineering & Design	1	LS		$3,680,000	$368,000	10%	$4,048,000
31	Construction Management	1	LS		$3,250,000	$487,500	15%	$3,737,500
	TOTAL				$46,227,276	$6,660,091		$52,887,367

308. **Contingency, Engineering, and Design and Construction Management**. Engineering and design costs include preparation of the feasibility report, plans and specifications, cultural and environmental pre-construction monitoring, the development of the PCA, and engineering during construction. Construction management costs are based on 6.7% of the construction costs. Pertaining to contingencies, 15% was applied to beach placement work to account for the possibility of additional fill quantities at the time of construction due to erosion between preparation of this document and construction. A 15% contingency was also applied to dune grass and sand fence to account for the variances in the beach profile at the dune location from a changing topography. For economic comparison purposes, a cost was included for interest during construction expenditures at a 6-7/8% annual interest rate over the 2 year construction period for the Interim Plan and a 3 year construction period for the Modified Authorized Plan.

309. **Annual Charges**. The estimate of annual charges for the Interim Plan is based on a project life of 6 years with an interest rate of 6-7/8%. The annual charges include the annualized first cost with interest during construction, annualized renourishment at a three year interval, major rehabilitation cost on an annualized basis to restore the design profile after major storm events beyond nourishment operations, annualized coastal and environmental monitoring, and annual dune and beach maintenance cost. The total annual cost for the Interim Plan is displayed in Table 16.

310. **Monitoring Costs**. Pre-construction and post-construction monitoring costs include coastal monitoring over the project life and environmental monitoring over the first four years of this project, as described in the monitoring section of the report. Annualized monitoring costs are shown in Table 16 for the Interim Plan.

311. **Major Rehabilitation**. Major rehabilitation fill volumes are included to account for impacts to the design profile from storm/hurricane events with frequencies less than 50% occurrence within the 3 year nourishment cycle. This translates to a 5 year storm and greater. Annual major rehabilitation costs are also presented in Table 16.

312. **Comparison of Plans**. The benefits, costs, and benefit cost ratios are presented in Table 17. Two separate benefit cost ratios are displayed in Table 17. The table clearly shows that the interim project is justified based upon mainland benefits alone, excluding benefits derived from storm damage reduction or increased recreation value on the barrier island. The mainland only BCR

TABLE 16 ANNUALIZED PROJECT COSTS FIRE ISLAND INTERIM STORM DAMAGE REDUCTION PROJECT		
FEATURE COST	INTERIM PLAN 6-YRS	MODIFIED PLAN 6-YRS
FIRST COST (a)	$52,887,000	$127,343,000
Interest During Construction (b)	$3,549,000	$13,242,000
Total Investment Cost	$56,436,000	$140,585,000
Annulized Total Investment Cost (c)	$11,794,000	$29,380,000
Annualized Nourishment Costs (d)	$3,025,000	$9,747,000
Major Rehabilitition Costs (e) (i)	$503,000	$811,000
Monitoring (f)	$693,000	$693,000
Berm Renourishment (g) (i)	$1,013,000	$490,000
Dune Maintenance (h)	$12,000	$30,000
TOTAL ANNUAL COST	$17,040,000	$41,151,000

Notes:
a. From Table 15

b. Based on 2-year construction time for interim plan and 3-year construction time for modified plan and 6 7/8 % interest rate.

c. Based on 6-yr project life for the interim plan and 6-yr life for the modified plan and 6 7/8 % interest rate.

d. Based on 6-year annualization at 6 7/8% interest throughout project life for:
(1) 6-year Interim plan at an average $4.60/cy for 2,802,754 cy., $406,424 mob&demob (1 dredge), 10% Contingency and 6% E&D, 7% S&A for a total $ 16,530,772 per operation.
(2) 6-year modiefied plan at an average $5.24/cy for 3,988,079 cy., $812,848 mob&demob (2 dredges), 10% Contingency and 6% E&D, 7% S&A for a total $ 26,986,005 per operation.

e. Cost based on trucking 15,000 cy/yr @$13.70/cy from stockpile and 15,000 cy/yr backpassed (or 30,000 cy every other year) @19.80/cy for the interim plan; and 59,200 cy/yr trucked @ $13.70/cy from the stockpile for the modified plan.

f. Based on $ 393,000/yr for coastal monitoring, and $ 300,000/yr for environmental monitoring for 6 years of monitoring for interim plan and for modified plan.

g. Cost based on trucking 45,000 cy/yr @$13.70/cy from stockpile and 20,000 cy/yr backpassed (or 40,000 cy every other year) @19.80/cy for the interim plan; and 35,800 cy/yr trucked @ $13.70/cy from the stockpile for the modified plan.

h. Dune Maintenance is the responsibility of the local sponsor. Estimated costs are $12,000/yr for the interim plan and $30,000/cy for modified plan and includes sand fence and dune grass repairs.

i. Major rehabilitation and berm renourishment costs which disperse sand from the stockpile and backpassing operations are part of total renourishment costs, supplementing the annualized nourishment cost (above) for dredging and placement of sand on the beach and supplying the stockpile.

TABLE 17

Benefit-Cost Comparison-Interim Plan

Annual Benefit*	$21,685,000
Annual Mainland Benefit*	$16,997,000
Annual Cost*	$17,040,000
Mainland	
Benefit Cost Ratio (BCR)	1.01
Net Annual Benefits	$95,000
Total	
Benefit Cost Ratio (BCR)	1.3
Net Annual Benefits	$4,783,000

*6-7/8 Discount Rate, 6 Year Project Life, Feb. 1999 Price Level

SELECTED INTERIM PROJECT

Selected Design

313. The interim project has been developed to provide remedial protection for six years, which is the estimated time period between the completion of initial construction of the interim project, and prior to implementation of the results of the fire Island Inlet to Montauk Point, NY Reformulation Study. The selected Fire Island Interim Plan is intended to reinforce the existing dune and berm system along approximately 40% of the island's 31 mile length, addressing essentially all of the developed areas, and the areas having a high breach potential. Restoring the natural protective features in these areas provides protection to the communities along Great South Bay and Fire Island. The design is intended to withstand the forces of a storm having a 44-year return period. Thus, areas whose island width and existing dune elevations are inadequate for protection against such a storm are considered to require fill to elevate dunes or protect existing dunes. Breach potential in the area of Old Inlet will be mitigated by use of a stockpile at Smith Point County Park. For the individual design reaches of Fire Island, the various protective measures are described below, summarized in Figure 5, and presented in detail in Plates 1-19 at the end of the main text. In addition to initial construction, the plan described herein also includes a single renourishment cycle.

314. **Design Reach 1 (Robert Moses State Park)**. Design Reach 1 extends from the east jetty at Fire Island Inlet, 26,700 feet to the eastern boundary of Robert Moses State Park. Development in the design reach consists of roads, parking areas and recreational facilities.

315. This design reach currently features a variable beach berm elevation providing protection from storms and long-term erosion. The island width along most of Design Reach 1 is adequate to protect against breaching, and provides a 44-year level of protection. However, the beach widths in the design reach are particularly variable, and there exists a central region where localized erosion has exposed the park roadway and parking areas and narrowed the island. For the interim project, fill placement is required between profiles 3 and 3B, which consists of a mile of shoreline protecting the public access road and parking to Robert Moses State Park. A minimum design berm of 90 ft. at elevation +9.5 ft. NGVD plus advance nourishment fill fronting the existing dune is necessary to provide protection.

316. **<u>Design Reaches 2 and 3 (Kismet to Davis Park)</u>**. Design Reach 2 extends from Kismet to Point O'Woods and includes 24,700 feet of Atlantic shoreline. This design reach includes the most highly developed areas of Fire Island. Development consists primarily of residential structures. Design Reach 3 includes the communities of Cherry Grove to Davis Park, covering 42,800 feet of coastline. This area is less developed than Design Reach 2. Design Reach 3 development also consists primarily of residential structures.

317. The existing berm width in these reaches is highly variable. Design Reaches 2 and 3 feature some of the lowest existing dunes on the island. Sections of the barrier island in design Reaches 2 and 3 are very narrow and are potential sites for breaching during severe storms. Therefore, the project layout calls for the construction of beach fill and dune (where necessary to provide the design level of protection) over the entire length of the reaches. The proposed dune protects against overtopping and breaching and reduces storm damage. The fill plan in the most vulnerable areas of Design Reaches 2 and 3 provides a minimum berm width of 40 ft. at elevation +11.5 ft. NGVD, fronting a dune of elevation +18 ft. NGVD. The fill plan for most of Design Reach 3 and the remainder of Design Reach 2 provides a berm width of 90 ft. at elevation +9.5 ft. NGVD, fronting a dune at elevation +15 ft. NGVD. These dimensions are measured from the baseline generally corresponding to the seaward toe of the existing dune. In areas of Reach 2 and Reach 3 greater sand volumes are required to provide a 44 year level of protection due to the increased vulnerability of the dune from very low landward elevations, and reduced dune width.

318. Due to the vulnerability of the shoreline in Design Reaches 2 and 3, sand losses are expected to be significant. To ensure the condition of the design profile, advance nourishment and renourishment fill will be added throughout the shoreline in these reaches. The renourishment will account for average erosion losses between placement and renourishment. Furthermore, to account for the variability in the loss rate over time and to provide material required for annual maintenance, a 140,000 cy stockpile at Point O'Woods will be used to mitigate against short-term (hot spot) erosion losses. Alongshore losses will increase sediment transport to adjacent Design Reach 1.

319. **<u>Design Reach 4 (Watch Hill to Moriches Inlet)</u>**. Design Reach 4 includes the Otis G. Pike Wilderness Area and Smith Point County Park and includes a total of 67,800 feet of Atlantic coastline. The design reach is generally undeveloped with the exception of parking areas and recreational facilities at the County Park.

320. The fill layout for Reach 4 does not include fill within the Otis G. Pike Wilderness Area but includes fill at Smith Point County Park which is intended to protect the existing public facilities. A minimum design berm of 90 ft. at elevation +9.5 ft. NGVD fronting the public facilities is recommended along with a 120,000 cy stockpile to renourish in Reach 4 and available for breach closure, as needed at Old Inlet. With generally moderate to high existing dune elevations, and moderate berm widths, a 44-year level of protection is provided, except at Old Inlet, where frequent overwashing and low beach elevations exist.

321. Renourishment. The proposed project includes a single renourishment. The renourishment operation will place material two years following the completion of the initial construction, consisting of approximately 2,709,000 cy of renourishment fill. The renourishment fill is expected to maintain the project design for four years. The fill performance will be monitored, and adjustments made in the planned renourishment cycle as needed, to account for timing, volume requirements, and the alongshore requirements for placement of fill. Based upon project monitoring, it is possible that renourishment fill could be placed along any area within the Fire Island Inlet to Moriches Inlet project area, excluding the Otis G. Pike Wilderness Area.

Real Estate Requirements

322. Real Estate requirements, including the lands, easements, relocations and rights-of-way needed to construct and maintain the proposed interim project are described below. The three types of easements required for the interim project include a perpetual beach nourishment easement, a perpetual dune easement, and a temporary work easement. Either a perpetual beach nourishment easement or a perpetual dune easement would be obtained along all areas where beachfill material is placed, or could be potentially placed, during renourishment operations, to allow continual access to construct, operate, maintain, patrol, repair, renourish, and replace the beach berm and dune. This easement precludes development, other than approved dune crossings and ensures that the design section, including 25 feet landward of the landward toe of the dune, would be held inviolate from future development. A temporary work area easement would be obtained to allow right of way in, over, and across the land for a period of three years for construction operations. The responsibility for the acquisition of the necessary lands and easements are a responsibility of the non-federal interests. New York State Law (Title 4, Chapter 7, sections 1531-1539 of the Unconsolidated Laws, requires that lands upon which beachfill is placed must be municipally owned, while lands upon

which dunes are erected may be privately owned with permanent easement granted to a municipality. In either case, the municipality holding either fee title or permanent easement to ~~the~~ project lands will be responsible for providing the easements described in this paragraph.

Public Access

323. Suitable public access is required for any areas where Federal expenditure of funds will be utilized for beach restoration. Analysis and acceptability of public access on Fire Island is complicated by the unique nature of the project area, including both the fact that the project area is largely within a national park, and that there is limited vehicular access to the majority of the area. Typically, public access analysis focuses on alongshore access relative to available parking areas. In the areas of Robert Moses State Park, and Smith Point County Park, the existing access clearly meets Federal and State Requirements. Within the boundary of FIIS, the existing public access has been established based upon the Fire Island National Seashore General Management Plan and EIS, which established a visitor usage pattern consistent with the park objectives (including low recreational usage areas). As the existing public access has been established by the NPS under its own EIS, the intent of the interim project is not to change the existing access, but to ensure that existing access is acceptable, recognizing the park objectives. Analysis of the existing public access, as detailed in the Public Access Plan, indicate that the area is equally accessible. Based upon review of the existing public access, and Federal and State requirements, existing public access is considered acceptable for the interim project.

Construction and Funding Schedule

324. The construction and pre-construction sequence and time schedule of the Interim Plan is given in Table 18. The schedule is based on the timeliness of this report's approval and allocation of funds by Congress, the foregoing construction procedures, and the ability of local interests to implements items of local cooperation. These items of local cooperation are principally the furnishing of offshore borrow easements by the State of New York as well as required shoreline real estate easements, and structure acquisition and relocation.

TABLE 18 CONSTRUCTION SCHEDULE	
Item	**Duration Months**
1. Report Approval	4/00
2. Record of Decision	6/00
3. Preparation & Approval of Plans & Specs	5/00 - 5/01
4. Review Real Estate Easements	1/01 - 8/01
5. Preconstruction Monitoring	5/00 - 11/01
6. PCA Executed	11/00
7. Advertise; Open, Evaluate & Review Bids	9/01 - 11/01
8. Construction	11/01 - 11/03

Monitoring

325. A monitoring program has been developed in order to improve the understanding of project functioning; in order to schedule nourishment operations; and in order to verify project impacts. The proposed monitoring program for the Fire Island Interim Project consists of coastal processes and biological monitoring.

326. **Coastal Process Monitoring**. The following descriptions detail the requirements of the coastal processes monitoring. There are three tasks within coastal processes monitoring: wave monitoring, fill and shoreline monitoring, and borrow area monitoring.

327. Wave Monitoring. Wave data will be collected by deployment of a directional wave gage, and by observations from shore. Directional wave data will be collected with the deployment of one pressure and velocity meter which will provide continuous data reporting for the project area. A directional wave gage will be relocated to Fire Island in 2000. This wave gage should remain in place for the 6 years of monitoring. Analysis will include information on the wave height and period, energy spectra, peak direction, mean current, and tidal elevation.

328. Fill and Shoreline Monitoring. The fill and shoreline monitoring includes beach profile surveys, aerial photography, sediment samples, and analysis of the data. 84 beach~~-profiles~~ (from the landward toe of the dune, to a depth of –30 feet) will be surveyed before and after initial fill placement and twice a year (spring and fall) throughout the project life. Post-storm profile surveys will also be conducted subsequent to all major storm events. Aerial photographic overflights of the project area will be performed pre-fill, immediately post-fill, and at the time of bi-annual beach profile measurement during years 1 through 2. During years 3 through 6, aerial photography will be performed once a year. Additionally, aerial photos will be taken subsequent to major storm events (estimated at one per year) for 6 years. Concurrently with profile surveys, sediment grab samples will be collected along 15 profile lines. This data will be analyzed to provide: profile volume change and shape readjustment, grain size statistics of native and fill material, and maps of successive shorelines.

329. Borrow Area Monitoring. Borrow area monitoring, with hydrographic surveys, is used to determine borrow site in-filling rates, and to assess potential borrow reusability. In addition, vibracores and a sub-bottom survey will be taken to determine type and quantity of sediment underlying dredged areas. Hydrographic surveys, including GPS locations, of the borrow area will be taken before dredging and immediately after dredging, for initial construction and renourishment operation. These will be compared to determine the borrow area in-filling rate. Subbottom surveys using a bottom penetrating acoustic device will be taken after initial dredging and in year 6 of monitoring. These will be used to determine type and quantity of sediments available at greater depth. Sediment cores will be taken prior to the first nourishment cycle in those areas which were dredged to determine the composition of the in-filling material and to help quantify volumes of in-filling. At this time, ten 20-foot long cores are proposed. Actual number, length and location of cores will be decided based on bathymetric and seismic surveys performed in year 3 of monitoring. During construction the Corp will employ a real-time monitoring methodology using Global Positioning System (GPS) to locate the position of the dredge. GPS will also be used to facilitate comparison of pre- and post-construction ecological monitoring data sets.

330. **Environmental Monitoring**. The environmental monitoring is primarily undertaken in order to support the impact assessment contained within the EIS. The environmental monitoring component consists of monitoring of the offshore borrow area for impacts to the benthic resources, and placement area for impacts to the endangered species known to utilize the area. In addition to

providing baseline information to assist in the evaluation of impacts to the project area, the data will be used to provide a comparison with other data that have been collected by the Corps.

331. Offshore Ecological Borrow Area Monitoring. Monitoring of the offshore borrow area consists of benthic macroinverterbrate grab samples, surf clam trawls, and demersal finfish trawls. Benthic invertebrate sampling will be undertaken utilizing the Smith-Mac (or equivalent) grab. Thirty (30) benthic grab samples will be taken twice annually (spring and fall), both pre- and post-construction, in order to verify the benthic recovery discussed in the attached DEIS within the disturbed borrow area. Similarly, to determine presence or absence of surf clams, surf clam trawls, utilizing NYSDEC approved protocol, will be taken prior to construction and three years after construction. Demersal finfish trawls will be undertaken monthly, pre-construction and if needed post-construction, in order to determine usage, and relative impacts associated with borrow area dredging. Finfish sampling will also include stomach content analysis on selected species. The exact details of the borrow area monitoring plan will be refined based upon further consultation with the resource agencies.

332. Placement Area Endangered Species Monitoring. Threatened and endangered species of concern within the placement area include the piping plover, least tern, and seabeach amaranth. Endangered species monitoring will consist of observations during the shorebird breeding season and Seabeach amaranth growing season to verify the impacts anticipated as part of the proposed project. Details of the endangered species monitoring will be further coordinated with the resource agencies, particularly through Endangered Species Act consultation.

RELATIONSHIP TO OTHER PLANS

Authorized Plan Comparison

333. The Interim Plan is similar to the Authorized Plan in that it is a beach fill plan which would provide storm damage protection to the barrier island and mainland areas. The Interim Plan is, as its name suggests, a storm damage protection plan for the Fire Island area that will provide an interim protection until the Fire Island to Montauk Point Reformulation Study is complete, and the results potentially implemented. The plan will provide immediate storm damage reduction to areas which are imminently threatened.

334. The Interim Plan offers a solution for reduction of storm damage, which can be abandoned if determined to be unacceptable, or complemented with additional features to create a more permanent solution, such as the originally authorized project. The reformulation effort will evaluate the optimum project configuration. The recommended Interim Plan deviates from the Authorized Plan as shown in Table 19.

TABLE 19

Comparison of Interim and Authorized Plan
(For Interim Plan - 26 Mile Project Length)

Item	Authorized Plan	Interim Plan
Berm Height (ft. NGVD)	14	9.5 or 11.5
Berm Width (ft.)	100	90 or 40
Dune Height (ft. NGVD)	20	15 or 18
Dune Width (ft.)	25	25
Beach Fill Length (ft.)	123,400	59,900
Beach Fill Slope	1V on 20H	1V on 15H onshore 1V on 30H offshore

Relationship to NED

335. Since the concept of an interim plan is to provide an acceptable short term level of protection within the framework of a long-term solution, the plan formulation did not seek to optimize the level of protection. The project assessment considered both the proposed interim solution and some longer term, comprehensive solution. Comparing the reliability and economic performance of the two plans will provide insight into whether the Interim Plan is consistent with National Economic Development (NED) Planning Criteria. As described in ER 1105-2-100, the upper limit of Federal support is normally defined by the plan which reasonably maximizes NED benefits over costs. While the intent of this analysis is not to specifically identify the NED plan, if the analysis indicates that some larger plan provides higher net benefits than the interim improvements, it is reasonable to infer that the Interim Plan does not exceed the limit for Federal participation. Accordingly, in addition to the Interim Plan, the analysis of costs and benefits has considered an upgraded design level which is a modification of the Authorized Plan. These design modifications consist of revising the design slope of the beachfill from 1:20 to match the existing slopes of 1:15 onshore and 1:30 offshore, and reducing the design berm elevation from 14 feet NGVD to 11.5 feet or 9.5 feet NGVD. Based on the procedures ~~described previously~~, annual costs and benefits were calculated for conditions without-project; with the Interim Plan; and with the Modified Authorized Plan. These costs and benefits were estimated for a project life of 6 years.

336. Table 20 compares the annual costs and benefits of the Interim Plan and the Modified Authorized Plan. The Modified Authorized Plan was selected for comparison since it represents a constructable design which provides a greater level of protection. The table shows that the selected plan is of less magnitude and provides less net benefits than the Modified Authorized Plan. These results indicate that the selected plan has not reached optimization, thus indicating that a higher level of protection would yield the National Economic Development (NED) Plan. Accordingly, the Interim Plan does not exceed the limits of Federal participation.

TABLE 20 Benefit-Cost Comparison Interim Plan and Modified Authorized Plan		
	Interim Plan	**Modified Authorized Plan**
Annual Benefit*	$21,685,000	$66,931,000
Annual Cost*	$17,040,000	$41,151,000
Benefit Cost Ratio (BCR)	1.3	1.6
Net Annual Benefits	$4,783,000	$25,780,000
*6-7/8 Discount Rate, 1999 Price Level		

PROJECT COORDINATION

337. In the development of the Interim Plan, extensive coordination has been underway for approximately five years to develop a project that is locally acceptable and mutually agreeable with the National Park Service, Fire Island National Seashore (NPS-FIIS). Concurrent with project scoping for the EIS, the U.S. Department of the Interior, including U.S. Fish and Wildlife Service, and NPS-FIIS were requested to be cooperating agencies. These agencies agreed to be cooperating agencies, indicating that their involvement would be limited to review of pertinent sections of the report. Subsequent to project scoping, further meetings were held in June 1998 with the involved agencies to detail the scope of the EIS, focusing on the alternatives to be contained within the analysis, and the extent of environmental analysis to be included. The outcome of the meeting was an outline to be utilized in the preparation of the DEIS. Additional meetings were held in October and November 1998 with the involved agencies to develop a project duration that achieves the project objectives and an analysis approach consistent with the duration discussed. Generally, the outcome of these discussions has been that the Corps would present a report with a selection of a project of a minimum duration (6 years) in order to achieve project objectives. Additional discussions have been held with the involved agencies to present and clarify the proposed plan configuration. Meetings in March 1999 focused on measures to address development concerns as

a result of the project, and measures which can be incorporated into the project design for vehicular access. Additionally, these meetings provided clarification on the existing policies governing ~~work~~ within the Federal tracts of land on Fire Island. The result of this coordination has been 1) NYSDEC clarification that the proposed project would not result in a change in the Coastal Erosion Hazard Areas Act line, 2) inclusion of dune vehicle crossing features, and 3) reconfiguration of the plan alignment to reduce fill within the major federal tracts of land, and recognition of the policies regarding fill within these areas. Prior to release of this report, the report and DEIS were provided to the cooperating agencies for comment. Revisions in response to these comments have been incorporated and are reflected herein. Coordination regarding additional development controls is continuing. The extent of documented coordination to date is summarized in the pertinent correspondence section (Appendix A).

338. In accordance with the National Environmental Policy Act, a DEIS accompanies this report. Coordination with agencies has occurred. The EIS will be completed following full coordination with, but not limited to the following agencies:

National Park Service

U.S. Department of the Interior-Office of Environmental Policy and Compliance

U.S. Fish and Wildlife Service

U.S. Environmental Protection Agency

National Marine Fisheries Service

New York State Department of Environmental Conservation

New York State Department of State Coastal Zone Management Program

New York State Office of Parks, Recreation and Historic Preservation (SHPO)

Suffolk County Executive

Towns of Islip and Brookhaven

Villages of Saltaire and Ocean Beach

339. A Section 404 (b)(1) evaluation has been prepared in order to obtain a Water Quality Certificate (WQC) from the NYSDEC (see DEIS Appendix C). A Consistency ~~Determination~~, exhibiting the proposed project's compliance, has been prepared for review to document consistency with New York's Coastal Management Program administered by the Department of State (see DEIS Appendix D).

LOCAL COOPERATION

340. The local sponsor for this project is the New York State Department of Environmental Conservation (NYSDEC). They have expressed support for the project by a letter dated November 30, 1999. A draft Project Cooperation Agreement (PCA) will be prepared which identifies the responsibilities of the Federal Government and the non-Federal sponsor. Upon approval of this document, including all supporting environmental documentation, the New York District will fully coordinate the PCA with the sponsor to ensure timely execution of the PCA. The non-Federal sponsor shall be required to:

a. Provide 35 percent of initial project costs assigned to hurricane and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and 35 percent of periodic nourishment costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and as further specified below:

(1) Provide, during construction, funds needed to cover the non-federal share of design costs;

(2) Provide all lands, easements, and rights-of-way, and perform or ensure the performance of any relocations determined by the Federal Government to be necessary for the initial construction, periodic nourishment, operation, and maintenance of the project;

(3) Provide, during construction, any additional amounts as are necessary to make its total contribution equal to 35 percent of initial project costs assigned to hurricane and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits and 35 percent of periodic nourishment costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits;

b. For so long as the project remains authorized, operate, maintain, and repair the completed project, or functional portion of the project, at no cost to the Federal Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

c. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall relieve the non-Federal sponsor of responsibility to meet the non-Federal sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance;

d. Hold and save the United States free from all damages arising from the initial construction, periodic nourishment, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors;

e. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments in 32 Code of Federal Regulations (CFR) Section 33.20;

f. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended, 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the non-Federal Sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

g. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

h. Agree that the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and to the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;

i. If applicable, comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

j. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army, and Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of flood plain management plans;

k. Provide 35 percent of initial project costs assigned to hurricane and storm damage reduction plus 100 percent of initial project costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits, 35 percent of periodic nourishment costs assigned to hurricane and storm damage reduction plus 100 percent of periodic nourishment costs assigned to protecting undeveloped private lands and other private shores which do not provide public benefits, and 35 percent of the costs of that portion of total historic preservation mitigation and data recovery costs attributable to hurricane and storm damage reduction that are in excess of 1 percent of the total amount authorized to be appropriated for hurricane and storm damage reduction;

l. Participate in and comply with applicable Federal floodplain management and flood insurance programs;

m. Within 1 year after the date of signing a project cooperation agreement, prepare a floodplain management plan designed to reduce the impact of future flood events in the project area. The plan shall be prepared in accordance with guidelines developed by the Federal Government and must be implemented not later than 1 year after completion of construction of the project;

n. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder future periodic nourishment and/or the operation and maintenance of the project;

o. Not less than once each year, inform affected interests of the extent of protection afforded by the project;

p. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain, and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project;

q. For so long as the project remains authorized, the non-Federal sponsor shall ensure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based;

r. Provide and maintain necessary access roads, parking areas, and other public use facilities, open and available to all on equal terms;

s. At least twice annually and after storm events, perform surveillance of the beach to determine losses of nourishment material from the project design section and provide the results of such surveillance to the Federal Government, the exact nature of which will be defined in the OMRR&R manual;

t. Do not use federal funds for its required cost share for the project, unless the federal granting agency confirms in writing that such use of the federal funds is explicitly authorized by statute;

u. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

CONCLUSIONS

Summary

341. The Fire Island Inlet to Montauk Point, NY authorized project is currently being reformulated to account for changed conditions and current policy as well as consideration of all coastal, economic and environmental factors for a wide array of alternatives. The reformulation effort is intended to be a long term (50-year) solution to the erosion and storm damage potential facing the 83 mile long shoreline from Fire Island Inlet to Montauk Point. In the interim, a temporary (6-year) measure of protection is necessary to reduce the storm damage potential for Fire Island and the mainland of Long Island. Erosion has reduced the height and width of the Fire Island primary dunes with consequent increased exposure of the mainland shore to storm damage as a direct result of storm recession and overtopping.

342. The analysis presented in this report indicates that federal interest is established in the construction of an interim plan for storm damage protection for the project area on the basis that the beneficial effect exceeds the costs of the project and any possible adverse effects.

343. The tentatively selected plan, as described in the "Selected Interim Project" Section, complies with federal and state policy and regulations and could be incorporated into a larger comprehensive plan for Fire Island to Montauk Point. In light of the overall public interest, the proposed action has been reviewed and evaluated, and the views of the State of New York and other interested agencies and the concerned public, relative to the various practicable alternatives for storm damage protection from Fire Island Inlet to Moriches Inlet, have been solicited. The possible consequences of alternatives have been evaluated for engineering feasibility, economic effects and environmental impacts.

Cost Apportionment

344. The analyses conducted for this report indicate that the selected plan is justified based on the benefits provided by storm damage reduction. The project as authorized calls for cost sharing of 65% Federal and 35% non-Federal (Table 21). This cost sharing percentage applies to the initial cost of construction as well as the subsequent periodic nourishment.

345. The non-Federal sponsor shall be responsible for the acquisition costs of all real estate necessary for implementation of this project, which is currently estimated to be $486,000. However, the sponsor shall be credited for these costs, which will be credited against the non-Federal cash amount. The development of the real estate cost estimate is shown in the Real Estate Plan (See Appendix G). Dune grass planting and sand fencing have been included as a project cost which shall be cost shared at the same percentage as the project costs. Beach and dune maintenance is a non-Federal responsibility. Costs associated with emergency beach rehabilitation, above the normal periodic nourishment required for the project shall be cost shared as nourishment, not maintenance.

346. Based on the above, the cost sharing for the first cost of the project is shown below, based on the estimated total first cost of $52,887,000. These costs do not include interest during construction, which is used only for purposes of economic analysis.

TABLE 21
Interim Plan Cost Apportionment
1999 Price Level, 6.875% Discount Rate

	Federal Share	Non-Federal Share	Total
Initial Cost	$34,377,000	$18,024,000	$52,401,000
LERRD		$486,000	$486,000
Total First Cost	$34,377,000	$18,510,000	$52,887,000
Annual Periodic Nourishment	$1,966,000	$1,059,000	$3,025,000
Annual Major Rehabilitation Costs	$327,000	$176,000	$503,000
Annual Monitoring Costs	$450,000	$243,000	$693,000
Annual Berm Nourishment Costs	$658,000	$355,000	$1,013,000
Annual Dune Maintenance		$12,000	$12,000

RECOMMENDATIONS

Prefatory Statement

347. In making the following recommendations, I have given consideration to all significant aspects of this study as well as the overall public interest in protective measures for the Fire Island Inlet to Moriches Inlet Reach of the Fire Island Inlet to Montauk Point Project. The aspects considered include engineering feasibility, economics effects, environmental impacts, social and legal concerns and compatibility of the project with the policies, desires, and capabilities of the state, federal and other interested parties.

348. The interim project has been developed to serve as a bridge of the time gap until the outcome of the Reformulation Study, and the implementation of any potential recommended project. It should not be construed to be the permanent solution to the area that the Corps of Engineers could recommend for a long term project. The Interim Plan provides a greater level of protection to the barrier island and mainland shore in the project area than currently exists.

Recommendations

349. I recommend that the plan selected herein be constructed as an increment of construction of the authorized project for beach erosion control for Fire Island Inlet to Montauk Point, New York, as authorized by the River and Harbor Act of 1960, subsequently modified by the River and Harbor Act of 1962, and the Water Resources Development Acts of 1974 and 1986. I make this recommendation based on my findings that the selected plan constitutes a justified increment of construction within the limits of Federal participation; that all features are common components of a final NED plan configuration; none of the components or overall placement precludes continuation of construction of beachfill alternatives up to the authorized project level or any other currently conceived NED configuration which may result from the reformulation; and that this plan provides a solution in the critical erosion areas on Fire Island which shall be modifiable through change, continuation, or further increment of construction upon completion and approval of the Reformulation Study. I also recommend Federal participation in up to 6 years of nourishment of the project to provide interim protection to the project until completion, approval and potential

implementation of recommendations of the Reformulation Study. These recommendations are made with such further modifications thereof, as in the discretion of the Chief of Engineers may be advisable, at a first cost to the United States estimated at $34,377,000 (February 1999 price levels), provided that non-Federal interests comply with all the requirements substantially in accordance with the draft Project Cooperation Agreement which will be prepared upon approval of this report.

Disclaimer

350. The recommendations contained herein reflect the information available at this time and current Department of the Army policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and/or implementation funding.

William H. Pearce,

Colonel, Corps of Engineers

District Engineer

References

Abel, C.E., Tracy, B.A., Vincent, C.L., and Jensen, R.E. 1989. "Hurricane hindcast methodology and wave statistics for Atlantic and Gulf hurricanes from 1956-1975," Wave Information Studies Report 19, US Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Andrle, R.F. and J. Carroll. 1988. "The Atlas of Breeding Birds in New York State". Cornell University Press, Ithaca, New York.

Berg, Dan. 1992. "Long Island Shore Diver: A Diver's Guide to Long Island, New York Beach Diving Sites", Aqua Explorers Publications, East Rockaway, New York.

Birkemeier, W.A., Savage, R.J., and Leffler, M.W. 1988. " Collection of storm erosion field data," Miscellaneous Paper CERC-88-9, US Army Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

"Bypass System to be Tested at Shinnecock," Coastal Reports dated Jan.-Feb. 1977.

Cialone, M.A., Mark, D.J., Chou, L.W., Leenknecht, D.A., Davis, J.E., Lillycrop, L.S., Jensen, R.E. 1992. "Coastal Modeling System (CMS) User's Manual," Instruction Report CERC-91-1, US Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Dolan Research, Inc. 1998. "Research on Shipwrecks in the Near Shore Area, Fire Island to Montauk Point, Long Island, Suffolk County, New York, Reach 1: Interim Project, Fire Island Inlet to Moriches Inlet." Prepared in association with the Greeley-Polhemus Group, Inc. Prepared for the U.S. Army Corps of Engineers, New York District.

Downer, R. and C. Leibelt. 1990. 1989 "Long Island Colonial Waterbird and Piping Plover Survey". The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

Governor's Coastal Erosion Task Force (GCETF). 1994. "Final Report," New York.

Gravens, M.. 1999. "Periodic Shoreline Morphology, Fire Island, New York", Coastal Sediments '99, pp. 1613-1626.

Holland, F. Ross. 1989. "Great American Lighthouses". Great American Places Press. The Preservation Press, Washington, D.C.

Jack McCormick and Associates. 1975. "Environmental Inventory of the Fire Island National Seashore and the William Floyd Estate, Suffolk County, New York", Submitted to the National Park Service, U.S. Department of the Interior, Denver Service Center, Denver, Colorado.

Jarrett, J. T. 1976. "Tidal Prism-Inlet Area Relationship," GITI Report No. 3, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

John Milner Associates. 1998. "Cultural Resources Study, Fire Island Inlet to Montauk Point, Suffolk County, New York, Reformulation Study: Phase I Archaeological Survey ~~Volumes I and~~ II." Prepared in association with the Greeley Polhemus Group, Inc. Prepared for the U.S. Army Corps of Engineers, New York District.

Kana, Timothy W. and Ram Krishnamohan. 1994. "Assessment of the Vulnerability of the Great South Bay Shoreline to Tidal Flooding." Prepared for New York Coastal Partnership, Babylon, NY.

Kraus, N.C., and Wise, R.A. 1993. "Simulation of January 4, 1992 Storm Erosion at Ocean City, Maryland," Shore and Beach, (62)1, pp. 34-41.

Kriebel, D.L. 1984a. "Beach erosion model (EBEACH) users manual, Volume 1: Description of computer model, beaches and shores technical and design memorandum No. 84-5-I, Division of Beaches and Shores", Florida Department of Natural Resources, Tallahassee, FL.

Kriebel, D.L. 1984b. "Beach erosion model (EBEACH) users manual, Volume II: Theory and Background", beaches and shores technical design memorandum No. 84-5-II, Division of Beaches and Shores, Florida Department of Natural Resources, Tallahassee, FL

Kriebel, D.L., and Dean, R.G. 1985. "Numerical simulation of time-dependent beach and dune erosion," 19th International Coastal Engineering Conference. ASCE, Vol. 9, pp 221-245.

Larson, M. and Kraus, N.C. 1989a. "SBEACH: Numerical model for simulating storm-induced beach change," Report 1: Empirical foundation and model development, Technical Report CERC-89-9, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Larson, M., and Kraus, N.C. 1989b. "Prediction of Beach Fill Response to Varying Waves and Water Levels," Proceedings, Coastal Zone '89, American Society of Civil Engineers, pp. 607-621.

Larson, M., Kraus, N.C. and Byrnes, M.R. 1990. "SBEACH: Numerical model for simulating storm-induced beach change," Report 2: Numerical Formulation and Model Tests, Technical Report CERC-89-9, US Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Leatherman, S.P. and Allen, J.R. 1985. "Geomorphic Analysis Fire Island Inlet to Montauk Point, Long Island, New York Reformation Study," Final Report for USACE NY District.

Maclean, D., et al. 1988. 1987. Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

McCluskey and Nordstrom . 1985. "The Effects of Houses and Sand fences on the Eolian Sediment Budget at Fire Island, New York", Journal of Coastal Research.

Moeller, H. W. and Murphy, R.J. 1978. "Cultural Resources Reconnaissance in Moriches Inlet Navigation Project." Report on file at the U.S. Army Corps of Engineers, New York District, Environmental Analysis Branch.

National Marine Fisheries Service. 1992. Correspondence to CENAN-PL-E. United States Department of Commerce.

National Marine Fisheries Service. 1993. "Status of the Fishery Resources off the Northeastern United States for 1992," United States Department of Commerce.

National Park Service. 1994. Inventory of Historic Light Stations. National Maritime Initiative, U.S. Department of the Interior, National Park Service, History Division. Washington, D.C.

National Park Service, US Department of the Interior.1988. Management Policies.

National Research Council. 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press. Washington, D.C.

New York State, Department of State. 1987. "Significant Coastal Fish and Wildlife Habitats in Nassau and Suffolk Counties," 16 February.

New York State. Department of State, Division of Coastal Resources and Waterfront Revitalization and The Nature Conservancy. 1991. "(Draft) Long Island's Beach-Nesting Shorebird Habitat: Protection and Management of a Vulnerable Resource."

New York State. Department of State. 1995. "Governor's Coastal Erosion Task Force, Final Report, Volume One, Emergency Response to Coastal Storms".

Ocean Seismic Survey, Inc. 1983. "Development of Borrow Areas for South Shore Long Island, New York."

Pickman, Arnold . 1993. "Cultural Resources Reconnaissance Atlantic Coast of Long Island. Jones Inlet to East Rockaway Inlet, Long Beach Island, Nassau, County, New York." Report on file at the U.S. Army Corps of Engineers, New York District, Environmental Analysis Branch.

Paper presented at the Public Archaeologists of New York City (PANYC) Symposium on Environmental Reconstruction. 1994. "Considerations in the Evaluation of Possible Submerged Prehistoric Site Locations."

Prater, M.D., Hardy, T.A., Butler, H.L, and Borgman, L.E. 1984. "Estimating error of coastal stage frequency curves," 19th International Conference on Coastal Engineer. ASCE, Houston, TX, 3-7 September, 1984.

Reiss, Warren. 1993. "Atlantic Coast of New York City, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay, New York, Section 934 Study Borrow Areas 1A and B Remote Sensing Survey." Report on file at the U.S. Army Corps of Engineers, New York District, Environmental Analysis Branch.

Reiss, Warren. 1996. Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, Fire Island to Moriches Inlet Interim, Suffolk County, New York. Prepared by Moffatt and Nichol, Engineers, in affiliation with Ocean Surveys, Inc. Prepared for the U.S. Army Corps of Engineers, New York District.

Rosati, J.D., Wise, R.A., Kraus, N.C., and Larson, M. 1993. "SBEACH: Numerical model for simulating storm-induced beach change," Report 3: User's manual, Instruction Report CERC-93-2, U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS.

Schwab, W., Thieler E., Allen, J., Foster, D., Swift, A., Denny, J., and Danforth, W., 1999. "Geologic Mapping of the Nearshore Area Offshore Fire Island, New York", Coastal Sediments '99, pp. 1552-1567.

U.S. Army Corps of Engineers, New York District, North Atlantic Division. 1995. Fire Island to Montauk Point Long Island, New York, Breach Contingency Plan, Executive Summary and Environmental Assessment, August.

U.S. Army Corps of Engineers, New York District. 1989. "Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York," Reconnaissance Report, March.

U.S. Army Corps of Engineers, New York District. 1958. "Cooperative Beach Erosion Control and Interim Hurricane Study of the Atlantic Coast of Long Island, New York, Fire Island to Montauk Point."

U.S. Army Corps of Engineers, New York District. 1963. Report on Storm of 6-8 March 1962.

U.S. Army Corps of Engineers, 1963b. Report on Operation Five-High, Disaster Recovery Operations from 6-8 March 1962 Storm Under Public Law 875, 81ST Congress. North Atlantic Division.

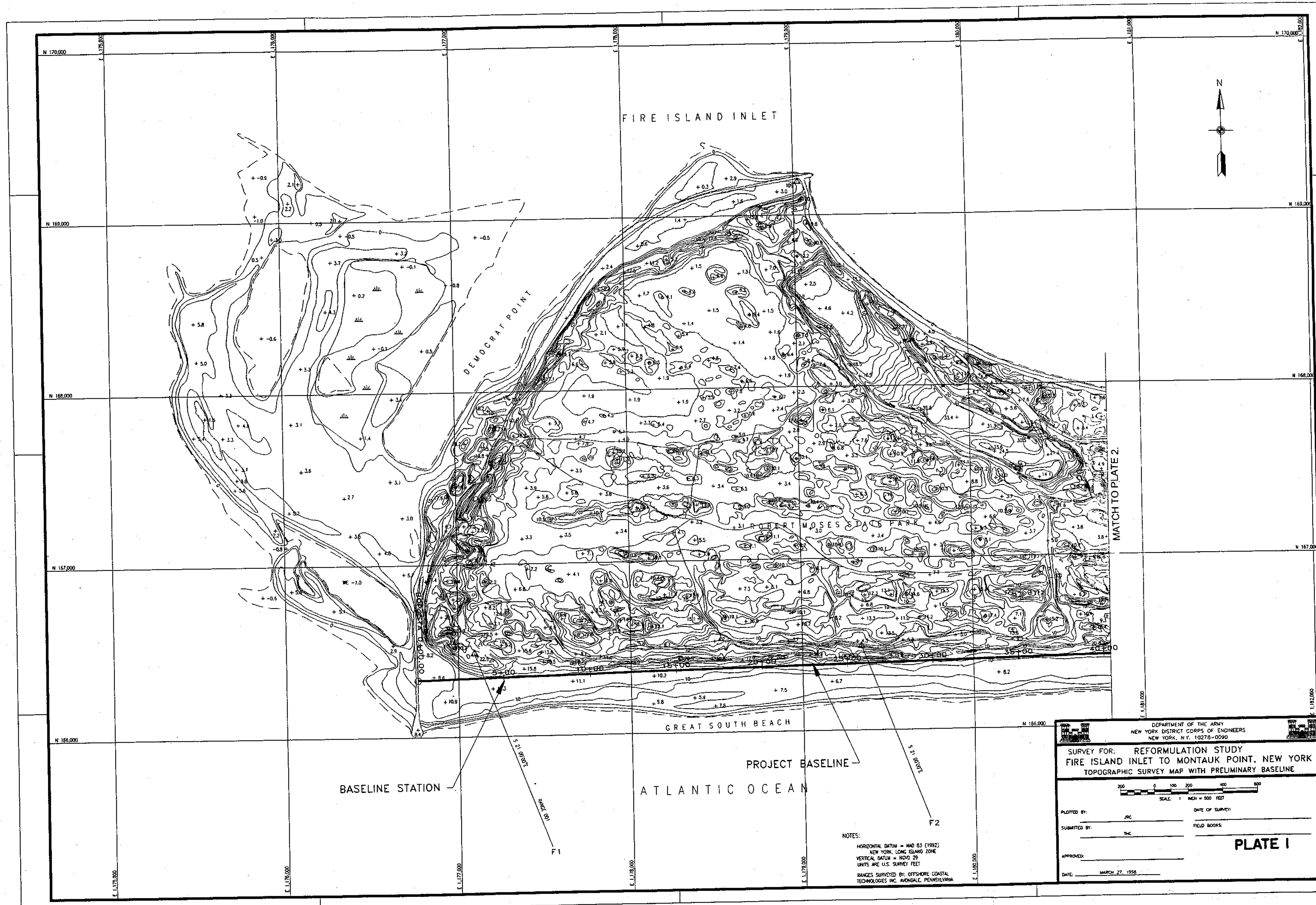
United States Army Corps of Engineers. 1977. Fire Island Inlet to Montauk Point, New York Beach Erosion Control and Hurricane Protection Project. Final Environmental Impact Statement. New York District.

United States Army Corps of Engineers. 1980. Fire Island Inlet to Montauk Point, New York: Beach Erosion Control and Hurricane Protection Project. Supplement No. 2 to ~~General~~ Design Memorandum No. 1 Moriches to Shinnecock Reach. New York District.

Wise, R.A., and Kraus, N.C. 1993. "Simulation of Beach Fill Response to Multiple Storms, Ocean City, Maryland," Proceedings, Coastal Zone '93, American Society of Civil Engineers, in press.

Wise, R.A. and Kraus, N.C. 1993b. "Simulation of overwash in dune erosion models," J. Waterway, Port, Coastal and Ocean Energy, submitted.

Woodhead, P.M.J. and McEnroe, M. 1991, "A Report on Task 5.1 of the NY-NJ Harbor May 1996 Estuary Program: Habitat Use by the Finfish Community," SUNY at Stony Brook.


FIRE ISLAND INLET
DEMOCRAT POINT
ROBERT MOSES STATE PARK
GREAT SOUTH BEACH
ATLANTIC OCEAN
MATCH TO PLATE 2.
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BASELINE STATION
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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
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TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET
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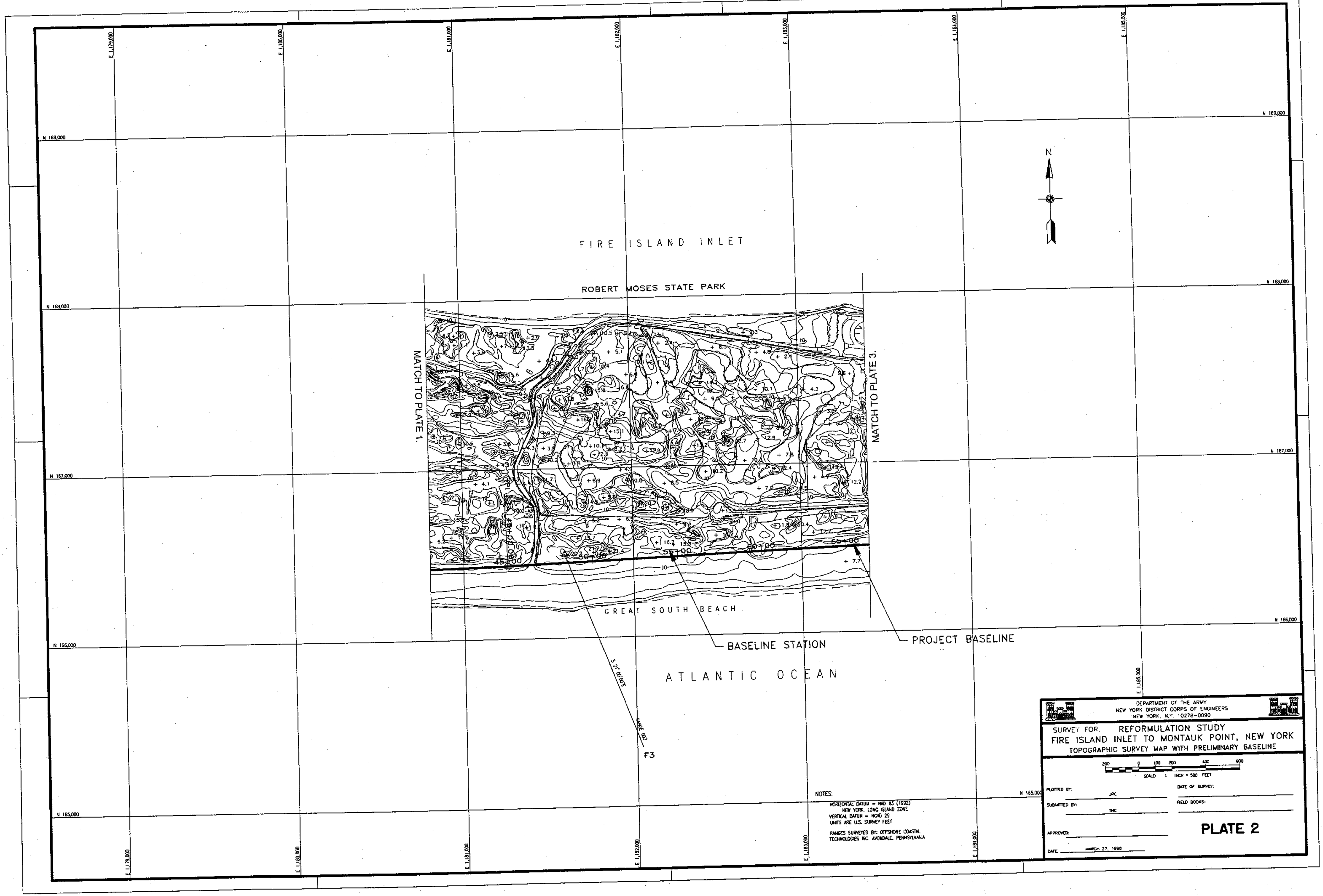
SUBMITTED BY: THC
APPROVED:
DATE: MARCH 27, 1998
DATE OF SURVEY:
FIELD BOOKS:
PLATE I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ROBERT MOSES STATE PARK
MATCH TO PLATE 1.
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GREAT SOUTH BEACH
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VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA
DEPARTMENT OF THE ARMY
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NEW YORK, N.Y. 10278-0090
SURVEY FOR. REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 500 FEET
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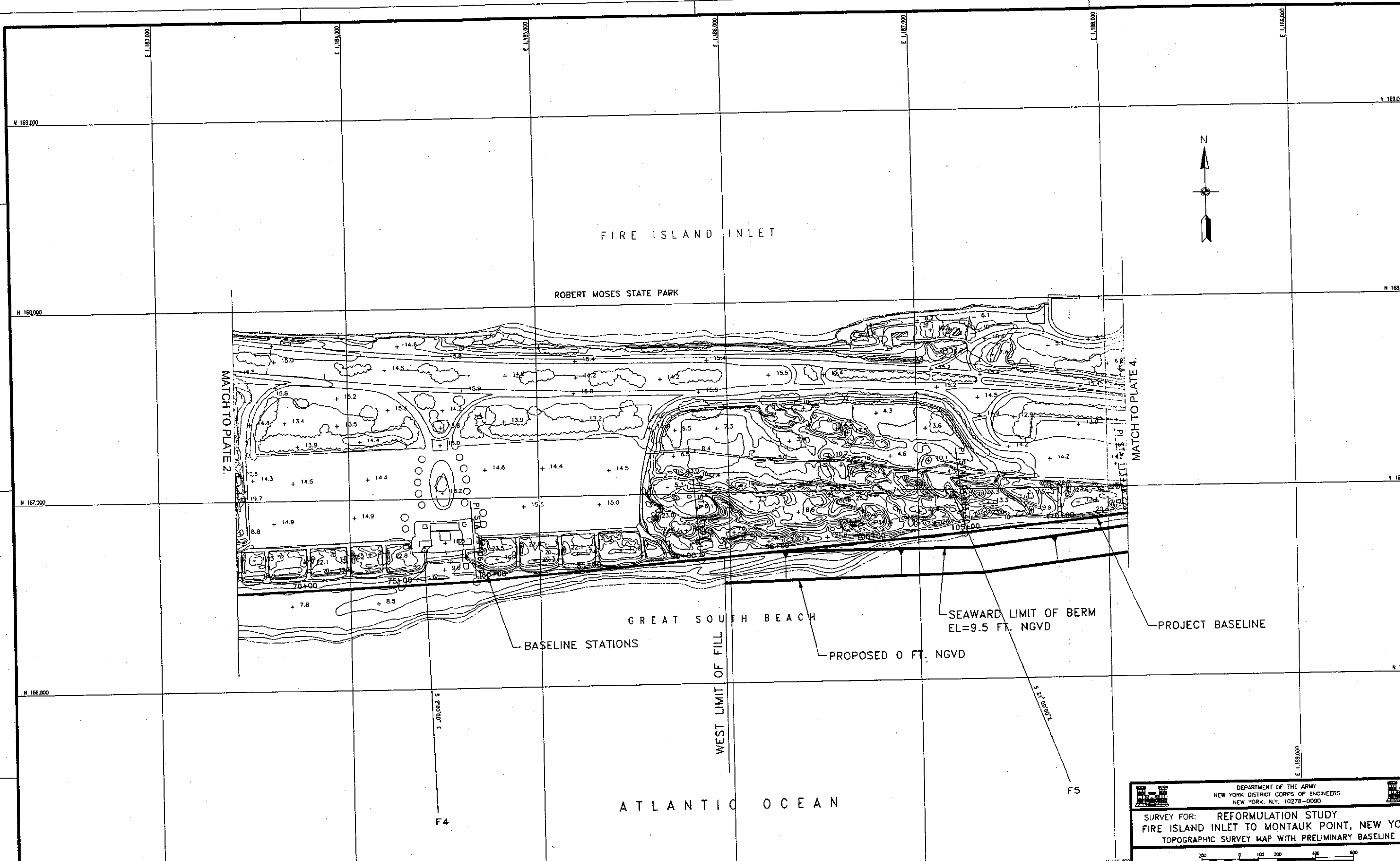
PLATE 2



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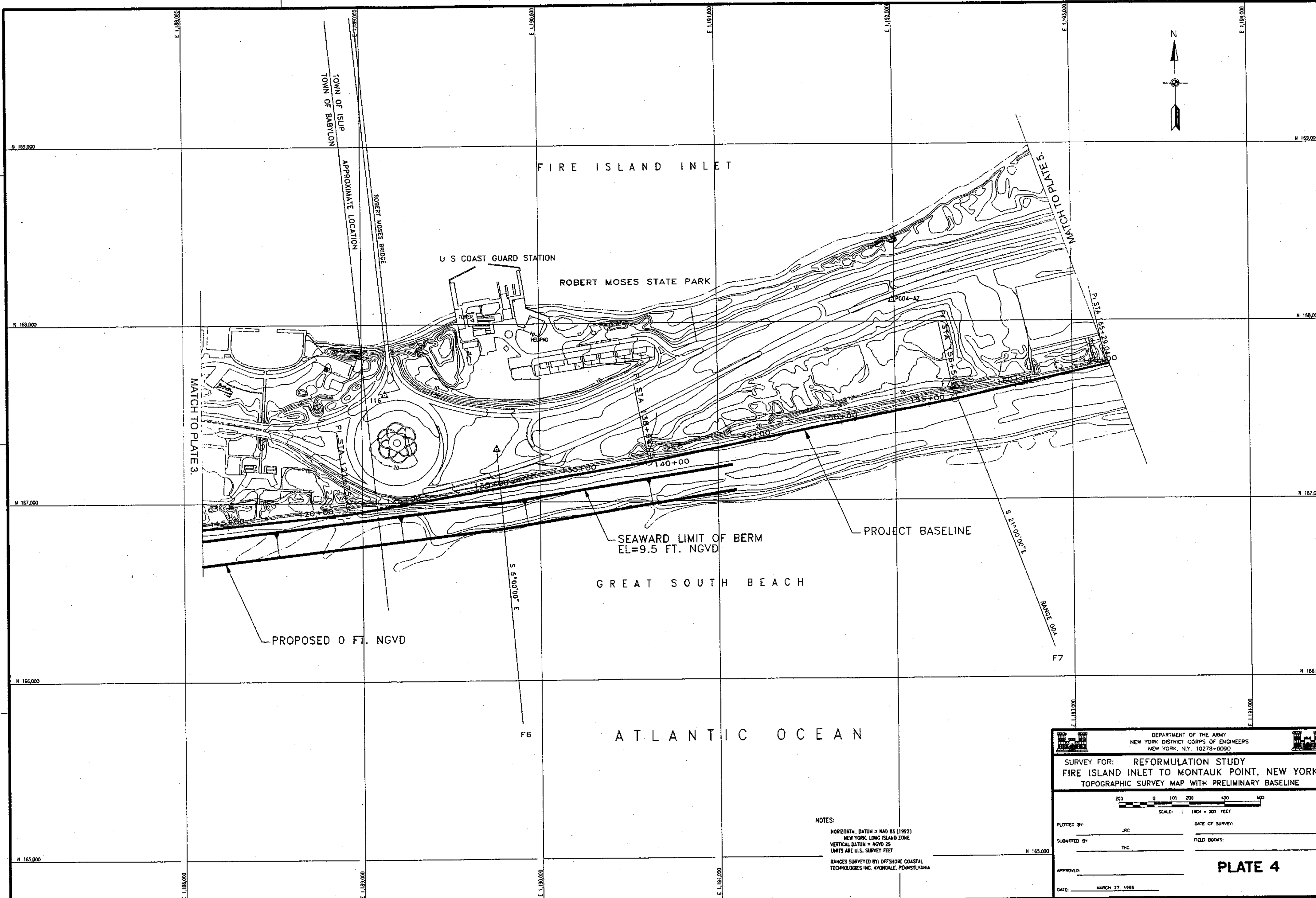
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
SUBMITTED BY: THC
APPROVED:
DATE: MARCH 27, 1998
DATE OF SURVEY:
FIELD BOOKS:

PLATE 3



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

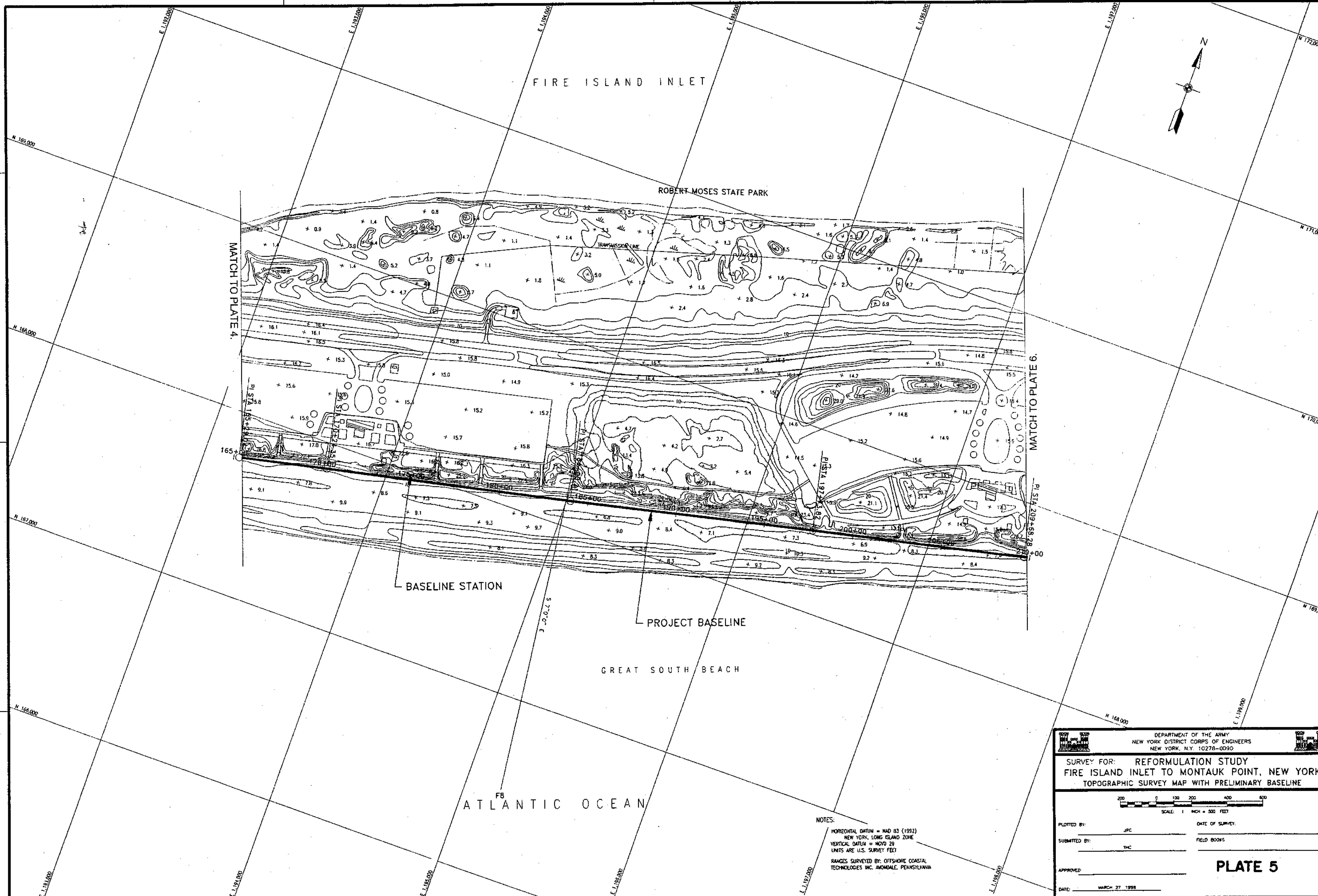
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

200 0 100 200 400 600
SCALE: 1 INCH = 300 FEET

PLOTTED BY: JRC
SUBMITTED BY: THC
APPROVED:
DATE: MARCH 27, 1998

DATE OF SURVEY:
FIELD BOOKS:

PLATE 4



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

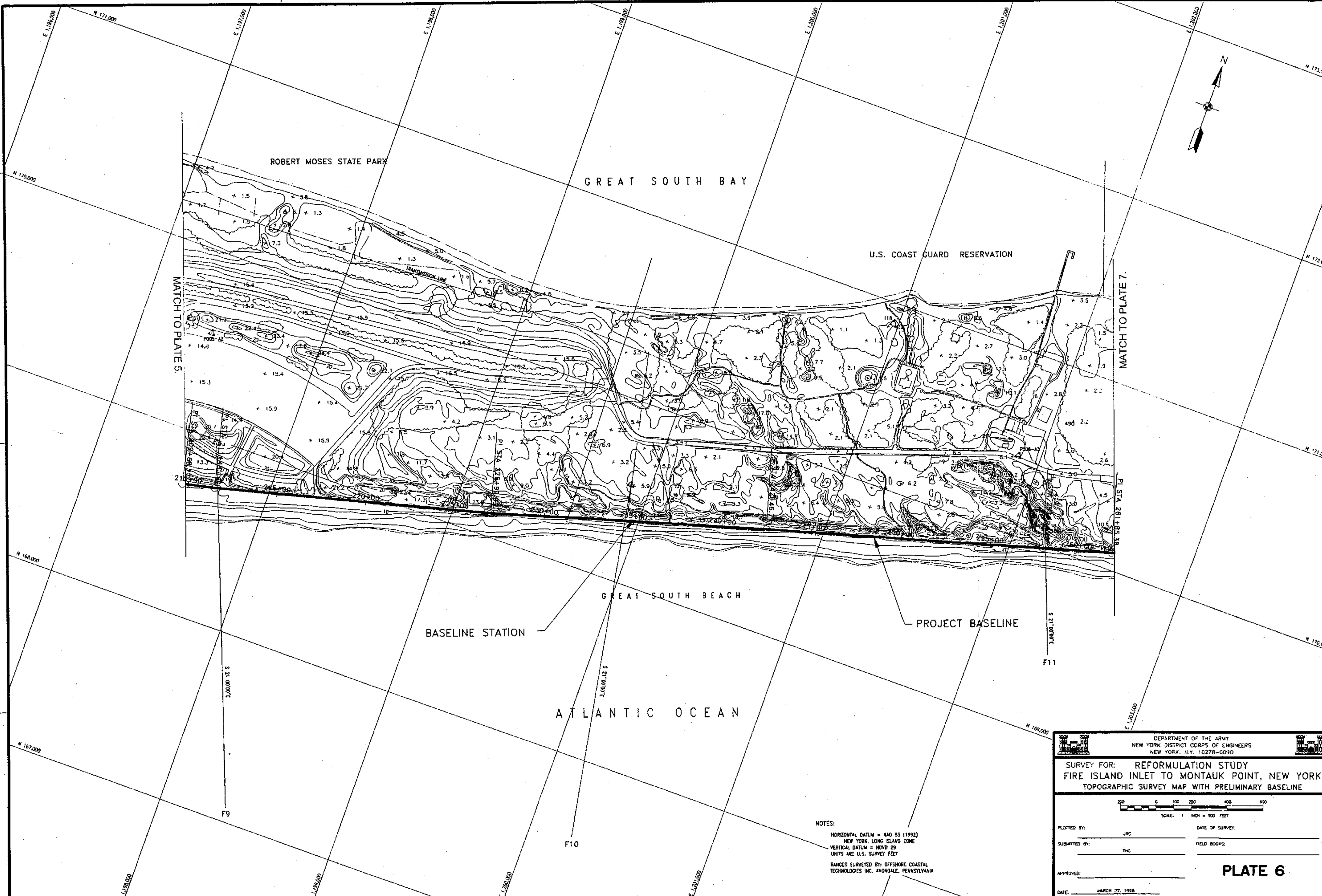
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS
APPROVED:
DATE: MARCH 27 1998

PLATE 5



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

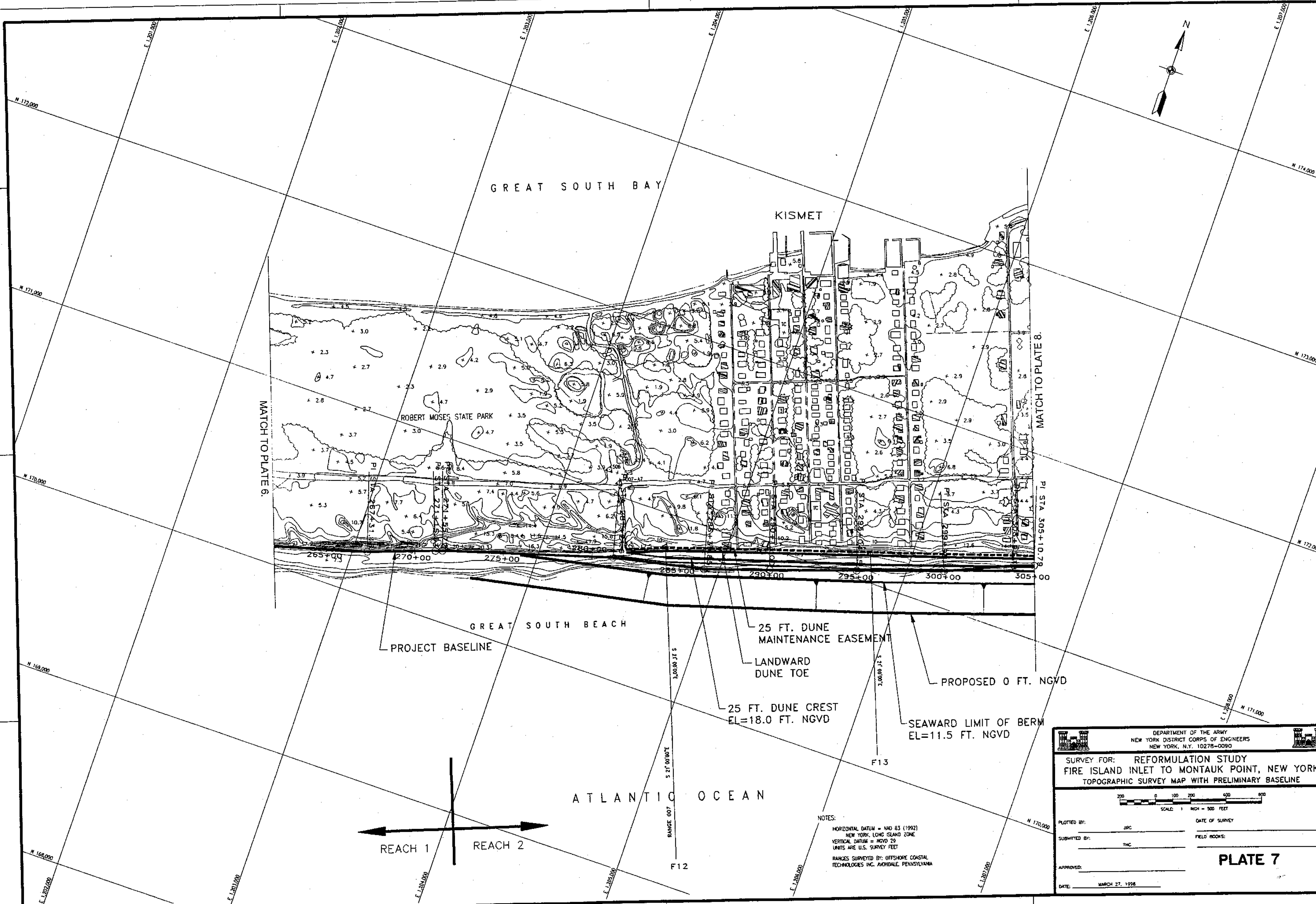
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 6



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

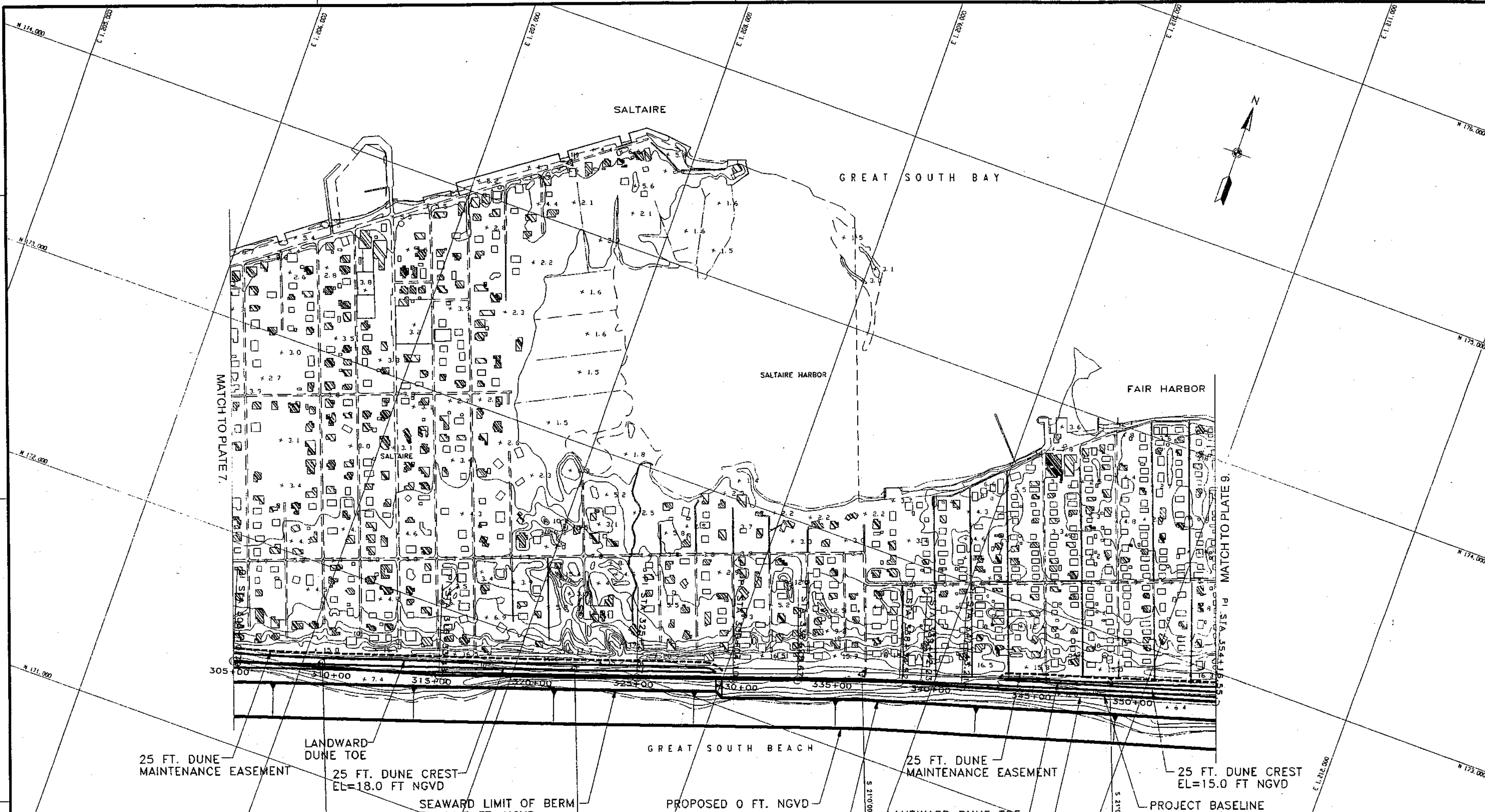
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 7



MAPPING FACTORS COMPUTED AT CENTER OF MAP SHEET:
SCALE FACTOR = 1.00000166
CONVERGENCE = + 0-31-44.2

NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

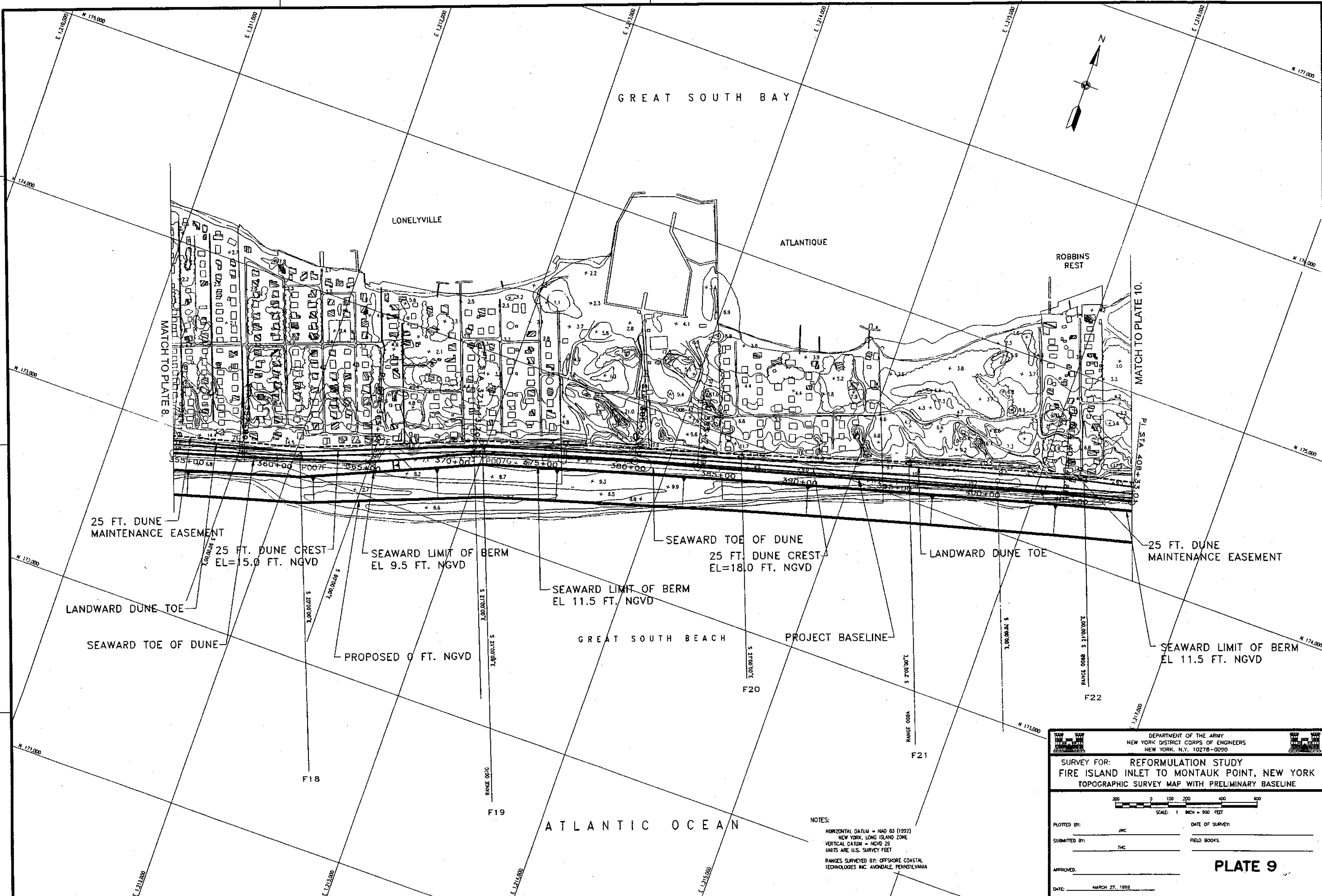
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 8



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

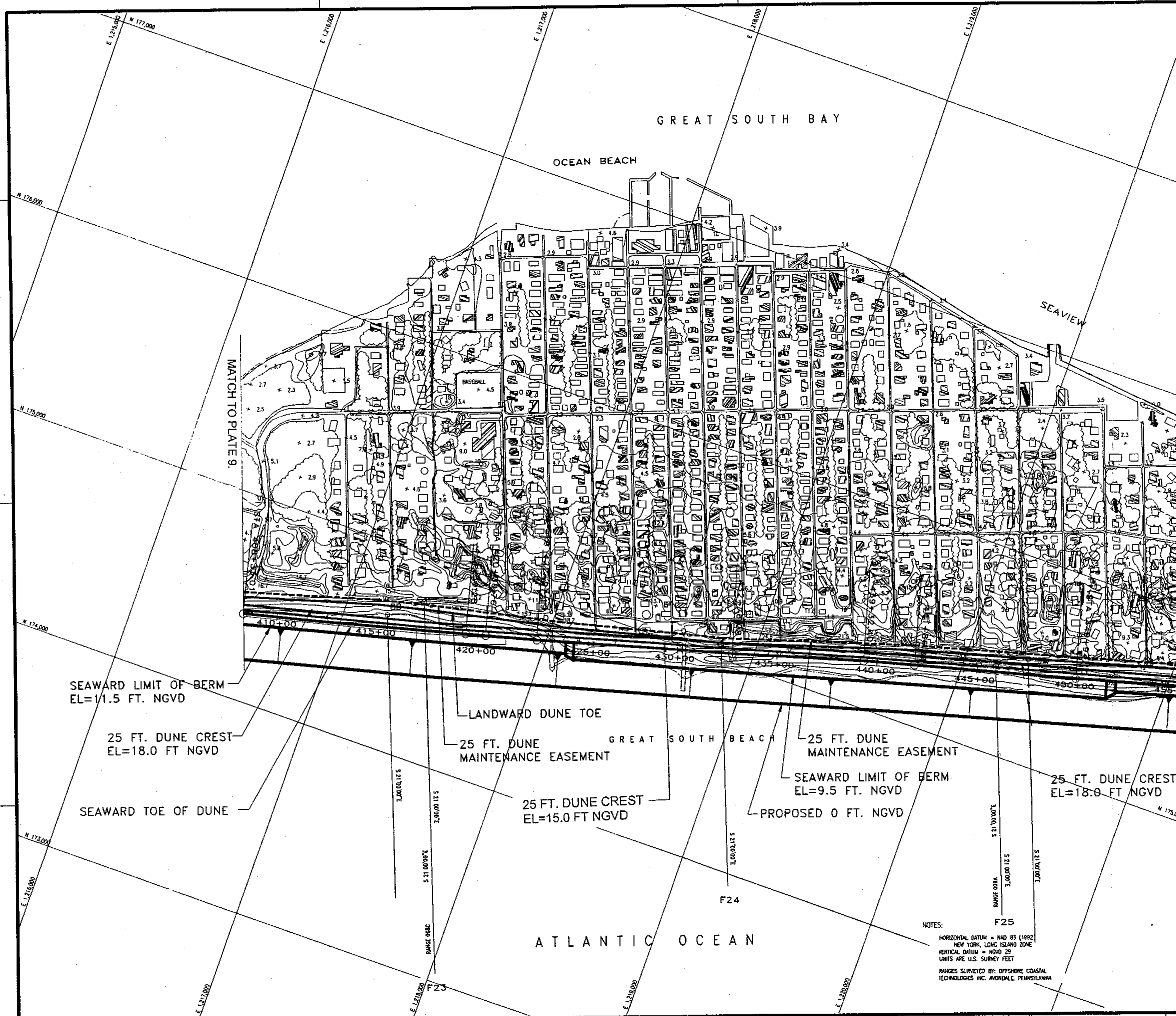
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS.
APPROVED.
DATE: MARCH 27, 1998

PLATE 9



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

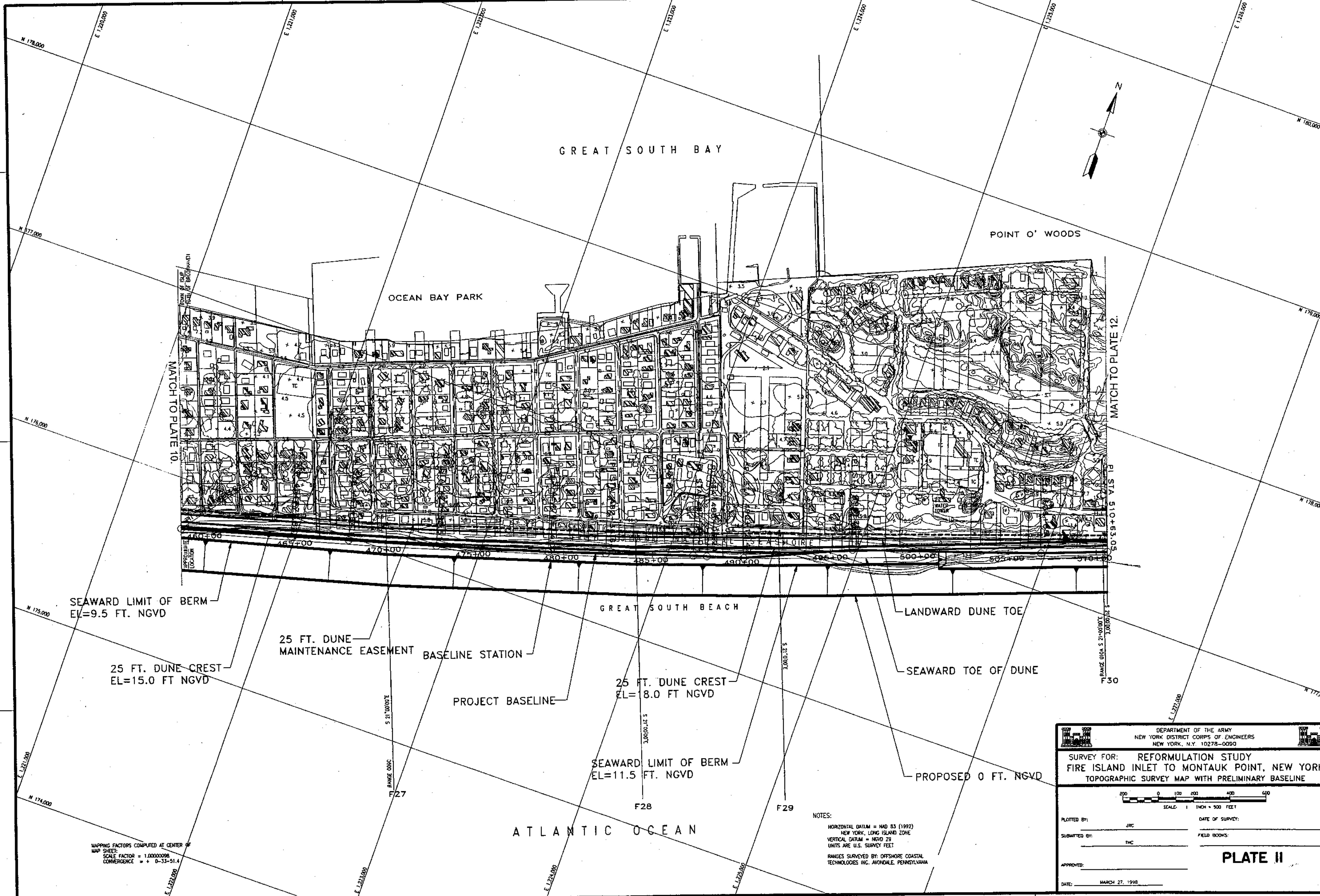
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 10



MAPPING FACTORS COMPUTED AT CENTER OF MAP SHEET:
SCALE FACTOR = 1.00000098
CONVERGENCE = + 0-33-51.4

NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

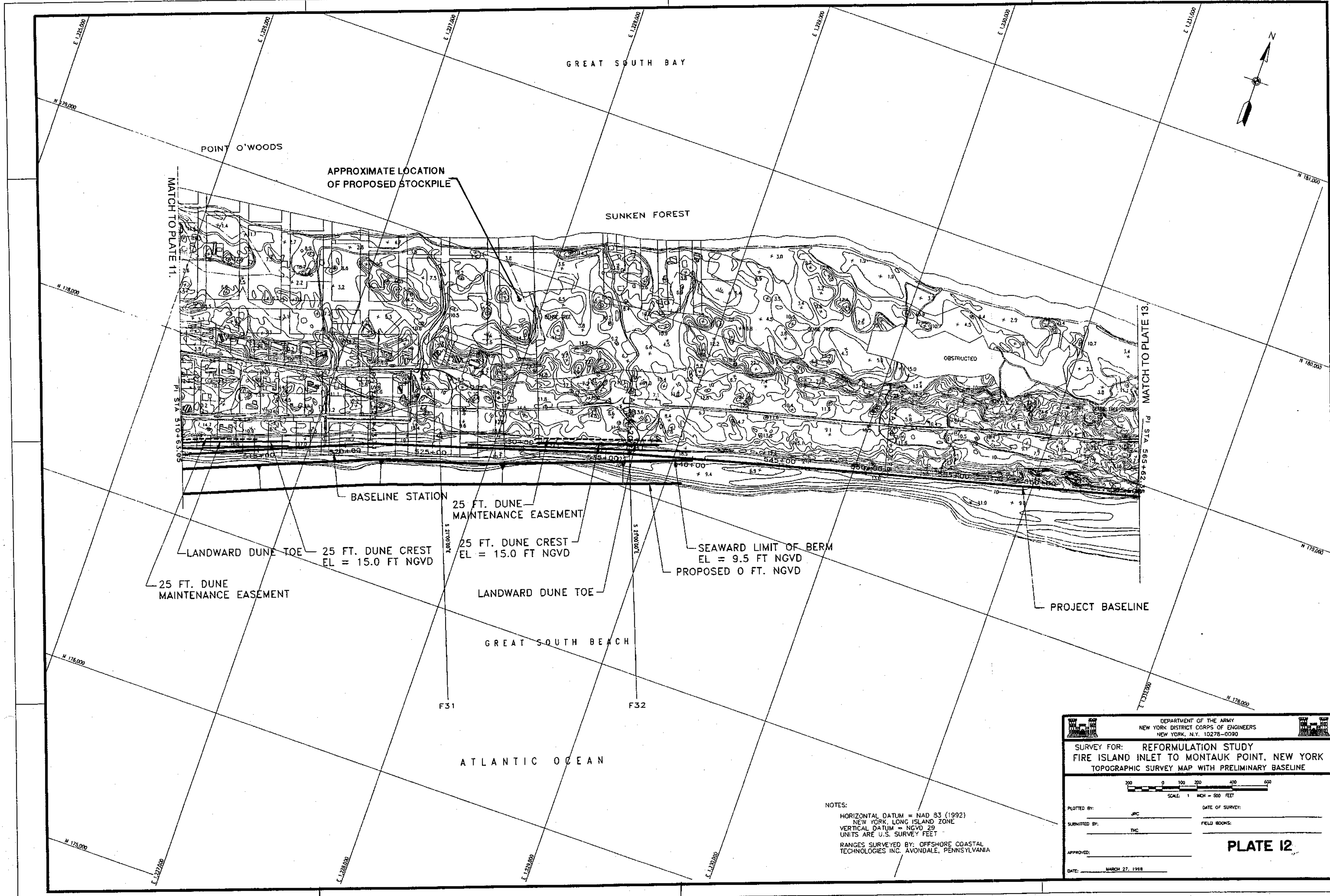
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

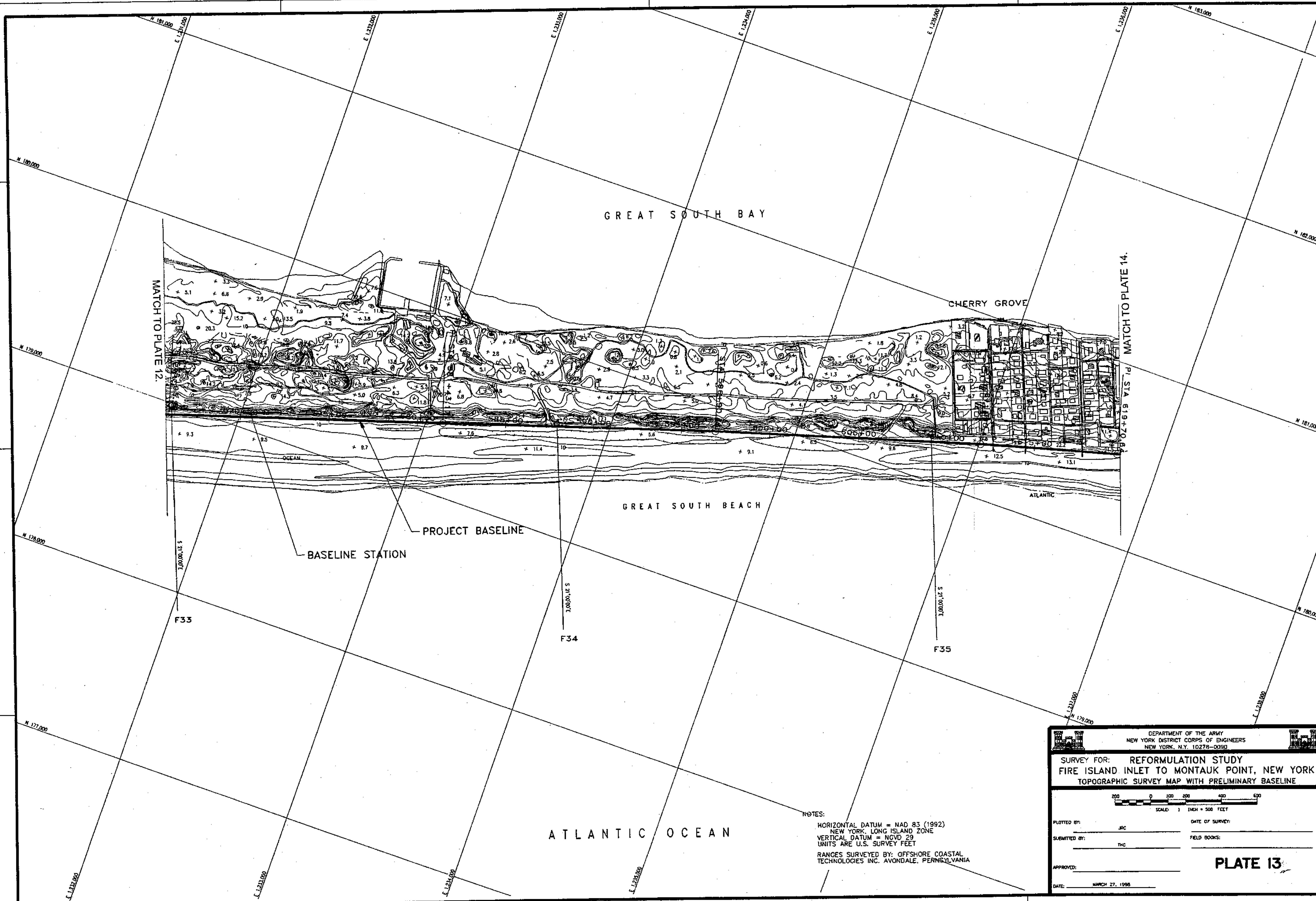
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE II


GREAT SOUTH BAY
POINT O'WOODS
APPROXIMATE LOCATION OF PROPOSED STOCKPILE
SUNKEN FOREST
MATCH TO PLATE 11.
MATCH TO PLATE 13.
PI STA 510+63.05
PI STA 565+62.35
OBSTRUCTED
BASELINE STATION
25 FT. DUNE MAINTENANCE EASEMENT
LANDWARD DUNE TOE
25 FT. DUNE CREST EL = 15.0 FT NGVD
25 FT. DUNE CREST EL = 15.0 FT NGVD
25 FT. DUNE MAINTENANCE EASEMENT
LANDWARD DUNE TOE
SEAWARD LIMIT OF BERM EL = 9.5 FT NGVD
PROPOSED 0 FT. NGVD
PROJECT BASELINE
GREAT SOUTH BEACH
F31
F32
ATLANTIC OCEAN
NOTES:
HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: TNC
FIELD BOOKS:
APPROVED:
PLATE 12
DATE: MARCH 27, 1998



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

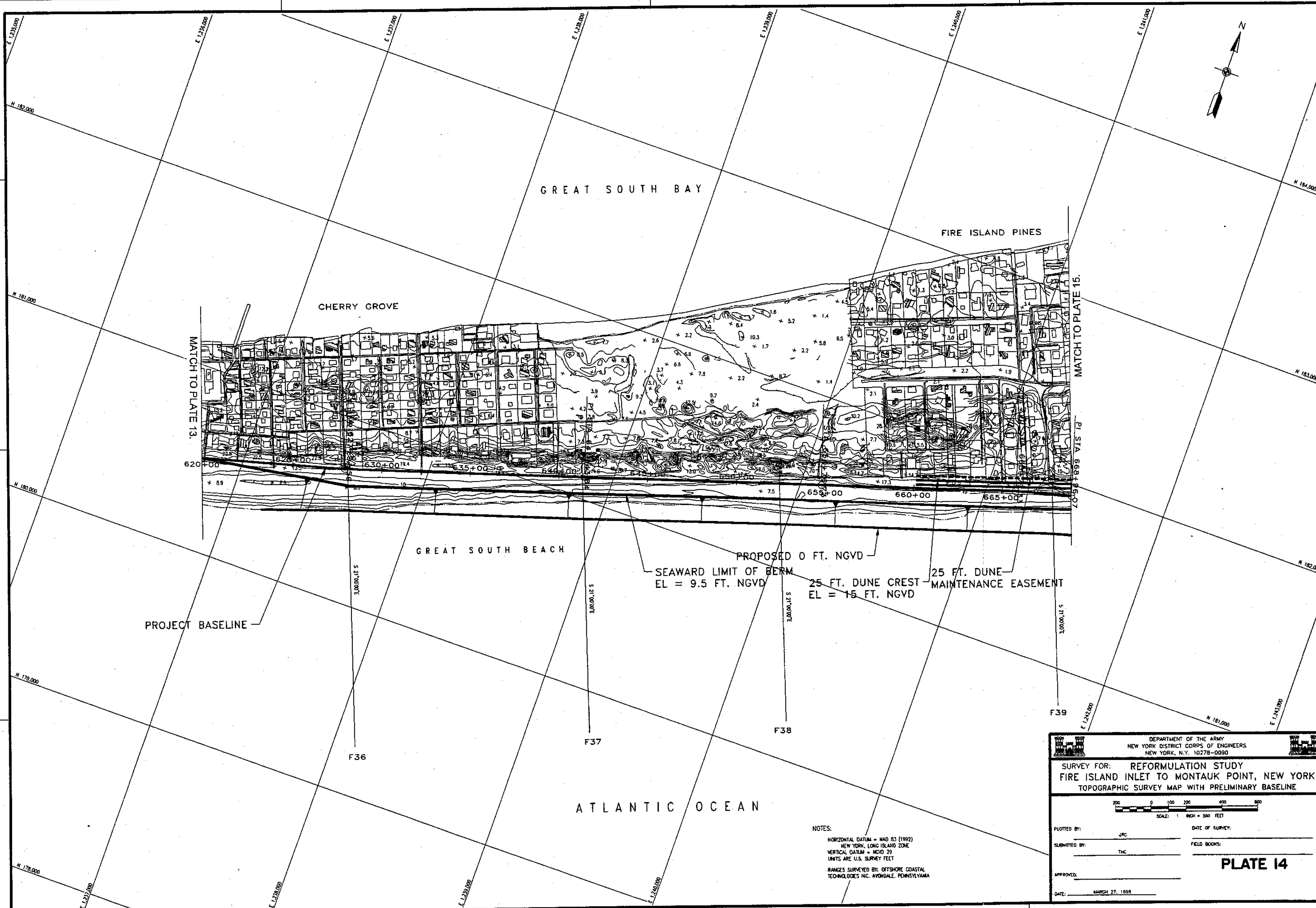
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

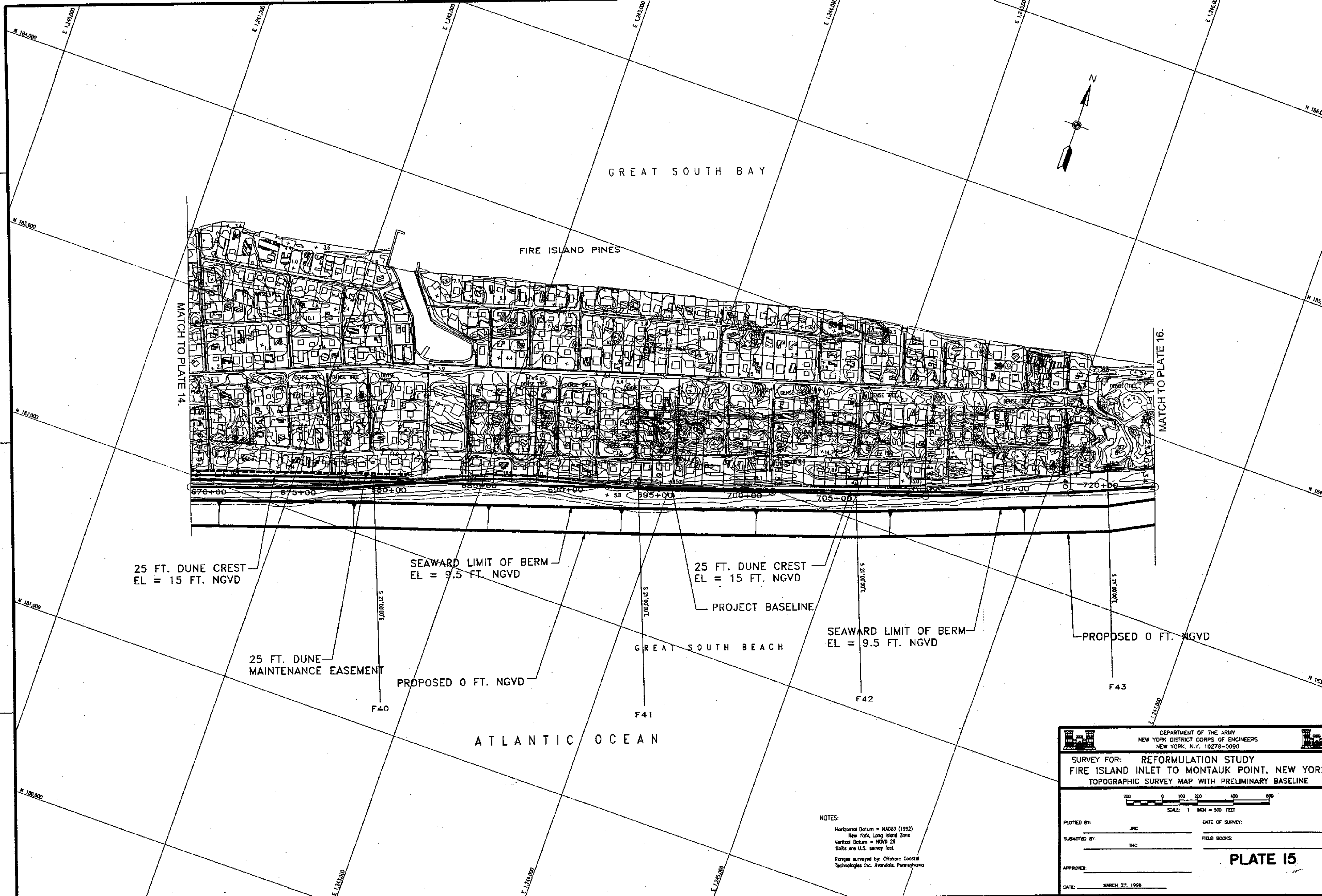
SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 13



GREAT SOUTH BAY
FIRE ISLAND PINES
CHERRY GROVE
MATCH TO PLATE 13.
MATCH TO PLATE 15.
PI STA 668+98.07
620+00
625+00
630+00
635+00
640+00
645+00
650+00
655+00
660+00
665+00
GREAT SOUTH BEACH
PROPOSED 0 FT. NGVD
SEAWARD LIMIT OF BERM
EL = 9.5 FT. NGVD
25 FT. DUNE CREST
EL = 15 FT. NGVD
25 FT. DUNE
MAINTENANCE EASEMENT
PROJECT BASELINE
S 21°00'00" E
F36
F37
F38
F39
ATLANTIC OCEAN
N
NOTES:
HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL
TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
SUBMITTED BY: TNC
APPROVED:
DATE: MARCH 27, 1998
DATE OF SURVEY:
FIELD BOOKS:
PLATE 14



NOTES:

Horizontal Datum = NAD83 (1992)
New York, Long Island Zone
Veritcal Datum = NGVD 29
Units are U.S. survey feet

Ranges surveyed by: Offshore Coastal Technologies Inc. Avondale, Pennsylvania

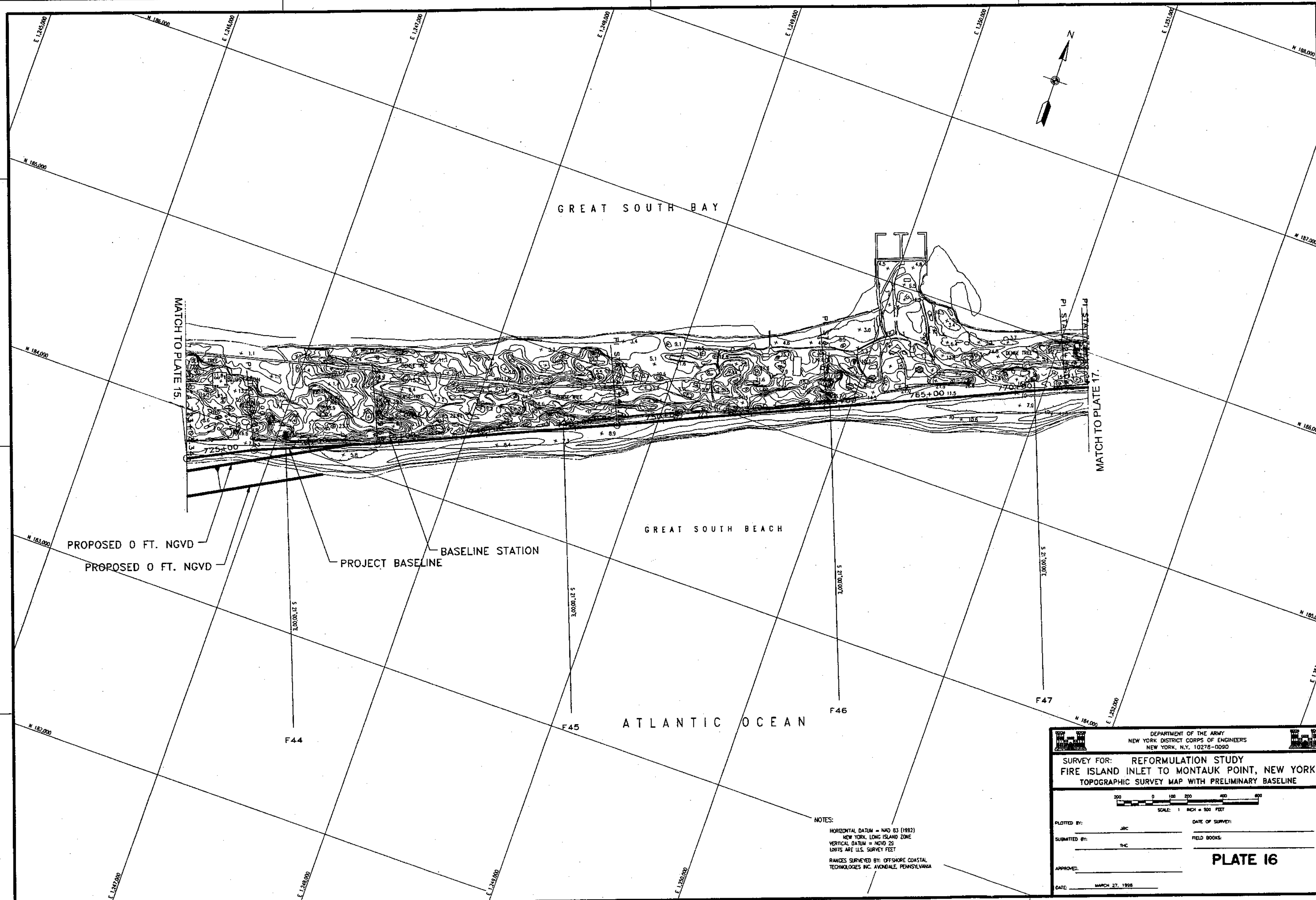
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 15



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

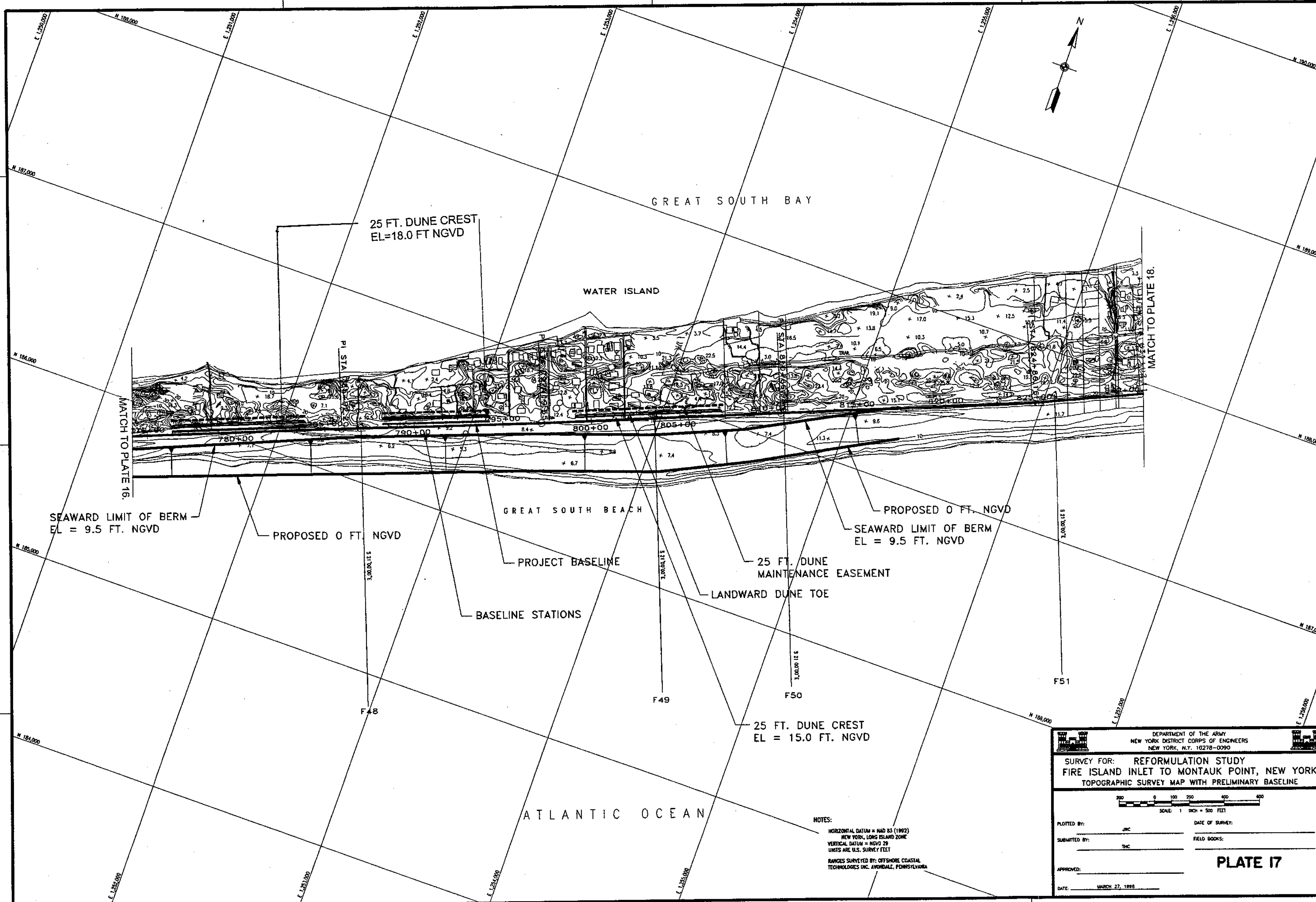
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED.
DATE: MARCH 27, 1998

PLATE 16



NOTES:

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NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

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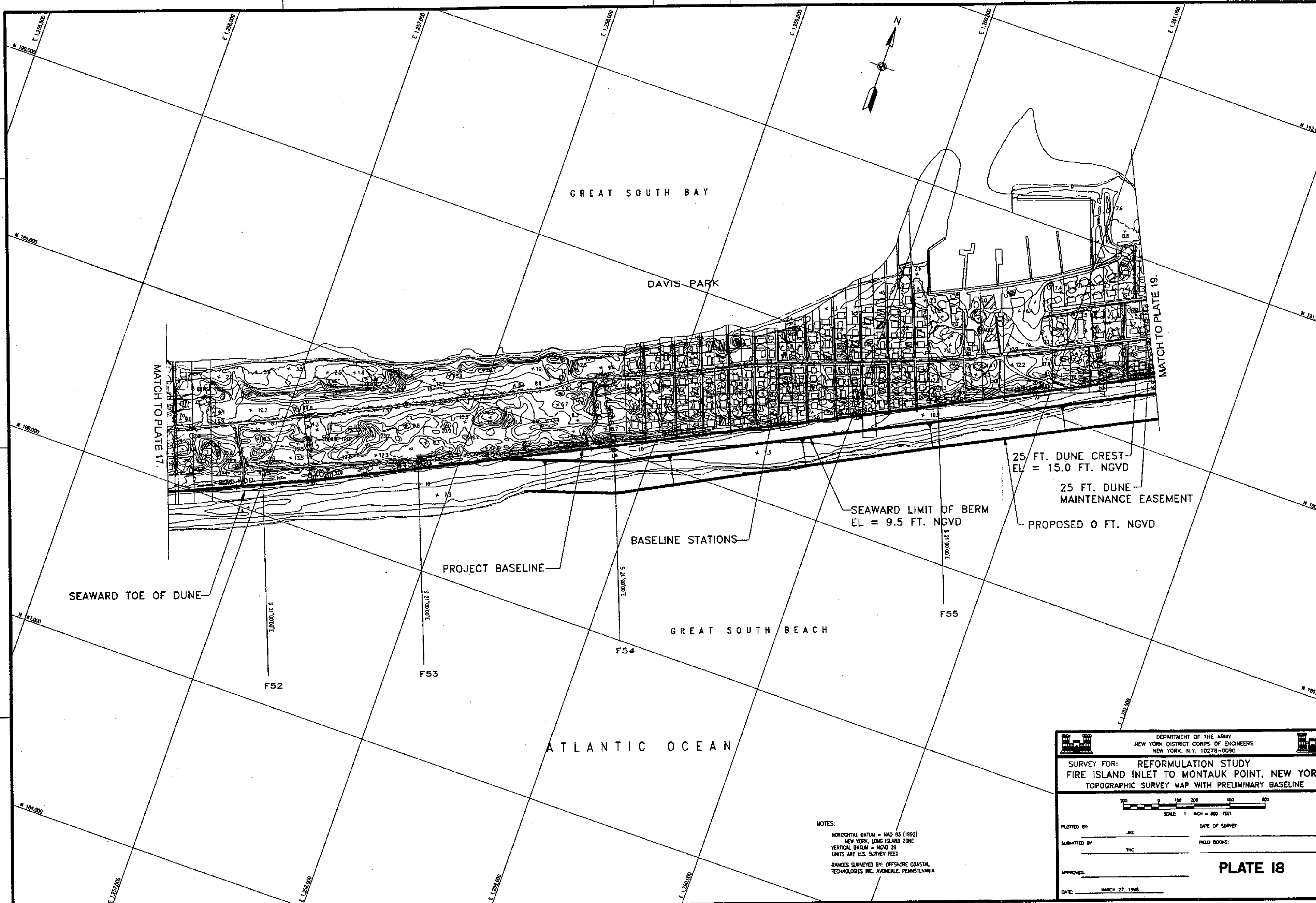
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 17



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

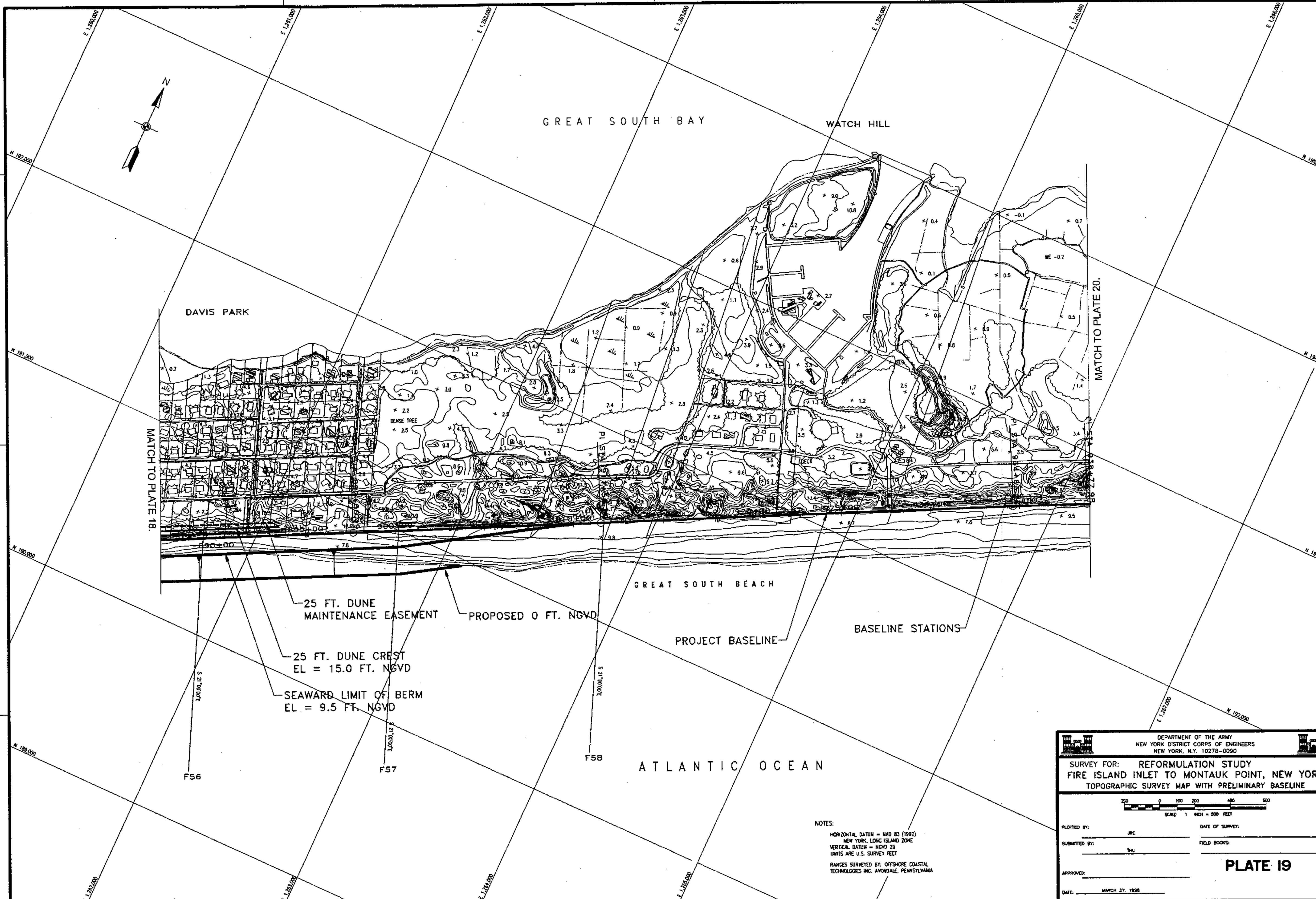
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 18



NOTES:

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NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

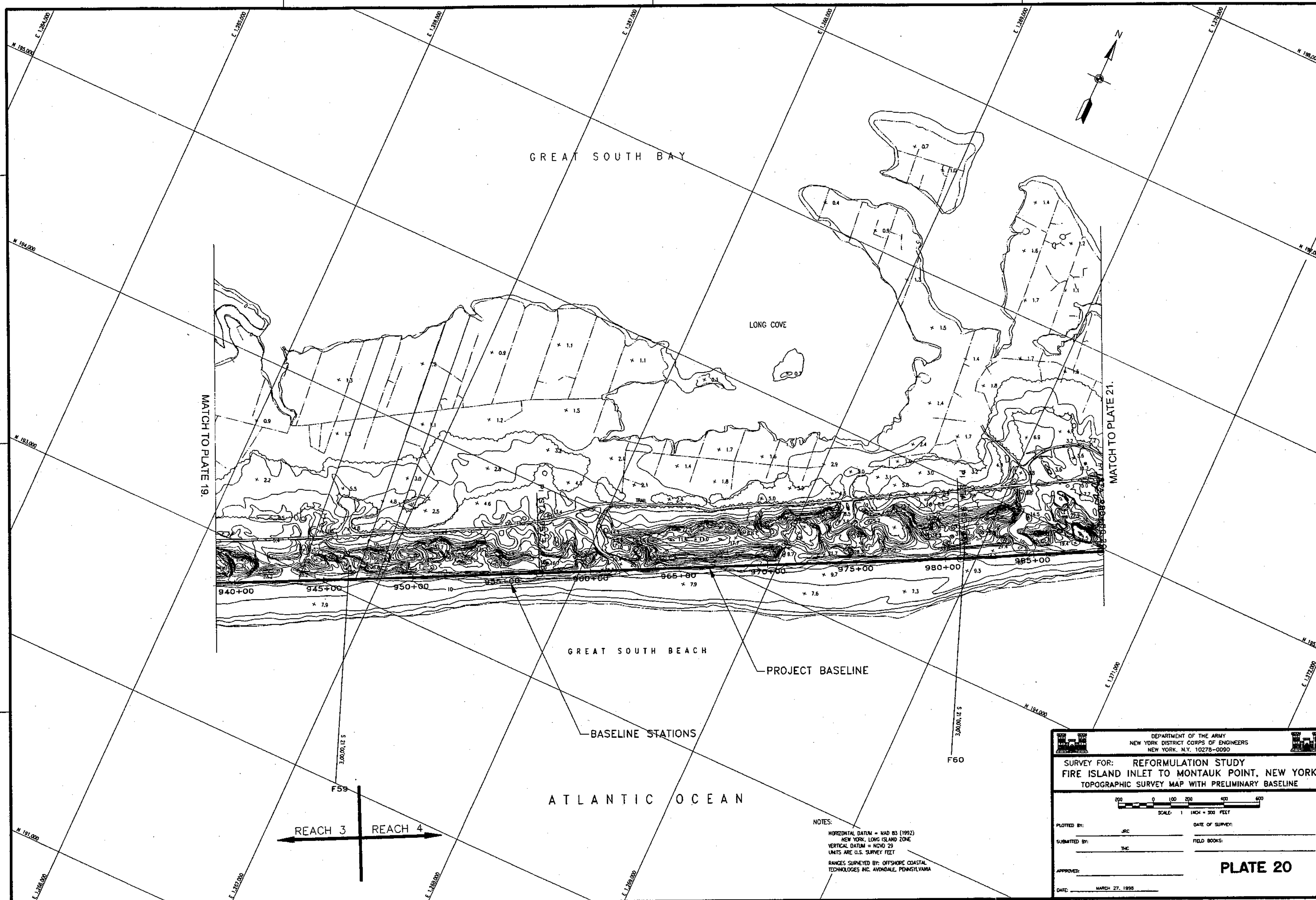
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: TMC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 19


GREAT SOUTH BAY
LONG COVE
TRAIL
MATCH TO PLATE 19.
MATCH TO PLATE 21.
940+00
945+00
950+00
955+00
960+00
965+00
970+00
975+00
980+00
985+00
GREAT SOUTH BEACH
PROJECT BASELINE
BASELINE STATIONS
ATLANTIC OCEAN
F59
F60
REACH 3
REACH 4
NOTES:
HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA
DEPARTMENT OF THE ARMY
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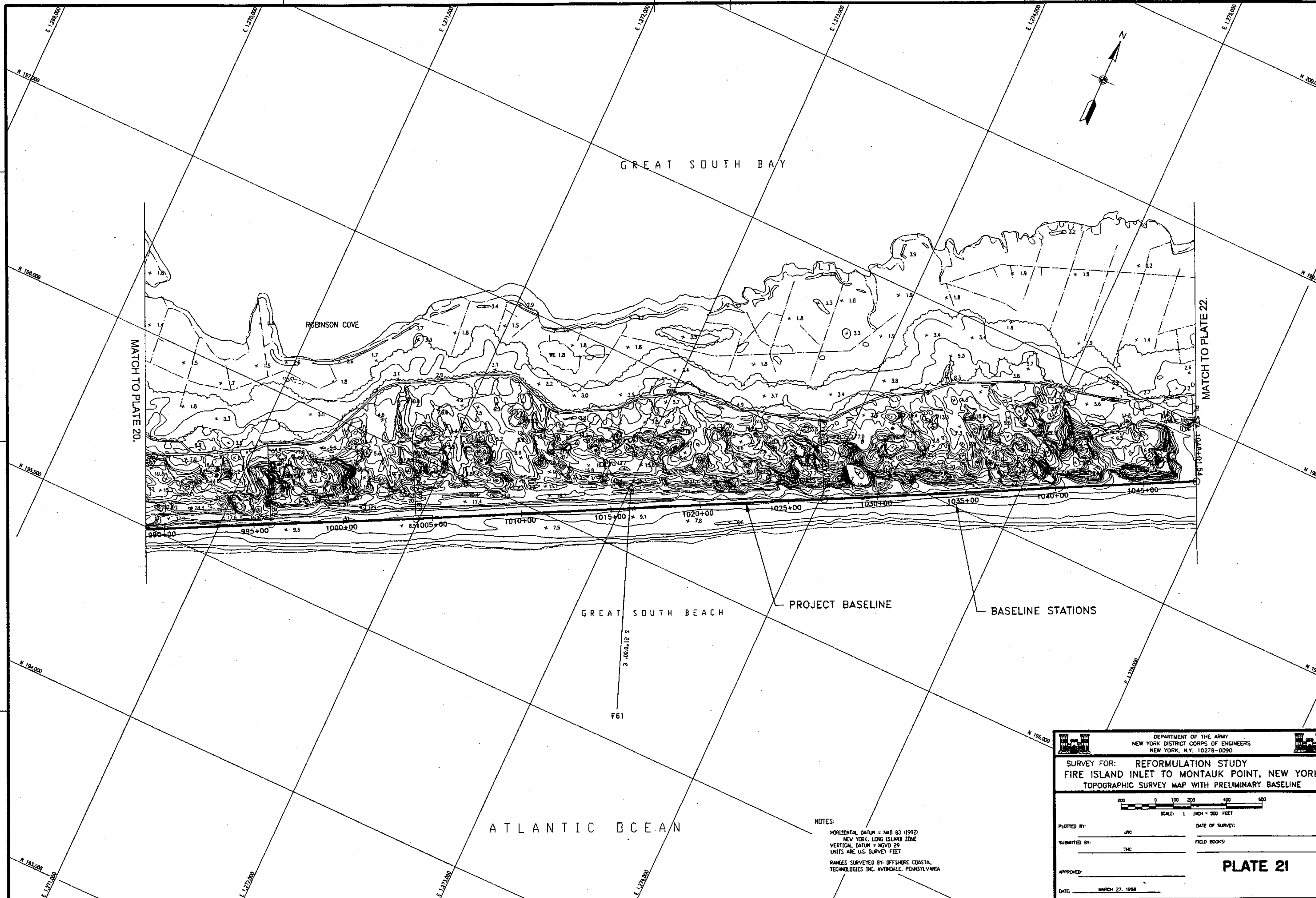
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
PLATE 20
DATE: MARCH 27, 1998



NOTES:

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VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

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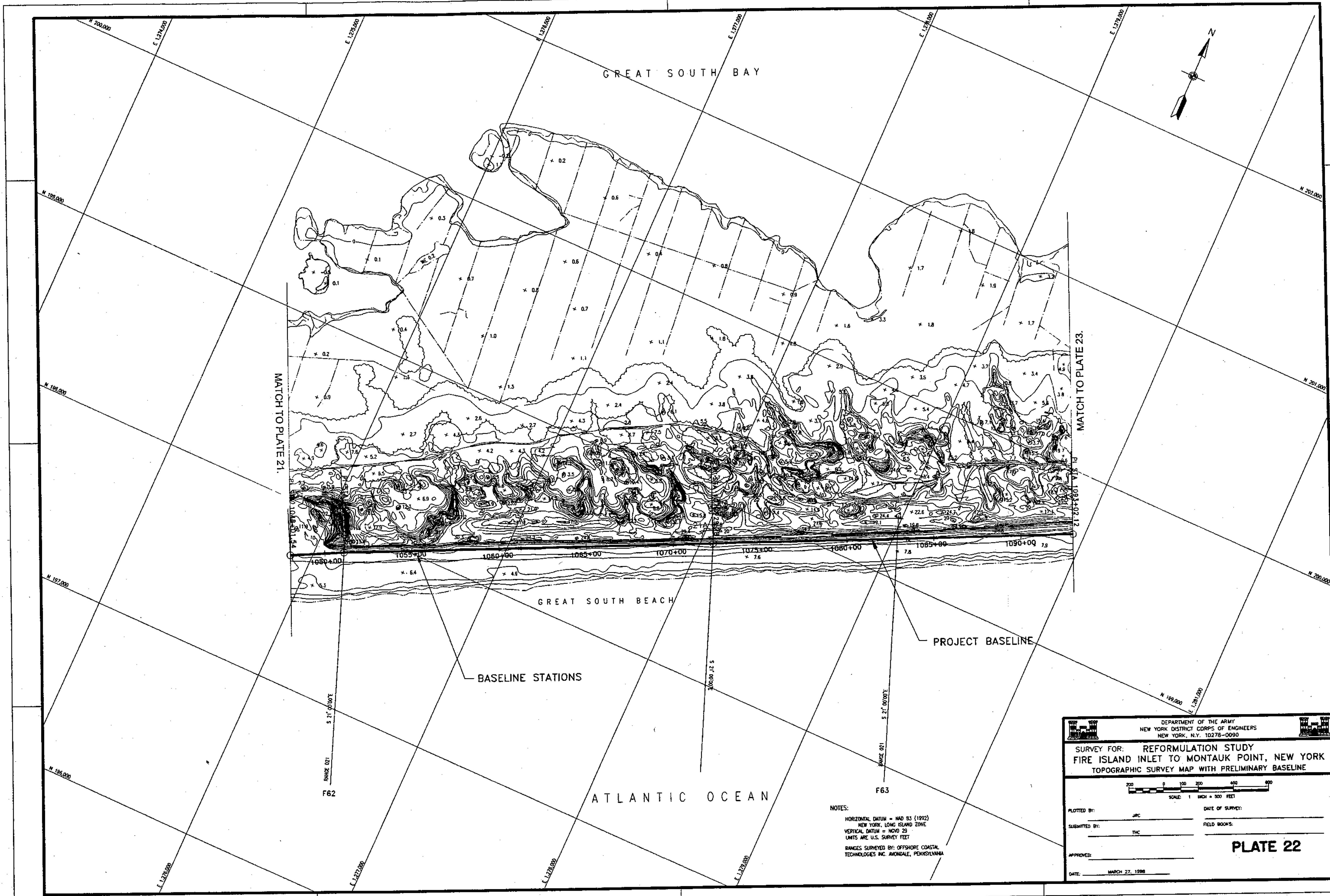
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

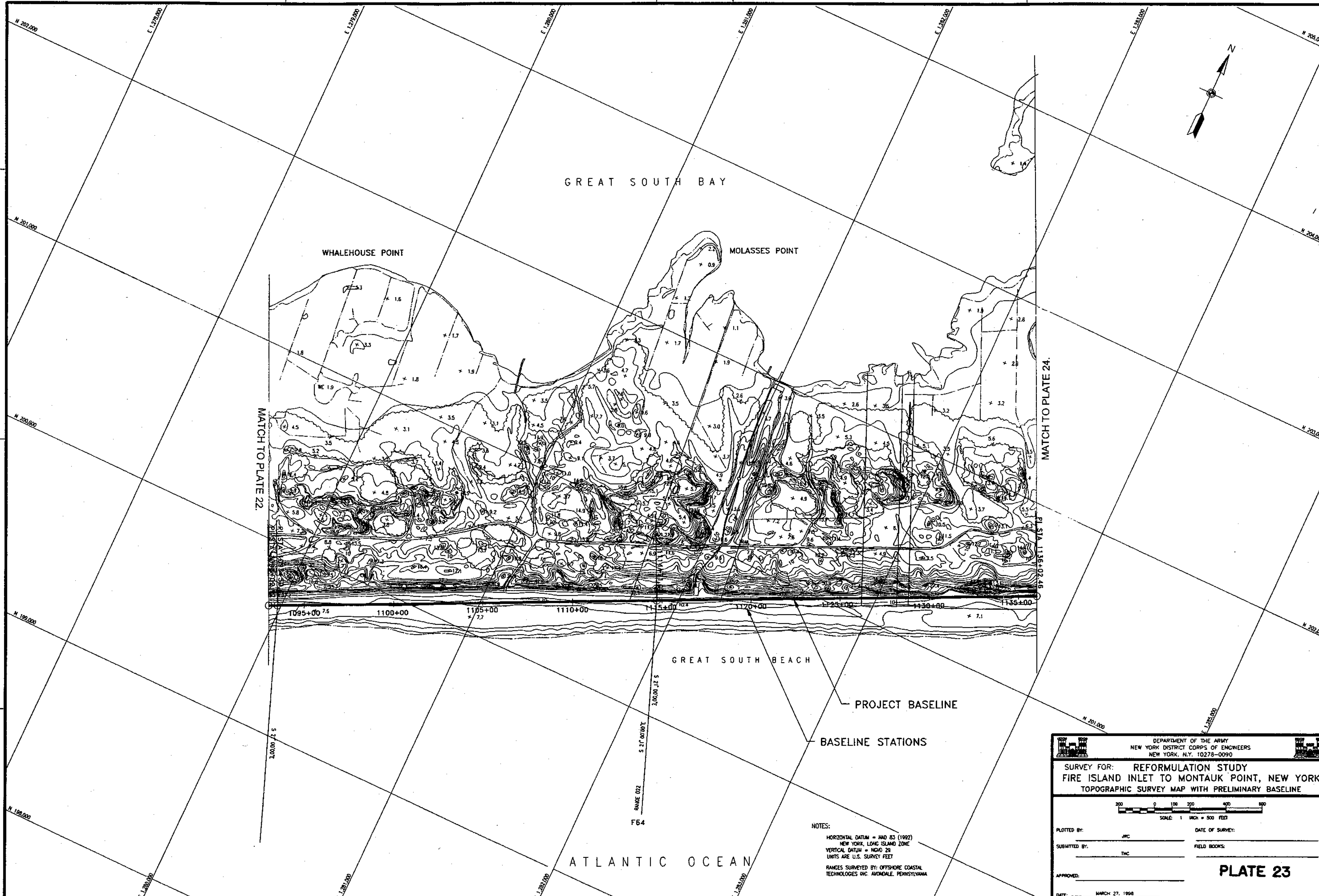
200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET

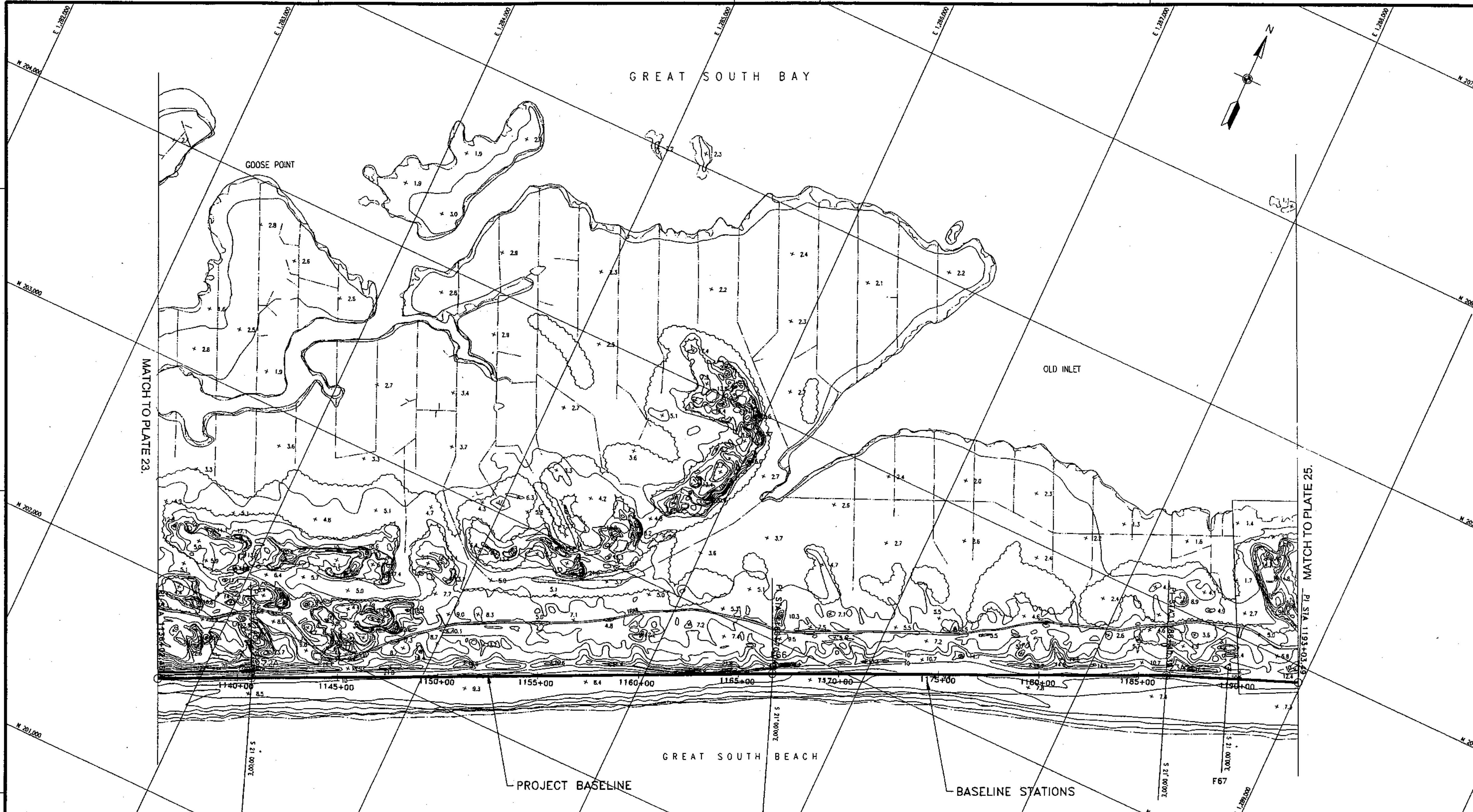
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 21



GREAT SOUTH BAY
N
MATCH TO PLATE 21.
MATCH TO PLATE 23.
GREAT SOUTH BEACH
PROJECT BASELINE
BASELINE STATIONS
1050+00
1055+00
1060+00
1065+00
1070+00
1075+00
1080+00
1085+00
1090+00
S 21° 00'00"E
RANGE 021
F62
F63
ATLANTIC OCEAN
N 199,000
E 1,281,000
NOTES:
HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL
TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998
PLATE 22


GREAT SOUTH BAY
WHALEHOUSE POINT
MOLASSES POINT
MATCH TO PLATE 22.
MATCH TO PLATE 24.
1095+00
1100+00
1105+00
1110+00
1115+00
1120+00
1125+00
1130+00
1135+00
GREAT SOUTH BEACH
PROJECT BASELINE
BASELINE STATIONS
F64
ATLANTIC OCEAN
N
NOTES:
HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL
TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998
PLATE 23



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

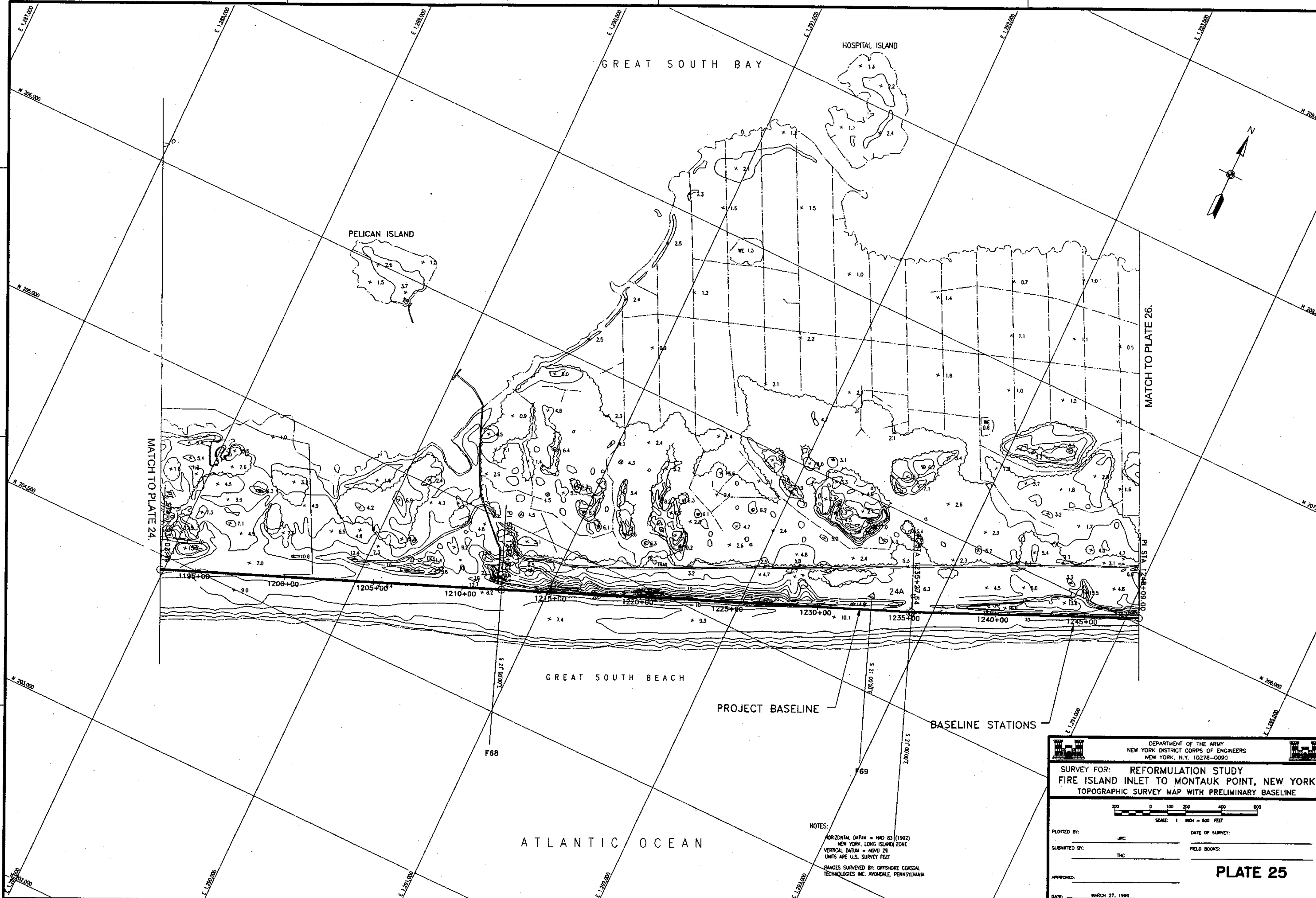
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 24



NOTES:

HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET

RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA

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NEW YORK, N.Y. 10278-0090

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TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC

DATE OF SURVEY:

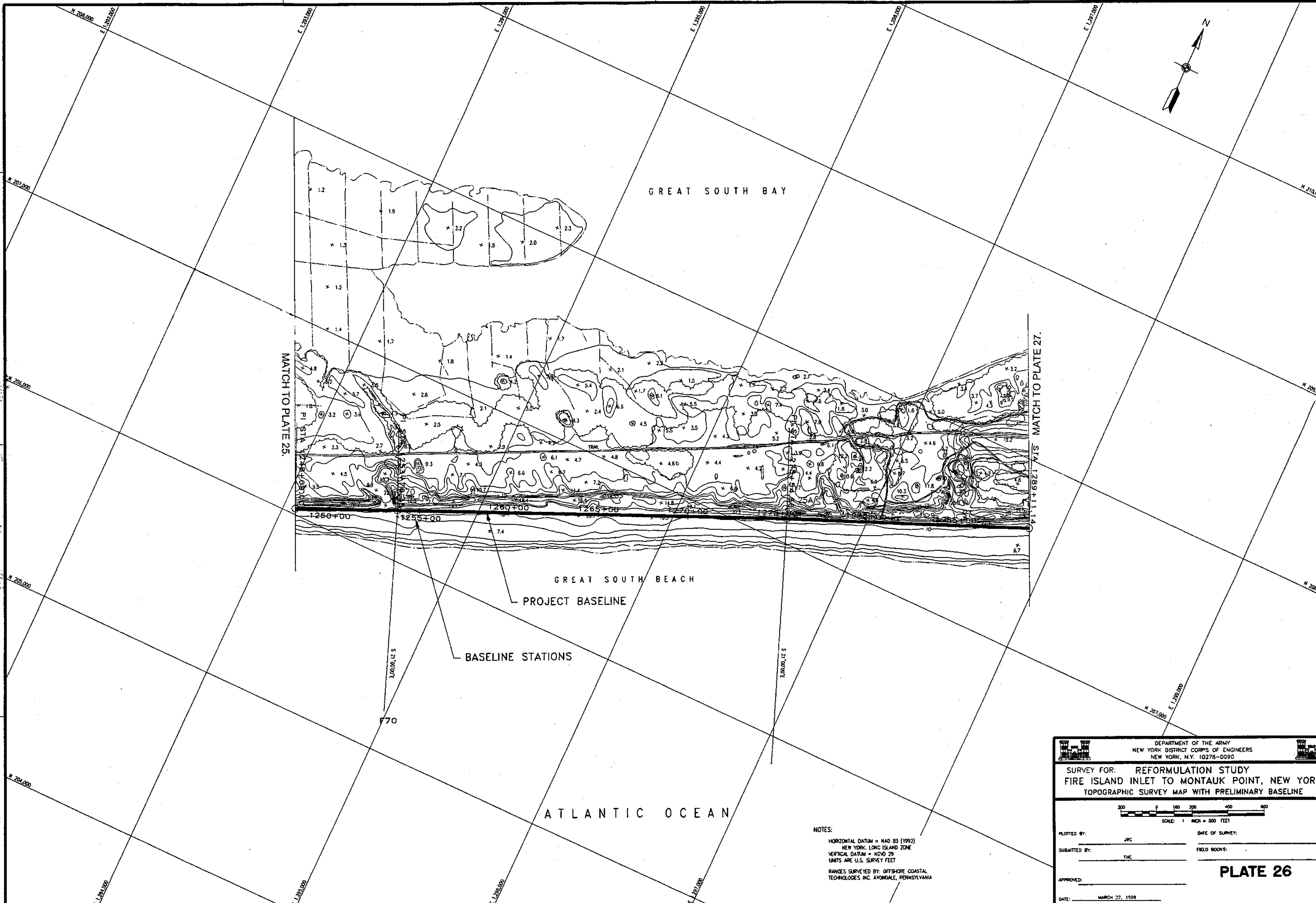
SUBMITTED BY: THC

FIELD BOOKS:

APPROVED:

DATE: MARCH 27, 1995

PLATE 25



NOTES:

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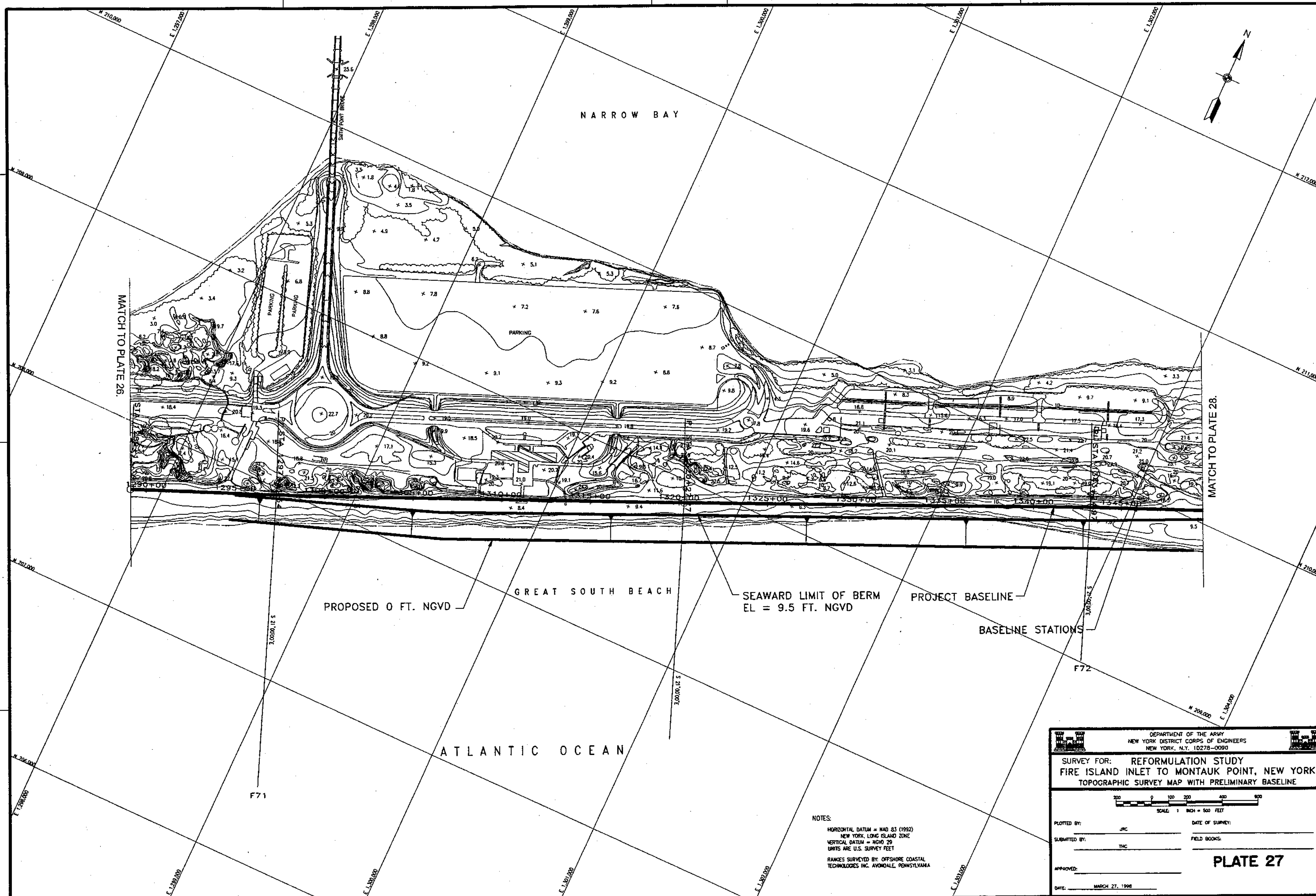
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

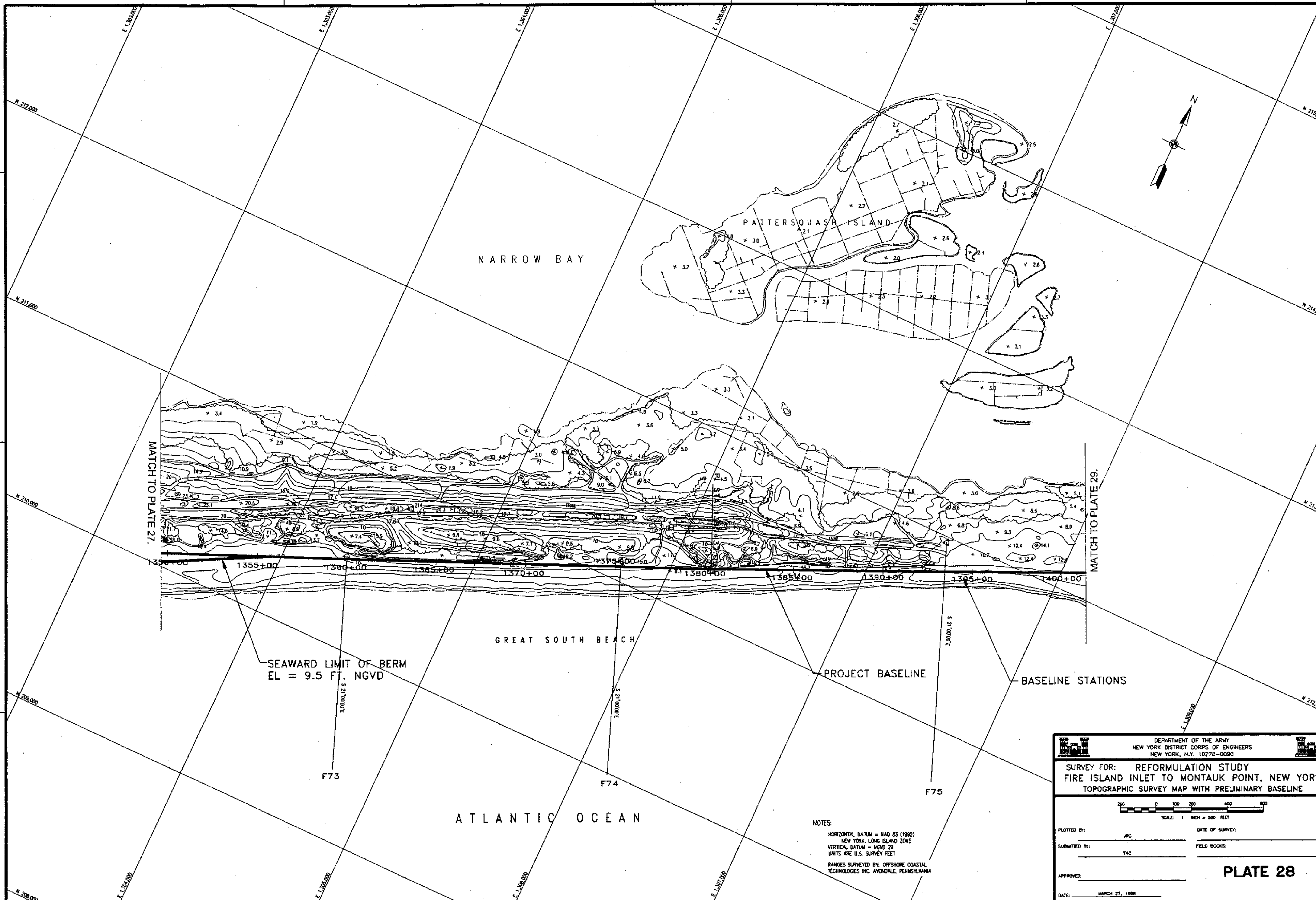
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JPC
DATE OF SURVEY:
SUBMITTED BY: TNC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 26


NARROW BAY
GREAT SOUTH BEACH
ATLANTIC OCEAN
MATCH TO PLATE 26.
MATCH TO PLATE 28.
PARKING
SMITH POINT BRIDGE
PROPOSED 0 FT. NGVD
SEAWARD LIMIT OF BERM
EL = 9.5 FT. NGVD
PROJECT BASELINE
BASELINE STATIONS
F71
F72
N
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998
PLATE 27
NOTES:
HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA



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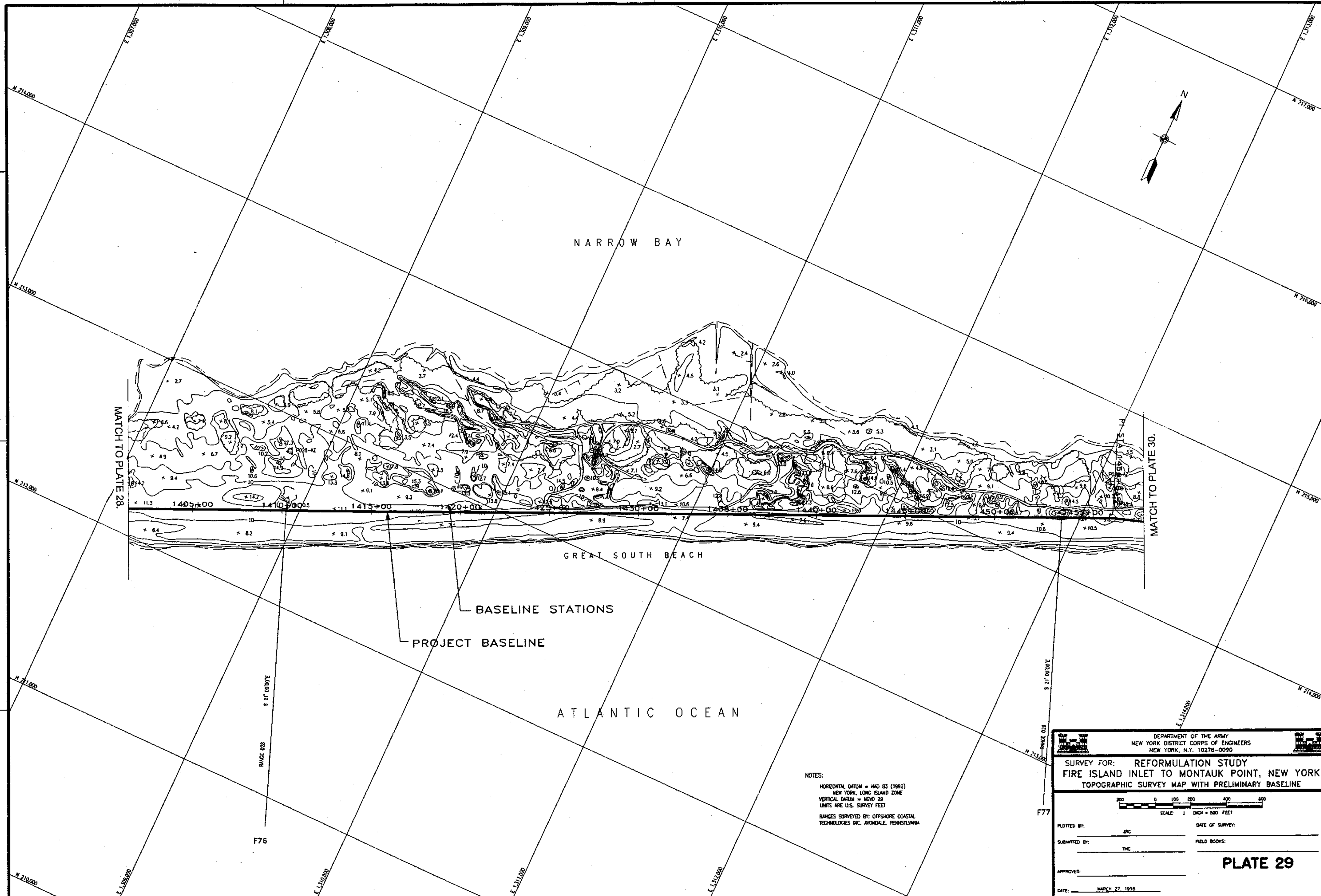
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 28



NARROW BAY
GREAT SOUTH BEACH
ATLANTIC OCEAN
MATCH TO PLATE 28.
MATCH TO PLATE 30.
BASELINE STATIONS
PROJECT BASELINE
1405+00
1410+00
1415+00
1420+00
1430+00
1435+00
1440+00
1450+00
F76
F77
RANGE 028
RANGE 029
S 21° 00'00"E
N 214,000
N 213,000
N 212,000
N 211,000
N 210,000
N 217,000
N 216,000
N 215,000
E 1,308,000
E 1,309,000
E 1,310,000
E 1,311,000
E 1,312,000
E 1,313,000
E 1,314,000
N
NOTES:
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DEPARTMENT OF THE ARMY
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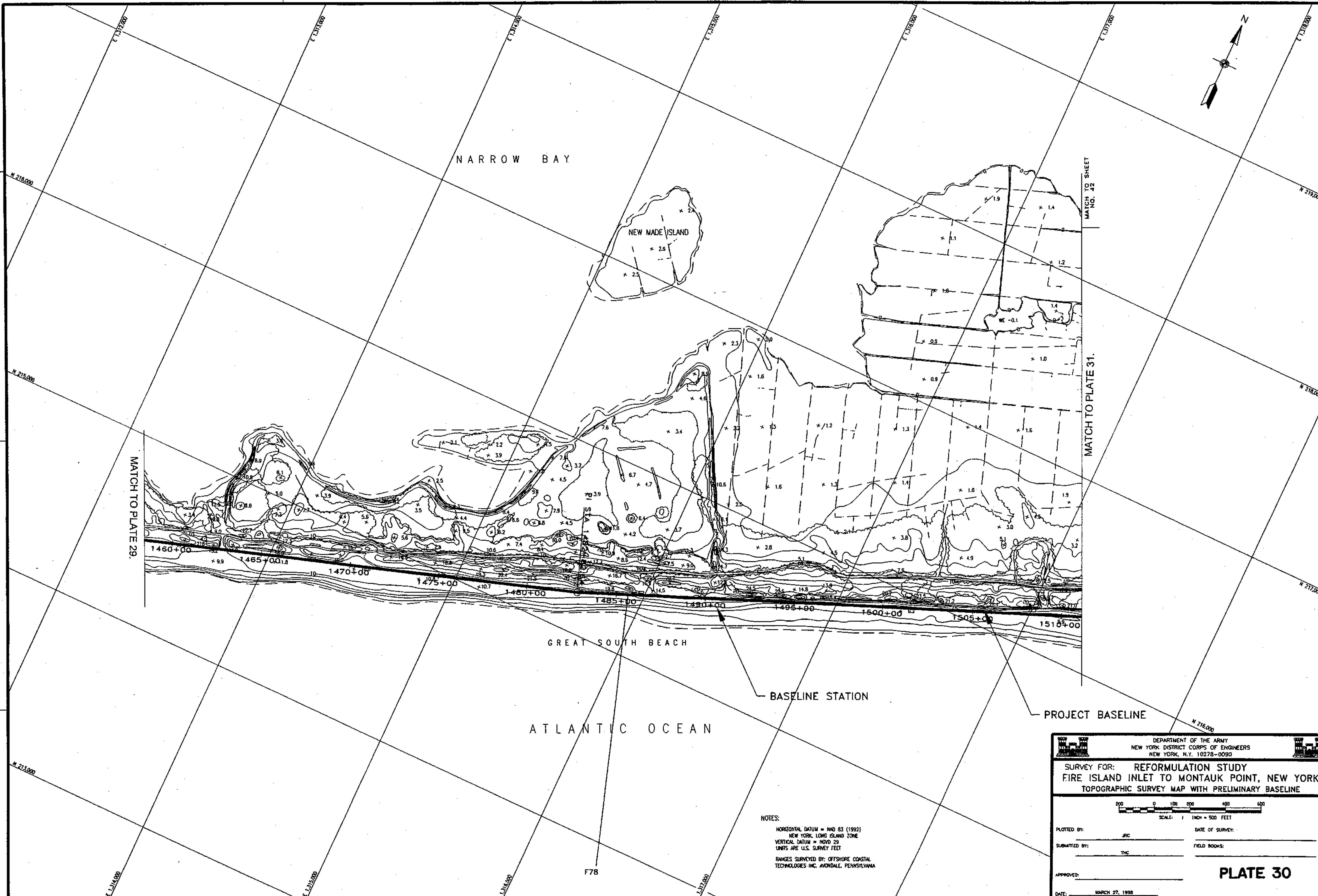
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1996
PLATE 29



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VERTICAL DATUM = NGVD 29
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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090

SURVEY FOR: REFORMULATION STUDY
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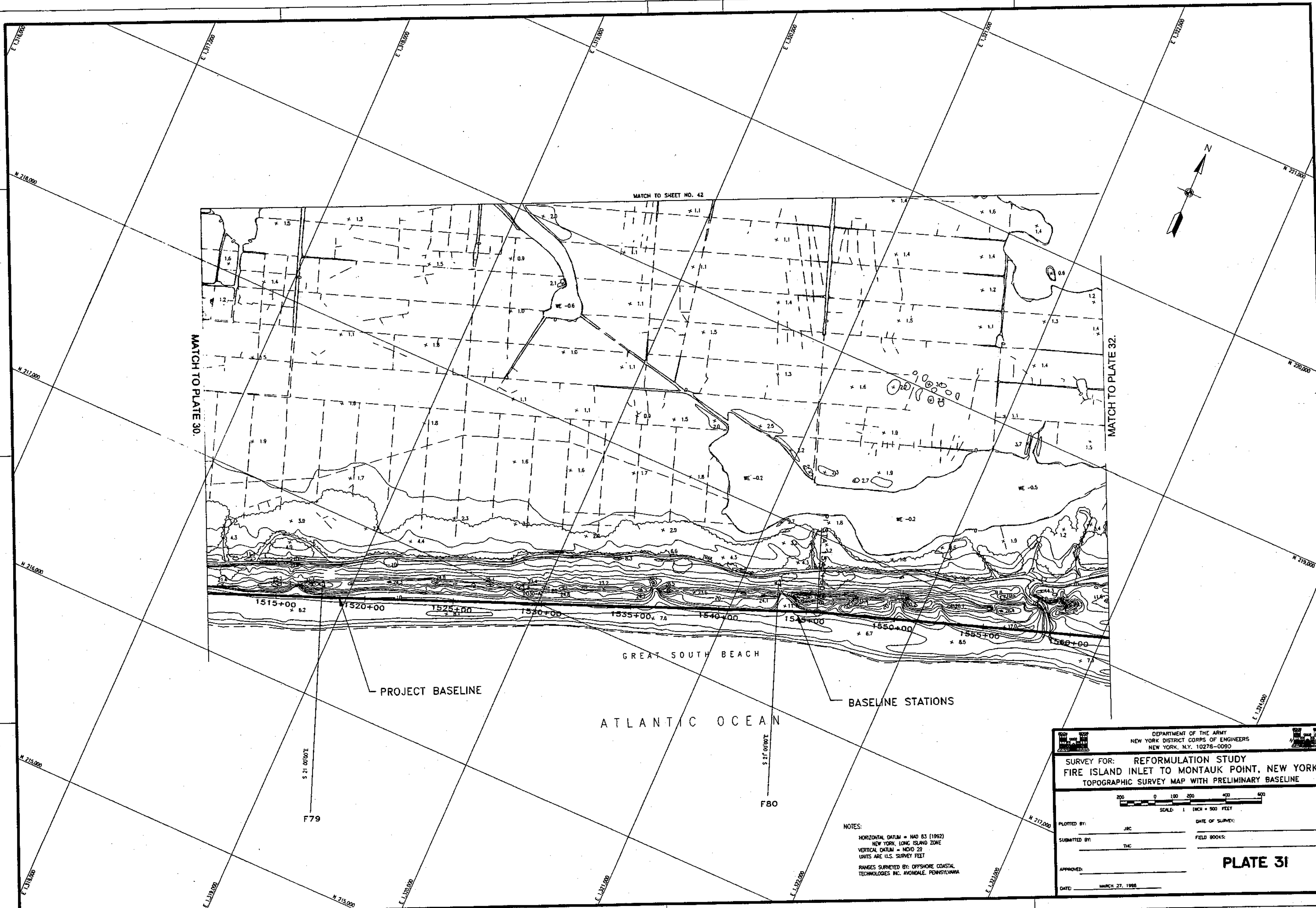
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE

SCALE: 1 INCH = 500 FEET

PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998

PLATE 30


MATCH TO SHEET NO. 42
MATCH TO PLATE 30.
MATCH TO PLATE 32.
N
GREAT SOUTH BEACH
ATLANTIC OCEAN
PROJECT BASELINE
BASELINE STATIONS
1515+00
1520+00
1525+00
1530+00
1535+00
1540+00
1545+00
1550+00
1555+00
1560+00
F79
F80
S 21 00'00" E
N 218,000
N 217,000
N 216,000
N 215,000
N 221,000
N 220,000
N 219,000
E 1,316,000
E 1,317,000
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E 1,321,000
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E 1,324,000
NOTES:
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NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
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DEPARTMENT OF THE ARMY
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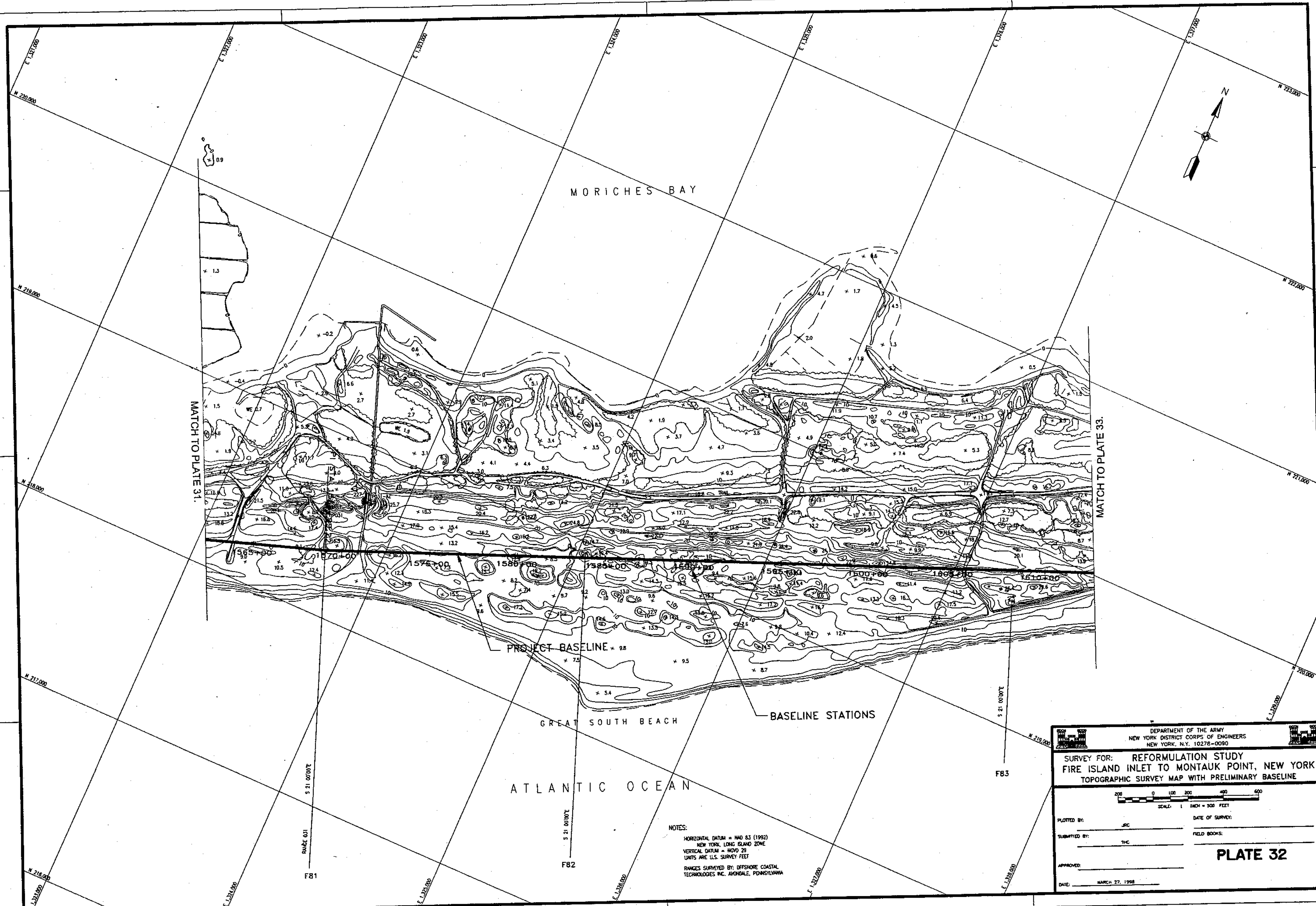
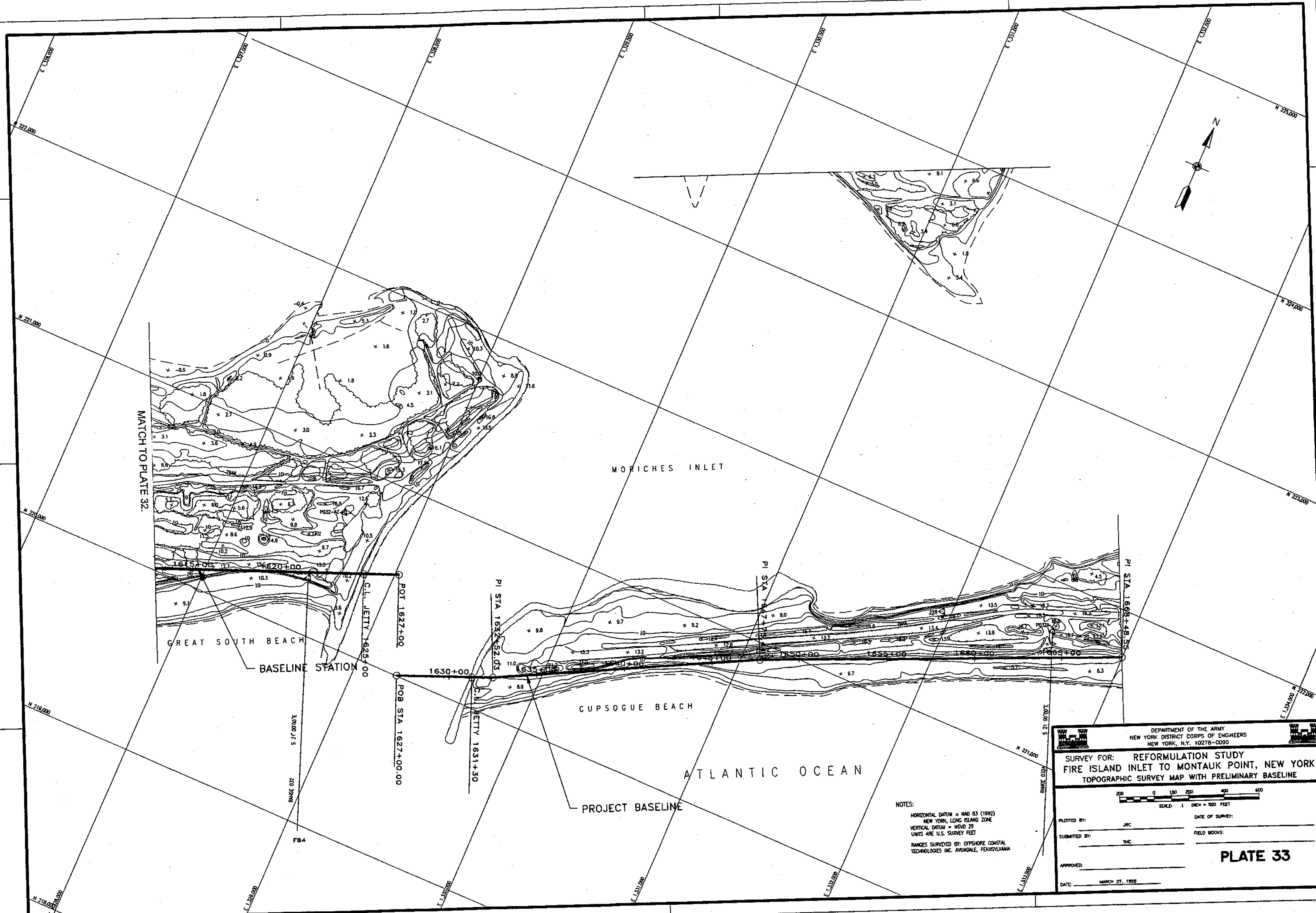
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
SUBMITTED BY: THC
APPROVED:
DATE: MARCH 27, 1998
DATE OF SURVEY:
FIELD BOOKS:
PLATE 31


MORICHES BAY
MATCH TO PLATE 31.
MATCH TO PLATE 33.
N
PROJECT BASELINE
BASELINE STATIONS
GREAT SOUTH BEACH
ATLANTIC OCEAN
F81
F82
F83
S 21 00'00" E
NOTES:
HORIZONTAL DATUM = NAD 83 (1992)
NEW YORK, LONG ISLAND ZONE
VERTICAL DATUM = NGVD 29
UNITS ARE U.S. SURVEY FEET
RANGES SURVEYED BY: OFFSHORE COASTAL
TECHNOLOGIES INC. AVONDALE, PENNSYLVANIA
DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
SCALE: 1 INCH = 300 FEET
PLOTTED BY: JRC
SUBMITTED BY: THC
APPROVED:
DATE: MARCH 27, 1998
DATE OF SURVEY:
FIELD BOOKS:
PLATE 32


MATCH TO PLATE 32.
MORICHES INLET
GREAT SOUTH BEACH
CUPSOGUE BEACH
ATLANTIC OCEAN
BASELINE STATION
PROJECT BASELINE
POT 1627+00
POB STA 1627+00.00
C.L. JETTY 1625+00
C.L. JETTY 1631+30
PI STA 1632+52.03
PI STA 1668+48.55
1615+00
1620+00
1630+00
1635+00
1640+00
1650+00
1655+00
1660+00
1665+00
RANGE 032
RANGE 032A
S 21°00'00"E
FB4
N 218,000
N 219,000
N 220,000
N 221,000
N 222,000
N 223,000
N 224,000
N 225,000
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E 1,328,000
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E 1,331,000
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N
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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT CORPS OF ENGINEERS
NEW YORK, N.Y. 10278-0090
SURVEY FOR: REFORMULATION STUDY
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
TOPOGRAPHIC SURVEY MAP WITH PRELIMINARY BASELINE
200 0 100 200 400 600
SCALE: 1 INCH = 500 FEET
PLOTTED BY: JRC
DATE OF SURVEY:
SUBMITTED BY: THC
FIELD BOOKS:
APPROVED:
DATE: MARCH 27, 1998
PLATE 33

Atlantic Coast of Long Island, Fire Island to Montauk Point

Reach 1
Evaluation of Interim Plan for Storm Damage Reduction

Draft Environmental Impact Statement

November 1999

Prepared By

United States Army Corps of Engineers
New York District
Planning Division
Environmental Analysis Branch
26 Federal Plaza
New York, NY 10278-0090

With the Cooperating Agencies of:
National Park Service
Fire Island National Seashore
United States Fish and Wildlife Service

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ATLANTIC COAST OF LONG ISLAND

FIRE ISLAND INLET TO MONTAUK POINT, NY

REACH 1 – FIRE ISLAND INLET TO MORICHES INLET

INTERIM STORM DAMAGE PROTECTION PROJECT

Suffolk County, New York

The responsible lead agency for the proposed project is the U.S. Army Corps of Engineers, New York District. The responsible cooperating agencies are the National Park Service's Fire Island National Seashore and the U.S. Fish and Wildlife Service, both branches of the U.S. Department of the Interior. New York State, represented by the New York State Department of Environmental Conservation, is the project's local sponsor.

ABSTRACT

This Draft Environmental Impact Statement (DEIS) has been prepared for the Fire Island Interim Project (FIIP). FIIP is a 6-year temporary project to be followed until the Fire Island to Montauk Point Reformulation Study, Combined Beach Erosion Control and Hurricane Protection Project (Reformulation Study) can be implemented. The FIIP project area lies along the south shore of Long Island, in Suffolk County, New York. It is bounded by Fire Island Inlet to the west and Moriches Inlet to the east, and includes the Fire Island National Seashore (FIIS), populated communities within the FIIS, Robert Moses State Park, and Smith Point County Park. The island is approximately 31 miles long, with a width that generally varies between 800 and 2,500 feet. Fire Island is separated from the mainland of Long Island by the Great South Bay. The study area for this Draft Environmental Impact Statement (DEIS) includes the shoreline, barrier beaches, bay areas and mainland areas. This study area is subject to an increasing cycle of storm damage due to a combination of historical and ongoing human activity, natural coastal processes, and storm events. The purpose of the project is to provide temporary and reversible storm damage protection of the barrier island and mainland areas until the findings of the Reformulation Study are available and can be implemented, if feasible.

The U.S. Army Corps of Engineers, New York District has investigated public concerns within the study area in providing interim storm damage protection. The proposed interim project is the environmentally preferred plan because it provides temporary and reversible storm damage protection on Fire Island and in Long Island bay shore communities while maintaining the natural protective features of the barrier island.

The proposed interim project consists of construction of beach fill and a dune system along approximately 11.3 miles of Fire Island. Although the study area contains the entire island coastline, the proposed project targets only those sections of the Atlantic shoreline which currently provide inadequate levels of protection against storm damage. The proposed project would involve one initial beach fill and dune building and is anticipated to be renourished once during its six-year life. During this six-year period the proposed interim project would be able to reduce storm damages for storms of up to a return period of 44 years. The interim project would provide adequate protection to the barrier island and the bay shore of Long Island while the Fire Island to Montauk Point Study is being reformulated.

This interim plan has been developed in accordance with the Partnership Agreement between the Department of Interior and the Army Corps of Engineers. This Agreement is presented in the "Pertinent Correspondence" section of the Draft Decision Document.

THE OFFICE CLOSING DATE FOR THE RECEIPT OF COMMENTS IS 45 DAYS FROM THE DATE ON WHICH THE NOTICE OF AVAILABILITY OF THIS DRAFT EIS APPEARS IN THE FEDERAL REGISTER.	If you would like further information on this statement, please contact: Mr. Peter M. Weppler Project Biologist U.S. Army Corps of Engineers CENAN-PL-E 26 Federal Plaza New York, NY 10278-0090 Telephone: (212) 264-0195

❖

DRAFT ENVIRONMENTAL IMPACT STATEMENT

ATLANTIC COAST OF LONG ISLAND

FIRE ISLAND INLET TO MONTAUK POINT, NY

REACH 1 – FIRE ISLAND INLET TO MORICHES INLET

INTERIM STORM DAMAGE PROTECTION PROJECT

SUFFOLK COUNTY, NEW YORK

SUMMARY

MAJOR CONCLUSIONS AND FINDINGS

The Preferred Alternative for the Fire Island Interim Project (FIIP) proposes to provide storm damage protection by placing sand on selected areas of Fire Island's Atlantic beaches and dunes to strengthen the natural protective features of the island. Approximately 11.3 miles of the 31-mile Fire Island coastline would receive some additional protection. Most of the areas of project activity would be in the Community Districts of the Fire Island National Seashore (FIIS), i.e., in developed areas. Placement of sand on major federal lands of the FIIS would be held to the minimum necessary. No sand would be placed in the Otis G. Pike Wilderness Area. The project has been designed so that only those areas which currently provide inadequate levels of protection against storm damage would receive beach fill.

The Preferred Alternative consists of four design sections, classified by conditions of the beach berm and primary and secondary dunes and the associated need for improved storm damage protection. As shown on Table S-1, in three sections the beach would be filled to an elevation of +9.5 feet above National Geodetic Vertical Datum (NGVD) and a width of 90 feet. In one section (Design Section 2) the beach width would be narrower, 40 feet, and elevation would be higher at +11.5 feet NGVD. Two design sections would also require increases in dune height to +18 feet NGVD (Design Section 2) and +15 feet NGVD (Design Section 3). These design types would be applied as necessary along segments of beach. The total length of shoreline that would receive sand placement is approximately 11.3 miles, or about 36 percent of Fire Island's 31-mile Atlantic coastline.

Table S-1				
Fire Island Interim Project Design				
Design Section	**Berm Width (feet)**	**Berm Elevation (feet NGVD)**	**Dune Width (feet)**	**Dune Elevation (feet NGVD)**
1	90	9.5	No Dune	No Dune
2	40	11.5	25	18
3	90	9.5	25	15
4	90	9.5	No Dune	No Dune
Note:	Berm widths do not include advance fill.			

The sand for the beach fill would be taken from the ocean floor in an area of about 3,000 acres, centered approximately 1.3 miles off shore. This is known as the "borrow area." The amount of sand required—approximately 7.74 million cubic yards—would be dredged from the bottom. The borrow area currently contains 25 million cubic yards of suitable substrate. The depth of the dredging generally be only a few feet, but could go down to a maximum of 20 feet.

The Preferred Alternative would best serve the purposes of an interim project by maintaining the natural protective features of the barrier beach and protecting the bay shore of Long Island as the Fire Island to Montauk Point Study is being reformulated and the results potentially implemented. The proposed project would involve one initial beach fill and dune construction and is anticipated to be nourished again once during its six-year life. In addition, as part of the interim plan, an assessment would be made each Fall of conditions in the sand placement area and the need to undertake localized measures to account for specific locations on the highly variable shoreline where enough erosion has taken place to need immediate correction. If necessary, these areas would be replenished either by bringing sand from stockpiles set up for the purpose or by dredging fill from those areas where sand may have accreted. It is anticipated that if local filling is necessary, it would occur in the last four years of project life. During this six-year period, the proposed interim project would be able to reduce storm damage for storms with up to a return period of 44 years.

In the No Action Alternative, 12,000 structures on the mainland and 3,100 structures on the barrier island would be at risk from storm damages. With the preferred alternative, the frequency and extent of inundation would be reduced for 10,500 mainland structures, as 1,500 mainland structures would be removed from the damage pool completely. Similarly, 2,850 structures on the barrier island would benefit from reduced frequency and extent of damages, with 250 barrier island structures being removed from the damage pool completely. Additional effects on the human environment would be beneficial, because of the reduction in disruption from storm damage to various recreational and commercial activities and to access. Short-term adverse impacts during construction would be unavoidable. These would include temporary disruption of beach access, interruption of pedestrian paths along the beach, and noise from trucks and heavy equipment.

The direct impacts of the Preferred Alternative on natural and cultural resources would be the deposition of beach fill on the placement areas. Indirect effects would include a change in coastal processes and erosion potential that would reduce the possibility of overwash and breaching and related storm damage. The direct and indirect effects are summarized below.

Placement of sand along the Fire Island beaches would result in temporary degradation of the existing beach habitat during initial construction, during the one periodic nourishment, and during the filling of locally eroded areas that might occur annually in the Fall. Existing benthic organisms would be buried. Benthic species are expected to recolonize the new beachfront with no substantial long-term impacts. Use of the shoreline area by fish and avian species for feeding would be disrupted during the placement of the fill. Decreased water quality and increased turbidity associated with the hydraulic placement of fill would also be expected. These impacts are anticipated to be minor and short-term due to the existing high degree of natural and human disturbance in the beach fill areas. Fish and wildlife species which use these areas are those adapted to the high energy, dynamic condition of the ocean shoreline. Fish and bird species would return following the period of disturbance. A program of minimization measures for the piping plover and seabeach amaranth would be included as part of the Preferred Alternative. These measures include:

a. A survey/monitoring effort during construction to ensure adequate protection of these two rare species.
b. Ongoing coordination with USFWS.
c. Installation of symbolic fencing and/or nest exclosures within 660 feet of construction area, where applicable.
d. Limits on locations for storage of equipment and materials to protect the intertidal zone.
e. No disturbance to vegetated tidal wetlands, if any, outside the boundaries of the placement area as a result of the construction activity.
f. Coordination with contractor and employees about Endangered Species Act concerns, and contractor specifications written accordingly.

g. The NYD biologist present on site during laying of the pipeline and sand placement to ensure it is aligned to minimize adverse impact to plovers and amaranths, as determined by NYD after consultation with the local, state, and federal agencies involved with project review.

h. Use of only "clean" sand material, to maintain suitable piping plover and seabeach amaranth habitat.

Placing sand and stabilizing the barrier island would have beneficial impacts on the Fire Island Lighthouse, a National Register historic resource, and on any archaeological or other buried resources on the island.

Dredging of sand from the borrow area would temporarily disrupt the benthos, eliminating the non-mobile species and some mobile organisms caught in the dredge. The benthic organisms would be able to repopulate the borrow area within 12 to 18 months. Potential shipwreck remains in the borrow area would be protected by a buffer ("no-dredge") zone of 150 feet around those resources confirmed by additional monitoring.

AREAS OF CONTROVERSY

The Department of Interior (DOI) and Fire Island National Seashore (FIIS) have indicated concerns about the consistency of the FIIP with the General Management Plan (GMP) that has been prepared and adopted for FIIS. The GMP seeks to manage the FIIS by restoring, to the extent possible, natural processes on the island, and to limit development to those areas that are already set aside for that purpose. For those properties within the FIIS owned by the federal government, GMP policies recognize the difference between major land holdings, which can be managed to serve as natural recreation areas, and smaller tracts interspersed between the existing communities on Fire Island. Although the objectives of the GMP apply to all of the FIIS, the focus on restoration of natural processes and protection of natural resources is strongest on major federal land holdings and in the Otis G. Pike Wilderness Area. The GMP also recognizes that much of the island has been altered by human habitation, which has disturbed the natural morphology and coastal processes.

The Preferred Alternative has been designed to avoid all disturbance to the Otis G. Pike Wilderness Area, to keep to a minimum the placement of sand on major federal lands. The NYD, DOI, and FIIS have been meeting and will continue to coordinate to resolve these concerns.

Compliance with Environmental Requirements and Protection Statutes

The Preferred Alternative/Interim Project has been developed to minimize environmental impacts and comply with all applicable environmental requirements and protection statutes. These are listed in Table S-2.

Table S-2 Compliance with Environmental Requirements and Protection Statutes	
	Required Compliance
Federal Policies	
Archaeological and Historic Preservation Act, as amended	Full
Clean Air Act, as amended	Full
Clean Water Act of 1977, as amended	Full
Coastal Zone Management Act of 1972, as amended	Full
Coastal Resources Barrier Act	Full
Endangered Species Act of 1973, as amended	Full
Estuary Protection Act (PL 90-454)	Full
Federal Water Project Recreation Act, as amended	N/A
Fish and Wildlife Coordination Act, as amended	Full
Land and Water Conservation Fund Act of 1965, as amended	Full
Marine Protection, Research, and Sanctuary Act of 1969, as amended	Full
National Environmental Policy Act of 1969, as amended	Full
Organic Act of 1916	Full
Fire Island National Seashore Act (PL 88-587)	Full
Wilderness Act (PL-88-577)	Full
Fire Island Wilderness Act (PL-96-585)	Full
Rivers and Harbors Appropriation Act of 1899, as amended	N/A
Watershed Protection and Flood Prevention Act, as amended	N/A
Wild and Scenic River Act, as amended	N/A
Floodplain Management (E.O. 11988)	Full
Protection of Wetlands (E.O. 11990)	N/A
Toxic Substances Control Act (PL 94-469), as amended	N/A
Section 106 of the National Historic Preservation Act of 1966, as amended	Full
Executive Orders, Memoranda, Etc.	
Floodplain Management (E.O. 11988)	N/A
Protection of Wetlands (E.O. 11990)	N/A
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	N/A
Impacts on Prime and Unique Farmlands (CEQ Memo 8-30-76)	N/A
State and Local Policies	
The proposed project will comply with all appropriate state and local policies.	

As shown on Table S-3, the Preferred Alternative/Interim Project will have no unmitigatable, significant adverse environmental effects on resources of principal national recognition.

Table S-3		
EFFECTS OF SELECTED PLAN ON RESOURCES OF PRINCIPAL NATIONAL RECOGNITION*		
Type of Resource	**Principal Source of National Recognition**	**Measurement of Effects**
Air Quality	Clean Air Act, as amended (42 USC 185h-7 et seq.)	Minor construction effects.
Areas of Particular Concern within the Coastal Zone	Coastal Zone Management Act of 1972, as amended (16 USC 1451 et seq.)	Significant effect: Beach berm will be restored along 11.3-miles of shoreline; access to the public shore for recreation will be improved; littoral drift to west will be improved.
Endangered and Threatened Species	Endangered Species Act of 1973, as amended (16 USC 1531 et seq.)	Ongoing coordination.
Fish and Wildlife Habitat	Fish and Wildlife Coordination Act (16 USC Sec. 661 et seq.)	Short-term effect: Loss of benthos in the borrow and disposal areas. Long-term effect: Creation of offshore borrow areas; restoration of beach berm and slope; maintenance of coastal habitats.
Floodplains	Executive Order 11988, Floodplain	No effect.
Historic and Cultural Properties	National Historic Preservation Act of 1966, as amended (16 USC Sec. 470 et. seq.). Abandoned Shipwrecks Act of 1987.	Ongoing coordination.
Prime and Unique Farmlands	CEQ Memorandum of August 1, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA.	Not present in project area.
Water Quality, Water Pollution, Public Health	Clean Water Act of 1977 (33 USC 1251 et seq.)	Local short-term effects on sedimentation and turbidity. No measurable long-term sedimentation or turbidity effects; increased public safety.
Wetlands	Executive Order 11990, Protection of Wetlands, Clean Water Act of 1977 (33 USC 251, et seq.)	Not present in project area.
Wild and Scenic Rivers	Wild and Scenic Rivers Act, as amended (16 USC 1271 et seq.)	Not present in project area.
Wilderness Areas	The Wilderness Act of 1964, Otis G. Pike Wilderness Area, Public Law 95-585.	No fill placement, no effect.
Note: * Project area limited to area defined in Chapter 1 of this DEIS.		

PERTINENT DATA

The Preferred Alternative/Interim Plan is to provide storm damage protection until a more permanent solution could potentially be implemented. The plan provides for a protective beach berm and dune. The following is a list of pertinent data:

Beach Fill Length	59,900 ft
Volume of Initial Fill	7,747,000 cubic yards
Width of Design Beach Berm	Varies between 40 or 90 feet
Elevations	
Dune Crest	Varies between +15 or +18 ft NGVD
Beach Berm	Varies between +9.5 or +11.5 ft NGVD
Slopes	
Dune (landward)	1V to 5H
(seaward)	1V to 5H
Beach (onshore)	1V to 15H (to -2 ft NGVD)
(offshore)	1V to 30H
Nourishment Fill Volume	2,709,000 cubic yards
Project Cost	
Initial	$52,887,000
Annual (Discounted at 6-7/8%)	17,040,000
Average Annual Benefits	
Reduced Damages	$19,665,000
Increased Recreational Value	$936,000
Reduced Breach Contingency Plan Cost	$1,084,000
Post Project Benefit	$6,915,000
Total Benefit	$21,685,000
Benefit Cost Ratio	1.3
Net Annual Ration	$4,645,000
Cost Apportionment (First Cost)	
Federal (65%)	$34,377,000
Non-Federal (35%)	$18,510,000

NOTE: NGVD is the National Geodetic Vertical Datum.

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1.00 NEED FOR AND OBJECTIVES OF PROPOSED ACTION

AUTHORITY

1.01 This Environmental Impact Statement (EIS) has been prepared for the Fire Island Interim Project (FIIP). FIIP is a 6-year interim project to be followed until the potential recommendations of the Fire Island to Montauk Point Reformulation Study, Combined Beach Erosion Control and Hurricane Protection Project (Reformulation Study) can be potentially implemented. The Reformulation Study was authorized by the River and Harbor Act of 14 July 1960, and subsequently modified in accordance with Section 103 of the River and Harbor Act of 12 October 1962. The project authorization was modified again by Section 31 of the Water Resources Development Act (WRDA) of 1974. The authorization was further modified by Section 502 of the WRDA of 1986 (P.L. 99-662). For portions of Fire Island to Montauk Point other than the portion from Moriches Inlet to Shinnecock Inlet, Section 103 of the WRDA of 1986 (P.L. 99-662) defined the cost sharing of the first cost to be 65 percent federal. A more detailed discussion of project authority and history can be found in the Draft Decision Document (Project Authorization and History).

1.02 ~~Fire Island~~ is a barrier island ~~approximately 31 miles long~~, ~~located on the south shore of~~ Long Island. Fire Island is bounded by the Atlantic Ocean to the south, Fire Island Inlet to the west, Moriches Inlet to the east, and the Great South and Moriches Bays to the north. Nearly all of the island lies within the boundaries of the Fire Island National Seashore (FIIS), under the management of the National Park Service (NPS). The study area for this project is Fire Island and areas of the south shore of Long Island in close vicinity (see Figures 1-1 and 1-2).

1.03 NYD is currently leading the planning effort for the Reformulation Study with the NPS-FIIS and the U.S. Fish and Wildlife Service (USFWS) as the responsible cooperating agencies and New York State, represented by the New York State Department of Environmental Conservation (NYSDEC), as the local sponsor. The proposed FIIP project requires approval from the Headquarters of the U.S. Army Corps of Engineers and a Special Use Permit from NPS-FIIS for construction in the National Seashore. The approval of FIIP and the NPS-FIIS Special Use Permit are subject to the regulations of the National Environmental Policy Act of 1969 (NEPA), which requires the preparation of an Environmental Impact Statement (EIS) whenever major actions of federal agencies may significantly affect the quality of the human environment.

1.04 The State as local sponsor has actions to take as well, including approval of project funding and a project cooperation agreement as well as NYSDEC's Water Quality Certification and Coastal Zone Management Compliance (see Appendix A). These actions are subject to the regulations of the New York State Environmental Quality Review Act (SEQR), which places requirements on state agencies similar to those of NEPA.

1.05 This document is a Draft Environmental Impact Statement (DEIS), and it has been prepared in accordance with NEPA regulations as promulgated by the President's Council on Environmental Quality (CEQ) (40 CFR Parts 1500-1508) and SEQR regulations promulgated by NYSDEC (6 NYCRR, Part 617). The 404(b) analysis provided as Appendix B to the DEIS has been prepared to meet the requirements of the Clean Water Act of 1977 and to advance SEQR review. The policies of New York State's Coastal Zone Management Program were taken into account throughout the project planning (DEIS Appendix A). Relevant environmental statutes are listed in Table S-2 of the summary section of this report.

PROBLEM IDENTIFICATION

1.06 The problems encountered in the FIIP study area consist of the loss of sand fronting the populated areas due to storm-induced erosion, and the deterioration of the natural protective features and consequent storm damage to structures in Long Island's bay shore communities. Erosion has gradually reduced the width and height of the Fire Island beach berm and dunes. This has increased the potential for tidal inundation on the bay shoreline of Long Island and erosion of the barrier island leading to economic losses and threats to human life and safety. Natural forces that act on an environment altered by development and human activity cause damage to the shorefront structures and buildings in the project area. These forces were examined individually and in combination within the mechanism(s) which tend to produce the most damage to any given structure. Damage mechanisms examined were: a) storm recession; b) inundation; and c) wave attack.

PROJECT PURPOSE AND NEED

1.07 The purpose of the FIIP is to alleviate conditions conducive to the threat of storm damages in the study area by providing temporary storm damage protection until the findings of the Reformulation Study are available and more permanent protection can be implemented, if feasible.

1.08 The FIIP study area is subject to an increasing cycle of storm damage due to a combination of historical and ongoing human activity, natural coastal processes, and storm events. Historical human activity includes: the stabilization of Fire Island and Moriches Inlets (in 1941 and 1952, respectively), which has altered the natural characteristics and coastal dynamics of the barrier island; the loss of a large area of bayshore wetlands to development in the decades following the end of World War II, which has reduced the flood storage capacity of the bay shore; and the construction of beachfront homes on Fire Island in locations that contribute to the erosion and destabilization of the barrier island's dunes, its most potent natural protective feature. Erosion from natural coastal processes and storms events on this altered environment has gradually reduced the width and height of the beach and dunes. This has increased flooding on the bay shoreline of Long Island and made the island itself more vulnerable to storm damage. Specifically, the natural forces that cause damage are storm recession (erosion during a storm), inundation (flooding), and wave attack. For a more detailed discussion, please refer to the Draft Decision Document.

1.09 Barrier islands such as Fire Island provide a unique ocean-side habitat and protection from the flooding and erosion of the far bay shores. Northeasters and hurricanes periodically strike the southern shores of Fire Island and the shoreline of the Great South Bay. These storms produce tides and waves that flood the bay shoreline of Long Island and erode the barrier island. Flooding in the Great South Bay intensifies when the storm surges wash over the island into the bay ("overwash") or break through ("breach") the narrow barrier island and carve out a new inlet to the bay. These are natural phenomena that have been observed over the last two hundred years.

1.10 The storms create flood damage to homes and businesses on Fire Island. The analysis conducted for this project shows that the number of structures currently at risk from flooding during a 44-year frequency storm total 3,138, or approximately 75 percent of the structures on the barrier island. Some 1,897 structures would be flooded above the main floor.

1.11 Responding to the increasingly severe erosion problem, Fire Island communities have taken substantial protective measures over the last 40 years, including beach scraping, dune creation, and installation of sand fences and dune vegetation. These efforts have been supplemented with periodic local and federal nourishment projects, particularly after major storm events. Between 1955 and 1994, approximately 6.4 million cubic yards of fill were placed on Fire Island by the federal government, local municipalities, and local interests. Approximately 54 percent of this fill activity occurred during the 1960's in response to the severe erosion caused by Hurricane Donna (1960) and the Ash Wednesday storm of 1962. Some 1.66 million cubic yards of fill was placed on Fire Island's beaches more recently, between 1993 and 1997. Most of this latter fill was placed by local communities at Fire Island Pines, Ocean Bay Park, Fair Harbor, and Saltaire in response to the severe storms that occurred during the early 1990's.

1.12 Also in response to the devastating storms of the early 1990's, the NYD, in cooperation with local and state authorities, developed a Breach Contingency Plan (BCP). Under this plan, any breach occurring along the barrier island system from Fire Island Inlet to Southampton would be closed within three months. Breach closure would be initiated within three days of the storm event.

1.13 Despite the various efforts to rectify conditions, severe erosion of the protective dunes has left many of the island's natural features and built structures exposed to even minor storms. The lack of dry beach seaward constrains access for emergency vehicles, NPS patrols, and residents. The resulting potential safety hazard is clear: options for emergency response and evacuation in these areas are limited to the narrow pathways through the island's center.

1.14 While long-term erosion and large storms have posed a significant threat to the study area for many years, the series of recent storms has created a potentially imminent hazard of widespread overtopping of the island and subsequent flooding of mainland communities on Great South and Moriches Bay. Previous investigations indicate that at several locations, overtopping may erode the barrier to the point where a breach, or new inlet could be formed (Moffat and Nichol, Engineers 1994). This area is low-lying and extensively developed. The inventory of buildings undertaken for the FIIP has identified a total of 11,954 mainland structures potentially subject to flood damage in this portion of the study area from a storm of a 44-year frequency. Of these, some 5,645 would be flooded above the main floor.

1.15 During most storms, the presence of the barrier island prevents widespread inundation along the bay shore. Tidal surges enter the bay at defined points, which constrict the flow of water that can approach the bay shore. When the surges are large enough and the barrier low enough, the water will wash over the island, greatly increasing the volume of water flowing to the bay and the potential for flooding of the bay shore, as occurred in the series of storms in 1992 and 1993. As the width of Fire Island has narrowed and its dunes lowered over time, the incidence of flood surges and related flooding in the bay has increased. The island is now eroded enough in some places that a full breach is possible. This would substantially add to the already present danger of flooding of Long Island bay shore communities. The Problem Identification section of the Draft Decision Document contains a more detailed discussion of these problems, presenting them as a sequence of the following three closely related components: shoreline change; breach and overwash impacts; and tidal flooding.

1.16 In summary, shoreline change has seriously reduced the ability of the Fire Island shoreline to act as storm protection for both the barrier island and the bay shores and has as a result increased the amount of development subject to storm damage and imminent hazard. Without immediate intervention, the historic shoreline change trend will continue to increase the potential for breaching, overwash, and flooding leading to economic losses and threats to human life and safety. As stated above, the purpose of the FIIP is to provide temporary and reversible storm damage protection of the barrier island and mainland areas until the findings of the Reformulation Study are available and can be implemented, if feasible. The level of protection contemplated is, in effect, a return to pre-1992/93 storm conditions. Planning and evaluation of the FIIP alternatives have been undertaken within the context of project purpose and need and of the planning objectives and policies of the cooperating and decision-making entities on the project—NYD, NPS-FIIS, USFWS, and New York State—as discussed below.

Study Objectives and Constraints

1.17 A number of study objectives have guided project planning. These reflected the needs of the FIIP and the mandates and related policies of the responsible federal lead agency, the U.S. Army Corps of Engineers NYD, federal cooperating agencies (NPS-FIIS and USFWS), and local sponsor NYSDEC. The objectives formed the basis of the scope of analyses undertaken to identify and evaluate alternatives and to identify and mitigate, as necessary, the potential adverse impacts of project alternatives. As they relate to this project, the role and objectives of the local sponsor and cooperating agencies are summarized below.

U.S. Army Corps of Engineers

1.18 NYD planning objectives and constraints were identified based on the problems, needs, and opportunities, and existing physical and environmental conditions in the project area. Accordingly, the following objectives have been identified:

a. The plan must reduce the imminent threat of damages to buildings, and infrastructure due to the effects of storms, with an emphasis on tidal flooding and breaching.

b. In accordance with the limits of institutional participation, plan components may not exceed levels which reasonably maximize National Economic Development (NED) benefits.

c. Preserve, restore, and maintain existing ecological resources and habitats suitable to native fish and wildlife, where possible; and avoid or minimize any possible adverse effects of the project on the environment.

d. Preserve, maintain, and enhance the cultural resources and human use, where appropriate, of the area.

e. As an interim project, the plan must be temporary and reversible, with a foreseeable life of 6 years.

National Park Service-Fire Island National Seashore

FIIS Actions and Responsibilities

1.19 Approximately 26 miles of the 31-mile-long Fire Island portion of the project study area lie within the FIIS, which was created by the Fire Island National Seashore Act in 1964 (P.L. 88-587). In addition, a portion of FIIS was established as the Otis G. Pike Wilderness Area in 1980 (P.L. 95-585) pursuant to the Wilderness Act of 1964 (P.L. 88-577). The FIIS is managed by NPS under a General Management Plan (GMP) approved in 1978 and revised in 1979, NPS Management Policies established in 1988, and the FIIS Resource Management Plan approved in 1993. A Special Use Permit would be required from the NPS before the implementation of those components of the FIIP preferred alternative that are located in the FIIS. As they relate to this project, the objectives of the GMP are summarized below.

FIIS GMP Objectives

1.20 The GMP seeks to manage the FIIS by restoring, to the extent possible, natural processes on the island, and to limit development to those areas that are already set aside for that purpose. For those properties within the FIIS owned by the federal government, GMP policies recognize the difference between major land holdings, which can be managed to serve as natural recreation areas, and smaller tracts interspersed between the existing communities on Fire Island. Although the objectives listed below apply to all of the FIIS, the focus on restoration of natural processes and protection of natural resources is strongest on major federal land holdings and in the designated wilderness area.

a. Preserve and enhance the serenity and natural beauty of the island, which includes protection of the beaches, dunes, and other natural features fundamental to the concept of the FIIS.

Manage Fire Island to enhance natural processes and mitigate the impacts of human interference with these processes.

b. Resource management actions are necessary, as Fire Island is a culturally manipulated barrier-island system, and cannot be managed as if natural geomorphic processes had been totally unimpeded.

c. Provide for and continue to serve the recreational needs of Fire Island's users, who are largely drawn from Nassau and Suffolk Counties and from New York City, making the seashore accessible to a cross section of the national and regional population.

d. Identify and preserve cultural resources.

e. Protect and preserve natural plant and animal communities.

f. Maintain and/or restore all areas not required for public or administrative use to a natural condition using aesthetically appealing and environmentally compatible methods.

g. Maintain and provide only those dune crossings (vehicular and pedestrian) required for the proper use and preservation of the area.

h. Integrate planning and management for FIIS into regional planning and economic considerations.

U.S. Fish and Wildlife Service

USFWS Actions and Responsibilities

1.21 USFWS also has a role in the project approval process through the Fish and Wildlife Coordination Act of 1958 (P.L. 85-624), which requires USFWS to prepare a report and recommendations on the wildlife resources that could be affected by the FIIP. (USFWS has prepared a draft coordination act report, which is included in Appendix C, along with the NYD's response and request for a revision based on the revised proposed project.) In addition, under the Endangered Species Act of 1973 (P.L. 93-205), USFWS will issue a Biological Opinion on the FIIP's plans for the protection of endangered or threatened species in the project area. In addition, a portion of Fire Island lies within the Coastal Barrier Resources System, which is administered by USFWS pursuant to the Coastal Barrier Improvement Act of 1990.

USFWS Objectives

1.22 The objectives of the USFWS as they relate to the FIIP derive from the legislative mandate to protect wildlife resources and conserve endangered and threatened species. Accordingly, the project was planned to:

a. Minimize disruption to the area's wildlife resources.

b. Avoid disturbance to the federally listed threatened piping plover (*Charadrius melodus*), and other such listed species that may occur in the project area and related borrow area.

c. Prohibit the spending of new federal monies that tend to encourage development or modification of coastal barriers that are within identified coastal barrier units on Fire Island.

New York State

Actions and Responsibilities

1.23 The FIIP was initiated in February 1995 with NYSDEC as the non-federal (local) sponsor. In correspondence dated May 23, 1995 and April 29, 1996, the project sponsor, NYSDEC, has indicated support for an interim project for Fire Island. Subsequent to the approval of FIIP, a Project Cooperation Agreement (PCA) will be prepared, which will identify the responsibilities of both federal and state parties. The exact terms of the local sponsor agreement are discussed as the items of local cooperation in the Draft Decision Document. This includes the institutional and financial obligations of both state and federal governments. In addition to the non-federal share of project costs, New York State will:

- Provide all lands, easements, rights-of way, and disposal areas, or any other necessary interests for initial construction and periodic renourishment during the life of the project;
- Hold and save the United States free from damages arising from the construction (including periodic nourishment), operation maintenance, and replacement of the project, except where such damages are due to the fault or negligence of the United States or its contractors;
- Pay the required non-federal costs for initial construction and periodic nourishment over the project life as stipulated in the PCA;
- Upon completion of initial construction, New York State will operate, maintain, rehabilitate, repair, and replace the works;
- Upon completion of initial construction, New York State will acquire, rehabilitate, repair, re-place, operate and maintain easements for public areas created or enhanced by the project;
- Assist in the development of a Public Access Plan, and provide the lands, easements and rights-of-way necessary for the Public Access Plan.
- As set forth in Section 401 of the Clean Water Act of 1977 (P.L. 95-217), the project requires a water quality certificate from NYSDEC before it can be constructed. (USACOE is currently in the application process for this.)

- In addition, the New York State Department of State (NYSDOS) must review NYD's determination of the FIIP's consistency with the policies of the State's Coastal Zone Management Program (Coastal Zone Management Act of 1972, P.L. 92-583 and New York State Waterfront Revitalization and Coastal Resources Act of 1982). (See Appendix A.)

Related New York State Policies

1.24 As local sponsor, NYSDEC must apply to the FIIP the objectives that derive from its basic mandate, to protect the environment of New York State, and from other relevant policies, particularly those of SEQR, of the Coastal Erosion Hazard Act (CEHA) of 1981 (Article 34 of the NYS Environmental Conservation Law) and of Section 401 of the federal Clean Water Act. In addition, NYSDEC maintains lists of locally threatened and endangered species that require special protection. The objectives can be summarized as follows:

a. Proposed actions should minimize impacts on the environment, broadly defined to include, in addition to natural, air, and water resources, elements such as land use and population patterns, community character, visual resources, historic and archaeological resources, noise levels, transportation and other infrastructure, and community facilities.

b. NYSDEC has identified the Fire Island coastline as one most prone to erosion hazards, and has mapped, but not yet approved, a coastal erosion hazard area along its length. Activities within the coastal erosion hazard area should be limited and restricted to avoid exacerbation of erosion hazards and to protect natural protective features.

c. Non-structural actions to minimize erosion damage are preferred to structural features. Erosion protective structures, if required, should be designed to minimize damage to other man-made property, natural protective features, or other natural resources.

d. Avoid disruption to the state-listed threatened and endangered species that may occur in the project area and related borrow area.

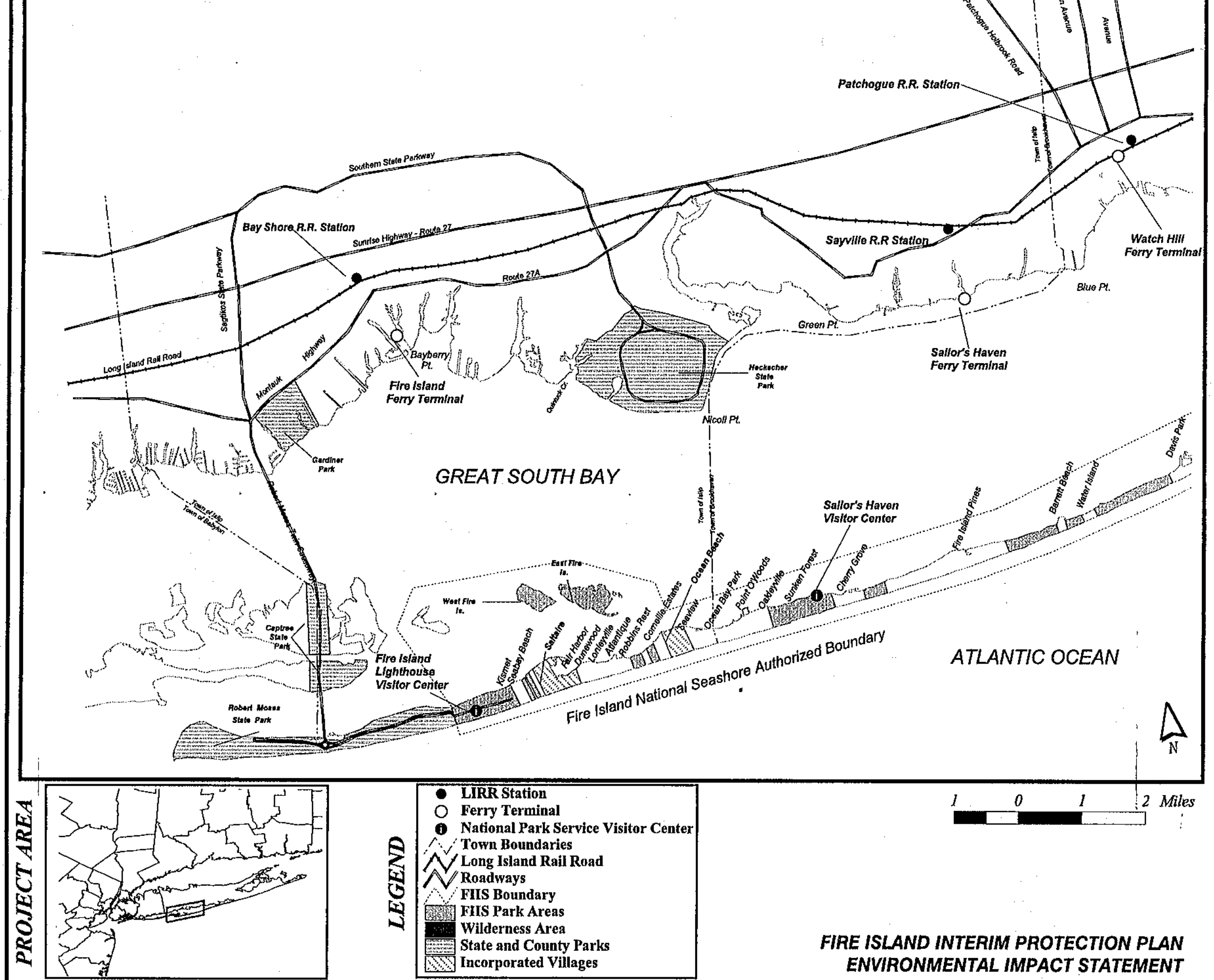
1.25 In addition, New York State has framed 44 policies for the management and protection of its coastal zones under the aegis of NYDOS. These policies, which seek to preserve the State's coastal resources for public enjoyment, appropriate economic activity, and the protection of important natural resources, are described in detail in Appendix A, "New York State Coastal Zone Management Program Consistency Determination."

PROJECT STATUS

1.26 Planning for the FIIP entailed an evaluation of a number of alternatives according to the objectives and policies above and led to the identification of a preferred alternative. This process of screening alternatives is summarized in Chapter 2: Project Alternatives and described in more detail in the Draft Decision Document.

1.27 This DEIS has been prepared to examine the full range of potential effects of the project alternatives and to identify and, if necessary, develop mitigation for any potential significant adverse impact resulting from the proposed project. The DEIS will be subject to agency and public review and comments, after which a Final EIS (FEIS) will be prepared. The FEIS will incorporate and respond to all relevant comments made on the DEIS, and will reflect any further refinement of the project alternatives that may have taken place during public review. At least 30 days following issuance of the FEIS, during which time additional public comments may be received, NYD and USDOI will make their decisions on the project, and each will issue a Record of Decision. NYSDEC will make SEQR Findings, a document similar to the Record of Decision, for its discretionary actions. ❖

Figure 1-1 Fire Island Interim Project Study Area: Western Sector



**FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT**

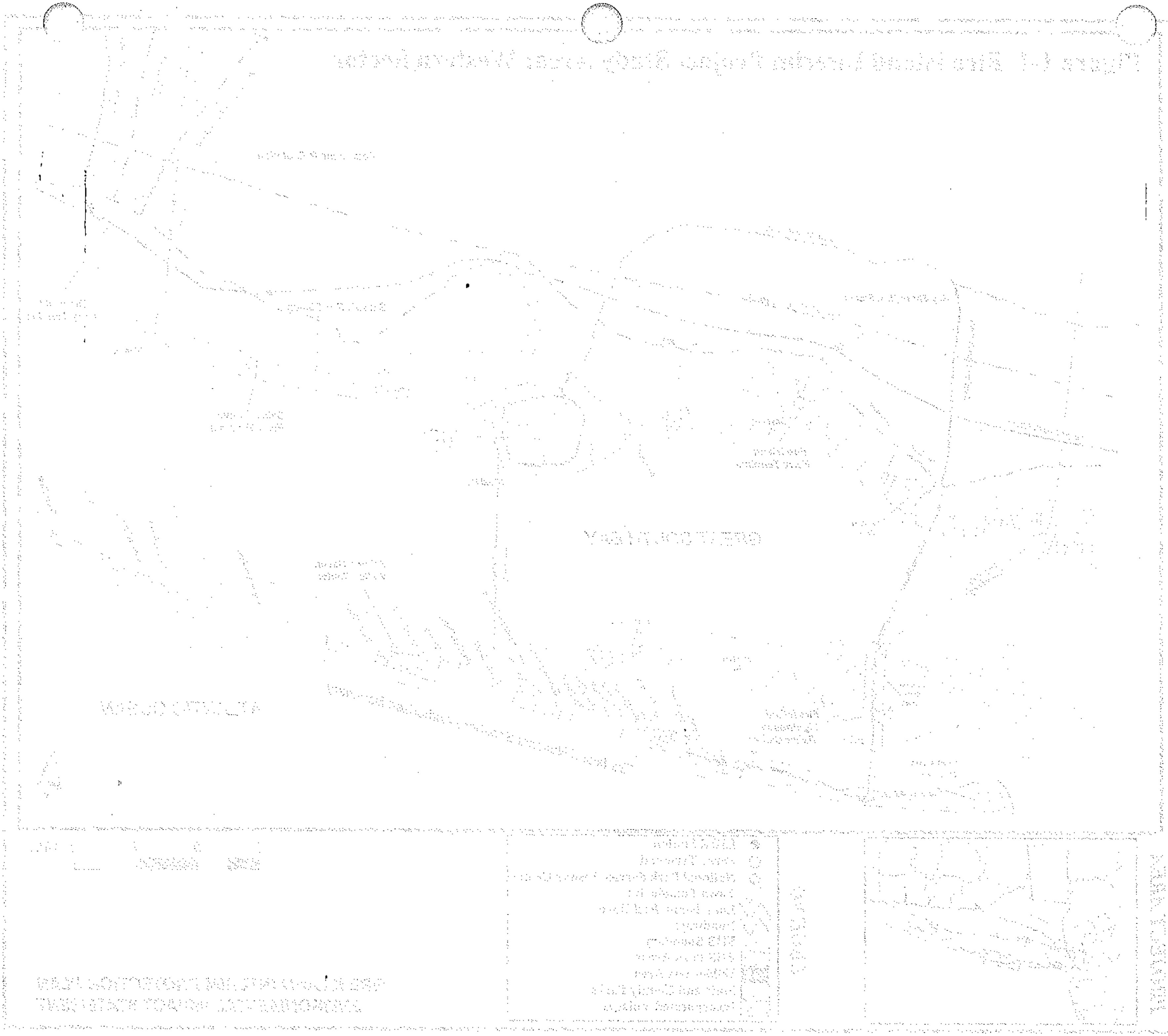
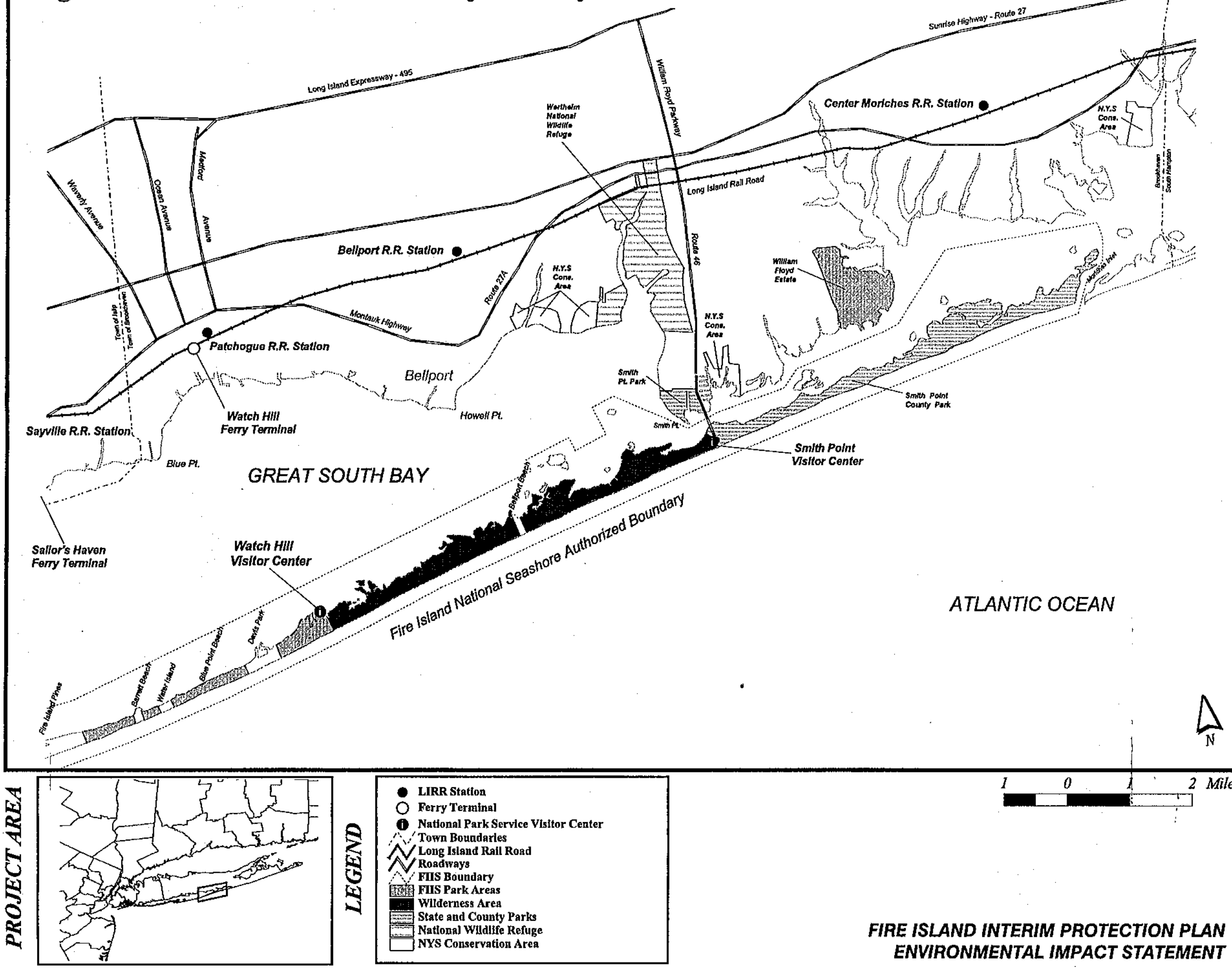


Figure 1-2 Fire Island Interim Project Study Area: Eastern Sector



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

2.00 ALTERNATIVES TO THE PROPOSED ACTIONS

PRELIMINARY SHORE PROTECTION ALTERNATIVES

2.01 This section describes the alternatives that have been considered in the overall project analysis. Certain alternatives were eliminated early in the engineering analysis because they did not sufficiently meet project goals. Hard structural alternatives were screened out because they could not easily be reversed. Certain alternatives, which offered little protection, were screened out because they did not meet the design requirements. After initial consideration, only those alternatives, which were determined to meet the objectives of providing interim protection against storm damages, were considered for further evaluation. Possible solutions considered in the initial step of plan formulation are listed below:

a. No Action
b. Buy-Out Plan
c. Floodproofing/Retrofit
d. Dune District Management Plan
e. Upland Sand Management
f. Sand Bypassing
g. Beach Nourishment
h. Revetments
i. Revetments and Beach Restoration
j. Breakwaters
k. Breakwaters with Beach Restoration
l. Seawalls
m. Seawalls with Beach Restoration
n. Groins
o. Groins with Beach Restoration

2.02 The following paragraphs briefly describe the objective and the evaluation of each alternative.

No Action (Without Project Future Conditions)

2.03 This plan, simply, means that no additional measures beyond those currently approved or planned, such as the Breach Contingency Plan (BCP), would be taken to provide for storm damage protection of the barrier island or mainland property along the Great South Bay. This plan fails to meet any of the objectives or needs for the project. While this plan was not considered for further development, it does provide the basis against which the project benefits are measured.

Buy-Out Plan

2.04 Permanent evacuation of existing areas subject to erosion or inundation involves the acquisition of this land and its structures either by purchase or by exercising the powers of eminent domain. Following this action, all development in these areas is either demolished or relocated. The value of affected mainland structures alone could reach $4.7 billion, and Fire Island structural values exceed $640 million. Considering the amount of development, both commercial and residential, along the ocean front and bay side of the barrier and all of the affected properties on the mainland, this plan is both prohibitively expensive and socially unacceptable and was dropped from consideration as a stand-alone option. The plan is not readily reversible, does not meet the objective of providing interim storm damage protection to properties on the mainland, and thus will not be considered further as an interim measure.

Floodproofing/Retrofit

2.05 A nonstructural plan consisting of a combination of floodproofing, structure raising, ring walls, and buyouts was considered to protect structures on both the mainland and the barrier. The screening analysis identified nonstructural measures to provide a 44-year frequency level of protection. This would require floodproofing over 9,500 buildings, raising over 3,600 buildings, and providing ring walls for approximately 150 buildings. The preliminary initial cost estimates ranged between $400 million and $500 million. This plan was eliminated from consideration as an interim measure due to the comparatively high cost, and the fact that it is not readily reversible.

Dune District Management Plan

2.06 The basis of this alternative is that removing development within the primary dune (Dune District) will eliminate obstacles to dune growth and migration. Over time, dune growth may provide an increased level of protection. Some possible property acquisition methods suggested by the Department of the Interior are:

- Life-tenancy until 50 percent or more of home is destroyed by flooding or storm;
- Trade for National Park Service lots located inside communities or in "strips" of non-major federal tracts of land, with payments for difference in values;

- Transfer ownership if erosion makes sites unbuildable; transfer from Suffolk County for unpaid taxes; or continued private ownership in a natural condition;
- Condemnation and purchase of developed and undeveloped tracts;
- Purchase from willing seller.

2.07 It is assumed that this alternative would require acquisition of the estimated 380 properties located within the Coastal Erosion Hazard Area. Since this alternative would permanently remove structures and would not provide any near term reduction in overwash and flooding, it does not meet the immediate storm damage reduction objectives or reversibility constraints for interim protection.

Upland Sand Management

2.08 Upland sand management consists of the regrading of existing material at the project site to optimize the configuration of the existing material to provide an additional degree of protection. In many areas along the south shore of Long Island, local communities participate in beach scraping projects, where material is removed from the top of a beach berm having sufficient height and width, and is placed in a dune configuration, to reduce the possibility of dune overtopping. These measures typically move material in the cross-shore direction, and do not redistribute material in the alongshore direction. This alternative is minimally effective as there is no net increase volume of sand, and only may be considered a viable solution where the existing beach berm is both high and wide. Many areas of Fire Island do not currently have a sufficient amount of material fronting the beach to provide a source of material for upland sand management operations to be successful. Upland sand management can be a component of any alternative which includes periodic beach renourishment to reduce the quantity of beach fill that is required as advance fill or renourishment. In a renourished beach scenario, sufficient quantities of material are usually present in the area to allow for redistribution of material and to ensure the project design is maintained. This redistribution of material would typically include the transport of sand alongshore and would move material from an accretional area to an erosional area. While upland sand management is not recommended for further consideration as a stand-alone alternative, it will be considered as a component for alternatives that include beach nourishment in order to minimize renourishment requirements and to offset the difficulties in addressing erosion undulations along the shoreline.

Sand Bypassing

2.09 Sand bypassing involves the placement of material that is currently trapped within an inlet system to areas on the downdrift side, thereby reintroducing material into the littoral system to offset the impacts of the inlet as a sediment trap. At Moriches Inlet, sand that accumulates in the navigation channel is routinely placed on the downdrift shoreline when it is removed for maintenance of the Moriches Inlet Navigation Project. It should be noted, however, that this procedure does not bypass all the sand trapped by the inlet system, only that portion that is deposited within the navigation channel and associated deposition areas. Such bypassing, while critical to helping mitigate the impact of the inlet, is not sufficient to be considered a stand-alone option for providing storm damage protection to the Fire Island barrier. The existing longshore transport rate deficit caused by Moriches Inlet is estimated at 130,000 cubic yards (cy) per year. Shoreline change model results indicate that fill bypassed to Fire Island would not migrate sufficiently west to have a major impact on the project area beaches. Its contribution to the maintenance of the project would at best be limited during the 6-year project life.

Beach Nourishment

2.10 Beach nourishment involves placement of sand directly on an eroding shoreline to restore its form and subsequently maintain an adequate beach width by means of periodic renourishment fill. This option would include a berm backed by a dune to reduce the storm damage potential to the barrier island and mainland areas. It is regarded as the most environmentally compatible means of shoreline engineering, since this technique can mimic the natural process of sand addition to the barrier chain (Leatherman 1982). Introduction of new sand supplies, obtained from sources outside the nearshore sand-sharing system, provides the material for adjustment of the beach and shoreface according to the energy conditions and sea-level position. The principal effect of beach nourishment would be the delay in advent of the natural geomorphic processes involved in landward barrier migration. A sand-fill-only plan was considered a viable alternative interim plan because it would tend to restore natural protective features using material similar to native shorefront materials. Beach nourishment will also tend to revert to near pre-project conditions, if a decision to discontinue results from the reformulation. This alternative is discussed in greater detail throughout this report.

Revetments

2.11 Revetments are a facing of resistant material, such as rock, built to protect shorelines from erosion and storm damage. They consist of an armored layer of rock placed over a dune or berm in the back portion of the beach. Revetments are designed to protect the land immediately behind them. Erosion will continue adjacent to and in front of the revetment. Because of this, the revetment must have a substantial toe foundation to prevent undermining of the structure. This plan fails to check erosion, does not significantly increase storm inundation protection, and was not considered for further development.

Revetments with Beach Restoration

2.12 Beach restoration combined with revetments will provide added storm protection and will act to protect the revetment from undermining. The beach restoration will also reduce the effects of erosion and provide recreational beach area. This plan would have extremely high costs. The plan is also not readily reversible and was not considered for further development.

Breakwaters

2.13 Breakwaters are structures that protect beaches from wave action by dissipating wave energy before it reaches the beach. A decrease in wave energy will reduce sediment transport, thus reducing the erosion rate. The breakwater does not, however, provide protection from tidal surges and is not readily reversible; therefore, this plan was eliminated from further development.

Breakwaters with Beach Restoration

2.14 To minimize the effect of breakwaters on downdrift beaches they are usually constructed in conjunction with beach restoration. This plan would effectively check erosion and also create a wider beach berm and dune system to provide storm damage reduction. This plan was eliminated due to the associated high costs and because the plan is not reversible as an interim plan.

Seawalls

2.15 Seawalls provide upland erosion protection and are usually employed to protect upland structures from erosion and flooding damage. Seawalls provide some storm protection for the backshore areas. Many seawalls cause scour problems in the beaches fronting them, which could become a potential safety hazard. This plan is not reversible as an interim plan and fails to check erosion of existing beaches; it was therefore was eliminated from further consideration.

Seawalls with Beach Restoration

2.16 With this option, seawalls would provide upland storm protection, while beach restoration would check erosion along the shoreline. Beach restoration would also provide an extra buffer for storm protection. This plan is an irretrievable commitment of resources for interim protection and the cost of a seawall is likely to exceed benefits for these areas.

Groins

2.17 Groins are coastal structures which are normally constructed perpendicular to the shoreline. They extend from the back beach area into the water and are designed to retard erosion. Properly designed groins will reduce erosion. This plan fails to meet all of the objectives since the groin plan fails to provide adequate storm protection and is not readily reversible as an interim feature.

Groins with Beach Restoration

2.18 Groins alone, as described above, would not widen the existing beach because there is a severe deficiency of sand. Beach restoration would provide a wider dry beach area and would benefit from the erosion reduction by the groins. While groins with beach restoration may be beneficial at some locations on Fire Island, such a plan is not readily reversible.

Environmental Impact Alternatives

2.19 The purpose of alternatives in an environmental impact analysis is to compare the level of impacts expected from the proposed project to other approaches that could achieve the project's goals. One of the purposes of alternatives is to develop approaches that can eliminate or minimize impacts. In addition, alternatives can frame the range of effort that could be used in achieving the project goals so that the decisionmakers have a context in which to judge the potential impacts of the proposed project. This latter approach to developing alternatives is particularly effective when the potential impacts increase as the size, duration, or extent of the proposed project increase. To disclose the range of environmental impacts that could occur from FIIP, three alternatives will be analyzed in this EIS. These alternatives include the No Action Alternative, the Modified Authorized Plan, and the Interim Plan.

2.20 The No Action Alternative does not maintain the shoreline and associated habitats and because of this it is not the environmentally preferred alternative. The No Action Alternative is considered a continuation of the status quo and includes the possibility of continuing local and state efforts to prevent erosion. The No Action Alternative is not the environmentally preferred plan, as it will not provide adequate shoreline protection. In addition, some local and state efforts will not be reversible. The Modified Authorized Plan is considered larger in size. Due to this, the Modified Authorized Plan is not the environmentally preferred plan for interim protection. The proposed interim project is the "environmentally preferred plan" because it provides bay shoreline protection while maintaining the natural protective features of the barrier island. These three alternatives present the range of environmental impacts that could be expected from beach nourishment on Fire Island and provide the decisionmakers with a context within which to judge the potential impacts of their actions.

No Action Alternative

2.21 Under the No Action Alternative, the U.S. Army Corps of Engineers, New York District (NYD) and the federal government would take no action before the Reformulation Study is completed and implemented except that the BCP would be undertaken in the case of a breach. The BCP would provide a minimal beach profile to close any breaches, but would not rebuild the shorefront to the degree that it could withstand future storms. Local and state governments as well as non-governmental agencies, such as home owner associations, could take actions to prevent erosion and build up the beach and dune profiles, subject to permitting requirements. Therefore, the No Action Alternative involves the least amount of construction that is likely to occur under current laws and conditions. Out of the three alternatives, the No Action Alternative would provide the least shoreline protection.

Modified Authorized Plan

2.22 Another alternative is the Modified Authorized Plan, without hard structures. The Modified Authorized Plan is larger and involves greater volumes of beach renourishment than either of the two other alternatives. The beach would be wider and the dunes would be higher than with the Interim Plan (discussed below). Hard structures which are envisioned as part of the Authorized Plan are not included in this analysis because they could not easily be removed. Therefore, the structures do not meet the project goal of being easily reversed.

Interim Plan (Preferred Alternative)

2.23 The Interim Plan involves beach fill to provide protection against storm damages, as described below. The life of the Interim Plan is 6 years, which is when the Reformulation Study is to be finished and the findings potentially implemented. The Preferred Alternative is discussed in greater detail below, and in the Draft Decision Document.

PREFERRED ALTERNATIVE: THE INTERIM PLAN

2.24 Based on the screening analysis, the Preferred Alternative is beach fill. Beach fill is a "soft" engineering approach in that no structures, such as groins or bulkheads, are involved. Ease of reversibility is a key element in beach fill. After the initial beach fill, renourishment is required periodically or the beach will eventually erode. By ceasing the maintenance beach fill, the situation tends to reverse over a period of years with no further effort or expense. Based on the schedule for renourishment, the 6-year duration requirement can be met with initial construction and one renourishment cycle, which is estimated to provide 6 years of protection. For the purposes of this report, it is assumed that there will be a permanent alteration of the geomorphology of the ocean bottom in the borrow area. This change and its associated impacts are discussed in Chapter 4 and in the Draft Decision Document and its appendices.

2.25 The sand for the beach fill would be taken from the ocean floor in an area of about 3,000 acres, centered approximately 1.5 miles off shore. This is known as the "borrow area." The amount of sand required—approximately 7.74 million cubic yards—would be dredged from the bottom. The borrow area currently contains 25 million cubic yards of suitable substrate. The depth of the dredging would generally occur to a depth of only a few feet, but could go down to a maximum of 20 feet.

Project Design

2.26 The existing beach and dune conditions along the island were reviewed to identify specific design requirements. The project was divided geographically into four design reaches. Beachfill and dune requirements were developed for four typical design sections. Each of the four design sections correspond to specific areas along Fire Island that do not meet the design levels. Although some sections within the Otis G. Pike Wilderness Area do not meet the technical design requirements, fill placement at this location is not compatible with FIIS and NPS policies. A stockpile sited at Smith Point County Park will be utilized to provide fill material to quickly respond to a breach.

2.27 The requirements for alongshore placement of fill were based on existing dune and beach characteristics. In areas where the existing dune and berm meet the minimum standards, no fill is required. Additionally, consideration has been given to areas where the volumetric requirements for the minimum survivability may be provided by the volume of sand within the existing primary and secondary dunes in the instance where the fronting berm is insufficient. Due to the presence of secondary dunes over much of the island's undeveloped areas, consideration of this second criterion was used to minimize the need for fill placement within the major federal tracts of land.

Due to the range of existing conditions, the required design beach and dune cross- sections vary along the Fire Island interim project area. Table 2-1 presents a comparison of Design Sections. The Draft Decision Document provides detailed discussions of the Interim Project's fill design,

Table 2-1

Fire Island Interim Project Design

Design Section	Berm Width (feet)	Berm Elevation (feet NGVD)	Dune Width (feet)	Dune Elevation (feet NGVD)
1	90	9.5	No Dune	No Dune
2	40	11.5	25	18
3	90	9.5	25	15
4	90	9.5	No Dune	No Dune
Note:	Berm widths do not include advance fill.			

and illustrations depicting the fill layout on topographic maps. Each of the design sections is summarized below.

Design Section 1

2.28 The first design section is applicable to areas in which back shore dune elevation and island width are currently sufficient to prevent frequent overtopping or breach formation, but where eroded beach berm conditions are inadequate to protect the existing dunes. Localized areas of inadequate beach width threaten emergency access and a continuation of the erosion trends could cause future overtopping.

2.29 Fill placement in these areas would create a minimum beach berm width of 90 feet and elevation of +9.5 feet above National Geodetic Vertical Datum (NGVD) in front of the existing dune. The design elevation was chosen to be comparable with providing beach berm conditions throughout the barrier islands as was used at the Westhampton project. Beach slopes would be designed as 1 vertical foot for every 15 horizontal feet (1[v]:15[h]) onshore to 2 feet below NGVD and 1(v):30(h) offshore. This design section would be used for approximately 1 mile in an area located eastward from the center of Robert Moses State Park. This region has been affected by a high rate of prevalent erosion. The fill alignment has been selected to provide smooth transitions and to facilitate more uniform littoral transport, reducing the potential for severe erosion of the beaches and dunes to the west. An additional 23 feet of fill width will be provided as advance fill and periodic renourishment to maintain the design section. This design includes an additional volume of fill acting as advance nourishment against anticipated erosion.

Design Section 2

2.30 The second design section would be applicable to areas where the existing beach and dune have eroded and are subject to frequent wave overwash. At these locations, there are no secondary dunes, and the primary dune is backed by low lying areas with typical elevations of only 5 to 6 feet above NGVD. These dunes erode rapidly during a storm, creating a potential path of breach formation.

2.31 The design in these locations would create a minimum beach berm width of 40 feet at elevation +11.5 feet NGVD, fronting a dune with a crest width of 25 feet at an elevation of 18 feet above NGVD. There are some discrete locations in this design reach where there would be a beach berm width of 90 feet at +9.5 feet NGVD fronting a dune with an elevation of +15 feet NGVD. This design section would be used, as needed, in selected developed areas, such as between Kismet and Point O' Woods. It would also be used at any location where the existing beach or dunes do not meet these minimum dimensions and where landward areas are low-lying. An additional 23-foot width of beach fill, acting as advance nourishment against anticipated erosion, and to be provided as periodic nourishment, would provide reasonable assurance that the dunes would maintain their design stability prior to renourishment. This design section allows for vehicular access to the Point O' Woods stockpile contained in Design Section 3.

Design Section 3

2.32 The third design section also incorporates beach and dune elements to minimize overtopping in areas of eroded beaches and dunes. Because of differences in topography, such as higher landward elevations, the design beach and dune elevations for interim protection are not required to be as high as for Design Section 2. Fill placement for Design Section 3 would create a minimum beach berm width of 90 feet at an elevation of 9.5 feet above NGVD in front of a dune with a crest width of 25 feet and an elevation of 15 feet above NGVD. Within this design section there is a single location with a +18-foot dune elevation. This elevation is due to low-lying back elevations. This design section could be used intermittently at such areas as between Kismet and Point O' Woods and between Cherry Grove eastward to Davis Park. As described for Design Section 2, Design Section 3 would also rely on the design dune to reduce the chance of overwash of the island. Accordingly, the Preferred Alternative would also incorporate a 23-foot-wide advanced nourishment feature and periodic renourishment. The Point O' Woods stockpile is contained in this design section.

Design Section 4

2.33 The final design section is applicable to areas in which the primary and/or secondary dunes are sufficient to prevent significant overtopping, despite eroded beach berm conditions, which are inadequate to protect the dunes. This design section would be utilized east of the other fill areas, providing an additional source of material to reduce the extensive sediment deficit.

2.34 The initial fill placement for this design section would provide a minimum beach berm width of 90 feet at an elevation of +9.5 feet above NGVD. The section would be used in the most eroded portions of Smith Point County Park, to protect existing public facilities and to maintain a minimal beach for this area of shoreline. No advance fill would be included in the design for this section. However, the stockpile at Smith Point County Park would be reinforced and could be used to accelerate breach closure, if needed.

Design Fill Alignment

2.35 In general, the cross-shore location of the dune and berm is based on a consideration of several factors, including the quantity of material required and costs required for real estate acquisition. The intent is to select a dune alignment that is as far landward as possible and ties into the existing dune line, thus minimizing the volume of material required. Due to real estate requirements, a dune cannot be constructed under an existing structure. Structures located on the remnants of existing, eroded dunes require that consideration be given to the most cost-effective design, which requires a balance of real estate and sand placement costs. The options available for project design, to account for structures, include: relocation of existing structures, realignment of the dune farther seaward, acceptance of structures as pre-existing nonconforming, or acquisition and demolition of the structures. In establishing the landward-most position of the dune, there are several considerations. For purposes of construction and access for maintenance of the dune, an easement of 25 feet is generally required landward of the landward toe of the dune. In addition, the State Coastal Erosion Hazard Management Act regulations preclude construction on the primary dune, including an area 25 feet landward of the dune. To minimize both existing and new development within the primary dune and to ensure adequate access for dune maintenance operations, the dune alignment was generally selected to maintain this 25-foot area.

Stockpiling and Backpassing Operations

2.36 The Preferred Alternative calls for the use of an initial fill placement to create a design profile of berms and, where necessary dunes, as shoreline protection measures. As noted in the Cost Appendix of the Draft Decision Document, overall construction of the design sections is anticipated to take approximately 2 years. Because highly variable shoreline change patterns will continue to affect the project area after project construction, it is expected that there will be locations along the project area where erosion significant enough to cut into the dimensions of the design profile may occur. It is also expected that there will be areas that will accrete to dimensions greater than the design fill. Rather than placing a greater amount of advance fill to account for these shoreline undulations, an additional monitoring and nourishment component, to take place during the project life, would be included to address areas of high erosion.

2.37 As part of the interim plan, monitoring will be undertaken in the spring and fall, consisting of profiles and aerial photography. Based upon the fall profile surveys, an assessment would be made of the existing conditions and the need to undertake localized measures to account for erosional areas. An assessment will be made of locations where the design section may be impinged upon, and a determination made as to the level of severity relative to a threat of dune survivability. If conditions indicate that a dune would be vulnerable to compromise, actions would be initiated to truck sand from a stockpile at Point O' Woods, or to backpass material from areas of accretion to areas of erosion. Depending upon the severity of conditions, trucking operations could be required to transport up to 40,000 cy/year. Backpassing operations, accomplished by a small hydraulic dredge, could be undertaken every other year, in the amount of 70,000 cy. Work would be accomplished in the off-season, in the months of October through December. The stockpiling and backpassing operations are discussed below.

Stockpiling

2.38 It is estimated that a sand stockpile of approximately 75,000 cy/year ~~would be~~ required to maintain the design sections within the FIIP project area, with the exception of Smith Point County Park. To reduce the impact of stockpiling on federal lands, the interim plan would use backpassing of sand from accreted areas on the beach to reduce the required upland stockpile from 75,000 cy/year to 40,000 cy/year. This stockpile would be located in an open area in the developed community of Point O' Woods.

2.39 Additionally, a stockpile of approximately 50,000 cy would be required at Smith Point County Park and that fill placement would be limited to those areas requiring protection of existing public facilities and the maintenance of a minimal beach for this shoreline.

Point O' Woods

2.40 As part of the initial construction, a 140,000 cy stockpile would be created east of Point O' Woods, which would potentially occupy a footprint of 650 feet by 520 feet, with a top elevation of +15 ft NGVD. The top elevation would be lower than the surrounding dunes. This stockpile would be used if necessary to renourish an area between 1 mile and 4.5 miles of the site (Design Reach 2). As needed, this stockpile would be accessed by front-end loaders into off-road dump trucks, which would transverse the beach and deposit the material, which would be reconfigured at the site. These operations would be undertaken following fall monitoring surveys, and if needed, would occur in the months of October and November. A conservative estimate of the stockpile operation during the 1 ½-month period between October and mid-November is provided below:

- Three 15-cy dump trucks would make an average of 26 trips each over an eight-hour day, to deliver sand from the stockpile to the landward side of the dune at one of four access ramps located within Design Reach 2.
- From there sand would be rehandled by front-end loader onto 30 cy off-road dump trucks to proceed over the access ramps and along the beach to the placement area. The 30-cy off-road dump truck is the recommended transport vehicle, since its large capacity would reduce the number of trips and its tires, specifically-designed for beach transport, would reduce beach disturbance.
- Two 30-cy off-road dump trucks would each make an average of 20 trips per eight-hour day along the beach within a maximum 2-mile round trip.

2.41 In all, the operation would require three 15-cy dump trucks, 6 front-end loaders, and two 30-cy off-road dump trucks. The production rate of sand delivered from the stockpile to the placement area would be approximately 1,200 cy/day. Two front-end loaders will load sand from the stockpile onto the dump trucks and two front-end loaders or bulldozers will grade the sand delivered by the off-road trucks.

Smith Point County Park

2.42 As part of the initial construction, a 50,000 cy stockpile would be created at Smith Point County Park, to occupy a footprint of 450 feet by 400 feet, with a top elevation of +15 feet NGVD. This stockpile would renourish an area approximately 1 mile from the site (Design Reach 4), if necessary. Front-end loaders would be used to load sand from the stockpile onto the dump trucks and would also be used to grade dumped sand to the required nourishment the design profile. The operation would take approximately three weeks and be accomplished starting after Labor Day. Each truck will make an average of 20 trips per an eight-hour day or a total of 40 trips for 1,200 cy/day. The operation would require two 30-cy off-road trucks and 6 front-end loaders (i.e., 3 at the stockpile site and 3 at the placement site).

Backpassing

2.43 In addition to stockpile operations, an alternative method to address erosional areas consists of backpassing, which is the rehandling of material from an area of accretion to areas of erosion. This would be undertaken utilizing a small hydraulic dredge, operating on the beach within a temporary work area 75 feet wide and 150 feet long, and dredged to a depth of –2 feet. This work area would be open to the ocean to allow for a continual water depth within the work area. The dredge would be fed by trucks and front-end loaders, as needed, to rework sand into the work area. The dredge would pump sand up to a distance of 1 ½-miles in either direction. The backpassing operation of 35,000 cy/yr could be undertaken in areas of historical accretion, including in the vicinity of Cherry Grove and Water Island, to be placed within the eastern quarter of Reach 2 and Reach 3. These operations are estimated to be undertaken every other year in the 1 ½-months between November and December. The following items outline its operation:

- At each backpassing location, land based excavation equipment (i.e. front-end loaders) would excavate from the 0 NGVD shoreline a channel way of about 50 ft wide with open side cuts extending approximately 100 to 150 ft landward. Within the newly dug channel, an excavated lagoon area would be dug approximately 150 ft long (parallel to the shoreline) by 75 ft wide with open side cuts and to a depth of -2 NGVD. A temporary stone weir at the entrance to the lagoon with crest elevation +1 NGVD would allow 3 ft of water in the lagoon at all times, which is the operating depth of the backpassing 12 inch portable hydraulic dredge used to pump sand out of the lagoon to the areas of renourishment. Sand trucked to the lagoon by 30 cy off-road trucks would feed the dredge operating in the lagoon with sand from accreted beach areas within 1 mile of each lagoon site.

- The dredge would then pump the truck-fed sand through a 12-inch pipeline along the beach to the renourishment areas between 1 and 2 miles from the lagoon; front-end loaders would assist in grading the beach to nourishment template requirements. Two 30-cy off-road trucks would service each lagoon.
- After approximately 18,000 cy of fill has been pumped from the lagoon, this lagoon would be filled in and restored to pre-lagoon grades, and a second lagoon would be constructed and the process repeated, if necessary.
- Each truck would make 20 trips over an eight-hour per day period or 600 cy/day/truck, totaling 1,200 cy per day for the two trucks. The 12-inch pipeline dredge will pump or backpass 1,200 cy per day from the overly accreted lagoon locations to depleted beach areas to be renourished.

2.44 This operation will require one portable 12-inch hydraulic dredge with one booster pump, two 30-cy off-road dump trucks and six front end loaders, i.e., three at the lagoon site and three at the placement site.

Summary of Damage and Benefits

2.45 Since the concept of an interim plan is to provide an acceptable level of protection within the framework of a long-term solution, the economic assessment considers both the proposed interim solution and some longer term, comprehensive solutions. Comparing the reliability and economic performance of the two plans provides insight into whether the interim plan is consistent with National Economic Development (NED) Planning Criteria. The upper limit of federal support is normally defined by the plan, which reasonably maximizes NED benefits over costs. If the analysis indicates that some larger plan provides higher net benefits than the interim improvements, it is reasonable to infer that the interim plan does not exceed the limit for federal participation. Accordingly, the analysis of costs and benefits considers a modified authorized plan as well as interim measures.

2.46 Based on the procedures described above, annual damages and benefits were calculated for the "without project" alternative and with FIIP. A summary of the damages for the alternative plans is shown in Table 2-2. The period of analysis consists of the project life during which the design level of protection will be maintained, and a post-renourishment period during which the impacts of shoreline change and storm erosion will reduce the effectiveness of the project. Average annual benefits were calculated for the project life. The total present worth of post-renourishment benefits was also calculated, and then amortized over the appropriate project life. A detailed discussion of damage and benefits is presented in the Project Benefits section of the Draft Decision Document.

2.47 Since the project's major benefit is reduced inundation damage to structures along Great South Bay, only these benefits are included in the analysis of post-renourishment impacts. Overall, FIIP is expected to reduce the cost of damages to non-shorefront structures by more than $11 million per year. When other factors are considered, such as shorefront structures and recreational usage, the total benefits are expected to be more than $13 million per year (URS 1999).

Table 2-2
Summary of Annual Damages

Structure Category	Damage Without FIIP	Damage With FIIP	Damage Difference
Non-Shorefront	$38,774,000	$27,743,000	$11,031,000
Shorefront	$2,309,000	$590,000	$1,719,000
Subtotal	$41,083,000	$28,333,000	$12,750,000
BCP Costs	$1,728,000	$644,000	$1,084,000
Total Costs	$42,811,000	$28,977,000	$13,834,000

Source: URS, 1999.

3.00 AFFECTED ENVIRONMENT

3.01 As shown in Figures 1-1 and 1-2, the FIIP study area lies along the southern shore of Long Island in the westerly portion of Suffolk County, approximately 50 miles east of the southern tip of Manhattan, the Battery. The area is centered on Fire Island and extends for its full 31-mile length. To the north of Fire Island is a large section of Great South and Moriches Bays and the shore communities on Long Island, in the towns of Babylon, Islip, and Brookhaven. South of Fire Island the study area extends seaward to include the proposed off-shore borrow areas described in Chapter 2.

3.02 Fire Island, a barrier island, is long and narrow, never exceeding a width of about 2,500 feet. Throughout recorded history it has been in the same position, though with considerable variability in its shoreline contours, beach berm and dune heights and locations and numbers of inlets and breaches to the bay. The island protects the mainland shores from the force and inundation of storms. These areas, once extensive tidal wetlands and marshlands, are now low-lying, developed communities, some criss-crossed by canals, all vulnerable to storm-induced flooding.

3.03 The entire FIIP study area supports a variety of environments which could be affected by the interim project. These include the "human environment," which comprises people and all relevant environmental aspects created by them, and the natural environment, which encompasses the full range of flora and fauna that have developed in response to the natural features and habitats in the study area. This chapter addresses those environmental aspects relevant to the project and contains a brief study area history and descriptions of the existing human environment, existing natural resources, existing cultural resources, and anticipated future conditions independent of any of the FIIP alternatives. The relevant geographic areas of concern vary depending on the resource being assessed, as described in each section below.

STUDY AREA HISTORY

3.04 This section discusses background information on the FIIP study area and sets the context necessary for describing the project and the affected environment. It includes a synopsis of the formation and erosion events on Fire Island, human settlement, establishment of the Fire Island National Seashore (FIIS), and the involvement of the U.S. Army Corps of Engineers, the New York District (NYD).

Formation History

3.05 Fire Island is a barrier island formed by the retreat of the glaciers during the Pleistocene Era (the last ice age). It provides protection to the bay shore of Long Island from Atlantic Ocean storm waves. These storm waves cause Fire Island to erode and accrete sand. The erosion and accretion vary greatly over both space and time. However, Fire Island has remained stable and in approximately the same location since European settlement of North America. Fire Island Inlet has been recorded on the earliest maps, although its size has varied. It was stablized in its current configuration in 1940. Moriches Inlet has come and gone several times in past centuries according to various maps. In addition, multiple inlets across Fire Island have been recorded. These inlets were formed generally during storm events and were then naturally filled over time. Old Inlet was used for a short time by Bellport for direct access to the Atlantic Ocean by ships in foreign trade. The current Moriches Inlet was formed in 1931 and was maintained at that time by local government. It was stablized in its present location in 1952 and became a federal channel in the 1980's.

3.06 The bay shore's formation is quite distinct from that of Fire Island. The land is part of the coastal plain that slopes gently southward from Long Island's glacial ridge to the marsh and meadowland that once bordered Great South and Moriches Bay. The mouths of two of Long Island's four major river basins are located in the FIIP study area: the Connetquot and Carmens rivers. This area was traditionally protected from storm surges by the barrier island and by the vast areas of marsh and flat meadow that acted to store flood waters.

3.07 Over the past century Fire Island and the bay shore that it protects have become increasingly developed, and a number of large storms have struck and caused erosion and damage to structures. Little has been recorded about storms and the effects on the barrier islands prior to about 1900. The hurricane of 1938 is the first well-known major storm of the 20th century that caused large-scale erosion and property damage. On September 21, 1938, the hurricane came ashore without warning. The winds exceeded 111 miles per hour. The water level rose about 10 feet above normal on the ocean front, and because of breaches in Fire Island allowing water into the Great South Bay, the water level on the bay shore rose about 13 to 15 feet above normal. Twelve new inlets were formed along the south shore of Long Island, and numerous small overtoppings occurred. It is estimated that about 20 square miles of the bay shore were inundated.

3.08 These overtopped inlets along Fire Island filled either naturally or with human intervention during the years that followed. A series of hurricanes and northeastern storms caused erosion and property damage during the 1940's and 1950's. After the storms, accretion of sand restored some of the beach width. According to anecdotal information, the dune heights lowered and beaches narrowed gradually. The next storm that caused heavy erosion and widespread property damage occurred in March 1962. This storm, often referred to as the Ash Wednesday storm, was a northeaster that last for about three days, or five tidal cycles. Two low pressure systems joined and became stationary to the south of Fire Island. Ocean waves of 20 to 30 feet were reported, and the water level rose to about 7.7 feet above National Geodetic Vertical Datum (NGVD), which approximates Mean Sea Level (MSL). About 50 overtoppings of the barrier islands were reported, and a new inlet at Westhampton, east of Fire Island, formed. About 12 square miles of the bay shore were flooded.

3.09 Again, sand accreted, dune heights rose, and beaches widened to the east both naturally and with human intervention after the Ash Wednesday storm. In the early 1990's, a series of storms struck and damaged the study area. The northeaster that occurred on December 11 and 12, 1992 reached flood levels of the 100-year storm. This storm lasted through four tidal cycles with water levels at or higher than 8 feet above NGVD. Ocean waves of 15 to 25 feet were reported. The entire bay shore in the study area was flooded. Then, on March 13 and 14, 1993, a blizzard struck Fire Island. Because the December 11th storm had eroded many of the dunes and had narrowed the beach, this blizzard caused extensive overtopping of the barrier island and flooding of the bay shore.

3.10 Several storms have caused erosion and property damage since 1992. Local efforts have attempted to mitigate erosion and flooding problems caused by storms, but the effects of the storms are still evident. To this day, portions of the beaches of Fire Island are considered to be particularly narrow and subject to erosion.

Human Settlement History

Fire Island

3.11 Native Americans traveled to the barrier island for shellfishing, fishing, and hunting. No prehistoric sites have been identified on Fire Island, and intensive human habitation was not documented on Fire Island until the second half of the 19th century. However, Fire Island was used to access various important natural resources of the time, prior to general settlement. The early, historic uses of Fire Island did not require concentrated settlements. Whaling was commonly done from the beach until about 1750, when whales were no longer found near the shore. Salt hay from the marshes was harvested for mulch and insulation. Horseshoe crabs were gathered as fertilizer by farmers.

3.12 By the late 18th century, Fire Island's reputation as a dangerous place, inhabited by pirates was long-established. In fact, shipwrecks were common along Fire Island during this time. From 1787 to 1890, New York State law allowed wreck masters to salvage cargo and parts from grounded ships. To reduce the number of groundings and shipwrecks, the federal government began to build lighthouses for safe navigation. The first lighthouse was built at Fire Island Inlet in 1825. The second lighthouse was built in 1858 at Shinnecock Inlet. However, the perception of Fire Island as home to pirates and shipwrecks persisted into the last half of the 19th century (Johnson 1983).

3.13 Controversy over land ownership also discouraged settlement on Fire Island until the late 19th century. The Patent of 1686, introduced by Governor Dongan conveyed shore lands and lands under water to the Towns, but did not include lands south of the bay shore, such as Fire Island. Because of this oversight, William Tangier Smith claimed ownership of Fire Island, Great South Bay, and Moriches Bay in 1693. The lands passed through various heirs and legal machinations. Today, most of the underwater land in Great South Bay is owned by the Town of Brookhaven. A large portion of underwater land in the Town of Islip, formerly owned by the Nicoll Family, was conveyed over time to the privately owned Bluepoints Company.

3.14 In 1845, David Sammis purchased land in order to build a hotel on Fire Island. However, the land ownership of the land was contested, and litigation that lasted well into the 1920's began. The Great Partition of 1878 is the basis for the eventual settlement of the lawsuits and claims on the land. David Sammis' Surf Hotel became a resort center in the second half of the 19th century. The Great Partition also allowed development of lots for summer homes. This coincided with the rise of the Chautauqua movement of self-improvement, which blossomed in the 1890's. Chautauqua Assemblies, active primarily in the summer time, became common on Fire Island at that time. These assemblies introduced Fire Island to a large number of people who stayed in tents and bungalows. To accommodate these visitors, regular ferry service from the bay shore to Fire Island began.

3.15 With the Great Partition of 1878 allowing secure purchase and ownership of land and the Chautauqua Assemblies bringing people to Fire Island, communities were settled. The first of these, the Point O' Woods Association, began in 1898. Other communities quickly followed, although the youngest community, Dunewood, was formed in 1958. Each of the communities developed with its own distinctive personality. The summer population began to grow. According to an analysis of aerial photographs, approximately 950 structures were found on Fire Island in 1928. This number grew slowly to 1,260 in 1955, and the number of structures had doubled to about 2,400 in 1962. The number of structures reached about 3,500 in the 1970's and now stands at approximately 4,150.

The Bay Shore

3.16 In constrast to the rather forbidding environment of Fire Island, the bay shore attracted people from the first. Native Americans were drawn to the unique freshwater rivers and the brackish environment of the bay shores for the abundant shellfish and other fish life and for the hay from the salt marsh meadows. The relatively protected shores allowed these peoples to protect their boats, which they used for fishing and whaling.

3.17 Although much of Long Island was attractive to European settlers for farming, the shoreline developed first around marine industries. Shellfishing, whaling, and eventually boat building and related industries (rope works, cooperages, etc.) were core industries. However, farmers soon discovered the value of the meadowlands for salt hay and began to acquire property on and near the shore. As the New York City region began to grow and railroads came to Long Island, these two basic industries—marine and agriculture—intensified. With the railroads, Long Island became important as a source of fresh produce for the city. In 1873, nine ducks, descended from the imperial flocks of China, were imported, starting the "Long Island duckling" industry. Several major duck farms were located in the study area.

3.18 In the late 19th century the railroad also spurred a new development trend, suburban communities oriented to employment centers in the city. This development form did not at first affect the bay shore, which at 50 to 80 miles was rather far from Manhattan. However, as time went on and closer in areas began to fill up, the Towns of Bablyon, Islip and Brookhaven began to feel development pressure from commuters. Their zoning resolutions passed in 1938 clearly show a concern for this type of development.

3.19 The greatest development push came after World War II. The War had introduced the defense industry to Long Island and it continued to flourish afterward. The baby and economic boom of the post-War era led to enormous growth on Long Island. Within 10 years of the War's end, developers had turned their sights to the wetlands along the bay shores. As reported in the 1974 Long Island Regional Planning Commission's, *A Methodology to Achieve the Integration of Coastal Zone Science and Regional Planning*, between 1954 and 1959 some 13 percent of Long Island's wetlands were destroyed by landfill projects. At the time of that report, the estimate stood at 25 percent; it is greater now. In the western portion of the south shore estuary marshland has basically disappeared. Along the bay shores of the study area, some marshlands remain, but substantial portions have been lost to development and to dredging.

Fire Island National Seashore (FIIS)

3.20 FIIS was established by Public Law 88-587 on September 11, 1964, and placed under the jurisdiction of the U.S. Department of the Interior (USDOI), National Park Service (NPS). As shown in Figures 1-1 and 1-2, FIIS encompasses much of Fire Island with only Robert Moses State Park on the far western end of the barrier island excluded. The boundaries of the seashore extend 1,000 feet into the Atlantic Ocean and 4,000 feet into Great South and Moriches Bays. The islands and marshlands adjacent to Fire Island are also included in FIIS. Since the establishment of FIIS, NPS has prepared a number of documents that have set the policies and management practices for the FIIS. The General Management Plan (GMP) and the Final Environmental Impact Statement (FEIS) on the GMP were accepted in 1978. FIIS' Statement For Management was last revised in 1979. NPS established Management Policies in December 1988. The Resource Management Plan was approved in August 9, 1993.

3.21 The enabling legislation states that the FIIS was established "for the purpose of conserving and preserving for the use of future generations certain relatively unspoiled and undeveloped beaches, dunes, and other natural features within Suffolk County, New York, which possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population." NPS has followed that charge in developing its policies and management procedures for the operation of the FIIS. This has involved a careful balance of making federal lands available and usable to the public while protecting and perpetuating the environmental features and values. Another factor to be balanced is that much of Fire Island is in private hands and has been developed. The property rights of the owners have to be respected, and access to the barrier island provided for the public and property owners.

3.22 To meet the mandate of its policies and responsibilities, NPS has established three districts within its boundary. These are: 1) the Community Development District; 2) the Seashore District; and 3) the Dune District. The Community Development District comprises 17 communities (shown in Figures 1-1 and 1-2), and encompasses the existing communities and villages. In the Community Development District, existing uses and development of single-family houses are allowed. The Seashore District includes all land in FIIS that is not in the Community District. No new development is allowed in the Seashore District, but existing structures may remain. The Dune District extends from Mean High Water (MHW) to 40 feet landward of the primary natural high dune crest which has been mapped by NPS. This district overlaps the other two districts. Only necessary vehicles, such as ambulances, and pedestrians are allowed. Like the Seashore District, existing legal structures may remain and may be repaired and maintained. NPS developed federal zoning standards that became effective September 30, 1991 under 36 CFR Part 28. These set standards that local zoning must meet, in order to be exempt from the condemnation authority of the Secretary of the Interior.

3.23 The Wilderness Act, which was passed by Congress on September 3, 1964, established the National Wilderness Preservation System and allowed the permanent acquisition and preservation of major tracts of Otis G. Pike Wilderness Areas. The FIIS Otis G. Pike Wilderness Area (see Figure 1-2) was established on December 20, 1980 under Public Law 95-585 and comprises 1,360 acres of the FIIS. It is the only federal wilderness in New York State. The Wilderness Management Plan for FIIS was accepted by the Secretary of the Interior in November 1983 and governs activities in the Otis G. Pike Wilderness Area.

Corps of Engineers Projects

3.24 The Fire Island Inlet to Montauk Point, NY project (FIMP) was originally authorized in the River and Harbor Act of 1960. FIMP extends another 53 miles to the east and includes Fire Island. A General Design Memorandum (GDM) was prepared for the project in 1963. The GDM recommended building groins and placing beach fill along the south shore of Long Island. Construction began east of Fire Island in 1965, when 11 groins were built, followed shortly after by four more groins. Two additional groins were built near Georgica Pond, bringing the total to 17. Although the project contemplated groin construction over a wider area including Fire Island, the FIMP project was halted in 1972 when New York State withdrew its support.

3.25 NYD continued to plan for and update the FIMP project. In 1978, NYD prepared an EIS for the FIMP project. After consultation with the U.S. Department of Interior, the EIS was referred to the Council on Environmental Quality (CEQ), which found the document to be inadequate because of the lack of consideration of alternatives. In addition, CEQ indicated that the impact analysis needed to treat the complete length of the barrier island as a system. Work began on a Reformulation Study for the FIMP project, but was halted in 1984 because of a disagreement with New York State about cost sharing. This disagreement was resolved following the adoption of the Water Resources Development Act of 1986.

3.26 Study efforts were resumed in 1994. However, the FIMP project EIS is not expected to be completed until 2002. In the interim, the barrier islands are still subject to storms that could damage structures, open breaches, and cause flooding on the bay shore. With support from state and local interests, four Interim Plans (including the FIIP) have been developed while the Reformulation Study proceeds.

3.27 The first Interim Plan entailed breach fill, dune construction, and support of the existing groin field in Westhampton Beach. A design by New York State was modified by the NYD to meet their policy and was approved by all involved local and federal agencies. The Westhampton Interim Project was constructed in 1997 and 1998.

3.28 The second interim project was the development of a Breach Contingency Plan (BCP). The BCP authorized the closing of a barrier island breach within three months, and rebuilding the beach and dunes to provide protection consisting of a berm at elevation 9 feet above NGVD. The BCP was developed and is in place.

3.29 A third Interim Plan currently being evaluated is protection of the commercial fishing facilities west of Shinnecock Inlet. The beach west of Shinnecock Inlet is subject to overwash with high breach potential, and the area is subject to severe erosion. Of these interim projects, only the BCP involves construction on Fire Island. The other interim projects are east of Fire Island. This DEIS has been prepared to evaluate the environmental impacts of the Fire Island Interim Plan (FIIP).

HUMAN ENVIRONMENT

3.30 Both Fire Island and the bay shore communities are developed and contain a variety of uses. Given the location on the ocean and bay, many of the uses are water- and recreation-related. To determine existing conditions and assess the potential for impacts, primary and secondary study areas within Suffolk County have been defined by geographic and economic boundaries. The primary study area encompasses Fire Island in its entirety, extending from Fire Island Inlet east to Moriches Inlet. Surrounding Fire Island along its 31-mile length are the Great South Bay to the north, the Atlantic Ocean to the south, and the inlets to the west and east. The secondary study area on the southern bay shore of Long Island was also defined. It is generally bounded by the Montauk Highway to the north, Great South Bay to the south, Robert Moses Causeway to the west, and Harts Cove in East Moriches to the east. The secondary study area also includes the eastern tip of the Jones Beach/Gilgo Beach barrier island and Captree Island, both of which lie north of Robert Moses State Park at the western end of Fire Island. This secondary study area includes parts of the Towns of Babylon, Islip (including the incorporated Village of Brightwaters), and Brookhaven (including the incorporated Villages of Patchogue and Bellport). The sections below describe land and water uses, land use regulation and shoreline development activity, transportation system, economic activity, utilities, and population characteristics related to the issue of environmental justice.

Land and Water Uses

Primary Study Area: Fire Island

Overview

3.31 The 2,940-acre island is narrow, with widths ranging from a few hundred feet at Talisman to a half-mile at Saltaire. From west to east Fire Island comprises Robert Moses State Park, 17 residential beach communities, and Smith Point County Park. All but Robert Moses State Park are located within FIIS (see Figures 3-1 through 3-11). Since World War II, the island has boomed into a renowned summer destination for New York City and Long Island residents. Consequently, its developable land is almost completely built. The remainder of the island has been federal park land since Congress authorized enabling legislation for FIIS in 1964. This law allowed NPS to acquire land on Fire Island through donations and condemnation. FIIS has not acquired additional lands within its legislative boundaries since the mid-1970's.

3.32 As shown in Figure 3-1, Robert Moses State Park, which encompasses the westernmost 4.5 miles of the island, consists of an open beach area covered with dunes and natural grasses. The central, non-waterfront area is composed of landscapes ranging from a sunken forest to wilderness to grassy dunes. FIIS begins at the state park's eastern edge, and encompasses the remaining 26 miles to Moriches Inlet. FIIS also includes surrounding waters and 25 smaller bay islands. Directly east of Robert Moses State Park and the FIIS western boundary are 13 of the island's 17 residential communities, from Kismet to Oakleyville. These communities span the island from the bay to the ocean, and are primarily occupied during the summer months, although small year-round populations live in the incorporated villages of Saltaire and Ocean Beach, and various other locations.

3.33 Continuing east from Oakleyville, the prominent landscape feature is the Sunken Forest, a native preserve accessible from the FIIS Sailors Haven Visitors Center. Sunken Forest is a unique maritime forest that is protected by dunes from direct exposure to the Atlantic Ocean. The hamlets of Cherry Grove and Fire Island Pines are east of Sunken Forest. The communities of Barrett Beach, Water Island, and Davis Park are interspersed with uninhabited FIIS property to the east of Fire Island Pines. The Watch Hill Visitor Center near Davis Park is a popular recreational area and the gateway to New York State's only congressionally designated Otis G. Pike Wilderness Area. A private beach under the jurisdiction of the Village of Bellport is located within the 8-mile-long Otis G. Pike Wilderness Area, which stretches to the east of Davis Park. Smith Point Suffolk County Park covers the remaining 6 miles of Fire Island from Smith Point to Moriches Inlet.

Residential Communities

3.34 All residential communities on Fire Island are within the towns of Brookhaven and Islip. Because they are also within the national seashore, any development must occur within established residential zones.

3.35 Each community has a distinctive character owing to its individual history and clientele. Saltaire and Ocean Beach, for example, were both developed as real estate promotions. Oakleyville was started as a base for construction workers, and Point O' Woods was established as an educational and religious community. Fair Harbor was founded in 1923 as a summer haven for working families, while Water Island grew around a well-known resort hotel founded in 1890. As a result of their various backgrounds, the communities of Fire Island now vary in size, density, and land use. Following is a brief description of each community, from west to east.

3.36 Kismet is a family community with a small commercial area around the ferry dock (see Figure 3-2). It is rustic, with large lots and wide sidewalks. Most of the wood houses have been built since the postwar boom, but a few newer homes are interspersed with the old.

3.37 East of Kismet, and at the widest point of the island is Saltaire, one of the island's two incorporated villages. The large lots and plentiful open spaces spanning the ½-mile between the bay and ocean are meticulously maintained. Because of Saltaire's strict zoning, the only commercial businesses are in a small area near the marina. It is a family community, allowing only single-family rentals and accommodating children with day programs and lifeguard-protected beaches (see Figure 3-3).

3.38 Fair Harbor is also a comfortable family community, with a small bayside commercial area (see Figure 3-3). Its 400 houses are built at a higher density than Saltaire's. Wooden boardwalks connect the homes, which are surrounded by lush vegetation.

3.39 Figures 3-3 and 3-4 show a series of smaller communities, including Dunewood, Lonelyville, and Atlantique. Dunewood was established in 1958 as the first planned community on Fire Island. This family-oriented community is zoned strictly for residential use, and features 100 homes and an excellent infrastructure. Lonelyville is one of the island's oldest and most private settlements. Most homes are vintage beach cottages, some dating back to early this century. Atlantique is also a private family community, accessible only by the sandy Burma Road or private boat. Atlantique Town Park is managed by the Town of Islip and has extensive recreational facilities.

3.40 Robbins Rest has 40 homes ranging from cottages to modern structures (see Figure 3-4). This secluded community is built at a low density. Fire Island Summer Club is one of the smallest communities. The houses are owned but the land is leased from the club, which maintains a private clubhouse and tennis courts. Corneille Estates is a 2-block long area with large lots and abundant foliage. The island's only elementary school, Woodhull School, is located immediately next to Ocean Beach.

3.41 The family-oriented Village of Ocean Beach is one of the most densely built locations on all of Long Island (see Figure 3-4 and 3-5). It has a thriving bayside commercial area and many recreational facilities. Outside the commercial area, Ocean Beach's quaint residential community consists of 600 homes. The Village maintains the island's only police department, which is needed to enforce the Village's many ordinances.

3.42 Next to Ocean Beach is Seaview, which features an eclectic mix of architectural styles on large, private lots as well as the island's only synagogue. The municipal line between the towns of Brookhaven and Islip straddles Seaview, at times bisecting individual parcels. The next community to the east is Ocean Bay Park, which is known for its relaxed and liberal attitude toward group renters. It has a bayside commercial district featuring an active social scene (see Figure 3-5).

3.43 Point O' Woods is the oldest and most private community, containing about 120 homes. Meandering paths connect the expensive shingle-style homes, which are surrounded by lush vegetation and large lots. Point O' Woods' exclusive nature is characterized by private ferry service and stringent residency standards. Oakleyville is the island's smallest settlement, with about a dozen homes. It is very private, nestled within the edge of the Sunken Forest (see Figures 3-5 and 3-6).

3.44 Cherry Grove is located east of the Sunken Forest (see Figure 3-7). Cherry Grove has a very active social scene and strong community spirit. Its commercial area near the dock serves the residents of its 300 cottages.

3.45 The Pines is the largest community on Fire Island, with more than 700 homes, a community-owned harbor, and exclusive commercial area (see Figure 3-8). It is zoned for large-lot development, and includes some of the island's most sprawling homes and swimming pools.

3.46 By contrast, Water Island is a quiet community of about 50 homes (see Figures 3-9 and 3-10). It is strictly residential and only recently accessible by ferry service. Davis Park, with its celebrated social circuit, is one of the most popular destinations for Long Island residents. Within the rustic community, the Town of Brookhaven manages Leja Beach, which is open to the public.

Recreational Uses

3.47 Visitors appreciate Fire Island for its abundance of recreational land and water activities. Each community has a beach for bay or ocean swimming, and sometimes both. Thirteen communities have lifeguard-protected beaches on the ocean and seven have bayside lifeguard protection. Generally, the bayside beaches are roped-off swimming areas near the town's marina or dock; therefore, these areas tend to attract families with children. In Saltaire and Ocean Beach, the beach areas are next to the village parks, bay beaches, and commercial areas. Other than swimming, popular water sports include surfing, sea kayaking, windsurfing, water-skiing, canoeing, and sailing. Area businesses rent windsurfing boards hourly, and stores on the mainland sell and rent other equipment, such as sea kayaks and jet-skis. Several Fire Island communities have organized sailing programs in which participants race each other and groups from Long Island throughout the season.

3.48 Local sport fishing in the Great South Bay and Atlantic Ocean is an activity for which the area is well-known, and the project area features a wide array of fish species plus shellfish and crabs, each of which has a designated prime season. In 1997, FIIS registered 1,430 recreational permits for fishing and clamming in the Otis G. Pike Wilderness Area alone. In addition, several local charter companies and headboats on Captree Island and the mainland offer deep-sea fishing excursions in the Atlantic.

3.49 Fire Island has a variety of land sports facilities, such as tennis courts and softball fields. Bicycles are commonly used for access and recreation. Along with the option of riding along the beach, bicyclists can use the concrete or sand paths connecting the communities. Bicycles are available for rental at local markets and hardware stores. Runners and walkers are provided with many opportunities for activity by the miles of beach, inland paths and boardwalks. Each residential community is generally self-sufficient regarding recreation. The convenience of local facilities suggests that residents rarely use the adjacent federal facilities. Following is a description of each public recreation area, and the facilities included in each.

3.50 Robert Moses State Park, at the west end of the island, has public beaches, picnic areas, comfort stations, and concessions (see Figure 3-1). Full lifeguard protection is provided in the summer season, and fishing areas are designated outside the swimming area. Within the Fire Island National Seashore, three major recreational areas are open to the public: Sailors Haven, Watch Hill, and Smith Point. Sailors Haven is the site of the Sunken Forest, a 300-year-old preserve, which features an elevated boardwalk for public access. Sailors Haven has a 47-slip marina, snack bar, and souvenir shop. Picnic facilities and lifeguard protection are also provided. Watch Hill is the largest FIIS site, featuring a 183-slip marina, restaurant, grocery, and souvenir shop. Along with lifeguard protection on its Oceanside Beach, Watch Hill has 25 camping facilities open from May through October. Along with these major recreational areas, a small public facility with a picnic area and restrooms exists at Talisman, the island's most narrow point.

3.51 The Otis G. Pike Wilderness Area is located east of Watch Hill. The area was established by Congress in 1980 (see Figure 3-11). Within this wilderness are several ecosystems through which visitors hike, canoe, kayak and camp. The National Park Service is currently proposing to designate additional property as part of the Otis G. Pike Wilderness Area, and in the process has removed several residential and agricultural structures from these territories. Back-country hikers and campers register at the Watch Hill visitor center. Smith Point County Park is to the east of the Otis G. Pike Wilderness Area and is technically within the boundaries of FIIS, but is managed by the Suffolk County Parks Department. The 6-mile-long park has public beach access, a visitor center, and camping facilities for 75 vehicles. Most of the recreational areas are found in the vicinity of the terminus of William Floyd Parkway.

3.52 The Town of Islip manages several parks on Fire Island exclusively for its residents' use. Atlantique Town Beach offers many amenities such as a 157-slip public marina, restrooms, grill area, basketball court, handball court, and playgrounds. Until recently, the Town also managed Barrett Beach, a facility near Tallisman with a marina, playground, and picnic facilities. In 1998, the title for this property was transferred to NPS. Long-term plans have not yet been determined for jurisdiction of the park. The Town of Brookhaven manages two public beaches, Leja Beach in Davis Park and Great Gun Beach in Smith Point County Park. Leja Beach has a public marina, picnic area, swimming beach, and playground. Great Gun Beach has a lifeguard-protected swimming area, playgrounds, and restrooms. The municipality of Bellport manages a beach within the Otis G. Pike Wilderness Area exclusively for its residents. The area has a private dock, visitor center/concession building, and oceanfront picnic deck. Access to Bellport Beach is provided by the Bellport ferry, a service exclusively for Bellport residents.

Community Services

3.53 The communities have powers that are similar to cooperatives or condominiums. They also act like hamlets. Many communities have individual volunteer fire and ambulance services, and several communities have doctors available. Suffolk County provides police coverage of the island, and the Ocean Beach Police Department and Saltaire Security enforce local ordinances.

The National Park Service is responsible for policing conservation laws on federal property, and the U.S. Coast Guard enforces boat safety regulations in surrounding waters.

Marinas

3.54 As shown in Table 3-1, Fire Island has 10 marinas that accommodate a total of approximately 1,000 boats. About one-third of the slips are leased on a transient basis, and the remainder are leased by the season. Six of the marinas are private and four are public concessions. Only two facilities, those at Robert Moses State Park and at Seaview, operate year-round. Half of the marinas, including both FIIS facilities, include such amenities as grocery or supply stores.

Table 3-1

Fire Island Marinas

Name	Location	Season/ Year-Round	Transient Berths	Total Berths	Amenities*
Robert Moses State Park Boat Basin	Robert Moses State Park	YR	40	40	G, I, M
Kismet Inn and Marina	Kismet	S		100	
Atlantique Marina	Atlantique	S	157	157	
Village of Ocean Beach Marina	Ocean Beach	S	17	130	
Sea View Marina	Sea View	YR	50	50	
Flynn's Marina and Restaurant	Ocean Bay Park	S	36	47	G, I
Sailor's Haven Marina	Sailors Haven	S		47	G, I, S
Fire Island Pines Marina	Fire Island Pines	S		85	
Davis Park Marina	Davis Park	S		250	G, I
Watch Hill National Seashore Marina	Watch Hill	S		183	G, I
Total			300	1,089	

Note: * G—groceries, I—ice, M—marine supplies, S—snacks.
Source: Fire Island Marina, 1998.

Public Access

3.55 According to the Fire Island Association's 1996 Recreation and Access Plan, approximately 6.3 million persons visited Fire Island in 1995. About 70 percent of total visits were by private automobile to Robert Moses State Park on the west end or Smith Point County Park on the east end. The remaining 30 percent traveled by ferry or private boat to the central area of the island where residential communities and FIIS visitors' centers are found. The three public ferry companies provide public access for approximately 1.2 million visitors to Fire Island, and two private ferries provide service to Point O' Woods and Bellport Beach exclusively for their residents. Although the transportation service to the island is adequate for its current visitor numbers, concern about the high price of travel (on average $11.50 round trip per person, by ferry) between the island and the mainland has been expressed. A national park that is inaccessible to potential visitors is an important issue.

3.56 The Robert Moses Causeway, which is an extension of the Sagtikos State Parkway, provides access over the Great South Bay to Captree State Park and over the Fire Island Inlet to Robert Moses State Park. Traffic to Smith Point County Park turns south off Route 27A to the William Floyd Parkway (County Route 46), which provides access over Narrow Bay.

3.57 Robert Moses State Park is open year-round. Its four parking fields have a capacity of 5,796 cars, and a $5 per car fee is charged during the summer season. In 1995, attendance at the park was 3.2 million persons, with an average weekday attendance between 20,000-30,000 and a weekend average of 50,000 per day. Occasionally, the beach reaches capacity and overflow traffic is rerouted to Jones Beach. At Smith Point County Park, the lot capacity is 5,000 cars and parking costs $5 per vehicle. During busy summer weekends, the lot is generally about two-thirds full. In 1995, more than 95,000 cars entered the parking lot, and 1.5 million individuals visited the park, making it the most heavily used Suffolk County park facility.

3.58 Docking facilities for private boats are located in many communities, including Atlantique, Seaview, and Fire Island Pines. Talisman/Barrett Beach and Water Island, which were previously accessible only by private boat, began service by ferry in 1998; however, private boat remains the most common form of access to that area. Communities, such as Lonelyville and Oakleyville, which have no direct ferry service, are accessible only by private boat.

3.59 Two alternative modes of travel used by a small number of visitors to Fire Island are seaplane and bicycle. The only seaplane landing is the public landing at the Fire Island Pines harbor. The William Floyd Parkway bridge over the Narrow Bay to Smith Point offers the only bicycle access to Fire Island, with a bicycle/pedestrian lane providing access to the county park and FIIS Otis G. Pike Wilderness Area visitors' center. The Robert Moses Causeway to Robert Moses State Park is too narrow to accommodate a bicycle lane.

3.60 Great Gun Beach, a Town of Brookhaven beach at Smith Point, is currently only accessible by private boats, and docking facilities are available for the day only. It is also accessible via 4-wheel drive vehicles or on foot from Smith Point County Park. Brookhaven's 1996 comprehensive plan discusses the possibility of ferry service from Mastic or Center Moriches to this area.

Secondary Study Area

3.61 There are three towns in the secondary study area: Babylon, Islip, and Brookhaven. Land and water uses along the bay shore in each of these towns are discussed below.

Babylon

3.62 The Town of Babylon includes part of Captree State Park on Captree Island and the easternmost tip of the Jones Beach/Gilgo Beach barrier island. The park, which is bisected by the Robert Moses Causeway and Bridge, features a boat basin, fishing pier, and other park amenities. Small pockets of residential development are found on Oak Island and in the community of Oak Beach, which faces Fire Island Inlet.

Islip

3.63 The study area within Islip is primarily residential, with open space uses throughout the town and commercial development concentrated along Montauk Highway. Communities in this area include West Bayshore and Bayshore, the Village of Brightwaters, Islip and East Islip, Great River, Oakdale, West Sayville and Sayville, and Bayport.

3.64 Residential development consists largely of medium-density detached homes on lots ranging from ½- to ¼-acre. Somewhat higher-density developments are found in West Bay Shore just south of Montauk Highway, in West Sayville near the county park, and in other scattered pockets throughout the town. Low density residential uses are also distributed through the study area, but are generally concentrated closer to the water's edge, particularly in the southern parts of Bayshore, Islip, and Bayport.

3.65 Almost all of the commercial uses in the Islip portion of the study area are centered along the Montauk Highway, with significant clusters of stores in Bayshore, Islip, East Islip, and Sayville, which includes the Sayville Shopping Plaza and a large supermarket. These are primarily small- to medium-sized shops and services, some of which are part of strip mall developments. Some of these businesses are described in further detail under "Economic Activities." Other commercial development related to recreational and maritime uses is located near the water (marinas are discussed below). There is no significant amount of industrial activity south of the Montauk Highway; industrial uses are located just outside of the study area, especially along Union Boulevard.

3.66 Within Islip the study area includes several recreational and open space uses. Major parks include Heckscher State Park, Gardiner County Park, Timber Point County Park and Golf Course, and the West Sayville Park and Golf Course. There are also several smaller town-operated parks and beaches, including Byron Lake Town Park, Shoreham Park, and the town beaches near the Bay Shore Marina, South Shore Nature Center, and Bayberry Point. Natural areas include the

Seatuck National Wildlife Refuge along South Bay Avenue, the South Shore Nature Center on Bayview Avenue, and part of the Sans Souci County Nature Preserve along Brown Creek.

Brookhaven

3.67 With 260 square miles of land area, Brookhaven is the largest municipality on Long Island. Within the secondary land use study area in Brookhaven, development is generally less densely concentrated than that found in Islip (with a notable exception being the area that includes Shirley and Mastic), with a number of undeveloped parcels. Communities in this area include Blue Point, the Village of Patchogue, Bellport, Brookhaven, Shirley, Mastic, Mastic Beach, Center Moriches, and East Moriches.

3.68 Residential development is predominantly medium-density, particularly in Blue Point, Patchogue, Shirley, Mastic, and Mastic Beach. Bellport, Brookhaven, and East Moriches also have significant medium-density residential development, but developed lots are interspersed with undeveloped or agricultural land and this variety gives an impression of a less densely developed area. East Moriches also appears less dense than actual lot sizes would indicate, because of a mix of low- and medium-density residences. Concentrations of higher-density housing are found along the Patchogue River in Patchogue, west of the Bellport Park Golf Course, and in the southwest part of Shirley/Mastic Beach. Low-density single family homes are spread throughout the study area, particularly in the southern part of Bellport, Brookhaven, and along the creeks and coves of Center and East Moriches.

3.69 Within the study area, retail commercial development is found along the Montauk Highway, especially in downtown Patchogue and in Shirley; there are also some small shops along the highway's length in Center Moriches. Industrial uses include the boatworks found along the Patchogue River as well as several businesses along Montauk Highway in Bellport.

3.70 Within the study area, major open space and recreational amenities in the Town of Brookhaven include the Bellport Park Golf Course at South Country Road and South Howell's Point Road, Smith Point County Marina near the Smith Point Bridge, and Wertheim National Wildlife Refuge, between Shirley and Brookhaven. There are also a number of smaller neighborhood parks and playgrounds.

Marinas

3.71 The numerous creeks, rivers and bays that line its shores make Long Island's South Shore an ideal location for maritime uses. As shown in Table 3-2, more than 40 marinas have been identified within the secondary study area. These marinas are primarily used by recreational boaters as a place to anchor or tie up their boats for a short- or long-term stay, and many of them provide a full range of repair, storage, and sales services.

Land Use Regulation and Oceanfront Development Activity

Federal and State Land Use Regulations

3.72 In New York State, the primary responsibility for zoning as a basic form of land use regulation rests with local municipalities, including towns and incorporated cities or villages. However, in the case of shorefront areas potentially subject to flooding or coastal erosion and for Fire Island in particular, a number of other federal and state zoning and other land use regulations pertain, as described below.

FIIS Federal Zoning Regulations

3.73 When Congress enacted FIIS-enabling legislation, the law mandated the Secretary of the Interior to establish federal zoning regulations. These regulations provide standards for local zoning to protect and preserve Fire Island, and they exist solely as an overarching law to which local ordinances must conform. FIIS Federal Zoning Regulations provide a set of standards for the use, maintenance, renovation, repair, and development of property within FIIS. The standards are intended to protect land within the national seashore using several means. These include controlling population density and protecting natural resources, limiting development to single-family homes, and prohibiting any new commercial or industrial uses. NPS is responsible for enforcing the federal zoning standards in the communities and villages; despite the presence of federal regulations, however, local governments maintain regulatory jurisdiction. The federal government ensures local compliance with the federal law by maintaining the power of condemnation. While local zoning ordinances conform to standards issued by the Secretary of the Interior, the federal power of condemnation is suspended.

3.74 Prior to 1980, federal zoning controls focused on limitations on the number of bathrooms permitted in a single-family home, and setback and frontage requirements. Current federal zoning controls have a 35 percent lot occupancy requirement, establish that base building heights must conform to the minimum elevation established by the federal flood insurance program, and require a minimum lot size of 4,000 square feet.

Table 3-2 Secondary Study Area Marinas					
Name	**Location**	**Season/ Year-Round**	**Transient Berths**	**Total Berths**	**Amenities***
Boatland Marina & Shipyard	Lindenhurst	NA	NA	NA	
Surfside 3 Marina, Inc.	Lindenhurst	YR	0	400	
Babylon Cove Marine	Babylon	S	0	56	
Babylon Marina	Babylon	YR	5	45	
Bergen Point Yacht Basin	Babylon	YR	15	96	M
Long Island Yacht Club	Babylon	S	0	86	
Rainbow Marine Services, Inc.	Babylon	NA	NA	NA	
Bay Shore Yacht Club	Bay Shore	YR	NA	NA	I
Burnett's Marina	Bay Shore	S	4	150	I, M
Captain Bill's Marina	Bay Shore	YR	5	140	
Seaborn Marina	Bay Shore	YR	NA	80	M
Coastal Yachting Center and Marina	Bay Shore	YR	0	160	G, I, M
Vanderbilt's Mechanical Service	Oakdale	YR	NA	120	I, M
Oakdale Yacht Service	Oakdale	YR	NA	300	I, M
Nicoll's Point Marina	Oakdale	S	NA	50	I, M
Dutchman Cove Marina	West Sayville	YR	5	60	M
Maple Avenue Marine	West Sayville	S	7	100	
West Sayville Boat Basin	West Sayville	YR	12	80	
Land's End Marina	Sayville	YR	2	34	I, M
Westin's Boat Shop	Sayville	YR	3	49	M
Brown's River Marina	Sayville	YR	0	16	M
Stein's Boat Sales	Sayville	YR	0	40	M
Bayport Marine Co., Inc.	Bayport	NA	NA	NA	
Blue Point Marina	Blue Point	YR	NA	140	I, M
Tabat Marina	Blue Point	YR	6	90	I, M
Island View Marina	Patchogue	YR	4	28	I
Leland Cove South	Patchogue	YR	10	225	M, G, I
Morgan's Swan River Marina	Patchogue	NA	NA	NA	
Old Mill Marina	Patchogue	YR	NA	74	
Steamers Marina	Patchogue	NA	NA	NA	
Weeks Yacht Yard	Patchogue	YR	4	73	M
White Water Marine Service	Patchogue	YR	2	50	M
Dockside 500 Resort Marine	West Bellport	YR	20	400	I, M
Patchogue Shores Marina	West Bellport	YR	0	70	M
Beaver Dam Boat Basin	Brookhaven	YR	10	100	M
Tooker's Boatyard	Brookhaven	YR	0	50	
Southwest Marina	Mastic Beach	NA	NA	NA	
Senix Marina, Inc.	Center Moriches	NA	NA	NA	
Hart's Cove Marina	East Moriches	YR	0	65	
Cerullo Brothers Marine	East Moriches	S	NA	NA	I
Silly Lily Fishing Station	East Moriches	S	5	40	I, M
Windswept Marina	East Moriches	NA	NA	NA	
Total			119	3,467	

Note * G—groceries, I—ice, M—marine supplies.
Source: Fire Island Marina, 1998.

Federal Emergency Management Agency

3.75 An organization indirectly affecting land use regulation is the Federal Emergency Management Agency (FEMA). Any community seeking to register with the Federal Insurance Association, which allows homeowners to obtain flood insurance, must join FEMA's National Flood Insurance Program (NFIP). Flood insurance is offered only on a community basis rather than to individual property owners to ensure the appropriate public entities have effectively established floodplain regulations. Public law prohibits any non-participating community from receiving financial assistance for construction in a flood hazard area. The process of joining NFIP requires development of a Flood Insurance Rate Map (FIRM) and adoption of a local flood damage prevention code. In this process, a community identifies its responsibilities and incorporates building standards into its zoning code. FEMA has the authority to acquire FEMA-insured properties that have been damaged by flooding. In practice, FEMA does not regularly use this authority, but rather reimburses property owners for the damages.

Coastal Barrier Improvement Act

3.76 The Coastal Barrier Improvement Act of 1990 established the Coastal Barrier Resources System (CBRS), which consists of specifically identified undeveloped coastal barriers on the United States coastline. The U.S. Fish and Wildlife Service (USFWS) is the responsible agency for administering the CBRS. Coastal barriers include barrier islands, bay barriers, and other geological features that protect landward aquatic habitats from direct wind and waves. Coastal barrier units within the CBRS are prohibited from receiving federal monies or financial assistance for the development of coastal barriers in areas that are currently undeveloped. The CBRA, however, identifies exceptions to this restriction, including non-structural shoreline stabilization similar to natural stabilization systems; the maintenance of channel improvements, jetties, and roads; necessary oil and gas exploration and development; essential military activities; and scientific studies. The USFWS is responsible for consulting with federal agencies that propose spending federal funds within the system. Regional directors (Region 5) are responsible for administering the coastal barrier protection program in this region.

3.77 The eastern portion of Robert Moses State Park is located in Fire Island Unit NY-59 (the identifier or designation under CBRS). The majority of Fire Island, however, is located within the Fire Island Unit NY-59P, which is an "otherwise protected area" not within the CBRS. The incorporated villages of Saltaire and Ocean Beach are excluded from the "otherwise protected area" designation, as are the communities on Fire Island, including Kismet, Fair Harbor, Lonelyville, Atlantique, Robbins Rest, Seaview, Ocean Bay Park, Point O' Woods, Cherry Grove, Fire Island Pines, Water Island, and Davis Park.

New York State Regulations

3.78 Due to the erosion-prone nature of parts of the New York coastline, the Coastal Erosion Hazard Areas Act (CEHA) (Article 34 of the Environmental Conservation Law) regulates construction in areas where buildings and structures could be damaged by erosion and flooding.

NYCRR Part 505 provides procedural requirements for development, new construction, and erosion protection structures. The responsibilities for NYSDEC regarding towns, counties, and regulation of coastal erosion hazard areas are defined by these regulations. Towns within an area determined by NYSDEC are required to submit erosion hazard area ordinances for approval and public review. All of the Atlantic coast of the south shore of Long Island is within the coastal erosion hazard area. Counties can submit erosion hazard area regulations upon failure of a town to do so. NYSDEC enforces the regulations if the city and county do not provide coastal hazard regulations. The standards and criteria for erosion protection structures are based on a 30-year life. The Commissioner of NYSDEC is required to review erosion hazard area maps every 10 years and after the occurrence of major events, both human and natural, including coastal storms. If the erosion hazard area boundary changes by 25 feet or more, coastal erosion hazard area maps must be revised.

3.79 New York State has identified the entire Atlantic Ocean shoreline of Fire Island as a coastal erosion hazard area. The entire beach and nearshore area, as well as the primary dune to a point 25 feet landward of the landward toe of the dune, are designated as natural protective features. New construction is not permitted in these areas and pre-existing development is strictly limited to only a 25 percent increase in ground coverage area.

3.80 At the state level, it is anticipated that the NYSDEC will continue to administer and enforce the CEHA along the entirety of Fire Island's ocean shoreline. At the time of this DEIS, four of the five municipalities with land use jurisdiction on Fire Island (Towns of Babylon and Brookhaven, and Villages of Saltaire and Ocean Beach) are administering, or in the process of adopting, local coastal erosion hazards area management programs. The NYSDEC is administering the regulatory program within incorporated areas in the Town of Islip. State law provides for the NYSDEC to revoke certification of local CEHA management programs if local administration is not consistent with statewide minimum standards, and to assert regulatory jurisdiction over these areas. Thus continuous future enforcement of New York's CEHA law and regulations is assured for Fire Island's ocean shorelines.

Local Zoning Regulations

3.81 Study area land uses are regulated by the zoning codes of each of the three towns and incorporated villages. Those towns and villages that come under the purview of the FIIS have conformed their Fire Island zoning regulations to the federal zoning requirements, as shown in Table 3-3 and described below.

Table 3-3					
Fire Island Local Land Use Controls					
	Federal	**Islip**	**Brookhaven**	**Saltaire**	**Ocean Beach**
Minimum lot size	4,000 sq. ft.	6,000 sq. ft.	7,500 sq. ft.	6,000 sq. ft.	4,000 sq. ft.
Maximum buildingcoverage	35%	25%	35%	30%	30%
Zoning districts	Community Development, Seashore, Dune	BAA (Fire I. Residential); AAAB (Dune Dist. Overlay)	Residential, Commercial, Oceanfront Dune	Residence, Business, Utility	Residence, Oceanfront Dune, Business, Bayfront Recreation
Building height	28'-0"	28'-0"	28'-0"	27'-0"	28'-0"
Conforms with federal	n/a	yes	yes	yes	yes
Source: Fire Island Municipalities, 1998.					

Town of Babylon

3.82 The Town of Babylon's two-mile parcel on the western tip of Fire Island is encompassed by Robert Moses State Park. Although the area is currently zoned as a Residential district, the town's Draft Comprehensive Plan of March 1998 recommends amending its zoning to a Land Conservation district. Because the state park is not included in FIIS, federal zoning regulations do not mention Babylon's jurisdiction on Fire Island. For the purposes of this study, new development in Robert Moses State Park is not likely. Consideration of the land use controls in Babylon is not necessary.

Town of Islip

3.83 Within the Town of Islip, the zoning ordinance includes a special Residence BAA (Fire Island Residential) District for Fire Island development. The zoning standards are in full compliance with the federal regulations and consistent with the FIIS General Management Plan. Along with residential and commercial development standards intended to protect the barrier beach from further overdevelopment, a special Ocean Front Dune District AAAB is superimposed onto the BAA zoning district. The minimum lot size allowed in Residence BAA is 6,000 square feet, and the maximum building coverage allowed is 25 percent. Residence AAAB boundaries, which cover the southern one-third of the island along the entire oceanfront, are based on Flood Hazard Boundary maps and the GMP. The code includes a flood damage prevention section that establishes areas of special flood hazard and penalties for noncompliance. Among the provisions for reducing flood hazards are the prohibition of sand dune disturbance, which is in compliance with state or local coastal erosion hazard area regulations.

Town of Brookhaven

3.84 The Town of Brookhaven's zoning ordinance conforms with federal zoning standards. Three zoning types are designated by the Town Board: residential, commercial and an oceanfront dune district. Residential standards permit single-family residential and municipal uses only, and the commercial district permits typical retail uses while prohibiting multi-family housing and hotels. Residential lots must be at least 4,000 square feet with no more than 35 percent building coverage. The intent of the Oceanfront Dune District (OFD) is to acknowledge the importance of sand dunes and ensure their protection from storm damage and erosion. In the spirit of this ordinance, the town permits reconstruction of structures, vehicular crossings and snow fences, and allows for continuation of existing uses. The code also introduces building standards for the OFD that are sensitive to the fragile environment. The flood damage prevention section of the code states requirements for construction within coastal high hazard areas, including a ban on man-made dune alterations.

Village of Saltaire

3.85 The Village of Saltaire has three zoning districts: Residential, Commercial and Utility. The village zoning ordinance includes regulations for construction that conform with federal zoning standards. The maximum building coverage per lot is 30 percent, and buildings cannot exceed 27 feet in height. Saltaire does not designate a special waterfront district, although specific setbacks for bayfront and oceanfront constructions exist. The regulations are in place to preserve the village as a family residential community rather than curb development. Saltaire does not have a flood damage prevention section in its code but is currently preparing a flood mitigation plan that will require the adoption of flood-mitigating standards.

Village of Ocean Beach

3.86 The zoning standards of the Village of Ocean Beach are in accordance with the village comprehensive plan and FIIS GMP. The ordinance is designed to prevent overcrowding of land, as Ocean Beach is built up to 95 percent of its total area. Building lots must be a minimum of 4,000 square feet with a maximum of 30 percent lot coverage. A special section of regulations states the relationship between the village and FIIS with respect to building permits and variances. In the Oceanfront DD Dune District, residential construction is inappropriate; the code states the distances from the water at which construction can occur. It does allow for the continuation of existing uses in the Dune District. The extensive Flood Damage Prevention article is intended to minimize the threat of damages resulting from flooding by regulating land use, requiring certain construction standards, and maintaining participation in National Flood Insurance Program.

Oceanfront Development Activity on Fire Island

3.87 Development activity near the ocean shore is of particular concern on Fire Island. Structures built too close to the primary dune could interfere with its natural functioning and weaken its ability to withstand wave and wind attack. Unfortunately, these locations have always been very attractive for beach-home development and there is considerable development of oceanfront property. Using the area seaward of the proposed coastal erosion hazard line as an indicator of the issue, there are approximately 380 structures (virtually all are houses) in a position to compromise the primary dune and to suffer severe storm damage themselves.

3.88 Although the Coastal Erosion Hazard Management Act (CEHA) precludes new development or redevelopment within the primary dune area, the capacity to enforce these restrictions is limited by the presence of pre-existing, nonconforming structures within the existing primary dune. Similar to local zoning limitations, the permitting agency cannot preclude new development, which is considered "infilling," even if the property is located within a designated hazard area. The intent of restricting development is to avoid human impacts on natural processes. It is difficult to demonstrate an adverse impact on the existing condition, when the proposed development is flanked by existing structures.

3.89 A review of the Tax Assessor's records for construction over the past 50 years in the Towns of Islip and Brookhaven found a pattern of steady development within the proposed CEHA area. As shown in Figure 3-12, a moving nine-year average of annual construction rose to a peak in the late 1960's and another peak in the early 1970's (when more than 40 oceanfront beach homes were built in Fire Island Pines in one year), before tapering off as the supply of such properties diminished. Since 1991, even accounting for a recent rush to build before CEHA is adopted, the annual rate of development on the oceanfront has been less than two units a year. Based on a comparison of the most recent available structure survey maps with 1998 aerial photos, an estimate of the number of lots in the proposed CEHA area that could be developed after CEHA is adopted is estimated at 35.

Transportation

3.90 Access to the project area is provided through a network of state and county roads and private ferry lines (see Figures 3-13 and 3-14). The Robert Moses Causeway on the west and the William Floyd Parkway on the east provide vehicular connections between Fire Island and the bay shore of Long Island. On Long Island, both roads intersect Montauk Highway (Route 27A), which is a major connector through developed areas of the south shore of Long Island. North of Route 27A are two of Long Island's major east-west highways: the Sunrise Highway (Route 27) and the Long Island Expressway (Interstate 495).

3.91 The Robert Moses Causeway provides access over the Great South Bay to Captree State Park, which is an island in the bay. It then proceeds over the Fire Island Inlet to Robert Moses State Park. The William Floyd Parkway (County Route 46) provides access over Narrow Bay to Smith Point County Park and the FIIS Smith Point Visitor Center. In 1995, the estimated daily traffic count on Route 46 was about 30,000 cars.

Access to South Shore and Ferry Terminals

3.92 Approximately 6.3 million visitors travel to Fire Island each year, of which about 1.2 million visitors travel to Fire Island by ferry. Of the Fire Island visitors traveling by ferry each year, approximately 70 percent travel to the ferry terminals by private automobile and 30 percent travel on the Long Island Rail Road (LIRR). A small percentage of visitors from New York City access the south shore by private coach service (USACOE 1997b).

Public Transportation

3.93 The total ferry traffic arrives via the LIRR uses the Montauk Branch, which stops at Bay Shore, Sayville, and Patchogue, the three terminals from which all Fire Island ferries depart. Diesel trains servicing the Montauk Route seat about 110 people per car and hold up to 1,000 standing passengers. From mid-May through mid-September, 21 trains run per weekday and 19 run per weekend day. On Friday evenings, Sunday afternoons, and Monday mornings in the summer, the trains generally operate at full capacity. On summer holiday weekends when the regular trains reach capacity, trains are added to accommodate extra traffic. Normal traffic (during off-peak, non-summer months) between Penn Station and Bay Shore, Sayville, and Patchogue is about 500 persons per station each day. During the summer, the "normal traffic" decreases about 10 percent because fewer daily commuters use the train. The LIRR does not have specific capacity information for summer ridership.

3.94 Suffolk County Transit Service (SCTS) runs a public bus route along Montauk Highway, with stops near the Bay Shore, Sayville, and Patchogue train stations. The Bay Shore and Sayville stops are approximately 1 mile (a 15-minute walk) from the ferry terminals. The Patchogue stop is within walking distance of the ferry terminal at Watch Hill, and 1 mile from the Davis Park ferry terminal. The bus runs bi-hourly from 6:00 AM until 7:00 PM and costs $1.50 per ride. This service runs at 50 percent capacity and is used primarily by Long Island residents traveling to and from work. SCTS also runs a feeder route to Smith Point County Park on Fire Island, with year-round and seasonal service. The seasonal service on the Route 74 line offers two trips in the morning and three trips in the afternoon, while the year-round service requires a transfer and runs throughout the day (SCTS 1998).

Private Transportation

3.95 Due to time constraints, many visitors use private taxi services to reach the ferry terminals from train stations. In Bay Shore, Tommy's Taxi provides taxi and bus service between the train station and ferry terminal, coordinating with train arrival and ferry departure times. In Sayville, Colonial Transportation charges $2.00 per person each way for a similar service between the Sayville train station and the ferry terminal, and is currently running at capacity. In Patchogue, four taxi services provide service from the Patchogue train station to the Davis Park ferry terminal and charge comparable rates. Visitors to the Watch Hill ferry departing from Patchogue walk the short distance from the train station to the terminal.

3.96 For New York City residents who want alternative private transportation to Fire Island, several companies provide bus service between Manhattan and the ferry terminals. Tommy's Taxi and David Brothers Taxi provide approximately 5 percent of the total traffic to Bay Shore. These companies run passenger vans of 11-14 passengers at a cost of $16.00 each way. From late June through Labor Day, the buses run about 10-15 times daily (each way). Horizon Coach runs a bus service between midtown Manhattan and the Sayville ferry terminal that costs $20.00 per person each way. The coach runs four times per week from Memorial Day through Labor Day. Horizon Coach buses hold 49-58 persons, and the service is currently operating at 85 percent capacity. In 1999, Colonial Transportation began similar service with 11- to 14-person vans between Manhattan and the Sayville ferries.

Private Automobile/Ferry Parking

3.97 About 70 percent of all Fire Island ferry traffic arrives by private automobile. Traffic reaches the three terminals by the extensive network of Long Island highways. A more detailed description of this system is provided below. On arrival in Bay Shore, visitors have the option of parking for $7 per day near the terminal in one of several private lots (Fire Island Ferries estimates capacity at 2,500-3,000 cars, including valet parking) or the Town of Islip's public lot 1 mile north, which holds about 700 cars. The parking is sufficient, although the lots, with capacity for more than 3,500 cars, are full on summer weekends. Anecdotally, ferry operators have said that they have not received capacity shortage complaints and drivers can generally find parking. In Sayville, the many private lots around the terminal provide space for more than 500 cars. Similar to Bay Shore, the parking lots are full on weekends, but capacity is sufficient. When the private lots are full, some visitors use the municipal lot reserved for Islip residents only. Capacity of this lot is unknown. In Patchogue, 154 free parking spaces are available at the federal lot for the Watch Hill terminal; the private parking lot at Davis Park ferry terminal provides space for about 300 cars. Both lots are near capacity on weekends.

Ferry Traffic

3.98 According to the U.S. Army Corps of Engineers Navigation Data Center, an annual average of 1.2 million visitors traveled on ferries between Fire Island and the south shore in the years 1995 to 1997. Three public ferry companies operating under federal concessions provide public access to Fire Island: Fire Island Ferries from Bay Shore, Sayville Ferry Service in Sayville, and the Davis Park Ferry Company in Patchogue. Fire Island Ferries services the communities of Kismet, Saltaire, Fair Harbor, Dunewood, Atlantique, Ocean Beach, Seaview, and Ocean Bay Park. Fire Island Ferries accounts for approximately 65 percent of total ferry traffic. The company's 12 boats can carry up to 3,300 passengers. During the summer, the system runs to Fire Island at 75-80 percent capacity on Thursdays and Fridays and at 100 percent capacity on Sunday afternoons. Fire Island Ferries accounts for approximately 64 percent of all ferry traffic. The Sayville Ferry Service transports visitors to Cherry Grove, Fire Island Pines, Sailors Haven/Sunken Forest, and Talisman/Barrett Beach and Water Island. With 7 boats carrying a total of about 1,400 passengers, Sayville Ferry Service accounts for about 25 percent of total ferry traffic. The Davis Park Ferry Company, which services Watch Hill and Davis Park, carries about 10 percent of all ferry traffic. Davis Park Ferry Company has 5 boats with a capacity of about 1,000 passengers. Two private ferry services, between Bay Shore and Point O' Woods (run by Bay Point Navigation, Inc.) and between the Village of Bellport and Bellport Beach, are run exclusively for the residents of those communities, and account for about 1 percent of total ferry traffic.

3.99 Private transportation is the predominant method of access to Fire Island, with 4.7 million visitors (70 percent of total visitors) accessing the island by automobile. In 1995, 3.2 million visitors traveled to Robert Moses State Park and 1.5 million visitors traveled to Smith Point County Park. Private access is also provided by private boat, water taxi, bicycle and seaplane. Additional information is provided discussed in the "Access" section, below and in the Main Text.

On-Island Circulation

3.100 The only vehicular traffic currently on Fire Island is at the western and eastern ends of the island. Vehicular access to Fire Island is allowed at Robert Moses State Park and Smith Point County Park; other areas on the island are vehicle-accessible only by a special permit issued by government agencies. Due to the lack of roadway infrastructure and prohibition of cars, travel around the island is an access issue. Bicycles are used extensively for local travel and between communities by residents. While on the island, day visitors can venture to neighboring communities by water taxi or on foot. Vehicles without a special permit are prohibited in the Fire Island National Seashore. In 1997, FIIS issued only 250 special permits, including 145 residential, 80 contractor, 30 essential (utilities businesses), and 30 municipal.

3.101 Water taxis provide convenient lateral transportation between the communities. The sandy "Burma Road" provides a route for construction, utility, and pedestrian traffic between the communities. Segments of Burma Road are difficult for pedestrians because of the large distance separating several communities. In addition, the sandy composition of Burma Road makes bicycle use difficult.

Economic Activity

3.102 The study area generates a high level of economic activity, and the invested capital is substantial, as discussed below.

Overview of Economic Activity on Fire Island

3.103 Fire Island has a seasonal economy that extends from April and October, but its peak economic activity occurs during the summer months of June, July, and August. The seasonal nature of Fire Island is evident in the island's year-round population of 409 individuals as compared with its significantly larger seasonal population of approximately 19,450 individuals (Long Island Regional Planning Board [LIRPB], 1998).

3.104 Economic data were assembled, in part, from three census tracts (1244.02, 1470.02, and 1595.07) that encompass all of Fire Island, and small portions of bay shore communities, including Lindenhurst, Bay Shore, and Mastic Beach. Data for the three census tracts indicate that there are a total of 190 businesses within these tracts. As shown in Table 3-4, the 190 businesses account for more than 1,000 jobs in the retail, service, construction, and manufacturing sectors. Based on field observations on Fire Island and Long Island, review of locally published materials prepared on Fire Island businesses, and examination of maps, it was determined that a high percentage of the retail, service, and manufacturing sectors included in the three census tracts are located on Fire Island, except in the category of contractors and special trades, which are largely located off Fire Island. Overall, it is estimated that there are approximately 135 businesses on Fire Island itself, and that these businesses account for about 800 jobs, many of which are seasonal. These estimates do not include the government concessions operating at

Table 3-4			
Economic Activity Reported for Census Tracts 1244.02, 1470.02, and 1595.07			
Economic Sector	**Number of Establishments**	**Sales (millions)**	**Employment**
Retail (excluding auto)	92	$48.3	686
Services	56	$9.0	172
Construction	36	$12.0	122
Manufacturing	6	$6.0	58
Total	190	$75.3	1,038

Note: Includes all of Fire Island, and minor bay shore portions of Lindenhurst, Bay Shore, and Mastic Beach, and areas of Captree and Gilgo State Parks and Cupsogue Beach County Park.
Source: Claritas Inc. using the business database from American Business Information, Inc., and Allee King Rosen & Fleming, Inc., 1998.

Robert Moses State Park, Sailors Haven, and Watch Hill Visitors' Centers, and Smith Point County Park. The concessions account for an additional 75 jobs, bringing total employment on Fire Island to approximately 880 jobs.

3.105 The retail sector comprises the majority of economic activity, accounting for more than three-quarters of employment. Key businesses in the retail sector include restaurants, grocery stores, and liquor stores. These types of businesses are important to the local economy, given that Fire Island has a high proportion of seasonal renters and second-home owners whose objective is to enjoy the island's recreational and vacation resources. In addition, there is limited access to the bay shore of Long Island, which creates a more captive market and greater demand for convenient goods and services.

Economic Activity by Fire Island Villages and Communities

3.106 Economic activity on Fire Island largely centers around the ferry terminals and marinas on the island, because these are the access points for residents and day visitors. Businesses tend to be located on the bay side of Fire Island, and along the primary routes from the bay to the ocean beaches, e.g., Broadway in Saltaire and Harbor Walk in Fire Island Pines. Some service sector businesses operate out of home offices, including real estate offices, accounting services, and desk-top publishing.

3.107 As mentioned under "Transportation," above, vehicles are restricted on Fire Island. Transportation routes on Fire Island are limited to boarded and paved walks in the villages and communities and sand pathways in less developed areas. Travel between villages and communities is somewhat restricted on Fire Island, resulting in relatively isolated communities or clusters of communities. People travel on Fire Island by walking, riding bicycles, and taking water taxis. The water taxis transport people between communities and villages on Fire Island that otherwise would be too distant or difficult (due to sand pathways) to access by foot or bicycle. Personal belongings and purchases are transported from the ferries and local shops to residences via small wagons. The primary economic activity in the villages and communities is described below and is organized by ferry stops, the mode by which most individuals travel to the residential communities and visitor centers on Fire Island.

Kismet

3.108 Retail businesses in Kismet are clustered around the ferry stop, and include the Kismet Inn and Marina, The Out (a restaurant), a grocery store, a pizzeria, and a liquor store. Kismet is the closest community to the Fire Island Lighthouse Visitors' Center and is a 15-minute walk from the Field Five parking lot at Robert Moses State Park. In addition, the 100-slip commercial marina at Kismet serves boaters from all over Fire Island and Long Island. As such, Kismet shops receive business from many sources. Kismet restaurants also serve neighboring Saltaire, as there are no such establishments in the village.

Saltaire

3.109 The commercial district in Saltaire is located on Broadway, the main thoroughfare between the ferry stop/bay and the ocean. Businesses in the commercial district include a grocery store with a sandwich counter, and a liquor store. The business district in Saltaire is limited due to strict zoning.

Fair Harbor

3.110 Fair Harbor's commercial district is located next to the ferry dock, and includes a restaurant, a general store, a liquor store, real estate offices, and a grocery store with ice cream, coffee, and candy sold to go. The restaurant and general store likely serve neighboring Saltaire as well due to the absence of this type of retail in the village. Dunewood and Lonelyville, which share a ferry stop, as well as Atlantique residents, are likely to also shop at Fair Harbor businesses due to the absence of retail in those communities.

Atlantique

3.111 Atlantique has little economic activity: a town-operated marina on the bay and a snack bar. The Atlantique Marina has 157 slips, operates from Memorial Day until Labor Day, and employs a total of 10 seasonal workers. Docking is only permitted on a daily basis, with a maximum period of 17 consecutive days allowed. On weekends, only Town of Islip residents are permitted to dock, while residents and non-residents (at higher fees) are permitted to dock on weekdays. The Atlantique Marina is used predominantly by local day visitors. The 17-day cap is likely to discourage Atlantique residents from relying solely on the marina, and the weekend resident requirement precludes extended stays by non-Islip residents.

Ocean Beach

3.112 Ocean Beach, with nearly 50 establishments, is the largest retail concentration on Fire Island. The retail district is located along Bayview Walk, and includes nine restaurants, three cafes, two bars, two hotels, a local department store, four clothing stores, a small movie theater, a hardware store, a sporting goods store, a liquor store, a florist, five realty offices, and other establishments. Located at the center of Fire Island's developed communities, Ocean Beach provides goods and services for other neighboring communities and is accessible via water taxi. The ferry docks at the Village of Ocean Beach Marina. The village and the Town of Islip share jurisdiction of the marina. The marina has 130 slips and a jet ski docking area, and operates from May through October. Of the total slips, 17 are reserved for transient use and 113 are reserved for the season.

Seaview

3.113 In Seaview, commercial activity is limited to the Sea View Marina (with 50 slips), a grocery, a liquor store, and an ice cream shop. The small commercial sector is located adjacent to the marina and ferry dock. Seaview residents probably travel to Ocean Beach for on-island shopping and recreation amenities.

Ocean Bay Park

3.114 Ocean Bay Park features the Fire Island Hotel and the Seashore Motel, and Flynn's Marina and Restaurant (with 47 slips), as well as three other restaurants, and a market. The commercial district is primarily located along Bay Walk near the ferry dock, with the exception of the Fire Island Hotel located on Cayuga Walk. The presence of lodging and other services encourages weekend visitors.

Point O' Woods

3.115 Point O' Woods has a small commercial center that includes a grocery store and a candy store near the ferry stop. A small railroad transports people and goods from the ferry dock to the ocean. The small commercial sector exclusively serves the Point O' Woods community.

Sailors Haven Visitors' Center

3.116 The Sailors Haven Visitors' Center primarily supports a day visitor population, although some overnight visitors are accommodated at the marina, which allows overnight docking for up to seven consecutive nights. The marina, restaurant, snack bar, and gift store at Sailors Haven are federally-operated concessions with 15 seasonal employees. The marina has a total of 47 slips, and operates from May 15 through October 15.

Cherry Grove

3.117 Cherry Grove is the second largest retail concentration on Fire Island, next to Ocean Beach. There are a total of 28 business establishments at Cherry Grove, predominantly located near the ferry dock on Bayview Walk, or on the primary route between the bay and ocean on Dock Walk and Ocean Walk. Cherry Grove has six hotels, and offers amenities for weekend visitors and residents. Business establishments include seven restaurants, four bars/dance clubs, three clothing boutiques, two florists, a jewelry store, a liquor store, and four real estate offices.

Fire Island Pines

3.118 Fire Island Pines, located east of Cherry Grove, has a total of about 23 businesses. The commercial district is located in the vicinity of the ferry dock and marina (with 85 slips), with shops located on the boardwalk of the harbor, on Harbor Walk (one of the primary routes between the ferry and the ocean), and on Fire Island Boulevard, which runs east-west just south of the harbor. Businesses in Fire Island Pines include four restaurants, three bars/dance clubs, three clothing boutiques, a hotel, a grocery, a meat market, two liquor stores, a hardware store, a pet food store, and three real estate offices.

Davis Park

3.119 Davis Park is isolated from other Fire Island communities, with its nearest neighbor Water Island lying more than a mile to the west. As such, the economy is localized with little influx from other Fire Island communities. The commercial sector includes the Davis Park Marina, which is operated by the Town of Brookhaven, a grocery store, and the Casino (a restaurant, bar, and snack bar). The town marina has 250 slips, operates from May through October, and employs approximately 16 seasonal workers.

Watch Hill Visitors' Center

3.120 The Watch Hill Visitors' Center, located east of Davis Park, is a popular destination for day trip visitors to Fire Island, and also for boaters docking for a relatively short period (less than seven days, due to length of stay limitations). The businesses at the visitor center are operated by a federal concessionaire, and include a marina, a restaurant and snack bar, a grocery store, and a gift shop. The Watch Hill National Seashore Marina has a total of 183 slips, and operates from Memorial Day to Labor Day.

Robert Moses State Park

3.121 Robert Moses State Park is located at the westernmost end of Fire Island. Annual park attendance is approximately 3.2 million people. The park is open year-round (closing only in inclement weather), but most visitation occurs between Memorial Day and Labor Day. The park contains one concession, which sells food and beverages. The concession is located south of the parking fields, and employs approximately 15 people. Its estimated 1997 revenues were approximately $750,000. The concession mainly provides food services for day trip visitors to this part of Fire Island.

Smith Point County Park

3.122 Smith Point County Park, located at the eastern end of Fire Island, has an annual attendance of approximately 1.5 million people, most of whom visit between Memorial Day and Labor Day. There is one food concession at Smith Point. The concession is open mid-May to mid-September, and employs 20 to 30 people. Up to 60 workers may be employed for special events. Like the Robert Moses State Park concession, the Smith Point County Park concession primarily provides food services to day trip visitors.

Long Island Bay Shore Communities

3.123 Fire Island visitation contributes to the economies of the Long Island bay shore communities. En route to Fire Island, individuals spend money on transport, possibly lodging, and sundries (although spending on sundries is limited, as described below). Bay Shore, Sayville, and Patchogue are the communities primarily affected by Fire Island visitors/residents, because the ferry services to Fire Island are based in these communities. The two primary modes of travel to the Fire Island ferries are by train and by car. Approximately 40 percent of ferry passengers arrive by train and about 60 percent by automobile. As discussed in "Traffic and Transportation," above, Bay Shore, Sayville, and Patchogue each have a LIRR station within about a 5-minute drive of the ferry terminals. Patchogue has two ferry terminals, one of which is a short walk from the train station. Local taxi services provide transport between the LIRR stations and the ferry terminals. Fire Island ferry passengers that drive to the ferry generally park in the large lots located near each of the ferry landings. In addition, there are two water taxi services, South Bay Water Taxi and Aqualine Water Taxi, that provide on-island transportation for Fire Island. Both water taxi services are based out of Bay Shore.

3.124 The routes between the train stations and the ferry terminals form a corridor of potential economic activity for travelers to Fire Island, including for individuals arriving by car, since the taxi route is the most direct route to the ferry terminals. Consumer spending is limited for individuals arriving by train since there is little time to shop or pick up sundries between the train's arrival and the next ferry's departure. Based on interviews with the taxi services, taxis generally drive directly to the ferries, making no stops along the route. Also, many taxi passengers opt to take the vans provided by the taxi services, and these vans do not make intermediate stops for sundries en route to the ferry terminal.

3.125 The potential for consumer spending by individuals arriving by automobile is also limited. Based on field observations and interviews with individuals arriving by car, individuals generally tend to bring groceries and other necessities from home rather than shopping in the communities with ferry access. Field observations also indicate that with the exception of Sayville, there are few easily accessible stores along the routes to the ferries. The communities' business districts in the vicinity of the ferry routes tend to have small local stores with predominantly street parking, busy streets, and few vacant parking spaces, making shopping somewhat difficult. As described below, of the three communities Sayville has the most potential for commercial activity from individuals traveling to Fire Island.

3.126 Bay Shore is the westernmost community on Long Island with ferry access to Fire Island, and transports approximately 60 percent of all ferry passengers to Fire Island. The LIRR train station is located on Union Boulevard, three blocks north of Bay Shore's business district on Montauk Highway (referred to as Main Street in Bay Shore). Retail activity in the immediate vicinity of the train station includes a 7-Eleven located ½-block east on Union Boulevard, a small strip mall with fast food across Union Boulevard, and two restaurants north of and adjacent to the station. As previously stated, Tommy's Taxi and David Brothers Taxi Service provide taxi service between the train and ferry, primarily via vans and small buses. The dispatch office of Tommy's Taxi is located immediately adjacent to the train station. Maple Avenue is the primary route between the train station and the ferry terminal, and is predominantly residential. At the intersection where

Maple Avenue crosses Main Street, there are a few establishments that provide goods and services for individuals traveling to Fire Island: two small pharmacies and a bank. In addition, the availability of street parking is limited. Near the two ferry terminals in Bay Shore, there are restaurants such as Molly Malone's Pub and Restaurant and Beefsteak Charlie's. Nicky's Clam Bar and the Just Barge In convenience store are located at one of the ferry terminals. Large municipal and private parking lots, with a total capacity of approximately 3,500 spaces, are available for individuals arriving to the ferry by automobile.

3.127 Sayville is located about 10 miles east of Bay Shore. Of the three communities, Sayville has the most active retail community in the vicinity of the LIRR station and ferry terminal. Approximately 30 percent of individuals going to Fire Island travel via the Sayville ferry terminal. The Sayville train station is located at the corner of Depot Street and Railroad Avenue, three blocks north of the business district on Montauk Highway (also referred to as Main Street). Buses, vans, and taxi cars are available from two taxi services, Colonial Taxi and Village Taxi. The route to the ferry follows Railroad Avenue, Main Street, and Foster Avenue. Retail activity along Railroad Avenue consists of a number of small businesses including hair salons, a meat market, liquor stores, and a fishing supply store. Main Street is the primary business corridor in Sayville, and consists of small (approximately 2,500 square feet) local stores including a pharmacy and craft stores. The Sayville Shopping Plaza, at the intersection of Main Street and Railroad Avenue, has eight businesses, including a drycleaners, video store, nature store, gift store, and small fast-food stores. There is a large strip mall at the intersection of Main Street and Foster Avenue with 12 businesses, anchored by a Grand Union supermarket. A True Value hardware store is located on the opposite side of the intersection. The remainder of the route to the ferry terminal on Foster Avenue is residential. Near the ferry terminal, there are two large and three smaller private parking areas for individuals arriving by automobile.

3.128 Patchogue is the easternmost community in Long Island with ferry access to Fire Island. It also has the smallest percentage of ferry passengers traveling to Fire Island (approximately 5 percent), in part due to the limited operation dates from late June to late August. Ferry passengers traveling out of Patchogue are more likely to be day trip visitors, due to the popularity of the Watch Hill Visitor Center, and the access-friendly nature of Watch Hill and Davis Park, both of which provide public restrooms and food services. The Patchogue train station is located on the corner of South Ocean Avenue and Division, three blocks south of the local business district on Montauk Highway. This business strip contains primarily small local stores. Taxis from four different companies, Hey Taxi, Lindy's Taxi, 112 Taxi, and Westhampton Taxi, are available to shuttle passengers between the LIRR station and the ferry terminals. Field observations indicated that taxi cars rather than vans are predominantly used to transport Patchogue ferry passengers. In the immediate surroundings of the train station there are primarily municipal buildings, including the Town Hall, the Village Hall, and a school. Auto repair shops and residences are also located near the station. Two ferries operate from two different locations in Patchogue. One, which travels to Watch Hill, is located two blocks west of the train station. Train passengers can walk from the station to the ferry terminal. Those who drive to this ferry can park in a lot that has a capacity of about 150 cars. A second ferry that travels to Davis Park is located on Brightwood Street, about a 5-minute drive south of the LIRR station. Taxi services are utilized to transport passengers to this ferry terminal. The route to the ferry follows Cedar Avenue and is entirely residential. There is one restaurant called On the Waterfront located near the ferry landing. A fee parking lot with approximately 300 spaces is located adjacent to the ferry landing.

3.129 Residents of and visitors to Fire Island also generate economic activity at recreation-related businesses on the bay shore of Long Island. Because of the limited marina and lodging capacity on Fire Island, and cheaper lodging rates on Long Island, some Fire Island visitors utilize bay shore facilities, which may also include boat repair. The marina and hotel facilities are profiled below.

3.130 Marinas on Long Island rent slips to people vacationing on Fire Island and to day trip visitors going to Fire Island. On Fire Island there are approximately 10 marinas, with a total of about 1,090 slips (see Table 3-1). These marinas are often at full capacity—particularly on weekends—and some have access restrictions based on place of residence. Based on interviews with bay shore marina managers, anywhere from 15-50 percent of their summer sales are attributable to people going to Fire Island. There are about 42 marinas along the Long Island bay shore between Lindenhurst and East Moriches, many more than on Fire Island. The number of slips at the bay shore marinas range from 16 at the Brown's River Marina in Sayville to 400 at the Dockside 500 Resort Marine in West Bellport. Overall, the bay shore contains approximately 3,500 slips. Bay shore marinas generally operate on a first-come, first-served basis. However, some marinas rent nearly all of their available slips for the entire season, keeping just a few transient slips available; others may rent slips by the day or the week.

3.131 Hotel managers on Long Island reported that 5-30 percent of their summer business can be associated with people visiting Fire Island. There are about 22 lodging places between Lindenhurst and East Moriches along the Long Island bay shore south of Highway 27, also called Sunrise Highway. By comparison, Fire Island has 15 hotels. The bay shore hotels have an approximate range in size from 10 rooms at the Land's End Motel in Sayville to 42 rooms at the Bay Shore Summit Motor Lodge in Bay Shore. The average is approximately 26 rooms. Prices at Long Island lodging range from $40 per night at the Brook Motel in Babylon to $175 per night at the Lindemere Bed & Breakfast in Center Moriches. These rooms are on average cheaper than those on Fire Island, e.g., the average cost of a hotel room on the bay shore is $72, as compared with $160 on Fire Island.

Sales and Payroll on Fire Island

3.132 As noted above, the Fire Island economy consists of approximately 135 businesses, which generated an estimated 880 jobs and more than $58 million in sales in 1997 (see Table 3-5). Retailers are the principal revenue generator, with more than $43 million in sales and an estimated 620 jobs in 1997, particularly restaurants, food stores, and clothing stores, which accounted for more than 40 percent of total sales. Hotels and personal and business services are also important components of the local economy, providing approximately 115 jobs and generating $6 million in revenues. Concession operations at Robert Moses State Park, Sailors Haven and Watch Hill Visitors' Centers, and Smith Point County Park contribute approximately $1.7 million in sales and 75 jobs to the local economy.

Table 3-5
Fire Island Sales, Employment, and Wages–1997

Sector	Estimated Sales (millions)	Estimated Employment	Average Weekly Wage (per person)	Estimated Total Payroll (millions)
Retail	$43.5	620	$355.17	$5.9
Services	6.0	115	571.17	1.8
Construction	4.0	40	693.87	0.7
Manufacturing	3.0	30	751.04	0.6
Concessions	1.7	75	335.17	0.6
Total	$58.2	880		$9.7

Source: New York State Department of Labor, Claritas Inc., and Allee King Rosen & Fleming, Inc.

3.133 The total payroll from business activity on Fire Island is estimated at $9.7 million, based on average weekly salaries for retail, services, construction, and manufacturing sectors, as reported by the New York State Department of Labor. The retail sector has the largest payroll with an estimated $5.9 million in wages; this represents 61 percent of the total payroll in the local economy. The service sector accounts for approximately $1.8 million in wages, which is approximately 18 percent of total wages. Payroll was estimated based on a seasonal work year, generally operating from April through October. The primary exception is Robert Moses State Park, which operates year-round; thus, wages for employment at Robert Moses were calculated based on year-round operation.

Commercial Fishing

3.134 The shores of Long Island developed first around marine commerce, and shell fishing is still an important industry in the study area, although it has declined in the past 20 years. The GMP reported that as of the mid-1970's, approximately 40 percent of the world's supply of hard shell clams was harvested from the Great South Bay region, with dockside sales of $12.4 million in 1974. Some 8,000 individuals were licensed to harvest clams and approximately 500 were employed in the industry (GMP 1978).

3.135 Today, the NYSDEC Shellfisheries Department estimates that less than 5 percent of the world's supply of hard shell clams is harvested from the Great South Bay region, with dockside sales of $19.2 million in 1998. Adjusting for inflation, this represents $5.9 million in 1974 dollars, a decline in real value of 52 percent. In 1998 other types of shellfish harvested from Great South Bay accounted for another approximately $5 million. Both the 1974 and 1998 figures are probably low estimates, since they account only for wholesale buyers. Sales from harvesters who send their products directly to retailers and fish stores are not included.

3.136 Individuals in New York State licensed to harvest shellfish totalled 2,402 in 1998. 620 were from Babylon, Islip and Brookhaven in the project study area.

Utilities

3.137 A wide variety of public and private entities supply basic services to the area. These utilities include water supply, sanitary waste, solid waste, and telephone, as discussed below.

Water Supply

3.138 Because of the seasonal nature of the island, the majority of groundwater is consumed between May and September, with peak demands occurring on weekend and holidays. Potable drinking water on Fire Island is supplied by the Suffolk County Water Authority (SCWA) and independent water companies. SCWA has four wells on the western portion of the island that serve the communities of Cherry Grove, Davis Park, Kismet, Lonelyville, and Point O' Woods. Annual pumping volumes for major public and community supply wells are presented in Table 3-6.

Table 3-6	
Water Supply	
Water Supply Area	**Total Annual Volume (gallons)***
Kismet	15,062,000
Saltaire Water District	53,178,000
Fair Harbor Water District	29,595,000
Lonelyville Water District	3,616,000
Ocean Beach Water District	73,077,000
Seaview Utilities	35,803,000
Ocean Bay Park Water Company	32,343,000
Point O' Woods Association	12,244,000
Cherry Grove	17,876,000**
Fire Island Pines Water Department	65,359,000
Davis Park	21,769,000

Notes:
* 1994.
** 1992.
Source: Groundwater Resources of Fire Island, Leggette, Brashears & Graham, Inc. for SCWA, 1996.

Sanitary Waste

3.139 All sanitary sewage on Fire Island is handled by on-site septic systems, with the exception of the Village of Ocean Beach. Ocean Beach provides a wastewater treatment facilities for its residents at a plant located along the bay at Surfview Walk and Bay Walk. The permitted capacity of the plant is 500,000 gallons per day (gpd) and average flows (during the peak summer months) are well below that limit, approximately 300,000 gpd. Treated effluent from the plant is discharged nearby into the Great South Bay.

Solid Waste

3.140 All solid waste generated by the residential, commercial, and recreational uses on Fire Island is handled by private carting companies, independently hired or under contract to a local municipality. Most waste is taken from the island by barge, while waste from Robert Moses State Park and Smith Point County Park is removed by truck. All waste is disposed of off the island at licensed landfill operations.

Telephone

Phone service on Fire Island is provided by Bell Atlantic. A system of cables running from the bay shore of Long Island traverse the Great South Bay from Bayport to Barrett Beach, Bayshore to Saltaire and Ocean Beach, and by the Robert Moses and Smith Point Bridges. From there, users are connected through a network of service lines, some of which are above-ground (particularly in developed communities), while others are buried below-grade (throughout parklands and the Otis

G. Pike Wilderness Area). The main distribution lines generally follow Burma Road along the length of the island; switching and transmission stations are located along the length of the distribution lines.

Environmental Justice

3.141 Executive Order 12898 directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. Consistent with this mandate, the population in the vicinity of the FIIP is evaluated to determine the potential for the project to adversely affect minority and/or low-income populations. Data are presented for median household income and race for a total of 27 census tracts. The demographic study area comprises all census tracts wholly or partly on Fire Island (the primary study area), as well as tracts along the bay shore of Long Island between the Robert Moses Causeway and the Moriches Inlet (the secondary study area).

Primary Study Area

3.142 As shown in Table 3-7, for the two census tracts that include Fire Island (excluding the west end of Robert Moses State Park), total population is 9,205 with median household incomes of $31,500 and $52,939. The population of the census tracts including Fire Island is overwhelmingly white (from 96.4 to 98.7 percent) with few minorities. As discussed above, the seasonal population during the summer months (on Fire Island only) is estimated at approximately 20,000; the racial composition of seasonal residents is assumed to be similar to that of permanent residents, with no significant concentrations of low-income households or minority populations.

Secondary Study Area

3.143 1990 Census data show a total of approximately 116,000 people residing in the 25 tracts that make up the secondary study area. The secondary study area is about 95 percent white, 2.5 percent black, and 5 percent Hispanic (other minority classifications are less than 1 percent each). This proportion is similar to Suffolk County as a whole, although the secondary study area has percentagewise slightly fewer minorities and more whites than the county.

3.144 Median household income ranges from $29,071 to $66,935, and most census tracts are higher than the Suffolk County median. Three census tracts exhibit both lower income and a higher proportion of minority population: tracts 1472 and1473 in Bayshore and tract 1590 in Patchogue. The Bayshore areas show a high proportion of blacks and hispanics; the Patchogue tract contains a high proportion of Hispanic residents.

Table 3-7 Study Area Household Income, Race, and Ethnicity[1]										
	Median Household Income	Total Population	White Population		Black Population		Other Minorities		Hispanic Population[2]	
Tract			Number	Percent	Number	Percent	Number	Percent	Number	Percent
Primary Study Area										
1470.02	$52,939	5,198	5,131	98.71	0	0.00	67	1.29	194	3.73
1595.07	$31,500	4,007	3,862	96.38	105	2.62	40	1.00	168	4.19
Subtotal		9,205	8,993	97.70	105	1.14	107	1.16	362	3.93
Secondary Study Area										
1244.02	$49,167	3,810	3,766	98.85	0	0.00	44	1.15	124	3.25
1470.01	$56,660	3,930	3,898	99.19	0	0.00	32	0.81	88	2.24
1471.00	$66,935	3,265	3,203	98.10	34	1.04	28	0.86	124	3.80
1472.00	$32,500	5,046	4,424	87.67	341	6.76	281	5.57	653	12.94
1473.00	$29,071	5,882	4,305	73.19	1,112	18.91	465	7.91	907	15.42
1474.02	$55,452	3,693	3,620	98.02	7	0.19	66	1.79	127	3.44
1475.01	$50,920	7,603	7,333	96.45	37	0.49	233	3.06	263	3.46
1475.03	$62,594	3,965	3,932	99.17	0	0.00	33	0.83	147	3.71
1476.01	$63,225	2,721	2,576	94.67	42	1.54	103	3.79	133	4.89
1476.02	$55,600	5,154	5,100	98.95	16	0.31	38	0.74	179	3.47
1477.02	$49,028	4,680	4,634	99.02	27	0.58	19	0.41	123	2.63
1478.02	$53,142	4,218	4,155	98.51	32	0.76	31	0.73	55	1.30
1479.02	$64,193	4,291	4,238	98.76	9	0.21	44	1.03	42	0.98
1588.02	$52,044	4,230	4,187	98.98	30	0.71	13	0.31	86	2.03
1590.00	$34,832	4,662	4,252	91.21	115	2.47	295	6.33	587	12.59
1592.01	$45,457	2,749	2,613	95.05	73	2.66	63	2.29	184	6.69
1592.03	$48,561	4,769	4,715	98.87	23	0.48	31	0.65	65	1.36
1592.04	$46,543	3,806	3,386	88.96	300	7.88	120	3.15	149	3.91
1593.00	$53,062	2,572	2,499	97.16	66	2.57	7	0.27	62	2.41
1595.04	$39,056	7,523	6,929	92.10	271	3.60	323	4.29	499	6.63
1595.05	$38,145	6,799	6,715	98.76	16	0.24	68	1.00	384	5.65
1595.06	$44,342	6,207	5,897	95.01	162	2.61	148	2.38	463	7.46
1595.08	$36,619	6,375	6,187	97.05	103	1.62	85	1.33	356	5.58
1596.01	$45,000	4,865	4,803	98.73	0	0.00	62	1.27	23	0.47
1596.02	$50,324	3,660	3,513	95.98	70	1.91	77	2.10	131	3.58
Subtotal		116,475	110,880	95.20	2,886	2.48	2,709	2.33	5,954	5.11
STUDY AREA TOTAL		125,680	119,873	95.38%	2,991	2.38%	2,816	2.24%	6,316	5.03%
Suffolk County	$44,128	1,321,864	1,190,315	90.05%	82,910	6.27%	48,639	3.68%	87,852	6.65%

Notes:
1 Source: U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1990.
2 Persons of Hispanic origin can be of any race.

Identification of Low-Income and/or Minority Populations

3.145 Based on 1990 Census data, there are three moderate concentrations of low-income populations and minority populations in secondary study area.

NATURAL RESOURCES

Introduction

3.146 The natural resources of the study area are discussed in this section. This information is based on the latest or most pertinent available literature, and field studies that are currently underway by NYD and other natural resources agencies. This natural resources section examines the flora and fauna associated with the study area. For ease of reference, a separate table is provided in

Appendix D which lists both the scientific and common names (where available) of each species discussed in this section. Several species mentioned in this report do not have equivalent common names; therefore, only a scientific name is provided in the text and in the table in Appendix D.

3.147 For the sake of clarity, this DEIS has subdivided the study area into five ecological zones, as follows: the offshore environment (including the potential borrow area), the near shore zone, the intertidal zone (potential sand placement area), the barrier island, and the back bay. The discussion of each ecological zone is further subdivided into separate discussions of each of the major life forms which characterize the zone (e.g., invertebrates, finfish, avifauna, flora). The threatened and endangered species which utilize each zone are described in detail at the end of each subsection.

3.148 From a natural resources standpoint, the barrier island zone can be further subdivided into the developed and undeveloped areas. The primary difference is the presence of densely spaced residential homes from the ocean front to the back bay and the accompanying presence of shoreline hardening structures (primarily bulkheads) on the bay side. Additionally, many of the developed areas have houses on the primary dune line.

3.149 This affected environment section reflects the current conditions of the natural resources in the study area, as described in the available literature. Ecological communities are often in a state of flux or succession. Therefore, many of the subsections include a discussion of seasonal and long-term trends, and natural succession. The rationale is to present the ecology of the study area as a temporal, dynamic system rather than a static one.

3.150 A coastal barrier beach is a dynamic phenomenon. Barrier beach profiles are generally altered during storm events. During a storm, erosive wave action typically removes sand from the upper beach and dunes and carries it seaward to the lower beach or beyond. In the weeks following the storm, much of the transported sand is returned to the beach and dunes from temporary offshore storm bars.

3.151 Most of the theories behind barrier formation are tied to the changes in sea level caused by the freezing and thawing of ice sheets during the ice ages. As the sea level rises, coastal barriers typically migrate landward gradually over a broad geologic timeframe. Over hundreds of years, coastal barriers are visibly re-shaped by overwash processes that typically occur during major storm events. The overwash processes typically aid the barriers in changing position by allowing them to roll over themselves, continuously "sharing" sand from the seaward side with the landward side. While most barrier islands on the Atlantic coast participate in off- to on-shore sand "sharing," Wells and Peterson (undated) report that the rollover process at Fire Island is somewhat different, in that it is eroding from both the landward and seaward sides. Please refer to the Main Report for more details.

3.152 The natural resources of the Fire Island study area are generally similar to ecological communities occurring on other barrier islands along the south shore of Long Island, except for the highly urbanized areas such as Long Beach Island and Rockaway Beach. No developed roadway exists for much of the central and eastern portions of Fire Island. This provides an opportunity—unique for developed areas—for uninterrupted transitions from one habitat to another. A typical Long Island south shore barrier island is characterized by a variety of habitats ranging from high-energy surf and intertidal zones on the ocean shore front, to primary and secondary dunes covered with beach grass further inland. Swale areas are often found between the dunes, and the dunes may transition to maritime shrub land followed by high marsh and low marsh on the back bay side of the barrier island. The ocean side of the barrier islands provide habitat for those species well adapted to salt spray, wind, xeric (droughty) conditions, and a shifting substrate. On the back bay side, conditions are more stable, favoring more lush, diverse vegetation. Plant assemblages are predominantly herbaceous, and shrub species comprise the majority of woody growth. With the exception of ornamental species planted in the Fire Island residential areas and parks, trees are present only within the sheltered back dune environment or protected areas such as the Sunken Forest. The harsh barrier environment tends to limit successional changes, and the usual colonizing plants (beach grass) often form stable, long duration communities.

3.153 In this natural resources section, as in other sections of the DEIS, the primary focus of the discussion and analysis will be on the developed areas and the adjacent undeveloped areas, since the larger undeveloped or wilderness portions of the study area would not be directly subject to project impacts. However, the discussions which follow will necessarily include parts of the Otis G. Pike Wilderness Area, since natural resources inventories often defy human boundaries and classifications. Further, while the primary impact area (for sand placement) includes the developed shoreline, the undeveloped areas may be indirectly affected by littoral drift or other impacts. This is also discussed in greater detail in the Main Report.

Offshore Environment/Borrow Area

3.154 For the purposes of this report the Offshore Environment is defined as the marine zone from the 3 fathom (18-foot) contour to 3 miles offshore of the barrier island. The offshore borrow area is located approximately ½ to 1½ miles offshore of Cherry Grove in approximately 30 to 60 feet MLW of water. The FIIP borrow area (known as Area 2) is approximately 3,000 acres (see

Borrow Area Appendix to the Draft Decision Document). The vicinity around the borrow area consists primarily of fine to medium sands (> 90 percent), with little or no relief in topography, with the exception of two potential cultural resources (Reiss, 1996) in the northwest and southeast quadrants of the borrow site. There are no wrecks or rock piles evident on the National Oceanic and Atmospheric Administration (NOAA) navigation chart in the vicinity of the borrow area (Reiss 1996).

3.155 There are no known Hazardous, Toxic, Radioactive Waste (HTRW), Comprehensive Environmental Response, Compensation, Liability Act (CERCLA) or Resource Conservation and Recovery Act (RCRA) sites within the study area; therefore, no HTRW impacts are expected. Since sediments beneath navigable waters proposed for dredging are regulated as HTRW only if they are within the boundaries of a site designated by the U.S. Environmental Protection Agency (USEPA) or a state for a response action or if they are part of the National Priority List (NPL) site under CERCLA, no preliminary assessment for HTRW at the borrow area was necessary.

3.156 Sand from the borrow area is predominantly quartzose sand; as such, it lacks affinity for binding of contaminants. The extremely low organic carbon and clay content of the borrow area sediments makes the presence of contaminants, at other than trace levels, extremely unlikely. Borrow area investigations revealed that clay channels exist within the delineated borrow area. As currently planned, dredging for this project will avoid the channels, so the clay layers will not be affected. Furthermore, the borrow area is geographically removed from the direct influence of any known point source of contaminants and from any historical disposal area.

Invertebrates

3.157 The proposed borrow location off Fire Island was sampled by RMC Environmental Service (1996) during July of 1996 for macrobenthic invertebrates (i.e., small clams, worms, and arthropods), and subsequently by Barry A. Vittor & Associates, Inc. (USACOE 1998) in July and September of 1997 and 1998. Both firms also sampled borrow locations off Shinnecock Inlet as well.

3.158 Results of the earlier RMC study revealed the presence of 54 taxa of macroinvetebrates with a mean density of 2,334.7/m^2 at the Fire Island borrow sites. Digger amphipods (*Protohaustorius wigleyi,* 47.4 percent), fringed worms (*Tharyx acutus*, 28.7 percent), polychaete worms (*Magelona papillicornis*, 9.2 percent), and dwarf tellin (*Tellina agilis*, 15.2 percent) represented the bulk of the species' composition in the RMC sample.

3.159 Barry A. Vittor & Associates, Inc. (VA) also collected macrobenthic invertebrates from two proposed borrow areas (i.e., east of Shinnecock Inlet and off Fire Island) during 1997 and 1998. A Smith-McIntyre benthic grab (area=0.1 m^2) was used to collect 15 sediment samples at the borrow area site near Fire Island (FI) and 10 sediment samples at the borrow area site near Shinnecock Inlet (SI) during June and 30 samples at both sites during October 1998. Macroinfaunal samples were sieved on ship through a 0.5-mm mesh screen and preserved with 10 percent formalin in the field. Samples were then shipped to BVA's laboratory in Mobile, Alabama for further analysis. Benthic samples were also collected at each station for sediment texture analysis.

3.160 All sorted macroinvertebrates were identified to the lowest practical identification level (LPIL), which in most cases was to species level unless the specimen was a juvenile, damaged, or otherwise unidentifiable. The number of individuals of each taxon, excluding fragments, was recorded. A voucher collection was prepared, composed of representative individuals of each species not previously encountered in samples from the New York/New Jersey region.

3.161 Results of the program are found in Table 3-8. A total of 6,167 organisms representing 107 taxa were collected from the Fire Island borrow area in June 1998 (Table 3-8). Polychaetes were the most numerous organisms present representing 46.8 percent of the total number of individuals collected, followed in abundance by bivalves (13.6 percent) and malacostracans (8.7 percent). Polychaetes represented 62.6 percent of the total number of taxa followed by malacostracans (16.8 percent) and bivalves (10.3 percent). A total of 7,418 organisms representing 145 taxa were collected from the same site in October 1998. Polychaetes represented 55.1 percent of the total number of individuals, followed in abundance by bivalves (19.2 percent) and malacostracans (12.7 percent). Polychaetes represented 49.0 percent of the total number of taxa collected followed in number by malacostracans (23.4 percent) and bivalves (10.3 percent).

3.162 A total of 1,774 organisms representing 73 taxa were collected from the Shinnecock Inlet borrow area in June 1998 (Table 3-9). Polychaetes were the most numerous organisms present representing 52.4 percent of the total number of individuals, followed in abundance by bivalves (10.4 percent) and malacostracans (8.6 percent). Polychaetes represented 64.4 percent of the total number of taxa collected, followed by malacostracans (19.2 percent) and bivalves (8.2 percent). A total of 5,875 organisms representing 127 taxa were collected from the same site in October 1998. Polychaetes represented 48.7 percent of the total number of individuals, followed in abundance by malacostracans (30.9 percent) and bivalves (6.6 percent). Polychaetes represented 42.5 percent

Table 3-8					
Summary of Abundance of Major Taxonomic Groups for the Fire Island Borrow Area During June and October 1998					
Month	**Taxa**	**Total No. Taxa**	**Percent Total**	**Total No. Individuals**	**Percent Total**
June	Annelida				
	Polychaeta	67	62.9	2,889	46.8
	Oligochaeta	1	0.9	1,115	18.1
	Mollusca				
	Bivalvia	11	10.3	836	13.6
	Gastropoda	2	1.9	17	0.3
	Arthropoda				
	Malacostraca	18	16.8	539	8.7
	Ostracoda	1	0.9	34	0.6
	Other Taxa	7	6.5	737	12.0
	Total	107		6,167	
October	Annelida				
	Polychaeta	71	49.0	4,088	55.11
	Oligochaeta	1	.7	425	5.73
	Mollusca				
	Bivalvia	15	10.3	1,422	19.17
	Gastropoda	11	7.6		
	Arthropoda				
	Malacostraca	34	23.4	945	12.74
	Ostracoda	1	0.7	28	0.38
	Arachnida	1	0.7	1	0.01
	Other Taxa	11	7.6	467	6.30
	Total	145		7,418	
Source: EEA, 1999.					

Table 3-9					
Summary of Abundance of Major Taxonomic Groups for the Shinnecock Inlet Borrow Area During June and October 1998					
Month	**Taxa**	**Total No. Taxa**	**Percent Total**	**Total No. Individuals**	**Percent Total**
June	Annelida				
	Polychaeta	47	64.4	929	52.4
	Oligochaeta	1	1.4	244	13.8
	Mollusca				
	Bivalvia	6	8.2	184	10.4
	Arthropoda				
	Malacostraca	14	19.2	153	8.6
	Ostracoda	1	.4	1	0.1
	Other Taxa	4	5.5	263	14.8
	Total	73	1,774		
October	Annelida				
	Polychaeta	54	42.5	2,860	48.7
	Oligochaeta	1	0.8	205	3.5
	Mollusca				
	Bivalvia	11	8.7	389	6.6
	Gastropoda	7	5.5	74	1.3
	Arthropoda				
	Malacostraca	43	33.9	1,816	30.9
	Ostracoda	2	1.6	10	0.2
	Other Taxa	9	7.1	521	8.9
	Total	127		5,875	
Source: EEA 1999.					

of the total number of taxa collected followed by malacostracans (33.9 percent) and bivalves (8.7 percent).

3.163 Benthic macroinvertebrate data collected in July 1996 from the Fire Island and Shinnecock Inlet borrow areas by RMC Environmental Services (Greeley-Polhemus Group, Inc. 1997) were compared to similar data collected by BVA in 1997 (Barry A. Vittor & Associates, Inc. 1999). These data were combined with data collected in 1998 to examine trends in macroinvertebrate assemblage structure.

3.164 The macroinvertebrate assemblage in the Fire Island borrow area during July 1996 was dominated by the polychaetes, *Tharyx acutus* and *Magelona papillicornis* and the bivalve, *Tellina agilis*; the assemblage in the same borrow area in June 1997 was dominated by a polychaete assemblage that included *T. acutus* and *Asabellides oculata,* and the families, Cirratulidae and Maldanidae. The Fire Island borrow area assemblage in November 1997 was dominated by the polychaetes, *A.* oculata and *Polygordius* sp. and the amphipod, *Gammarus annulatus.* In June 1998, the macroinvertebrate assemblage was dominated by oligochaetes, rhynochocoels, and the polychaetes, *Polygordius* sp. and *Brania wellfleetenis.* In October 1998, the assemblage was dominated by *Polygordius* sp. and the bivalves, *Spisula solidissima* and *Tellina agilis.*

3.165 The macroinvertebrate assemblage in the Shinnecock Inlet borrow area during July 1996 was dominated by the amphipods, *Protohaustorius wigleyi*, *Psammonyx nobilis* and *G. annulatus* and the bivalve, *Tellina gilis;* the assemblage in the same borrow area in June 1997 was dominated by the amphipods, *P. nobilis* and *Protohaustorius* sp. B, and the polychaete taxa, *Spiophanes bombyx* and Ampharetidae (LPIL). The Shinnecock Inlet borrow assemblage in November 1997 was dominated by the bivalve, *Spisula solidissima*, sand dollars (Echinoidea [LPIL]), probably *Echinarachnius parma*), the polychaetes, *Polygordius* sp., and the amphipod, *Tanaissus psammophilus.* The assemblage in June 1998 was dominated by oligochaetes, rhynchocoels, and the polychaete, *Scolelepis squamata.* The dominant taxa in October 1998 were the polychaete, *Polygordius* sp., and the amphipods, *P. wigleyi* and *Protohaustorius* sp.

3.166 The dominant species identified were the fringed worm (*Tharyx acutus*), ampharetid worm (*Asabellides oculator*), archiannelid worm (*Polygordius sp.*), and unidentified individuals from the family Cirratulidae and Maldanidae. Abundant bivalve species included the dwarf tellin, the surf clam (*Spisula solidissima*), and chestnut astarte (*Astarte castanea*), while the crustaceans were best represented by the scud amphipod (*Gammarus annulatus*), (*Pseudoleptocuma minor*) and the sharp-tailed cumacean (*Diastylis polita*).

3.167 The results of the sampling of Shinnecock Inlet indicated a more even distribution between groups, with 34.2 percent being crustaceans, 30 percent polychaete, and 20.2 percent bivalves. The crustaceans were dominated by the amphipods (*Psammonyx nobilis*) and (*Protohaustorius sp.*), while the polychaetes were best represented by the mudworm (*Spiophanes bombyx*) and archiannelid worm (*Polygordius sp.*). The bivalves were similar to those observed off Fire Island, being the surf clam and dwarf tellin.

3.168 In addition to macrobenthic invertebrate studies referenced above, planned site-specific studies conducted in and around the study area serve as a guideline in determining the macroinvertebrate species found offshore of Fire Island. These programs are described in a following section.

3.169 There are comparable studies from similar habitats, including the most recent U.S. Army Corps of Engineers (USACOE) 1998 Biological Monitoring Program for the Atlantic Coast of New Jersey from Asbury to Manasquan. Additional information is provided in the following reports, by RMC Environmental Service (1996) for the Shinnecock Inlet borrow site; Cerrato (1983) for the borrow site in upper bay New York Harbor; Ray & Clark (1995), for the borrow sites of Monmouth County, New Jersey; and Steimle & Stone (1973) and Franz & Harris (1988) for mapped benthic populations throughout the New York Bight. All of these studies report comparable findings on macrobenthic communities associated with proposed borrow site locations.

3.170 Based on the fact that beach nourishment requires the use of medium sands it is thereby assumed that the benthic community most affected will be dominated by organisms found in these sands. These communities are best characterized by amphipods such as *Pseudouniola obliquua*, the digger amphipod (*Acanthohaustorius millsi*), *Psammonyx nobilis*, the scud amphipod (*Gammarus annulatus*), the digger amphipod (*Protohaustorius wigleyi*), *Pseudoleptocuma minor*, and the sharp-tailed cumacean (*Diastylis polita*). In addition to the amphipods, large numbers of the archiannelid worms (*Polygordius sp.*) can be expected, as well as several polychaetes including *Magelona papillicornis*, ampharetid worm (*Asabellides oculator*), mudworm (*Spiophanes bombyx*), and fringed worm (*Tharyx acutus*). Shellfish typically present in the sand community are the surf clam and the dwarf tellin. Biomass will almost certainly be dominated by the surf clam or sand dollar (*Echinarachnius parma*). These species are universal to six previously reported studies and only vary in overall abundances between studies.

3.171 Invertebrates are the primary food source for many predatory species, such as finfish. The relationship between the benthic invertebrate communities and predatory species such as finfish is presently being defined for the borrow sites through the ongoing and planned fisheries studies in conjunction with the ongoing and planned invertebrate sampling programs. For example, a program is being conducted to determine the stomach contents of predatory finfish species found in the Shinnecock borrow locations. This program is referred to as BRAT, Biological Resources Assessment Technique.

3.172 Within the New York Bight, species diversity ranged from a low of 54 species (RMC 1996) to a high of 135 species (USACOE 1998) at a given site. Mean densities ranged from 806 individuals per meter square reported by RMC (1996) to 7,746 individuals per meter square reported by Ray & Clarke (1995). Given the high energy typically associated with shallow water near shore environments, it is anticipated that the benthic community structure and densities will vary with location and season, making it difficult to determine the exact benthic community present until a site-specific study is conducted.

Ongoing Mega and Macrobenthic Field Studies

3.173 Megabenthic invertebrates (e.g., shellfish, squid, and crustaceans) collected for the West of Shinnecock Inlet Interim Project during the otter trawls (collection methods and schedule are given in a following fisheries section) were sorted and counted prior to being returned to the water. Lengths and weights were recorded for squid. Table 3-10 presents a summary of the trawl catch by taxa, monthly total, total catch and percent composition. A total of 19 species of macrobenthic invertebrates were collected. The dominant species collected was the sand dollar. The 12,625 individuals collected represented 51 percent of the total catch.

3.174 An extensive macrobenthic field program is presently under way for the Reformulation Study. During July and August, 1999, a total of 240 benthic grab samples were collected in 11 proposed borrow locations. Numbers of stations for each site were prorated based upon the borrow sites area. Table 3-10 presents the borrow sites, the dates and the number of samples. This program will be replicated in November, 1999. The analysis of the samples is on-going and anticipated to be completed by February, 2000. Preliminary analysis indicates that the samples are dominated by sand dollars (*Echinarachnius parma*), Tellins (*Tellina agilis*), and the digger *amphipods* (*Acanthohaustorius mills, Psammonyx nobilis, Protohaustorius wigleyi* and *Grammarus annulatus*). In addition, small worms and worm-like creatures appear to be abundant (e.g., *Nemerteans, Ploygordius triestinus*, and *Aricidea catherinae*), to name but a few. Table 3-11 summarizes the locations and number of samples to be collected for the ongoing macrobenthic field studies currently being conducted for the Reformation Study.

Table 3-10 West of Shinnecock Inlet Interim Project Summary of Trawl Catch Data–Megabenthics Monthly Totals, Total Number, Percent Composition								
Taxa	**April**	**May**	**June**	**July**	**August**	**September**	**Total Caught**	**Percent Of Total**
Sand Dollar	2,605	226	2,582	3,413	1,215	2,584	1,2625	51.59
Long-Finned Squid	4	39	12	116	6878	1,216	8,265	33.77
Lady Crab	14	35	100	71	393	303	916	3.74
Northern Moon Snail	254	88	104	153	92	51	742	3.03
New England Dog Whelk	30	112	58	125	38	22	385	1.57
Long Claw Hermit	14	38	26	53	131	50	312	1.27
Rock Crab	30	79	63	13	41	17	243	0.99
Flat Claw Hermit	2	12	12	49	40	76	191	0.78
Sand Shrimp	14	88	30	47	6		185	0.76
Spider Crab	17	3	2	19	88	12	141	0.58
Other							234	0.96
Acadian Hermit	34	15	14	33	12		108	0.44
Surf Clam	21	2	3	30		6	62	0.25
Horseshoe Crab	2	3	1	2	9	4	21	0.09
Boreal Red Shrimp	9	7		4			20	0.08
Starfish	1		2	4	2	2	11	0.04
Squid Egg Mass					8		8	0.03
Octopus					1	1	2	0.01
Blueclaw Crab		1					1	0.00
Lobed Moon Snail				1			1	0.00
Monthly Totals	3,051	748	3,009	4,133	8,954	4,344	24,473	
Source: EEA, Inc., West of Shinnecock Inlet Multi-Species Sampling Program, report in progress.								

Table 3-11 Reformulation Study Ongoing Macrobenthic Field Studies: Locations and Samples		
Location	**Date**	**Number of Samples**
Shinnecock Borrow Area	July 12, 1999	35
Georgica Pond Borrow Area	July 13, 1999	10
Agawam Lack Borrow Area	July 13, 1999	10
Hook Pond Borrow Area	July 14, 1999	42
Beach Hampton Borrow Area	July 16, 1999	20
West Hampton Borrow Area	July 21, 1999	32
West Hampton West Borrow Area	July 27, 1999	20
Bayberry Dunes Borrow Area	July 28, 1999	24
Water Island Borrow Area	August 2, 1999	33
Fire Island Pines Borrow Area	August 3, 1999	17
Cherry Grove Borrow Area	August 3, 1999	33
Source: EEA, Inc., West of Shinnecock Inlet Multi-Species Sampling Program, report in progress.		

Shellfish

3.175 In this section, emphasis will be placed on shellfish that are of commercial importance, such as the surf clam (*Spisula solidissima*) and the ocean quahog (*Arctica islandica*) also known as black clam. Both species have been reported to occur off Fire Island. NYSDEC conducted a surf clam population assessment in 1992 throughout the entire study area. (Another survey was conducted by NYSDEC in 1994, but was limited to a proposed borrow site off Rockaway Beach.)

3.176 The 1992 NYSDEC survey was conducted from approximately three fathoms (18 feet) of water to three miles offshore. Three zones were established running the entire length of Fire Island, parallel to the shore in 1-mile bands. All samples were collected utilizing modified commercial clam gear. In general, average densities were greatest near shore at 4.79 bushels/tow, and decreased offshore to 0.17 bushels/tow. Additional average densities of surf clam were much greater to the west of Fire Island in all zones, ranging from 35.13 to 5.18 bushels/ tow. The trend of decreasing abundances with increasing distance off-shore was evident.

3.177 In general, the black clam is considered to be an off-shore species frequenting water depths from 8 to 177 meters (26 to 584 feet). Black clams are rarely found where bottom water temperatures exceed 16° C (61° F). Pearce, et al. (1981) indicates that the black clam is present off Fire Island with average densities ranging from 0.51 to > 1.01 individuals per square meter. Pearce also reports that black clams are more typically found in softer bottoms than the surf clam.

3.178 Surf clams represent a significant standing crop to commercial fishermen. Commercial landing of surf clams annually exceeds $5,000,000 and is considered a valuable resource. Based on 1992 NYSDEC data, it would appear that surf clam densities are relatively low south of Fire Island. However, the NYSDEC survey in 1996 showed high inshore (0-1 miles) densities between Fire Island Inlet and Moriches Inlet. Surf clam densities have historically been found to be fluctuating in space and time. Franz (1976 American Society of Liminology Oceanography Special Services Symposium 2, p. 404-413) suggested that the eastern offshore areas may serve as spawner sanctuaries for the commercial shellfisheries of the western end of Long Island. The surf-clam densities are extremely patchy and localized in distribution, site-specific densities cannot be assumed to remain constant. Thus, it is necessary to verify surf-clam density. A site-specific survey will be done prior to construction.

Squid

3.179 The long-finned squid (*Loligo pealei*) is a pelagic schooling invertebrate distributed in continental shelf and slope waters from Newfoundland, Canada, to the Gulf of Venezuela. The long-finned squid migrate seasonally. They move offshore during late autumn to overwinter in warm waters along the edge of the continental shelf and return inshore during the spring and early summer to feed and spawn (NOAA 1995). The month of May is typically peak season in Long Island waters, when the squid deposit communal egg clusters, which are banana shaped, gelatinous capsules that are attached to seaweeds and bottom debris and take several months to hatch along the south shore of Long Island, possibly in the study area. As shown in Table 3-9, substantial numbers of long-finned squid were caught during the 1999 sampling.

3.180 In addition to the long-finned squid, it is possible to encounter both the short-finned squid (*Illex illecebrosus*) and brief squid (*Lolliguncula brevis*). The short-finned squid is also commercially important, but in general, spends most of its life in offshore waters, and is not present in the study area. The brief squid, also found off the south shore of Long Island, is too small to be of commercial importance. Little or no information is currently available on the brief squid.

Crustaceans

3.181 Numerous species of crustaceans are documented to occur in the ocean water south of Long Island. A partial list of the more common species frequently encountered include: American lobster (*Homarus americanus*), spider crab (*Libinia spp.*), rock crab (*Cancer irroratus*), lady crab (*Ovalipes ocellatus*), and sand shrimp (*Crangon septemspinosa*) (Gosner 1978). All of the species mentioned, with the exception of the American lobster, can be found frequenting all bottom substrate types up to a considerable distance offshore. Although migrating lobster can be found on open sand bottoms like the borrow areas, they will more frequently concentrate on some form of structure (e.g., wrecks, reefs, rocks, etc.) in the waters south of Long Island (Briggs and Zawacki 1974; Briggs 1985). The American lobster is the focus of a major commercial fishery (Briggs 1985), and to a lesser extent, the rock crab and Jonah crab (*Cancer borealis*) support a limited commercial fishery or are treated as a by-catch to the lobster fishery (Briggs and Mushacke 1982). The most recent landing statistic indicates that 6,653,781 pounds of lobster were caught during 1995 on Long Island.

3.182 Two additional species are identified to be abundant in the waters south of Long Island. Neither species is considered to be crustacean or macrobenthos; both are from the class Echinoidea and can be found in abundance at times: sand dollar (*Echinarachnius parma*) (RMC 1996) and the starfish Forbe's asterias (*Asterias forbesi*).

Finfish

3.183 This discussion of finfish species associated with the borrow area is based primarily on historic data collected along the southshore of Long Island. These historic species accounts were then further extrapolated to predict which species are expected to utilize the borrow areas based on the habitat types present. (Also, a comparable survey of proposed borrow locations off the New Jersey shore conducted by NYD provides an additional reference for species present for the period of April and August of 1995 and 1996 and is ongoing.) In addition, NYD will undertake additional borrow area finfish studies to verify existing conditions and validate the impact assessment relative to the resources. These studies will be similar to the West of Shinnecock Borrow Area Monitoring Program.

Resident Species

3.184 The only true resident fish species found in the waters within three miles of the south shore of Long Island are the tautog or blackfish (*Tautoga onitis*) and cunner (*Tautoga labrus adspersus*). Both are species of the Wrasse family that do not seasonally migrate over an extensive area. At most, they move from shallow water in the spring and summer to slightly deeper water in the autumn and winter. The preferred habitat of the blackfish is along steep, rocky shores, submerged wrecks, reefs, and boulder strewn bottoms (Bigelow & Schroeder 1953). Other species of fish which are resident in the waters south of Long Island but may migrate outside of the study for brief periods include the winter flounder (*Pleuronectes americanus*), windowpane (*Scophthalmus aquosus*), and little skate (*Raja erinacea*). While all three species are typically found together, each has a slightly different habitat preference. The winter flounder are more commonly found on a muddy sand bottom, while the windowpane are chiefly found on a sand bottom. The little skate prefers a sandy or pebbly bottom. These three species are the most abundant benthic fish species found in the New York Bight. Most other species are transient and utilize the area at specific times of the year. The NYD 1998 New Jersey study confirms the presence of the window pane and skate in at least the two seasons sampled. The FIIP borrow site does not provide the rocky habitat required by the tautog and cunners, explaining their absence from the sampling.

Transient (Migratory) Species

3.185 Transient finfish species most frequently encountered in the waters within three miles of the south shore of Long Island include the bluefish (*Pomatomus saltatrix*), striped bass (*Morone saxatilis*), weakfish (*Cynoscian regalis*), summer flounder (*Paralichthys dentatus*), Atlantic mackerel (*Scomber scombrus*), black sea bass (*Centropristis striata*), butterfish (*Peprilus trian-*

canthus), Atlantic menhaden (*Brevoortia tyrannus*), and scup or porgy (*Stenotomus chrysops*). All species mentioned are either commercially or recreationally important. Other abundant species include: northern and striped sea robin (*Prionotus carolinus* and *P. evolans*), Atlantic silversides (*Menidia menidia*), and sand lance (*Ammodytes spp.*). Although both the silverside and sand lance are important forage species, they have little or no commercial or recreational importance (Briggs 1963, McHugh 1972, NOAA 1995, Brim & Schreiber 1972). The USACOE (NYD) 1998 report confirms the presence of these species in the vicinity of the borrow areas off New Jersey. Depending on the water temperature, these migratory species begin to enter the waters south of Long Island by the end of April, and depart by late November. With the exception of the mackerel, which is a cold water species (47° to 52°) that only passes through the area in the spring (April/May) and again in the winter (December/January), exact dates can vary based on climatic conditions.

3.186 Species such as bluefish, striped bass, weakfish, mackerel, butterfish, and menhaden are all pelagic, fast-swimming species. These species are constantly in pursuit of prey such as the butterfish, menhaden, Atlantic silversides, and sand lance and seldom remain in any one location for an extended period of time.

3.187 In contrast, the benthic (bottom dwelling) fish species, such as the black sea bass and scup, like the tautog, are extremely structure-oriented, taking up residence on a wreck, reef, or rock pile for extended periods of time. The summer flounder, another benthic species, can be found near structures, but are more likely to congregate in inlet areas waiting to ambush schools of forage fish, primarily Atlantic silversides and sand lance, as they move in and out of the inlet.

__Ongoing Fisheries Field Studies__

3.188 The demersal (near bottom) fish and macrobenthic invertebrate communities were sampled at the off-shore borrow area known as Shinnecock Borrow Area. Finfish and macro-benthic invertebrate communities were collected by towing a 30-foot otter-trawl form an ocean-going research vessel along the 30, 40, 50, and 60 foot contour lines at a speed of 2 to 3 knots for a distance of 500 yards. Sampling was performed once each month starting in April 1999. The data presented in Tables 3-10 through 3-12 are current as of September, 1999. The program will continue on a monthly basis until March 2000.

3.189 A total of 16 transects were sampled within and adjacent to the borrow area. The transects which were trawled outside the borrow area served as reference areas on the east and west sides of the proposed borrow area. The bottom time for each trawl was 8-10 minutes and the length of each trawl was 440 yards. Standard protocols for the catch included length, weight, aging, and stomach content.

3.190 The pelagic (free-swimming) finfish community was sampled along the same four transects as the demersal sampling. A high rise otter-trawl was deployed with an appropriate cable length to achieve a midwater depth ratio. The net was towed at a speed of 2 to 3 knots for a distance of 440 yards (1/4 mile).

3.191 Trawl samples were collected monthly from April 1999 to September 1999. A total of 96 samples, six at each of the 16 stations, were collected. Table 3-12 presents a summary of the trawl catch by taxa, monthly total, total catch and percent composition. A total of 47 finfish species were collected. The dominant species collected was the butterfish. The 13,020 individuals collected represented 45.4 percent of the total catch. The second through sixth ranked fish species by abundance, were scup, bay anchovy, little skate, striped searobin, and winter skate, respectively. These along with windowpane, bluefish and northern searobin, comprised 96.5 percent of the total catch. Table 3-12 presents the six month trawl results for these dominant species.

3.192 A water quality survey was conducted at the beginning and end of each trawl. Parameters included temperature, dissolved oxygen, salinity, conductivity, pH, and surface water transparency.

Seasonal and Long-Term Trends

3.193 As discussed, the vast majority of the finfish species known to utilize the water south of Long Island are mostly seasonal migrants. The greatest concentrations of fish can be found in May/June when large schools of fish (e.g., bluefish, striped bass, weakfish, etc.) migrate into the area from southern waters. Schools may disperse or migrate through the area, heading north during the summer (July/August) if the water temperature gets too high or forage is unavailable. Large schools will once again move into the area as fish begin fall migration (September/October), which can extend into November, depending on the water temperature. Based on the findings of the USACOE (NYD) 1998 New Jersey study the family clupeidae (herring), which most likely includes Atlantic menhaden, American shad (*Alosa sapidissima*), blueback herring (*Alosa daestivalis*), and alewife (*Alosa pseudoharengus*), dominated catches in the spring, representing 52.6 percent of all fish collected over the 2-year period studied, while the butterfish dominated catches in the fall sampling, representing 41.2 percent of all fish collected over the 2-year period.

Table 3-12
Summary of Trawl Catch Data
Monthly Totals, Total Number, Percent Composition

Taxa	April	May	June	July	August	September	Total Caught	Percent of Total
Butterfish	0	68	294	39	11,422	1,197	13,020	45.44
Scup	2	26	127	285	5,061	2,406	7,907	27.59
Bay Anchovy	0	72	43	5	4	3,170	3,294	11.50
Little Skate	530	365	284	361	53	205	1,798	6.27
Striped Sea Robin	0	15	10	21	467	45	558	1.95
Winter Skate	69	169	66	35	13	41	393	1.37
Windowpane	48	23	39	29	35	105	279	0.97
Bluefish	0	0	0	0	14	199	213	0.74
Northern Sea Robin	32	5	24	31	81	19	192	0.67
Winter Flounder	80	46	0	2	0	0	128	0.45
Summer Flounder	25	19	14	9	28	19	114	0.40
Spotted Hake	47	5	25	29	1	1	108	0.38
Small Mouth Flounder	31	14	7	18	22	5	97	0.34
*Sea Herring	1	23	2	70	0	0	96	0.34
Northern Puffer	0	0	0	0	10	74	84	0.29
Moonfish	0	0	0	0	62	2	64	
Silver Hake	42	0	1	6	6	7	62	0.22
Hake Sp.	4	32	5	2	0	0	43	0.15
Atlantic Menhaden	0	0	0	0	25	5	30	0.10
Black Sea Bass	16	2	2	5	0	1	26	0.09
Round Scad	0	0	0	0	23	2	25	0.09
Atlantic Cod	12	4	0	0	1	0	17	0.06
Red Hake	13	0	0	0	0	1	14	0.05
Weakfish	0	0	0	0	1	13	14	0.05
Clearnose Skate	0	0	5	0	2	5	12	0.04
Bluespotted Cornetfish	0	0	0	0	1	6	7	0.02
Inshore Lizardfish	0	0	0	0	5	2	7	0.02
Northern Kingfish	0	1	0	0	0	5	6	0.02
Smooth Dogfish	0	1	3	0	1	1	6	0.02
Eel Pout	5	0	0	0	0	0	5	0.02
Fourspot Flounder	1	1	0	1	2	0	5	0.02
Goosefish	3	0	1	0	0	0	4	0.01
Bigeye	0	0	0	0	3	1	4	0.01
Atlantic Mackerel	3	0	0	0	0	0	3	0.01
Flying Gurnard	0	0	0	0	2	1	3	0.01
Alewife	0	3	0	0	0	0	3	0.01
American Shad	1	0	1	0	0	0	2	0.01
Seahorse	0	0	0	0	1	1	2	0.01
White Hake	1	0	0	0	0	0	1	0.00
Pollock	0	1	0	0	0	0	1	0.00
Atlantic Torpedo	0	0	1	0	0	0	1	0.00
Blueback Herring	0	0	1	0	0	0	1	0.00
Atlantic Sturgeon	0	0	1	0	0	0	1	0.00
Conger Eel	0	0	0	1	0	0	1	0.00
Northern Pipefish	0	0	0	0	1	0	1	0.00
Plainhead Filefish	0	0	0	0	1	0	1	0.00
Striped Anchovy	0	0	0	0	0	1	1	0.00
Total	966	895	956	949	17,348	7,539	28,653	

Source: EEA 1999.

3.194 Cold weather periods (December through April) correlate to a great reduction in fish populations. Some species (e.g., blackfish, winter flounder, sand lance, little skate) are present in varying numbers. According to several historic accounts, several species, such as the Atlantic codfish (*Gadus morhua*), silver hake (*Merluccius bilenearis*), and red hake (*Urophycis chuss*), were more abundant in the study area during the winter months (Brim & Schreiber 1972, McHugh 1972, and NOAA 1995).

3.195 With very few exceptions, any fish species considered of commercial or recreational importance has been classified by the National Marine Fisheries Service (NMFS) as either being fully exploited or over-exploited. This means that the fish are being harvested faster than they can breed and the overall biomass is declining. It has been estimated that many fish populations have been reduced by 50 to 60 percent in the past 10 to 15 years; some have been reduced even more (NOAA 1995).

Eggs and Larvae

3.196 The eggs and larvae (ichthyoplankton) will be present in the study area, mainly from April through July. Species spawning both offshore and in Shinnecock Bay will be transported through the zone. The fish larvae feed primarily on zooplankton, so the abundance and diversity of the fish larvae is strongly influenced by the zooplankton population. Species expected to be observed include both bluefish and summer flounder, which spawn offshore. The developing larvae drift inshore into the bays. Sea herring, red hake (*Urophysis chuss*), spotted hake (*Urophysis regia*), and striped and northern sea robin (*Prionotus evolans* and *carolinus*, respectively) are all nearshore spawners. The sand lance (*Ammodytes americanus*), an offshore bait fish species important to many predatory fish, spawns throughout the winter months, and occurs in the study area.

Marine Mammals

3.197 Overall, the New York Bight has one of the highest diversities of marine mammals reported anywhere in the United States. The area is an important winter habitat for the harbor seal (*Phoca vitulina*), among other seals. The critically endangered northern right whale (*Balaena glacialis*) uses the far offshore waters for migration and possibly feeding. Also, several dolphin species can be found in the project offshore waters. The density and distribution patterns of marine mammals are not random. The patterns are directly correlated with prey density distributions or the distribution of other requirements (e.g., breeding banks).

Resident Species

3.198 The following information on marine mammal occurrences reported off Long Island's South Shore appeared in a 1993 Final Report prepared by the Okeanos Foundation for USFWS. Only two marine mammals appear year-round in the waters off Fire Island or the vicinity. These two species are the bottlenosed dolphin (*Tursiops truncatus*) and the harbor seal (Okeanos Ocean Research Foundation, December 1993).

3.199 The bottlenosed dolphin is present in the waters surrounding Long Island. There are two subspecies an inshore and an offshore one. The offshore subspecies appears year-round beyond the 50 fathom contour, largely concentrated around such significant submarine features as the Hudson and Black Canyons.

3.200 The harbor seal is the most common seal species in the New York Bight and Sadove and Cardinale, 1993, indicated that during the last four years of the study by Okeanos Ocean Research Foundation, Inc., Harbor seals were reported to remain in the Long Island region year-round. The largest numbers of animals were observed appear between November and May (Sadove and Cardinale 1993).

Transient Species

3.201 Although many marine mammals are transient in the waters off Fire Island, only those that have occurred regularly or in large numbers are discussed in this section. It should be noted that the occurrences were largely confined to offshore waters beyond the reach of the project. Transient species observations have differed depending on seasonal changes and long-term changes. The following discussion is based largely on information reported by the working group on marine mammal research by the National Oceanic and Atmospheric Administration (NOAA) in 1985 and the Okeanos Ocean Research Foundation's 1993 study. The cetaceans that have been most commonly observed include the northern right whale, the fin whale (*Balaenoptera physalus*), the Minke whale (*Balaenoptera acutorostrata*), and the humpback whale (*Megaptera novaeangliae*). There have been numerous sightings of the Beluga whale (*Delphinapterus leucas*), which was observed to stay near the waters off the study area for an extended period of time. However, there is no resident population of this species. Rare sightings of the harbor porpoise (*Phocoena phocoena*) have been reported in the Great South Bay.

Seasonal and Long-Term Trends

3.202 Many of the transient species exhibit seasonal trends. Some of the most noticeable trends involve the various dolphin species, which are generally observed between March and September. Whales tend to migrate to higher latitudes during the summer to feed, and most seal species have been observed in the study area during the months of November through May. These seasonal trends are usually the result of marine mammals searching for food (Sadove and Cardinale 1993).

3.203 The long-term trends of the marine mammals appear to be variable. While reports of certain species have increased (e.g., the harbor porpoise), observations of other species decreased (e.g., the Sei whale, *Balaenoptera borealis*). Species observations also vary at times, with the result that there are no noticeable trends and therefore no easy explanation of population numbers or trends. An example of this is the observations of humpback whales, which fluctuate widely on a yearly basis (Sadove and Cardinale 1993).

3.204 The long-term increases of marine mammals could be ascribed to the increased protection that these species have received from the United States government, including the Marine Mammal Protection Act of 1972. Long-term decreases could be attributed to occurrences of certain populations on a cyclical basis, a lack of essential food, direct or indirect human impacts, and many other natural factors.

Protection Afforded

3.205 Marine mammals are given protection under the Marine Mammal Protection Act of 1972, which is an act that is designed to protect marine animals, to establish a Marine Mammal Commission, and for other purposes. The act states that certain species and populations of stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities.

3.206 The Marine Mammal Protection Act of 1972 states that marine mammals have proven themselves to be resources of great international significance, and as such must be protected, as must their habitat. The primary objective of this Act is to maintain the health and stability of the marine ecosystem. The Act states that without an issued permit, there shall be no taking of any marine mammals from the "high seas."

Avifauna

3.207 According to Howe (1978), meaningful data on the distribution and abundance of pelagic (off-shore) birds in winter are limited. Most records of these species are obtained when strong easterly winds blow the birds in close enough to be identified and observed from the shore of the study area. The three most commonly observed pelagic bird species for the study area include gannets, shearwaters, and petrels (McCormick 1975). Other pelagic species that have been observed off the shores of the study area to a lesser extent include razorbill (*Alca torda*), murres (*Uria sp*), and dovekie (*Alle alle*), all of which fall into the Alcidae family. Of the Alcids, the dovekies are the most often observed off the shores of the study area (Bull 1974). All of the above mentioned pelagic birds utilize the off-shore waters of the study area to some degree as feeding and resting areas. The Alcidae species generally avoid warmer shallow waters along sandy shores, and are almost always forced into the off-shore waters of the study area, a matter of necessity, not choice (Bull 1974). The avifauna that utilize the borrow area most are not considered pelagic; these include gulls, terns, and cormorants. These birds utilize the off-shore waters of the study area to feed on pelagic fish that are occasionally forced to the ocean surface by predatory fish.

Resident Species

3.208 The data for pelagic bird species for the study area are not conclusive enough to determine that these are resident species. There are no studies that show any pelagic bird species nesting or breeding on or near the study area. The dovekie is a species that has been observed in the off-shore waters of or in the vicinity of the study area during every month of the year, but it is not considered a resident species (Bull 1974). The non-pelagic species discussed above (terns and gulls) are considered resident species of the study area (Peterson 1980). McCormick (1975) identifies herring gulls (*Larus argentatus*), common tern (*Sterna hirundo*), roseate tern (*Sterna dougallii*), and least tern (*Sterna antillarum*) as non-pelagic bird species that have probable or definite breeding habitats within the study area. Great black-backed gulls (*Larus marinus*) and laughing gulls (*Larus atricilla*) are two other non-pelagic bird species that commonly utilize the study area according to Andrle (1988). The roseate and least terns are both classified as endangered species by NYSDEC. The common tern is classified as "threatened" by the state. The roseate tern is also federally endangered. The rare and protected species listing and status are explained in detail in the Rare and Endangered Species section that follows.

3.209 Competition for nesting space with an expanding population of gulls has forced roseate terns to nest in concentrated colonies or attempt to nest on unsuitable islands (USFWS 1988). Some studies suggest that roseate terns feed exclusively along inshore waters at tidal rips, sandbars, and bay inlets. This type of feeding habitat is more limited than the foraging area utilized by common terns (USFWS 1988). Roseate terns can arrive in the study area as early as late April. Roseate terns typically select nest sites located in sandy areas on islands or at the ends of barrier beaches with about 80 percent vegetative cover. For food, these terns forage for small schooling fish in areas including open ocean waters within approximately 1¼ miles offshore. By October, all roseate terns have departed the study area (USFWS 1988).

3.210 Least terns generally arrive in the study area by early May (Cashin Associates 1994) and nest in open shoreline sites such as beaches and dredged material disposal areas with sparse vegetation. Least terns forage for small fish in areas including the ocean, often at considerable distances from their colony. This species generally departs the study area by early September.

3.211 The Cashin report (1994) states that the common tern nests in areas including barrier beach dunes, dredge material disposal areas, and marsh islands. These birds return to their breeding grounds in early May and leave by early October. Common terns feed primarily on schools of fish driven to the water surface by feeding bluefish. For this reason, it is believed that common tern populations are linked to bluefish populations.

3.212 The herring gull nests almost exclusively on islands, where it prefers dredge material disposal areas and abandoned buildings and docks (Andrle 1988). These birds commonly feed on small fish found in the off-shore waters of the study site. The great black-backed gull is a breeding species in the areas surrounding the study site, and utilizes the waters off the study area.

Migratory Species

3.213 The gannets, shearwaters, and petrels are more abundant in the summer, and are classified by Peterson (1980) as non-breeding summer visitors at sea. The razorbill, murre, and dovekie are described by Peterson (1980) as species that winter in the waters off the south shore of Long Island. Two of the non-pelagic species, the double-crested cormorant (*Phalacrocorax auritus*) and the laughing gull, are considered migratory species. The double-crested cormorant is the most common of these birds utilizing the off-shore waters of the study area (Bull 1974). The double-crested cormorant has a New York State status of "protected." Laughing gulls are commonly seen in the study area during the spring and fall migrations, and may visit the area during the summer months. However, laughing gulls are not common breeders of the study area.

3.214 Of the birds mentioned, the species that has been observed most commonly, according to McCormick, has been the sooty shearwater (*Puffinus griseus*), with the greater shearwater (*Puffinus gravis*) and Cory's shearwater (*Puffinus diomeda*) being observed relatively less. Of the petrels, Wilson's storm petrel (*Oceanites oceanicus*) is most often observed off the waters of the study area. The thick-billed murre (*Uria aalge*) is the most commonly observed of the murre species in the offshore waters of the study area. The northern gannet (*Morus bassanus*) is the only gannet which is a regular visitor off the waters of the study area.

Threatened and Endangered Wildlife Species

3.215 The Fire Island study area hosts numerous species of wildlife that carry are threatened and endangered. Several layers of regulation at the federal, state, and local levels which afford protection for these species. Species listed by NYSDEC are categorized as endangered, threatened, species of special concern, or protected. As stated in Part 182.5, Section 11-0535 of the Environmental Conservation Law, NYSDEC defines "endangered" species as any native species in imminent danger of extirpation or extinction in New York. Native species which are likely to become endangered within the foreseeable future in New York are considered "threatened" species by NYSDEC. "Species of special concern" are native species which are not yet recognized as endangered or threatened by NYSDEC, but are documented as being of concern with regard to their continued welfare in New York State. These species could become endangered or threatened in the future and warrant close monitoring. The "protected" species include wild game, protected wild birds, and endangered species of wildlife.

3.216 Pursuant to the Endangered Species Act (16 U.S.C. 1531 et seq.), species may also hold a Federal protection status assigned by USFWS. Federally "endangered" means any species which is in danger of extinction throughout all or a significant portion of its range. A "threatened" status is any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Equal levels of protection are provided to endangered and threatened species. Both NYSDEC and federal program rankings carry "legal status" protection for listed wildlife species.

3.217 The NYSDEC Natural Heritage Program (NHP) maintains a nonlegal rank system adopted from the Nature Conservancy which describes the current state of the population for the species. A Global Rank and/or a State Rank assignment may be given. A Global Rank reflects the rarity of the species throughout the world. The State Rank reflects the rarity of the species within New York State. The Heritage Program maintains a database of known locations of rare species within the state. These database reports are considered confidential for the protection of the species and critical habitats. However, general information will be discussed to promote a better understanding of the species biology, habitat needs, and management considerations. While some of the species discussed are referenced directly from the database, other rare species verified and known to inhabit the study area are referenced from the NHP Animal Status List (1998).

3.218 The following discussion centers on the rare species that are known to utilize offshore areas of the Fire Island barrier. Rare species information for the barrier island and back bay ecosystems are also presented below. Although species with a state legal status of protected are listed in the following tables, discussions will primarily focus on species listed as endangered, threatened, and species of special concern.

Resident Wildlife

3.219 Offshore of the study area, a small segment of the population of the double-crested cormorant is classified as sedentary resident. These common summer visitors typically migrate north to the arctic region and will also be classified as migratory species in the project area. This New York State protected species has a NHP Global Rank of G5 and a State Rank of S3 (ranking is explained in Table 3-13).

3.220 Flocks of cormorants have been observed moving across the study area during the spring and fall season. Breeding colonies have been confirmed at both Gardiners and Fishers Islands, north and east of the study area. Potential breeding areas exist in Nassau and upstate counties as well. The cormorant is a colonial nester, preferring undisturbed isolated areas. Trees are used for constructing elevated nest platforms, although ground nests have also been reported (Andrle and Carroll 1988). Within the study area, this species utilizes the offshore area for feeding grounds.

Migratory Wildlife

3.221 Table 3-13 indicates the status and ranking of rare migratory wildlife species that are known to utilize the offshore portion of the study area. Species with Natural Heritage Global and State Rankings and a state legal status of protected (P) are also included in Table 3-13. Wildlife species may utilize several of the ecological zones (offshore, nearshore, intertidal, barrier island, and back bay) at some time during their life cycle. For the purposes of this DEIS, details of the species' life history and a discussion of anthropogenic effects are provided in the section that describes the ecological zone supporting the breeding and nesting activities for a particular species. For example, the least tern will forage on the near shore of back bay areas, but relies on the barrier island for nesting habitat. Therefore, the life history of this species is described in detail in the barrier island section of this report.

Near-Shore Area

3.222 This section discusses species found in the nearshore environment, primarily defined as the surf zone and high energy area from the shore to approximately 18 feet water depth.

Table 3-13

Status and Ranking of Threatened Migratory Wildlife Species

Species Common Name	Species Latin Name	NHP Global Rank[1]	NHP State Rank[2]	New York State Legal Status[3]	Federal Status[4]
Least Tern	Sterna antillarum	G4	S3B	E	NA
Roseate Tern	*Sterna dougallii*	G4	S1B	E	LELTNL
Common Tern	*Sterna hirundo*	G5	S3B	T	NA
Black Tern	*Chlidonias niger*	G4	S2B	P SC	NA
Common Loon	*Gavia immer*	G5	S3S4	P SC	NA
Black Rail	*Laterallus jamaicensis*	G4	S1B	P SC	NA
Forster's Tern	*Sterna forsteri*	G5	S1	P	NA
Gull-billed Tern	*Sterna nilotica*	G5	S1	P	NA
Caspian Tern	*Sterna caspia*	G5	S1	P	NA
Laughing Gull	*Larus atricilla*	G5	S1	P	NA
Double-crested Cormorant	*Phalacrocorax auritus*	G5	S3	P	NA

Notes:

1 NHP Global Rank.
G1 (TEXT TO COME)
G2 (TEXT TO COME)
G3 Either very rare and local throughout its range (21-100 occurrences) or found locally (even abundantly at some locations) in a restricted range, or vulnerable to extinction throughout its range.
G4 Apparently secure globally, though it may be quite rare in parts of its range.
G5 Demonstrably secure throughout its range; however, it may be rare in certain areas.
2 NHP State Rank.
Critically endangered in New York State because of extreme rarity; there are typically five or fewer occurrences, or very few remaining individuals, or few acres or miles of stream remaining, or some factor of a species' biology making it especially vulnerable in New York State.
Imperiled in New York State because of rarity (6-20 sites or few remaining individuals) or highly vulnerable to extirpation from New York State due to biological factors.
S1 Critically endangered in New York because of extreme rarity; there are typically five or fewer occurrences, or very few remaining individuals, or few acres or miles of stream remaining, or some factor of a species' biology making it especially vulnerable in New York State.
S2 Imperiled in New York State because of rarity (6-20 sites or few remaining individuals) or highly vulnerable to extirpation from New York State due to biological factors.
S3 Rare in New York State (21-100 extant sites).
S4 Apparently secure in New York.
S#B A confirmed breeder with any state ranking (1-4).
Z A migratory species, not of conservation concern in New York State in winter.
N No specific habitat usage.
SA Accidental or casual in the State.
SR Reported in the state but without persuasive documentation.
3 New York State Legal Status.
E Endangered- Any native species in imminent danger of extirpation or extinction from New York State or any species listed as Federally Endangered.
T Threatened- Any native species likely to become an endangered species in the foreseeable future in New York State.
SC Special Concern-Documented concern exists for their continued welfare in New York.
P Protected-Wild game, protected wild birds and endangered species of wildlife.
4 Federal Status.
LE Formally listed as endangered.
LT Formally listed as threatened.
LELT Formally listed as endangered in part of its range and threatened in other parts.
NL May not be listed in some areas.
E(S/A) Taxon is endangered because of similarity of appearance to other endangered species.
LELTNL Formally listed as endangered in part of its range and threatened in other parts. May not be listed in some areas.

Source: NYS Conservation Law Section 9-1503 and 50 CFR17, 1999.

Invertebrates

3.223 Information pertaining specifically to the nearshore environment is available from the USACOE 1998 report, which specifically identifies benthic organisms from the nearshore environment of the New Jersey Coast. The ongoing borrow area invertebrate studies will update these data.

Benthic Invertebrates

3.224 All species discussed in the previous section have a range that extends from the intertidal zone to the offshore environment. Actual community structure is determined by the sediment grain size. Coarser sands and gravel are populated by a benthic community dominated by digger amphipods (i.e., *Haustorius canadensis*, *Acanthohaustorius millsi*, and *Protohaustorius wigleyi*) and the polychaete worm (*Scolelepis squamata*). In fine to medium sands, species such as the fringed and polychaete worms (*Tharyx acutus* and *Magelona papillicornis*) and the bivalve, dwarf tellin dominate the community. Digger amphipods may also be present. In the event a fine silty sand is available, the species assemblage would include the bivalve, near nut shell (*Nucula proxima*), the polychaetes (*Nephthys incias*, *Pherusa affinis*, *Clymenella torquata*), and the amphipod (*Leptocheirus pinguis*). The presence of these species in addition to several arthropod species (i.e., *Psammonyx nobilis*, *Unciola irrorata*), and the isopod (*Chiridotea tuftsi*) was confirmed by the USACOE 1998 New Jersey study.

Shellfish

3.225 As in the previous section, the discussion of shellfish is primarily confined to surf clams and black clams. All the remaining clam species are very small and considered a part of the macrobenthic invertebrate community. Surf clams are found from the lower intertidal zone to the subtidal zone down to approximately 100 feet (Gosner 1979).

Crustaceans

3.226 Gosner (1979) indicates that all of the commonly observed crustacean species (i.e., lobster, rock crab, spider crab, lady crab) have the potential to range from surf zone to offshore depths. All undergo an inshore-offshore migration to remain in their specific favored zone. Only the American lobster is dependent on the availability of structure. The young will come within 10 to 15 feet water depth, providing structure (i.e., jetty, reef, wreck, etc.) is available. Greater concentrations of adults are found offshore, usually in excess of 60 feet of water.

3.227 The lady crab is found in concentrations at the water line during the late spring through early fall period, but moves offshore in the winter looking for warmer water. The rock crab will follow the opposite pattern, moving inshore as the water cools in the fall, but moving back offshore during the late spring and summer season.

Finfish

The discussion of nearshore finfish is based primarily on historic data collected on the south shore of Long Island.

Resident Species

3.228 As mentioned in the offshore (borrow site) section, very few fish species are considered to be resident species in the nearshore environment. In particular, shallow near shore waters can exhibit temperature fluctuations ranging from 4° to 21° C (USFWS 1981). The only species likely to be found in the nearshore environment are the tautog and cunner, provided the same form of hibernation structure is present (i.e., rock, reef, wreck, etc.). The other two species discussed as potential year-round residents, windowpane and little skate, are likely forced from the shallower portion of the site during the coldest winter months. Windowpane can tolerate water temperatures as low as 2° to a high of 21° C. Little skate can similarly tolerate temperatures from 0° to 21° C, but prefer a more intermediate zone (Bigelow & Schroeder 1953). It is not expected there are any year-round resident species in the nearshore surf zone waters.

Transient Species

3.229 The fish species discussed in this section describing the near-shore area are similar to the species discussed in the section describing the offshore borrow area. A recently released study conducted by the New York District reports the results of a small mesh beach seine survey conducted along the New Jersey shore from 1994 to 1996 and is ongoing. The New York District study is dominated by several forage species including the Atlantic silverside (*Menidia menidia*), rough silverside (*Membras martinica*), striped anchovy (*Anchoa hepsetus*), and bay anchovy (*Anchoa mitchilli*), in addition to juvenile northern kingfish (*Menticirrhus saxatilis*), bluefish, and spot (*Leiostomus xanthurus*). Two additional studies conducted by the NYSDEC document species composition and abundance of finfish found in the surf zone (Briggs 1965 and Schaefer 1967). Briggs (1965) utilized an anglers survey and Schaefer (1967) conducted a 3-year seine survey. Both surveys identified the northern puffer (*Sphaeroides maculatus*), northern kingfish (*Menticirrhus saxatilis*), striped bass, bluefish, weakfish, and summer flounder as being abundant in the surf zone from April through November. Schaefer's seine survey also identified the blueback herring (*Alosa aestivalis*), hickory shad (*Alosa mediocris*), alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), and butterfish as making up a significant percentage (19 percent) of the fish sampled. Neither survey adequately sampled the Atlantic silverside, bay anchovy, or sand lance, which are the prime forage species in the surf.

3.230 As previously stated, the species discussed can range from the surf zone to a significant distance offshore. In particular, the bluefish, summer flounder, butterfish, and herring can and do travel offshore. The four species expected to remain closest to the shore include the northern puffer, northern kingfish, striped bass, and weakfish. The striped bass and weakfish roam several miles offshore in search of food and suitable water temperatures.

3.231 All fish species discussed are migratory, moving into the study area from late April to early May and departing by the end of November. Some species possibly linger to early December, depending on the water temperature. Two species that may be present in early winter to late spring are the sand lance and Atlantic herring (*Clupea harengus*), both species that spawn inshore during the winter (Robins, et al. 1986 and Bigelow & Schroeder 1953).

3.232 A total of 15 finfish species have been reported to spawn in the nearshore habitat (the USACOE 1998). Dominant species reported to occur are the four-beard rockling (*Enchelyopus cimbrius*), Atlantic silversides and rough silversides, bay anchovy, Atlantic menhaden, tautog, black seabass and conger eels (*Conger Oceanica*). Surface samples were dominated by the four-beard rockling, silversides, Atlantic menhaden, and anchovies while the bottom samples were dominated by the tautog, black seabass, and conger eels.

Seasonal and Long-Term Trends

3.233 In general, fish abundances fluctuate from year to year for a variety of natural reasons. As stated in the Offshore Finfish Section, past long-term trends clearly indicated that fish populations are declining. NOAA (1995) reported that most commercial and recreational fish species are either fully exploited or overexploited. A good example is the northern puffer, the most abundant species sampled by Schaefer (1967). Puffer landing peeked in 1963 at 947,700 pounds in New York State and bottomed out at 70 pounds in 1993, clearly indicating a decrease in species abundance (NMFS 1998). Another species showing wide fluctuation is the northern kingfish, with peak landings of 47,200 pounds in 1971 dropping to 200 pounds in 1975 and remaining low for four years before increasing to 15,100 pounds in 1980. No landings were reported in 1983, 1985, 1987, 1988, and 1989, but landings then steadily climbed to 14,769 pounds in 1994. Similar patterns can be observed for other species as well. Overall finfish populations are decreasing, and seasonal abundance varies greatly between years, although species composition remains consistent.

Intertidal Zones

3.234 Because of the potential for direct impacts, the sessile (immobile) organisms of the sand placement zone are discussed separately in the following section.

3.235 Species composition varies between the upper high tide zone marked by the wrackline (line of seaweed and debris deposited at high tide), the mid-tide zone, and the surf zone. The mid-tide zone can be further divided into the wet, saturated, and swash zone. The upper end of the zone is dominated by the beach flea amphipod (*Talorchestia longicornis*), a nocturnal species burying into the sand during the day (Gosner 1979). The mid-tide zone is dominated by the mole crab (*Emerita talpoida*), the amphipods (*Haustorius canadensis* and *Psammonyx nobilis*), and the polychaete worm (*Scolelepsis squamata*) (Reilly 1978, Kluft 1998, Gosner 1979, EEA 1998, work in progress). Many of the species in the surf zone are similar to those present in the mid-tide zone. In the surf zone, there are large numbers of the lady crab (*Ovalipes ocellatus*) during the summer months. The lady crab migrates to deeper water in the winter. All density levels fluctuate greatly with the seasons. Late spring, summer, and early fall are the most productive season.

Barrier Island Environment

3.236 The barrier island, exposed to the sea and with a nutrient-poor sandy soil, provides a unique habitat.

Flora of the Barrier Islands

3.237 Changes in the environmental gradients, largely in response to the barrier island topography, result in characteristic zonation of vegetational communities along the barrier island from the ocean shore to the bay side. Those gradients include salt spray, sand deposition, wind flow, and cyclic littoral erosion, as well as human and meteorological disturbances (Art 1971). The vegetative zones exhibit physiognomic similarities along this stretch of the barrier island. Herbaceous plants growing on primary dunes must be able to withstand high intensities of salt spray deposition and respond to periodic and regular burial by sand (Wells & Shunk 1938, Salisbury 1952). In the more stable and protected areas of the swales and secondary dunes, woody shrubs may dominate. Leeward of the secondary dunes, the maritime forest community may occur (Art 1971) as for example at the Sunken Forest. And bayward of the maritime forest the salt marsh communities exist. Although these profiles are not contiguous along the stretch of land from Fire

Island Inlet to Moriches Inlet, these characteristic communities are found extensively throughout. The vegetative profile described below is characteristic of Fire Island where both the primary and secondary dunes are well developed. Other areas within this study have lost the primary dune and portions of the secondary dune to erosion and therefore have incomplete or limited profiles.

Dune and Swale Community

3.238 The majority of the beach from the surf zone to the primary dune is devoid of vegetation. Vegetation sometimes found seaward of the primary dune are annual species growing within the drift line and include common saltwort (*Salsola kali*), seaside spurge (*Euphorbia polygonfolia*), and sea rocket (*Cakile edentula*). The seaward face and crest of the primary dune, where salt spray deposition and sand movement are greatest, is dominated by beach grass (*Ammophila breviligulata*). Although dusty miller (*Artemisia stelleriana*) and beach-pea (*Lathyrus japonicus*) exhibit their greatest abundance here, they do not contribute sizeably to the total vegetative cover. On the leeward side of the primary dune, beachgrass decreases in abundance as woody species increase.

3.239 The species occurring on the leeward slope of the primary dune, where the vegetational cover is relatively undisturbed, are dominated by a mixture of beachgrass, beach plum (*Prunus maritima*), bayberry (*Myrica pennsylvanica*), Virginia creeper (*Parthenocissus quinqeufolia*), and poison ivy (*Rhus radicans*). Bearberry (*Arctostaphylos uva-ursi*) is a procumbent woody species that occurs in the most undisturbed locations within the dune and swale community (Art 1971). Significant portions of the dune and swale community are subjected to disturbance, which results in large areas of bare sand and the abundance of species such as beach-heather (*Hudsonia tomentosa*), which is associated with erosional sites.

3.240 A major human disturbance in the Otis G. Pike Wilderness Area is associated with the unpaved roadways that run in an east-west direction just landward of the dune swale community. In this area the vegetative cover is reduced to zero, and erosion is significantly increased. Since the lack of vegetation decreases the thickness of the surface boundary layer, the frequently intense winds tend to create channels along these areas, and may result in severe erosional blowouts.

3.241 Revegetation of these blowout areas is a slow process. The finer sands which characterize the dunes are transported by wind (aeolian process) out of the blowout areas, resulting in an area with a very course grained (pebble) soil surface. Beach-heather and seaside goldenrod (*Solidago sempervirens*) are frequently the only species found established in these areas. Beachgrass is absent in these areas due to greater erosion than deposition of sand.

3.242 The central region of the swale between the primary and secondary dune is dominated by widely spaced beach-heather. The vegetation on the landward side of the secondary dune is dominated by an abundance of woody shrub and tree species including black cherry (*Prunus serotina*), pitch pine (*Pinus rigida*), eastern red cedar (*Juniperus virginiana*), winged-sumac (*Rhus copallina*), highbush blueberry (*Vaccinium corymbosum*), and American holly (*Ilex opaca*).

3.243 Transition into the maritime forest community (e.g., the Sunken Forest located between Cherry Grove & Point O' Woods) is marked by increasing dominance of eastern red cedar, pitch pine, black cherry, winged sumac (dominant on the edge of the forest) and American holly, sassafras (*Sassafras albidum*), serviceberry (*Amelanchier canadensis*), and highbush blueberry (dominant in the center of the forest). Sour gum or tupelo (*Nyssa sylvatica*) occurs frequently, but its distribution is limited to damp depressions, which form fresh water bogs. The forest on the leeward side of the secondary dune has a canopy typically uniform in height (5.5 to 7.0 meters). The tops of the trees, subjected to the shearing action of salt-laden winds, develop a smooth, closed canopy. The height of the trees is ultimately determined by the height of the secondary dune, since it governs the wind flow patterns.

3.244 Numerous vine species are found within the maritime forest community, including poison ivy, bullbrier (*Smilax rotundifolia*), Virginia creeper, sawbrier (*Smilax glauca*), and grape (*Vitus sp.*) The shrub layer includes highbush blueberry, serviceberry and red chokeberry (*Pyrus arbutifolia*), with infrequent stands of elderberry (*Sambucus canadensis*), arrow-wood (*Viburnum dentatum*), and *Rhus vernix*. The herbaceous layer includes poison ivy, wild-sarsaparilla (*Aralia nudicaulis*), black huckleberry (*Gaylussacia baccata*), Virginia creeper, Canada mayflower (*Maianthemum canadense*), starry false-Solomon's-seal (*Smilacina stellata*), and highbush blueberry.

3.245 Freshwater bog areas within the maritime forest differ greatly from the upland portions of the forest, largely due to the presence of a highly acidic humus layer at the ground surface (Schelte 1965). The shrub layer is dominated by swamp honeysuckle (*Rhododendron viscosum*), and highbush blueberry. The most abundant herbaceous species include marsh St. John's-wort (*Hypericum virginicum*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), and marsh shield-fern (*Dryopteris thelypteris*).

Natural Succession of Dune-Swale Communities

3.246 Three types of successional trends can be expected within the swale-dune community: (1) depositional succession; (2) erosional succession; and (3) stable sedimentary succession. A rise in sea level would cause changes in the ocean and bay shorelines as the vegetation readjusts within the immediate shore-front communities and adjacent areas, causing vegetational shifts and narrowing of zones. Some zones may be entirely lost due to inundation unless sea regression occurs.

3.247 Specifically, in areas of the dune and swale where sand is being deposited, beachgrass is a pioneer plant. Over time, beachgrass is displaced by black cherry, bayberry, and bearberry, except on the seaward face of the primary dune.

3.248 In blowouts where erosion is an active process, beach heather is the main pioneer species. Bearberry grows on the margins of the blowouts and spreads vegetatively into the beach heather stands, eventually displacing it. Species including winged sumac, sawbrier, and wild sarsaparilla invade the dense bearberry stands in the subsequent succession. Pitch pine and eastern red cedar may become established directly on relatively stable bare sand areas in the dune and swale community.

Natural Succession of the Maritime Forest Community (Ilex-Sassafras-Amalanchier)

3.249 The former evergreen components of this community, eastern red cedar and pitch pine, appear to be declining and becoming replaced by a climax forest comprising American holly, sassafras, serviceberry, and sour gum. A "climax" forest or community is defined as a mature, self-sustaining community, which is the end result of the process of natural succession. The smallest diameter tree layer species (presently precluded from dominance by the shading of the overstory) could in fact, under continuing disturbed conditions (severe storm damage, man-induced damage), become the climax species. Those species include pitch pine, eastern red cedar, post oak (*Quercus stellata*), and black oak (*Quercus velutina*).

3.250 In areas such as Saltaire, Fair Harbor, and the eastern portion of Smith Point County Park (approximately 1,000 feet west of Moriches Inlet), Japanese black pines (*Pinus thunbergii*) exist as they were planted under the Robert Moses Administration. These stands consist of a single canopy species, with a thin layer of needles on the sand surface and virtually no understory species.

Planted Exotic Lawn-Scrub

3.251 Due to the encroachment of residential communities into the natural vegetational communities, many exotic species have been introduced by human activity. These include mowed Eurasian lawngrass mixtures, with scattered shrubs. Prominent shrub species include rugosa rose (*Rosa rugosa*) and Japanese yew as well as many others. In addition, vegetable gardens planted by the summer community can be common in certain areas. Significant areas supporting non-native horticultural varieties include Ocean Beach, Saltaire, Fair Harbor, Atlantique, Corneille Estates, Ocean Bay Park, Point O' Woods, Cherry Grove, Fire Island Pines, Water Island, Ocean Ridge, and Smith Point County Park.

Barrier Island Intertidal Marshes

3.252 Tidal flats develop either along open coasts of low relief and relatively low wave energy or behind barriers on high-energy coasts where production of waves by barrier islands, spits, reefs, and man-made structures occurs. Tidal flats along the south shore of Long Island occur within estuaries, bays, barrier-island complexes, and tidal deltas.

3.253 The most common types of salt marshes in the area between Fire Island Inlet and Moriches Inlet are formed on washover fans along the back barriers and flood-tidal deltas. Washover fans result whenever a storm surge breaks through a dune line of a barrier island. The resultant deposit is a wedge of thin, lobate sheets of sand, which typically extend to the shoreline and out over the lagoonal environment. After deposition, washover fans can become vegetated. Flood tidal deltas are formed when inlets on Long Island's barrier beaches are formed. Wave dominated barrier islands like those along the south shore of Long Island tend to have open lagoons and large, multi-lobate flood tidal deltas, but small, poorly developed ebb-tidal deltas (S. Tangren 1988). Flood tidal deltas become inactive when inlets close or migrate away (typical for Long Island's south shore). Once inactive, the sandy shoals may eventually support salt marsh vegetation. If the sediment supply permits, the young salt marsh will accrete and mature. Based on the analysis of cores collected from salt marshes along Long Island's south shore, it is clear that salt marsh accretion and maturation is a long and on-going process that may last for several hundred years, depending on available sediment load transport and breaching induced by storm activities (S. Tangren 1988).

3.254 The tidal flat environment can be divided into three zones: (1) subtidal zone; (2) intertidal zone; and (3) supratidal zone. The subtidal zone is the part of the tidal flat that normally lies below mean low-tide level. It is inundated with water most of the time and is normally subjected to the highest tidal current velocities. Tidal influence in this part of the environment is particularly important within tidal channels, where bedload transport and deposition are predominant, although this zone is also influenced to some extent by wave processes (Boggs 1987). The subtidal zone substrate is typically composed of rocks, pebbles with bioclasts (material derived from the "supporting or protective structures of animals or plants, whether whole or fragmentary"), gravels, biogenic (sands produced directly by the physical activities of living organisms, either plant or animal e.g., peat) gravelly sands, and biogenic sands. This area is typically populated by macro-algae including sea lettuce (*Ulva lactuca*), rockweed (*Fucus vesiculosis*), green fleece (*Codium fragile*), hollow green weed (*Enteromorpha sp.*), Irish moss (*Chondrus crispus*), graceful red weed (*Gracilaria foliifera*), Agardh's red weed (*Agardhiella tenera*), false agardhiella (*Gracilaria verrucoasa*), and banded weeds (*Ceramium sp.*).

3.255 The intertidal zone lies between mean high- and low-tide levels. It is subaerially exposed either once or twice each day, depending upon local wind and tide conditions. This zone typically supports salt marsh cordgrass (*Spartina alterniflora*) in the upper 50 percent of the area inundated daily along the south shore of Long Island. Both bedload and suspension sedimentation take place in this zone. Intertidal sediment is typically composed of biogenic fine sands and muddy sands. This zone is the most biologically productive habitat for this geographic region; it supports ribbed mussels (*Guekensia demissus*), and serves as nursery habitat for small forage fish species. It also provides habitat for various diving and dabbling ducks as well as the diamondback terrapin, musk-rat, and raccoon.

3.256 The supratidal zone (storm tide zone) lies above normal high-tide levels but is incised by tidal channels and flooded by extreme tides. This part of the tidal flat is exposed to subaerial conditions most of the time, but may be flooded by spring tides twice each month or by storm tides at irregular intervals. Sedimentation is predominantly from suspension. Sediment is typically composed of sandy muds. Vegetation for this geographic location typically consists of stands of salt-meadow cordgrass (*Spartina patens*), groundsel-tree (*Baccharis halimifolia*), seaside goldenrod, bayberry, sea lavender (*Limonium carolinianum*), spike grass (*Distichlis spicata*), blackgrass (*Juncus gerardi*), and glasswort (*Salicornia sp.*).

3.257 Sediments (vertically and laterally) of tidal flats during periods of transgression show coarsening of grains upward in the sequence. This is the sequence presently forming on Long Island's south shore. This change in sediment transport and deposition results in drowned plain marshes, flood tidal delta marshes, and washover marshes. These processes will leave new sandy shoals for new salt marshes to colonize.

3.258 Several studies are being completed to assist in framing relevant baseline and impact analysis studies for the barrier and backbay environments of the South Shore of Long Island. These studies are discussed below.

- Water Quality Modeling: Breach impact, including salinity, temperature, circulation, and bay residence time are being evaluated. A model is being constructed, calibrated, and applied to breach scenarios to estimate impacts on the aforementioned parameters. Recommendations for additional studies, modeling, and data collection, will be made on the results of the anlaysis.

- Water Quality: A literature survey for all bay and ocean water quality studies is concluding at the time of this report. In addition, baymen are being interviewed to determine if they have observed changes in water quality. These interviews will be a qualitative analysis of water quality over a period of several decades by people who work on the bay waters every day.
- Summary of Known Impacts, Physical and Biological: Based on the existing literature, a summary report was developed that discusses the reported impacts on barrier island physical and biological systems. This report will serve as a hypothesis for the scheduled water quality modeling effort.
- Analysis of Historic Vegetation Zonation Changes Associated with Breach and Overwash Events: This study involves a comparative examination of vegetative patterns at historic breach and overwash locations on the barrier islands. The analysis will include a narrative description accompanied by photographs of the habitats immediately prior to disturbance and following the overwash/breach event. Four study locations were selected as follows: Old Inlet, Smith Point County Park, Pike's Beach, and West of Shinnecock Inlet. Historical aerial photographs have been acquired and field verification of conditions has been conducted. This analysis is nearly complete at the time of this report.

Natural Succession of Salt Marsh Community

3.259 The plant composition of salt marsh vegetation is related closely to the salinity of the water and to the frequency of inundation. On a geologic time scale, the fringing backbay salt marsh communities will shift location as the barrier island migrates. This shift, however, is not likely to be noticeable over a short time frame (e.g., a decade). Presently, and even as far back as the early 1970's, stands of groundsel-tree and marsh-elder have been dying back due to the more frequent inundation. All zones (low marsh, high marsh, and transitional zone into the maritime forest) will gradually shift landward due to the frequency of inundation and changes in salinity concentration. Areas that accrete sediments due to storms or man-induced disturbances (dredging, development) may be vulnerable to colonization by the opportunistic common reed (*Phragmites australis*).

Wildlife Usage

3.260 The vegetation of the Fire Island study area allows for unusually productive wildlife habitat. For instance, the high marsh zone located above the elevation of frequent flooding may be dry enough to provide ground nesting for a variety of shorebirds. At the same time, this fringe may also provide desirable habitat for small mammals, many of which fall prey to raptorial birds (Benyus 1989). The barrier island environment hosts many unique habitats which will be discussed. These include tidal swamp, reed grassland, bare sand, beachgrass, dwarf scrub, woody thicket, broadleaf forest, pitch pine woodland, black pine stands, residential land, and a mixture of beachgrass-low thicket-beach heather habitats. Of these habitats, tidal marsh shows the highest number of wildlife species, while broadleaf forest shows the highest utilization of breeding species (McCormick 1975).

3.261 There are approximately 11 different habitat types which characterize the study area. There habitats are briefly discussed below. These habitats provide food and shelter for many mammals, birds, and reptiles. This food includes berries, small invertebrates, mollusks, and others. Some of the mammals, reptiles, amphibians, and birds that forage in these habitats are prey for larger species, specifically raptors. These raptors often prey upon the young, sick, injured, or smaller animals inhabiting the study area.

3.262 In the tidal swamp habitat, many bird species feed on insect larvae, crabs, and other small crustaceans. Most of these birds are passerine species. The red-winged blackbird, song sparrow, muskrat, and mink are identified by McCormick (1975) as probably breeding within this habitat. Osprey, a NYSDEC threatened species, utilizes this habitat for foraging, and nesting is generally associated with man-erected platforms.

3.263 The reed grassland habitat is characterized by dense stands of common reed. This habitat provides relatively little food for wildlife, but provides escape and nesting cover for some species. Breeders of this habitat include red-winged blackbird, common yellowthroat, marsh wren, swamp sparrow, song sparrow, meadow vole, and Norway rat (McCormick 1975). The northern harrier, a NYSDEC threatened species, nests in the hummocks of this habitat further to the west of the study area.

3.264 The bare sand habitat is virtually devoid of vegetation. This region is a primary forage area for shorebirds that feed on invertebrates of sandy beaches. This region is also utilized as a nesting area for several of these shorebirds, including the piping plover (NYSDEC endangered, federally threatened), killdeer, least tern (NYSDEC listed as endangered), and black skimmer.

3.265 The beachgrass habitat consists of sand with a sparse cover of herbaceous plants. This habitat is of limited value for providing protective cover for wildlife. Turtles are the most prominent animals in this habitat. All species of turtles known to utilize the Fire Island Seashore are expected to breed in this habitat. The beach grass stands are also utilized by toads and snakes. The eastern hognosed snake is expected to breed in this habitat. Least terns and roseate terns prefer more sparsely vegetated habitats, while gulls and common terns will use areas that are more densely covered with vegetation.

3.266 Floristically, the beach grass-low thicket-beach heather habitat is the most diverse upland habitat on Fire Island. This habitat consists of relatively bare sand, with low herbaceous vegetation and shrubs as tall as 4 feet. Breeders found in this habitat include the box turtle, black racer, eastern hognose snake, and meadow jumping mouse, possibly among others.

3.267 The dwarf scrub habitat is composed of scattered clumps of low, dense shrubs, according to McCormick (1975). Many birds utilize this area, feeding on beach plums, bayberries, holly berries, serviceberries, and other berries. White-tailed deer can also be found in these habitats, feeding on the shrubs.

3.268 The woody thicket affords high quality protective cover for wildlife, with its dense stands of shrubby vegetation. The breeders of this habitat include the black racer, opossum, eastern cottontail, mockingbird, gray catbird, brown thrasher, and common yellowthroat.

3.269 The broadleaf forest habitat, which extends roughly from Point O' Woods easterly to Water Island, provides abundant food and effective cover for wildlife. The three main species that are found in the broadleaf forest are American holly, sassafras, and serviceberry. More than 100 bird species utilize the area, of which more than 20 nest in the habitat. The nesting species include the mourning dove, common flicker, downy woodpecker, black-capped chickadee, American robin, and red-eyed vireo. The white-footed mouse, red fox, and raccoon are among the mammals that breed in this habitat, according to McCormick (1975).

3.270 The pitch pine woodland habitat, which occurs in the eastern section of Robert Moses Park, and in the Fire Island Pines, tracts east of Seabay beach, and other areas, consists of relatively open stands of 10- to 20-foot-high pitch pines. Over 100 species of birds utilize this habitat for feeding and/or roosting. Many mammals and birds also breed in this habitat, including the mourning dove, gray catbird, brown thrasher, red fox, mink, and white-footed mouse.

3.271 The black pine habitat consists of planted stands of black pine, most of which are situated in Robert Moses State Park. Little herbaceous cover is present. Not as many wildlife species breed here as in other habitats. Breeders include the brown thrasher, chipping sparrow, eastern cottontails, and white-footed mouse.

3.272 The residential habitat includes developed portions of the study area comprising small buildings and managed lawns. Human activity in this area is primarily seasonal; therefore, the value of these developed areas for supporting wildlife typically increases during the off-seasons of autumn, winter, and spring. Many species utilize these areas, including the fowler's toad and numerous bird and mammal species. Nesting species include the mockingbird, American robin, starling, house sparrow, house finch, and chipping sparrow. The common breeding mammals include eastern cottontail, house mouse, and Norway rat. The raccoon, white-tailed deer, and herring gull are three species that often succeed or thrive with the interaction of humans. The herring gull and raccoon are known to target refuse areas to forage for food products left by humans, and the white-tailed deer is often fed by people. Artificial feeding of the Five Island white-tailed deer herd has contributed to the overpopulation of this species within the study area.

Deer Impacts on Vegetation

3.273 The Fire Island white-tailed deer population has impacted the vegetative community structure of the barrier island, and particularly the Sunken Forest. According to NPS (Pachta, 1990), selective foraging by deer has significantly affected the perennial herbaceous layer, nearly eliminating certain species and according to Art (1990) may have contributed to the decline of certain shrub species such as inkberry (*Ilex glabra*) and black huckleberry (*Gaylussacia baccata*). According to Sirkin (1972), wild sarsaparilla represented the dominant species of the interdunal area in 1972. However, by 1989 this species was nearly eliminated, along with false Solomon's seal and wild lily of the valley (*Maianthemum canadense*) (Stalter et al. 1986 and Art 1990). A deer exclosure study was conducted by Art (1990) to assess the extent of damages related to intensive deer browsing and to identify food preferences. Results of this study indicated that deer browsing had little effect on the tree layer. However, woody seedlings (shadbush, sassafras, tupelo, and red chokeberry), shrubs, root sprouts, and the herbaceous layer which was protected by the exclosures showed significant recovery. The herbaceous perennial starflower (*Trientalis borealis*) also showed a striking increase.

Avifauna

3.274 The Fire Island barrier, together with surrounding bays and their small islands, is an area of major importance to birds, particularly migratory species (McCormick 1975). Barrier island bird species in the study area include species such as terns and plovers. These species utilize the barrier island habitat for foraging, resting, and in some cases, nesting and breeding. A study conducted at Saltaire concluded that 13 shorebird species utilized the area (McCormick 1975). As discussed in the Rare and Endangered Species section, the piping plover (*Charadrius melodus*) has been given the status of a federally threatened species, the common tern is listed as threatened by New York State, the least and roseate terns are considered endangered by NYSDEC, and the roseate tern is also listed as federally endangered. Other commonly observed birds on the barrier beach of the study area include gulls, yellowlegs, and willets (*Catoptrophorus semipalmatus*). See Table 3-14 for a list of resident and migratory bird species which reportedly utilize the Fire Island barrier.

Table 3-14
Resident and Migratory Species List
Barrier Island Birds Reported in Study Area*

American avocet	Greater yellowlegs	Semipalmated plover
American coot	Hudsonian godwit	Semipalmated sandpiper
American golden plover	Killdeer	Short-billed dowitcher
American oystercatcher	Least sandpiper	Solitary sandpiper
American woodcock	Long-billed dowitcher	Spotted sandpiper
Baird's sandpiper	Marbled godwit	Stilt sandpiper
Bar-tailed godwit	Pectoral sandpiper	Upland sandpiper
Black-bellied plover	Piping plover	Whimbrel
Buff-breasted sandpiper	Purple sandpiper	White-rumped sandpiper
Common snipe	Red knot	Western sandpiper
Curlew sandpiper	Ruddy turnstone	Willet
Dunlin	Ruff	
Esser yellowlegs	Sanderling	

Note: * According to NYSDEC, 1998.

Resident Species

3.275 Herring gulls, the most abundant and familiar gull at all seasons in the study area, can have negative effects—through competition and predation—on the young of other shorebirds, according to Howe (1978). The great black-backed gull is another resident species in the study area.

Migratory Species

3.276 The study area lies within the Atlantic Flyway, an important migratory route for large numbers of shorebirds, especially during the spring and summer, according to Howe (1978). These migratory shorebird species use beaches, marshes, and especially intertidal flats as feeding grounds. The study area is a choice feeding area for flocks of semipalmated plovers (*Charadrius semipalmatus*), least sandpipers (*Calidris minutilla*), dunlin (*Calidris alpina*), semipalmated sandpiper (*Calidris pusilla*), sanderlings (*Calidris alba*), western sandpipers (*Calidris mauri*), purple sandpipers (*Calidris maritima*), short-billed dowitchers (*Limnodromus griseus*), and also many black-bellied plovers (*Pluvialis squatarola*) and greater yellowlegs (*Tringa melanoleuca*). The shorebirds in the study area feed almost exclusively on invertebrates. Large species such as willets feed extensively on small crabs, whereas the smaller species of shorebirds feed on various worms, small mollusks, and crustaceans, many of which are most accessible for about 2 hours after low tide, according to Howe (1978). After these intertidal flats are covered by the incoming tide, shorebirds rest in flocks on protected sandy beaches above the high tide line and on small islands.

3.277 The American oystercatcher (*Haematopus palliatus*) and the black skimmer (*Rynchops nigra*) are two migratory species known to breed on the salt marshes and barrier beaches of the study area. The black skimmer, according to Cashin (1994), is almost always found nesting in association with common and least terns. This species produces eggs between the end of May and the beginning of September. The American oystercatcher usually nests in relatively isolated places, such as on the backside of a barrier beach rather than on the beach itself, and away from human disturbance. American oystercatchers produce eggs in the study area between the end of May and the end of July (McCormick 1975).

3.278 Piping plovers are discussed in detail in the Threatened and Endangered Species section. The piping plover is the only species of plover that nests in the New York Bight region (Howe 1978). The habitat of the terns and gulls that are indigenous to the study area have been discussed previously. Of the terns, the common tern is by far the most prevalent nesting tern in the study area.

Historic Occurrences and Trends

3.279 Historically, most shorebird species in the study area have decreased in abundance over time. Some, such as the American oystercatcher, have never been an abundant species in the area, and their survival depends mostly on the health and success of the shellfish that constitute its diet. Other species, such as the piping plover, were at one time a fairly common and widely distributed nesting species to the study area. Through the 1950's and 1960's, observers noticed a gradual decline in the numbers of breeding piping plovers (Howe 1978).

Comparison of Species Utilization of Developed Versus Undeveloped Areas

3.280 Of the barrier island shorebird species mentioned above, some are more affected by anthropogenic development than others. Gulls, specifically the herring gull, seem to thrive in areas that are developed, and can commonly be observed feeding on scraps of food left by people. However, according to Howe (1978), shorebirds that breed in the study area, such as the black skimmer, have been known to nest successfully on sites heavily used by man, but cannot be expected to breed productively in such disturbed areas.

3.281 In 1991, EEA, Inc. conducted a comparative avifauna survey on developed and undeveloped areas on Jones Island, immediately west of Fire Island. Thirteen areas were surveyed for bird species and numbers; six of the zones were in developed areas and seven were considered undeveloped. The highest number of species counted was 30 from the JFK Wildlife Sanctuary near Tobay Beach, an undeveloped area. The lowest number of species encountered was 2, also from an undeveloped area near Cedar Beach. For the developed areas, the mean number of different species present was 10.8 and for the undeveloped areas the mean number of species was 11.3. These results of EEA's avian survey are summarized in Table 3-15.

Table 3-15

Avifauna Survey*

Zone	**Number of Species**
Developed Areas	
Oak Beach	12
Oak Beach Association	3
Captree Island	16
Captree State Park	12
Cedar Beach Marina	6
Oak Island	16
Undeveloped Areas	
JFK Wildlife Sanctuary	30
West Gilgo	7
Gilgo	7
Cedar Beach	2
Cedar Beach Overlook	7
Captree State Park	15
Captree Island	11

Note: * EEA 1991.

3.282 The report concluded that while different species assemblances were present, the overall diversity was similar.

3.283 But most breeding species suffer from the effects of development. The negative effects of development include pollution, nest disturbance from vehicles or pedestrians, and many others. Consequently, many of the presently successful colonies of species, such as the least, common and roseate terns in the study area, are located on protected reserves or refuges (Howe 1978).

Raptors

3.284 Raptors that have been observed in the study area include the sharp-shinned hawk (*Accipiter striatus*), turkey vulture (*Cathartes aura*), goshawk (*Accipiter gentilis*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), broad-winged hawk (*Buteo platypterus*), rough-legged hawk (*Buteo lagopus*), bald eagle (*Haliaeetus leucocephalus*), and gyrfalcon (*Falco rusticolus*) (McCormick, January 1975). These observations are accounts of species that simply fly over the study area, not landing, perching, or otherwise utilizing the area for feeding, nesting, or roosting (i.e., bald eagle). The owls that have been observed on the study site include barn (*Tyto alba*), screech (*Otus asio*), snowy (*Nyctea scandiaca*), long-eared (*Asio otus*), short-eared (*Asio flammeus*), and saw-whet (*Aegolius acadicus*). The short-eared, long-eared, barn and saw-whet owls have been reported as breeding in the study area. The raptor species that have been known to nest on the barrier island environment of the study area include the northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), and osprey (*Pandion haliaetus*). Raptors that are fall migrants to the study area include merlin (*Falco columbarius*) and peregrine falcon (*Falco peregrinus*), although the peregrine falcon is an uncommon visitor to the study area during the spring and summer (USFWS 1981).

3.285 Raptors that are species of special concern, endangered, or threatened are discussed in detail in a later section, and some are commonly observed on or near the study area. Unlike many other raptors, the northern harrier is a ground nester, with its nests being placed on hummocks in marshes, often in cattail marshes, in grassy meadows, and sometimes in dry upland fields (Bull 1974). Peregrine falcons may be observed at the study area in flight, or perched on telephone poles, fence posts, or even driftwood among the sand dunes (Bull 1974). Osprey have successfully bred on the south shore of Long Island, with the help of man-made timber nesting platforms (Andrle and Carroll 1988).

3.286 Merlins are most numerous in the study area during the latter half of September and the first half of October. American kestrels are sometimes seen in very large numbers during fall migration along the outer beaches of Long Island. This species is a hole nester, and selects such diverse sites as tree cavities, old woodpecker holes, telephone poles, fence posts, bird boxes, and building crevices. McCormick (1975) identifies pitch-pine woodland, broadleaf forest, and residential habitats as areas where the American kestrel is likely to nest.

3.287 The short-eared owl searches the marshes, dunes, and fields for its favorite food, the meadow vole. The barn owl and the short-eared owl are both known to breed on or around the study area.

Passerine Species

3.288 The study area is transient habitat for passerine or perching birds (see Table 3-16). These birds can often be observed feeding on berries, such as beach plum, holly berries, service berries, or many others. The study area is also used by migratory passerine species, such as warblers, thrushes, and many others (USFWS 1981). In a study conducted at the Fire Island Lighthouse, more than 150 species of songbirds were banded between 1969 and 1972. The bell's vireo, bullock's oriole, western tanager, and western subspecies of the dark-eyed junco and fox sparrow,

Table 3-16		
Passerine Species that Reportedly Utilize the Study Area		
American Crow	Fox Sparrow	Rock Dove
American Goldfinch	Golden-crowned Kinglet	Rose-breasted Grosbeak
American Redstart	Grasshopper Sparrow	Ruby-crowned Kinglet
American Robin	Gray Catbird	Ruby-throated Hummingbird
American Tree Sparrow	Hairy Woodpecker	Rufous-sided Towhee
Arcadian Flycatcher	Henslow Sparrow	Rusty Blackbird
Barn Swallow	Hermit Thrush	Savannah (Ipswich) Sparrow
Bay-breasted Warbler	Horned Lark	Seaside Sparrow
Belted Kingfisher	House Finch	Sharp-tailed Sparrow
Black-billed Cuckoo	House Sparrow	Slate-colored Junco
Blackpoll Warbler	House Wren	Snow Bunting
Black-capped Chickadee	Kentucky Warbler	Song Sparrow
Blue Jay	Sedge Wren	Swamp Sparrow
Boat-tailed Grackle	Magnolia Warbler	Tennessee Warbler
Brown-headed Cowbird	Marsh Wren	Tree Swallow
Brown Creeper	Mourning Dove	Tufted Titmouse
Brown Thrasher	Nashville Warbler	Vesper Sparrow
Cape May Warbler	Northern Cardinal	White-breasted Nuthatch
Carolina Wren	Northern Mockingbird	White-eyed Vireo
Cedar Waxwing	Northern Oriole	White-throated Sparrow
Chestnut-sided Warbler	Northern Parula	White-wing Crossbill
Chimney Swift	Northern Parula Warbler	Willow Flycatcher
Clay-colored Sparrow	Orchard Oriole	Wilsons Warbler
Common Grackle	Palm Warbler	Wood Thrush
Common Yellowthroat	Philadelphia Virco	Yellow Warbler
Downy Woodpecker	Prothonotory Warbler	Yellow-bellied Flycatcher
Eastern Bluebird	Purple Martin	Yellow-billed Cuckoo
Eastern Meadowlark	Purple Finch	Yellow-rumped Warbler
Eastern Wood-Pewee	Prairie Warbler	Yellow-shafted Flicker
Eastern Kingbird	Red Crossbill	Yellowthroat
European Starling	Red-breasted Nuthatch	Yelllow-throated Warbler
Field Sparrow	Red-eyed Vireo	
Fish Crow	Red-winged Blackbird	
Source: USFWS 1981.		

all of which are considered to be native to western North America, were also netted at Fire Island (McCormick 1975).

Wildlife of the Barrier Island

3.289 Seventeen species of land mammals have been reported on Fire Island in field studies done by McCormick (1974). All species undoubtedly breed in the study area. The most dominant species of these included whitetail deer (*Odocoileus virginianus*), eastern cottontail (*Sylvilagus floridanus*), red fox (*Vulpes fulva*), raccoon (*Procyon lotor*), masked shrew (*Sorex cinereus*), short-tailed shrew (*Scalopus aquaticus*), muskrat (*Ondatra zibethica*), and mink (*Mustela vison*).

Large Mammals

Art (1990) reports that one of the most significant biological events in the recent history of Fire Island has been the dramatic increases in the populations of whitetail deer. White-tailed deer are a fairly common sight in the Fire Island communities, particularly since many of the residents have taken to feeding these creatures. The deer can also be seen in the evening hours when they enter open areas to browse on grass and succulent plants. Deer populations increased faster on the western half of the study area that contains numerous residential communities than in the eastern half among its undeveloped park areas (O'Connell, Jr. 1989). This increase in deer has led to many concerns about possible over-population of deer, and its effect on the resources of the study area. Deer exhibit home range fidelity and utilize small ranges throughout the year.

3.290 Since deer have become such a topic of priority for management and conservation methods in the study area, there are certain goals that have been identified by NPS for the Fire Island National Seashore. The primary resource management goals include maintaining the assemblages of plants and animals characteristic of the park's natural vegetative communities and protecting threatened and endangered species. Other objectives related to deer management as specified by NPS (Patcha 1990) include recognizing the safety and health concerns of the visitors to the study area; and minimizing human activities which alter the population size, distribution, and behavior of native species (including deer).

Deer Population and Control

3.291 The following information was largely provided by NYSDEC (Lowry, July 2, 1998). Anecdotal information received from the Fire Island communities indicated that there was no perceived problem of white-tailed deer overpopulation prior to the early 1970's. No legalized hunts of deer were conducted on the Fire Island barrier through the 1960's and 1970's. The first legalized hunt in recent history was conducted in the fall/winter of 1981-82, on request of the Fire Island Association. The primary reason for their request was to control the human health threat of contracting Lyme Disease, with secondary concerns over physical damages to both person and property. Again in 1988-1989, the state opened a brief season (10 days of archery and 10 days of shotgun) for both sexes. The season was cut short, however, under order from NPS after receiving heavy public sentiment against the open deer season on Fire Island. According to state officials, the deer herd was not properly culled or reduced by this shortened season. Deer overpopulation problems persisted and were exacerbated by the supplemental feeding activities of some Fire Island community residents.

3.292 In response to the continuing deer overpopulation problem, the Humane Society of the United States (HSUS) initiated a 5-year pilot deer sterilization research project in 1994. The HSUS project entails vaccinating does with Porcine Zona Pellucida (PZP), a chemical which causes the females to produce antibodies to male sperm. This method had proven successful in controlling horses in Assateague and many zoo animal populations. However, the free ranging deer herd at Fire Island presents a major problem in delivery of the vaccine. For the vaccine to be fully effective, does must receive 2 shots the first year, followed by a booster shot every year after. To keep costs to a minimum, the HSUS does not capture, tag, and release any deer; rather, it relies heavily on volunteer assistance to monitor and identify those individuals in need of the vaccine for the researchers. Because of this method, it is likely that some does do not receive the initial or booster shots, and continue to reproduce at a rate which may compensate for population losses. The project is currently in its last year, and is being analyzed for its efficiency and effectiveness in achieving the project goals. NYSDEC is uncertain whether this method has been successful in reducing the Fire Island deer population below what would occur through natural mortality rates, and whether HSUS will request a permit extension to continue the project.

Small Mammals

3.293 Eastern cottontail rabbits are one of the most commonly encountered small mammals on the Fire Island barrier. They frequent the grassy areas bordering area roadways to feed, particularly in the early morning and evening hours. Rabbits begin to breed at six months old and can produce four to eight litters per year. This tremendous reproductive capacity is kept in check by predators on the barrier island, including red fox which are discussed below, as well by as motor vehicles.

3.294 According to accounts by Smith (1962), the red fox population on the Fire Island barrier is far greater than that on Jones Beach. This is due to the greater percentage of dense cover and a bountiful food supply. NPS will be conducting a red fox census study on the Fire Island barrier in the near future, however, the commencement date is undetermined at this time (Bilecki, Personal Communication, April 1999).

3.295 Raccoons are also plentiful on specific areas of Fire Island, where they are particularly attracted to the garbage cans of the residents. Smith (1982) suggests that raccoons gain access to Fire Island via the bridges that connect the barrier island to the mainland of Long Island.

3.296 Muskrats can be expected to be found wherever marshes, swamps, ponds, lakes, or slow-moving streams occur in concert with heavy growth of herbaceous vegetation. Connor (1971) reports that the most extensive habitats for muskrat on Long Island are the salt and brackish tidal marshes that encircle the bays along the south shore, including Fire Island.

3.297 According to Smith (1962), minks and shrews can be found on the beach areas. Smith (1982) also indicates that weasels (*Mustela sp.*) are fairly common on the outer beach areas, feeding on mice, rats, moles, water rats, and frogs. The masked shrew is a common species known to occur all along the outer barrier beaches of the south shore of Long Island (USFWS Inventory 1997).

3.298 Bats have been observed feeding on insects over the dunes at Fire Island (Smith, August 1962). Based on these sightings, these bats are primarily the little brown bat (*Myotis lucifugis*).

3.299 Rats are also commonly found around the garbage dumps on Fire Island (Smith 1962). Norway rat (*Rattus norvegicus*) is the most common species in the study area. This species is not native to the U.S.

3.300 The white-footed mouse (*Peromyscus leucopus*) is very common to the study area and can be found in valleys, depressions, and beachgrass-low shrub communities of the study area (USFWS Inventory 1997).

Feral Species

3.301 Readily apparent within the study area and throughout the adjacent natural areas are domestic cats, which may have been born either in domestic or wild situations, and are surviving in the wild as feral animals. Feral dogs are also suspected to be present in the study area.

3.302 Feral dogs and cats can have a significant impact on wildlife using the study area. Feral animals will rely on food scraps tossed out with household garbage, causing frequent human confrontations. In addition, feral animals will search for alternate food supplies and eventually compete with other natural predators for the same prey species. Disturbances by feral animals to ground nesting birds can also have serious consequences. Young piping plovers and terns may particularly be vulnerable to predators until they are fledged (capable of flying). Frequent attempts to attack birds nesting at the outer edge of colonies may drive nesting birds out of the study area altogether. Some of the species may not attempt to re-nest after being disturbed, while the young of others, even though successfully hatched, may not reach maturity in time to survive migration (Cashin 1993).

Herpetiles

3.303 Eight reptile and one amphibian species have been identified as utilizing the habitat on Fire Island between Fire Island Inlet and Moriches Inlet. They are the fowler's toad (*Bufo woodhousei fowleri*), eastern mud turtle (*Kinosternon subrubrum*), spotted turtle (*Clemmys guttata*), northern diamond back terrapin (*Malaclemys t. terrapin*), snapping turtle (*Chelydra serpentina*), eastern box turtle (*Terrapene carolina*), eastern hognose snake (*Heterodon platyrhinos*), eastern garter snake (*Thamnophis cyrotopsis ocellatus*), and northern black racer (*Coluber constrictor*)

(USFWS 1997b, NPS 1997). The state has proposed listing the eastern mud turtle as endangered and has proposed the eastern box turtle to be listed as special concern.

3.304 The fowler's toad is the most abundant herpetile found on the island, utilizing a variety of habitats.

3.305 The eastern mud turtle is a semi-aquatic reptile that wanders away from water more than other species. The preferred habitat of this species is shallow water, ditches, wet meadows, small pond marshes, etc. This species has a strong tolerance for brackish water, and is often found at the inner edges of tidal marshes (Conant and Collins 1991).

3.306 The eastern mud turtle is considered by NYSDEC to be a state threatened species, while the spotted turtle and diamondback terrapin are both NYSDEC species of special concern.

3.307 The spotted turtle and snapping turtle are also semi-aquatic turtles, each with different habitat requirements. The spotted turtle is more a freshwater species, at home in marshy meadows, swamps, small ponds, and ditches, while the snapping turtle prefers any permanent body of fresh water, large or small, and even enters brackish water.

3.308 The eastern box turtle, eastern hognose snake, and black racer have been identified as using the thicket/woodland community. The Fire Island habitat provides the moist, shaded environment required by these species (USFWS 1997b).

Insect and Arachnid Fauna

3.309 Although the insects and arachnid fauna in the study area have not been well documented, there are certain species typically associated with barrier beach environments.

Wrack Line

3.310 The wrack line (the vegetation and debris that accumulates at the uppermost reach of a high tide) provides food and cover for a myriad of saprophagous, scavenger, and predatory insects. Commonly encountered families that feed on decaying vegetation are springtails (*Poduridae*), darkling beetles (*Tenebrionidae*), feather-winged beetles (*Ptilidae*), kelp flies (*coelopidae*), and stable flies (*Muscidae*). These saprophagous insects in turn attract a variety of predators and parasitoids, including parasitic wasps (Order: *Hymenoptera*), rove beetles (*Staphilinidae*), ground beetles, and tiger beetles (*Carabidae*). A more detailed account of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) is provided below. The multitude of insects provide an important food source for shorebirds and play a valuable role in the decomposition of wrack.

Upper Beach

3.311 Many insects and spiders move between the wrack line and the upper beach to feed. For example, wolf spiders (*Lycosidae*) are nocturnal predators that can be found moving down the beach at night in search of food. Other insects common to the upper beach and primary dune areas are ants (*Formicidae*), grasshoppers (*Acrididae*), robber flies (*Asilidae*), velvet ants (*Mutilidae*), and sand wasps (*Sphecidae*).

Marsh Area

3.312 The salient insects of the saltwater marsh community are the voracious biting insects. Although considered pests, these insects provide an important food source for fish, birds, and other insects. The salt-marsh mosquito (*Aedes sollicitans*) and the brown salt marsh mosquito (*Aedes cantator*) are the dominant mosquito species in the salt marsh. Other commonly encountered insects are deer flies and greenhead flies (*Tabanidae*), biting midges (*Ceratopogonidae*), non-biting midges (*Chironomidae*), plant bugs (*Miridae*), assassin bugs (*Reduviidae*), crickets (*Gryllidae*), ladybug beetles (*Coccinellidae*), predaceous diving beetles (*Dytiscidae*), and dragonflies (Order: *Odonata*). Insects provide food for a variety of salt marsh birds.

Predator-Prey Relationships

3.313 In such a widely utilized region for wildlife as the study area, there are abundant relationships between predator and prey species. In some instances these relationships act to balance the ecosystem of the area. One such example of this is the rapid reproductive rates of the eastern cottontail rabbit, and the number of predators that feed on the young of this species, including feral dogs and cats, red foxes, and raptors. In other instances, a lack of predator species can create an opportunity for a species to potentially overpopulate an area. This is thought to be one of the explanations for the overpopulation of the white-tailed deer, since this species lacks a true predator, if man is excluded from the natural processes.

3.314 A classic example of the formation of a predator-prey relationship was in the formation of John Boyle Island, an island in the study area that was created by deposition of sand dredged during construction of the Intracoastal Waterway in 1938. Following the establishment of small mammals on this island, the marsh hawk and short-eared owl hunted over the island. As for the entire project area, the main avifauna that are considered predators are species that stage an impressive migration through the project area or surrounding areas during the fall. These include, in approximate order of their relative abundance, the American kestrel, merlin, sharp-shinned hawk, northern harrier, osprey, Cooper's hawk, and peregrine falcon. Avifauna that migrate in the study area or in areas surrounding the study area include the bald eagle, the rough-legged hawk, and the snowy owl (USFWS Inventory 1981). These avifauna predators are joined by red foxes, feral animals, raccoons and other land mammals that have been documented as the main predators in the project area. These predators generally prey on smaller species, such as mice, shrew, rats, reptiles or amphibians, or the young of other species such as eastern cottontail rabbits. Eggs laid by species such as waterfowl or other avifauna often become the prey of species such as raccoon, red fox, raptors, or feral animals.

3.315 Most of the hawks and falcons that migrate through the project area, and the owls that winter in the study area (e.g., the short-eared owl) depend on the grasslands of the dunes and the interdunal swales for feeding habitat, according to the USFWS inventory. The abundance of small mammals that these habitats promulgate may partially explain the spectacular migratory display that these raptors put on each fall.

Threatened and Endangered Species

3.316 The barrier island ecosystem provides breeding habitat for the state endangered/federally threatened piping plover. The peregrine falcon, another state and federal endangered species, is an infrequent visitor to Fire Island, utilizing the available habitat for hunting prey. The least tern, a state endangered water bird, also breeds within the study area. Roseate tern, which is state endangered and federally threatened, breeds in mixed colonies with the common tern in the study area. One state threatened raptor species, the northern harrier, is known to breed within the study area. Osprey, also a state threatened species, has successfully bred within the barrier island area. New York State has proposed that the short-eared owl be listed as endangered and the upland sandpiper and Henslow's sparrow be listed as threatened. In addition, the state has proposed the listing of the sharp-shinned hawk, Cooper's hawk, Northern goshawk, black skimmer, horned lark, and seaside sparrow as special concern. The species of special concern, which reportedly utilize habitats within the study area for breeding and/or over-wintering include: Cooper's hawk, grasshopper sparrow, Henslow's sparrow, vesper sparrow, short-eared owl, and common barn owl. Other species with Natural Heritage Global and State Rankings, and a state legal status of protected are noted in the following sections. Table 3-17 provides a listing of the rare and endangered wildlife species utilizing the barrier island, and a summary of the state and federal status of each species.

Table 3-17					
Threatened and Endangered Migratory Wildlife of the Barrier Island					
Species Common Name	**Species Latin Name**	**NHP Global Rank**	**NHP State Rank**	**New York State Status**	**Federal Status**
Piping Plover	*Charadrius melodus*	G3	S2B	E	LELT
Peregrine Falcon	*Falco peregrinus*	G4	S2	E	E(S/A)
Northern Harrier	*Circus cyaneus*	G5	S3	T	NA
Least Tern	*Sterna antillarum*	G4	S3B	E	NA
Roseate Tern	*Sterna dougallii*	G4	S1B	E	LELTNL
Common Tern	*Sterna hirundo*	G5	S3B	T	NA
Caspian Tern	*Sterna caspia*	G5	S1	P	NA
Gull-billed Tern	*Sterna nilotica*	G5	S1	P	NA
Forster's Tern	*Sterna forsteri*	G5	S1	P	NA
Black Skimmer	*Rynchops niger*	G5	S2	P SC	NA
Osprey	*Pandion haliaetus*	G5	S4	T	NA
Upland Sandpiper	*Bartramia longicauda*	G5	S4	P T	NA
Short-eared Owl	*Asio flammeus*	G5	S2	E	NA
Sharp-shinned Hawk	*Accipiter striatus*	G5	S4	P SC	NA
Cooper's Hawk	*Accipeter cooperii*	G5	S5	P SC	NA
Northern Goshawk	*Accipiter gentilis*	G5	S4	P SC	NA
Vesper Sparrow	*Pooecetus gramineus*	G5	S5	P SC	NA
Henslow's Sparrow	*Ammodramus henslowii*	G4	S3B, SAN	P T	NA
Grasshopper Sparrow	*Ammodramus savannarum*	G5	S4	P SC	NA
Common Nighthawk	*Chordeiles minor*	G5	S4	• P SC	NA
Bay-breasted Warbler	*Dendroica castanea*	G5	S2	P	NA
Yellow-throated Warbler	*Dendroica dominica*	G5	S1	P	NA
Palm Warbler	*Dendroica palmarum*	G5	S1	P	NA
Blackpoll Warbler	*Dendroica striata*	G5	S3	P	NA
Cape May Warbler	*Dendroica tigrina*	G5	S2	P	NA
Yellow-bellied Flycatcher	*Emidonax flaviventris*	G5	S3	P	NA
Acadian Flycatcher	*Emidonax virescens*	G5	S3	P	NA
Horned Lark	*Eremophila alpestris*	G5	S5	P SC	NA
Rusty Blackbird	*Euphagus carolinus*	G5	S3	P	NA
Merlin	*Falco columbarus*	G5	SA	P	NA
Yellow-breasted Chat	*Icteria virens*	G5	S3	P SC	NA
Red Crossbill	*Loxia curvirostra*	G5	S3	P	NA
White-winged Crossbill	*Loxia leucoptera*	G5	S2S3	P	NA
Kentucky Warbler	*Oporornis formosus*	G5	S2	P	NA
Northern Parula	*Parula americana*	G5	S3S4	P	NA
Prothonotary Warbler	*Protonotaria citrea*	G5	S2	P	NA
Boat-tailed Grackle	*Quiscalis major*	G5	S1	P	NA
Clay-colored Sparrow	*Spizella pallida*	G5	S2	P	NA
Seaside Sparrow	*Ammospiza maritima*	G4	S2/S3	P SC	NA
Golden-winged Warbler	*Vermivora chrysoptera*	G4	S4	P SC	NA
Tennessee Warbler	*Vermivora pelegrina*	G5	S2	P	NA
Philadelphia vireo	*Vireo philadelphicus*	G5	S3	P	NA
Wilson's Warbler	*Wilson's Warbler*	G5	S1	P	NA
Note: See Table 3-13 for explanation of global and state ranking and state and federal status.					

Resident Wildlife

Barn Owl

3.317 The common barn owl (*Tyto alba*) is a species of special concern (Global ranking G5, State Rank S3) in New York State. Barn owls are known to choose nest sites in manmade structures such as abandoned buildings, silos, bridge abutments, etc. They produce large broods once or twice a year from April through late June. Each young owl as it nears maturity will eat the equivalent of a dozen mice per night if such prey is available. Adult barn owls kill and consume the equivalent of one large rat or gopher per night. The young, which vary in size due to their hatching dates, fly at about seven weeks of age. Barn owls often nest in the same site repeatedly. Barn owls are considered to be our most beneficial owl, owing to their appetite for animal pests.

3.318 Nesting barn owls have been reported year round within New York State, although their nocturnal habits make them hard to find. Long Island has a well represented population as reported by Andrle and Carroll (1988). Breeding Bird Atlas data indicate that a nest with chicks was observed within the study area during the mid 1980's.

Migratory Wildlife

Piping Plover

3.319 On January 10, 1986 the piping plover was listed as federally threatened under provisions of the Endangered Species Act of 1973 (ESA), as amended (USFWS 1988). This species breeds only in North America in three geographic regions: the Atlantic Coast, the Great Lakes, and the Northern Great Plains. The Atlantic Coast population breeds on sandy beaches along the east coast of North America, from Newfoundland to South Carolina.

3.320 Plovers return to the New York area late in March/early April from the South Atlantic and Gulf coasts. Piping plovers nest within the study area at several locations, including Democrat Point, Fire Island East, Fire Island Pines, Fire Island Villages, Fire Island Sunken Forest, and Fire Island Wilderness.

3.321 Piping plovers are typically found nesting among least tern colonies. By early April, piping plover males begin to establish territories, which they defend aggressively against adjacent males by performing "horizontal threat," "parallel run," and aerial displays. Nesting piping plovers are monogamous. However, they usually shift mates between years and, less frequently, between nesting attempts in a given year. Plovers are known to breed at one year of age, but the rate at which this occurs is unknown.

3.322 Suitable nesting habitat includes: 1) a shallow depression in the sand between the high tide line and the foredune area; 2) sandflats at the end of sandpits; 3) blowout areas behind primary dunes; 4) sparsely vegetated dunes; and 5) washover areas cut into or between dunes. Piping plovers also nest on dredged material areas if sand, pebble, and shell fragments are present. Nest locations are typically spaced far apart (100-200+ feet) from each other. Egg laying can occur between mid-April through July. Typically, three to four eggs are laid per clutch, and incubation lasts for approximately four weeks. If a brood is successful, a pair will not attempt another clutch for the season. At four to five weeks, chicks will fledge. Plovers usually migrate by the beginning of September.

3.323 Piping plovers frequent intertidal portions of ocean beaches, washover areas, mudflats, sandflats, wrack lines, and shorelines of coastal ponds, lagoons, or salt marshes to feed. Wintering plovers on the Atlantic Coast are generally found at accreting ends of barrier islands, along sandy peninsulas, and near coastal inlets. The primary diet of piping plovers consists of invertebrates such as marine worms, fly larvae, beetles, crustaceans, and mollusks.

Terns

3.324 Terns utilizing the barrier beach area for breeding, foraging, and/or resting include Caspian, common, Forster's, gull-billed, least, and roseate. The tern diet consists primarily of fish and, in lesser quantities, aquatic invertebrates. Terns catch their food by plunge-diving into open water, catching their meal with their beaks. Terns are colonial ground-nesting birds. Gulls, crows, raccoons, fox, domestic and feral animals, and human activities pose major threats to the breeding success of these birds.

Roseate Terns

3.325 Terns nest on coastal islands in colonies, concealing their nest under grass, driftwood, or other flotsam. Roseate terns are commonly found in breeding colonies with common terns and less frequently with Forster's and arctic terns. Both parents take part in brooding, feeding, and fledgling the young. Roseate terns typically select nest sites located in sandy areas on islands or at the ends of barrier beaches with about 80 percent vegetative cover. The bare sand nests accumulate material during the incubation period and become well established nests. Nests are fairly close together (60-180 cm apart), with clutch sizes of 1-2 eggs, sometimes three or four. Fledging occurs at 3-4 weeks and most hatching is complete by the end of June. Parents must feed the fledglings for up to six weeks.

3.326 No roseate tern breeding colonies have been identified on the barrier island within the study area. However, roseates have been reported as utilizing the barrier island to the west of Fire Island Inlet and islands within the back bay area inside the study area. Roseate terns arrive in the study area as early as late April. By October, all roseate terns have departed the study area, but most are gone by the end of September (USFWS 1988). They winter off the coast of South America where they roost on sand bars and are vulnerable to human predation.

Least Tern

3.327 The least tern is the smallest North American tern. It is common and locally distributed on the east and Gulf coasts, and less common and declining inland and on the west coast. This lively tern nests in colonies on beaches and sandbars but breeds most successfully on unvegetated dredge-spoil islands or on flat rooftops in urban areas. The least tern typically arrives in May. Nesting activity continues through July. Colonies tend to be small; nests are typically bare sand areas, sometimes with shell fragments. Gestation is approximately four weeks, after which fledglings are fed small fish for another 4 weeks by the parents. Adults feed by plunging for fish close to the ocean beach or in protected bays and ponds. It is not uncommon to see groups of fledged chicks on the beach in August, preparing for the early September migration.

3.328 Breeding sites within the barrier beach study area include Fire Island Democrat Point, Fire Island Pines, Watch Hill and Long Cove, Fire Island Wilderness, and Smith Point (NYSDEC 1997). Least terns winter on the South American coast from Venezuela to Brazil.

Common Tern

3.329 The common tern is classified as the state's most abundant tern, arriving in May at their Long Island breeding grounds and leaving by the beginning of October. Nesting occurs from mid-May to Mid-August, with two eggs usually per nest. Nest structures range from sparse ground to nests made of dead vegetation and debris. Suitable colony sites include barrier beach dunes, dredged material areas, offshore islands, and salt marshes. As previously mentioned, common terns may be found in colonies with roseate terns. Although rearing conditions are similar for the two species, common terns will depart from Long Island about a month after the roseate terns.

3.330 Common tern breeding sites within the barrier beach study area include Fire Island Sunken Forest, Fire Island Wilderness, and Fire Island Long Cove (NYSDEC 1997).

Eagles

3.331 Two other state/federally endangered species, the bald eagle and golden eagle, are species known to fly over the study area. Both of these migrants may occasionally stop to hunt or rest. The remainder of rare wildlife species that utilize the barrier beach ecosystem can be considered migratory species and are addressed in the following subsection. The NHP ranking and the New York State and Federal Status Codes are defined in the Offshore Environment subsection in Table 3-13.

Osprey

3.332 Ospreys are usually found near seacoasts or by large bodies of water. Suitable nesting areas include undeveloped lands adjacent to estuaries, tributaries, bays, and islands. Suitable habitat does exist within the study area. Historically, Gardiners Island and Plum Island were well known colony sites, among others in southeastern Long Island. Osprey usually nest near the top of dead trees but are also found nesting on cliffs, atop power poles, and in ground nests, trash cans, and even cardboard boxes. Special platforms built for ospreys have been quite successful as well. Ospreys build their nests with long sticks, often driftwood, and line them with soft material such as seaweed and moss and more structured materials such as bones and fabric material. Ospreys usually lay two to four eggs, nesting from April to June. Fledglings are typically seen from late June to late August. There were 87 active nest sites on Long Island in 1980 with 101 successful fledglings. The Breeding Bird Atlas confirms their presence within the study area (Andrle and Carroll 1988).

3.333 Ospreys feed exclusively on fish, plunging into shallow waters to catch their prey. The osprey has made a significant recovery on Long Island after the decline in the late 1940's through the 1960's, when pesticides such as DDT were widely used. More detail is provided in the following subsection dealing with anthropogenic effects.

Peregrine Falcon

3.334 The peregrine falcon is considered a rare to common fall migrant within the study area. During their fall migration, peregrines have been sighted perched on telephone poles and fence posts, on driftwood in the sand dunes, and in flight along Long Island beaches. Nonbreeders have been documented within the beach community. Peregrine falcons are expert hunters, feeding on songbirds, shorebirds, waterfowl, seabirds, and pigeons, all of which are caught in flight. Peregrine falcons generally select elevated ledges on cliff faces, escarpments, or man-made superstructures (e.g., bridges, skyscrapers) to build their eyries (Andrle and Carroll 1988). Peregrines have been reported frequenting water towers on the barrier islands located west of the study area, but none have been found to breed there. The male will preform complex courtship flights for his mate, and by mid-May the female will lay an average of four eggs. Both adults help incubate the eggs which hatch in mid-June. The young birds are able to fly at about 35-40 days after hatching, but remain dependent on the adults for several weeks after they leave the nest. Peregrines rarely breed before three years of age, with the average life span being four to five years but individuals have been known to live much longer.

Cooper's Hawk

3.335 Cooper's hawk is a forest-dwelling raptor, typically found in deciduous woodlands but also seen in urban areas and farm woodlots. Cooper's hawks are not commonly found breeding on Long Island, due to the general lack of suitable habitat. They are more commonly seen foraging and as a migrant species within the study area.

3.336 Cooper's hawks build a stick nest high in the middle of a deciduous tree, where the female lays from 2-5 eggs. Although known to return to the same area to nest year after year, recent studies have shown that individual birds change mates and nest sites frequently in succeeding years. Cooper's hawk feeds on birds, but is also known to feed on mammals, particularly squirrels and chipmunks.

Northern Harrier

3.337 The northern harrier or "marsh-hawk," as it is commonly called, is a raptorial bird which primarily feeds on voles (*Microtus* sp.) in the study area. A 5-year study was conducted by England (1989) on the northern harrier population which occupied the Jones Beach barrier to the west of the study area. This study found that the adult male harriers overwinter in the area, along with juveniles born the same year. Adult female harriers generally migrate. When the females arrive by the third week of February, they find the males already occupying historic breeding territories. New nests are generally built on the ground near the upland fringe of tidal marshes, in dense strands of common reed, or in thickets of mixed common reed and poison ivy. Egg laying occurs sometime between late April to early May. Incubation lasts approximately 35 days. The northern harrier study conducted by England (1989) on the Jones barrier indicated that nesting pairs raised only one brood per season, and that if a nest failed, the harriers usually left the area within two days, and did not attempt to re-nest. Young are fed in the nest for about 40 days, with the greatest occurrence of juveniles fledging from the nest sometime in mid-July. Adults continue to feed the young for 3 to 4 weeks until they leave the nesting territory (England 1989).

Short-Eared Owl

3.338 Within the coastal lowland habitat, the short-eared owl prefers to nest in sand dunes on bare sand and a low density of beach grass cover. Generally, this owl prefers open country, and is a resident of mixed and tall grass habitats throughout the year. The short-eared owl is a nomadic species that tends to congregate in areas where vole populations are high. Hence, the numbers of breeding and wintering owls may fluctuate markedly from year to year, depending upon the availability of their rodent prey. This species withdraws from the northern breeding areas during the winter and frequents grassy marshes and grazing meadows. A wide variety of other small mammals, such as long-tailed field mice, shrews, rats, and young rabbits may be taken, as well as small birds.

3.339 The short-eared owl nest is a roughly lined scrape hidden among grass, heather, weed stalks, feathers, or dead reeds. The 4-8 white eggs (14 in years when voles are plentiful) are laid in late April or early May at 2-day intervals. Incubation, by the female alone, commences with the first egg and lasts 24 to 28 days. The young leave the nest after 12 to 17 days and fly after 24 to 27 days. One brood is usual, though in years of vole abundance, two broods may be attempted. Confirmed breeding within the study area has been reported by Breeding Bird Atlas data. Historically, greater numbers were confirmed breeders on Long Island, but these numbers have declined over the past century.

Upland Sandpiper

3.340 This species of sandpiper frequents open plains, short-grass fields, prairies, airports, and golf courses. Long Island populations have declined with the loss of this habitat, although the Breeding Bird Atlas reported confirmed sightings at JFK Airport in Queens. Egg clutches are invariably four in number; nest sites are confirmed from late April through June. Fledglings were observed from June through August (Bull 1974). Possible and probable breeding sites have been defined for the barrier beach ecosystem in Suffolk County. Fledged young were confirmed in the mid-1980's within the study area.

Vesper Sparrow

3.341 Vesper sparrows are typically found in relatively dry and sparsely vegetated areas, using scattered tall structures for song perches. In eastern North America, breeding pairs are most frequently found in pastures, hayfields, and along the edges of cultivated fields where hedgerows, scattered trees, power lines, or other tall structures can be used as song perches. However, they have been found in other habitats, including fallow fields in early stages of succession, golf courses, and open disturbed woodlots.

3.342 Ground nests are usually created in a depression surrounded by low plants or in tussock grass. The nest is built of dry and fine grasses, weed stalks, rootlets, and hair. Once a widespread breeder in New York State, and especially in the Hempstead Plains grassland, the vesper sparrow is now considered rare on Long Island. There are no known breeding accounts within the study area (Andrle and Carroll 1988).

Henslow's Sparrow

3.343 Henslow's sparrow is a true grassland species, utilizing open meadows and marshes. These birds will also occupy neglected grassy fields and pasture lands. Although they were historically breeding on the south shore of Long Island, by the early 1950's no nesting colonies were found. They now appear to be somewhat localized to upstate counties (Andrle and Carroll 1988).

Grasshopper Sparrow

3.344 Grasshopper sparrows are neotropical migrants that are widespread occupants of grassland habitats across North America. They are found in a variety of tall- and mixed-grass habitats, including native prairies, hayfields, pastures, and grassy fallow fields. They nest in a slight depression on the ground, with the rim flush with the ground, hidden by overhanging grasses and forbs. Andrle and Carroll (1988) reported probable breeding at the western end of the study area.

Common Nighthawk

3.345 The common nighthawk is chiefly a fall migrant, but is considered a statewide breeder in New York. They are crepuscular birds, active primarily during dawn and dusk hours. They have been reported exhibiting diurnal activities as well (Bull 1974). Historically, they nested on bare ground in open areas, but as habitat declined, they adapted to flat gravel rooftops in urban areas. Natural nesting areas on Long Island included sandy openings in mixed pine-scrub oak barrens, sand dunes, gravel beaches, and bare ground. Because they are difficult to locate, it is somewhat unclear if Breeding Bird Atlas data is complete. Probable breeding areas are noted within the study area, according to Andrle and Carroll (1988).

Anthropogenic Stresses

Piping Plover

3.346 Pressure on Atlantic Coast beach habitat from development and human disturbance is pervasive and unrelenting, and the piping plover species is sparsely distributed. Loss and degradation of habitat due to development and shoreline hardening may be major contributors to the species' decline. Disturbance by humans, particularly vehicular traffic, pets, and feral species, often reduces the functional suitability of habitat and causes direct and indirect mortality of eggs and chicks. Predation has also been identified as a major factor limiting piping plover reproductive success at many Atlantic Coast sites, and substantial evidence shows that human activities are affecting types, numbers, and activity patterns of predators, thereby heightening natural predation (USFWS 1995).

3.347 The coastal Long Island population was widespread before the mid-1800's. Hunting pressure reduced numbers dramatically, concentrating the population on Gardiners Island and the east end of Long Island. Protection efforts in the early 1900's helped the species recover, but development within coastal areas eliminated or destroyed nesting habitat, thus causing a second decline in the Long Island population (Andrle and Carroll 1988).

3.348 Intensive recovery efforts for the Atlantic coast population have contributed to the gradual comeback of the species in New York State, although from 1986-1989, it was unclear if population increases were actual or due in part to the increased survey and protection efforts. Since being listed as threatened in 1986, the Atlantic Coast population has gradually increased from approximately 800 pairs to 1350 pairs in 1995. Since 1989, the New England subpopulation has increased 346 pairs, while the New York-New Jersey and the Southern (Delaware, Maryland, Virginia, and North Carolina) subpopulations gained 62 and 18 pairs, respectively. Substantially higher productivity rates have been observed in New England than elsewhere in the population's range (USFWS 1995).

3.349 Preliminary population and productivity estimates for 1998 indicate that piping plover numbers have continued to increase along the Atlantic Coast. The total reported nesting pairs in New England was 632, and the combined New York-New Jersey and Southern Region subpopulations reached 541 pairs. Overall, the total number of pairs in the Atlantic Coast population was estimated to be 1,377 in 1998, an increase of approximately 2 percent since 1995 (USFWS 1998).

3.350 On Fire Island, NPS has implemented a protection plan for the species within the 22-mile section of the Island, the Fire Island National Seashore. The protection plan includes plover behavior monitoring, beach use restrictions, pedestrian vehicle escort systems, enforcement, and public education (NPS 1983; NPS 1994). Since 1983, NYSDEC, with cooperating agencies, towns, environmental groups, and naturalists, has conducted a colonial waterbird and piping plover survey. During the 1996 breeding season, 35 sites were monitored for piping plover from Queens County east to Long Island (NYSDEC 1997). It is still unclear whether the population is increasing due to the increased protection efforts; however, productivity was reported to increase from 1995 to 1997 (0.97 fledged/pair in 1995; 1.37 fledged/pair in 1997, USFWS 1998). Additional efforts for protection of nesting shorebirds were implemented by the New York State Department of State and the Nature Conservancy (1991), where over 50 sites were surveyed as part of a protection and management plan. These increased efforts have gradually reduced the anthropogenic effects on the piping plover. Preliminary 1998 data provided by the USFWS since would appear to indicate a slight decrease in piping plover production with a fledged/pair average of 1.09 (preliminary USFWS data 1998). The East Hampton Town Natural Resources/Environmental Protection Department (EHTNRD) reported a significant increase in fledged piping plover chicks from 0.74 fledged/pair 1997 to 1.09 fledged/pair in 1998, which is consistent with the state average (EHTNRD 1998).

Roseate Tern

3.351 The northeastern population of the roseate tern began to decline after peaking in the 1930's. Well established colony sites spanning New Jersey to Virginia and areas north of Cape Cod (Massachusetts) have either been abandoned or suffered major declines in nesting populations (USFWS 1988). Roseates are quick to abandon a colonial site that is disturbed by predators. They are vulnerable to any adverse event at the site that could eliminate a significant proportion of their numbers. Predation by gulls, human disturbance, erosion, pollution, and depletion of their prey species are all threats to them on their breeding range. Gull predation seems to have been a major factor in the decline. Displaced from the most favorable sites, they moved closer to the mainland where predation and human disturbance were more of a threat. The practice of roosting on sand bars on their wintering grounds leaves them vulnerable to trapping for food by indigenous populations, and they may face other problems during migration and on the wintering grounds.

Least Tern

3.352 Historically, this tern, like many other tern species, was hunted for the feathers. Once a common resident on the south shore, it was almost completely extirpated from the state by the late 1800's. After hunting pressure was lifted, the least tern recovered on Long Island, particularly on the south shore. The least tern was listed as endangered in New York State in 1983 as species numbers were observed to decline once again. Major causes included urban development, loss of habitat, and increased recreational pressures along coastal areas. Andrle and Carroll (1988) reported populations recently well documented on the north shore and Peconic bays area during the mid 1980's. Populations appeared to remain stable at that time.

Common Tern

3.353 The common tern has historically been impacted by feather hunting, as previously reported. Flooding, human disturbance, predation, and pressure from nesting ring-billed gulls have all contributed to declining populations in upstate New York. Within the Long Island coastal region populations have remained stable. Like the least tern, this species has expanded into the North Shore and Peconic Bays areas of the Island.

Osprey

3.354 In the 1950's and 1960's, osprey faced extinction from the effects of the pesticide DDT. Residues of DDT accumulated upward in food chains. DDT was particularly concentrated in fish, the major food of the osprey. Since the osprey represents the top of the food chain, bioaccumulation of DDT and the associated lethal effects were severely felt by this species. DDT interferes with a female osprey's ability to lay normal eggs. The eggshells became very thin and were easily broken, dented, or crushed. By 1966 the number of osprey nests on Gardiners Island in Peconic Bay had dropped from 300 (seen in 1948) to 50. When DDT was finally banned in 1972, these fish hawks began a long, slow recovery. There has been an intensive effort to restore the osprey to its former glory by installing nesting platforms on poles in appropriate habitat. In Rhode Island, ospreys have made nests on the cross arms of power poles. When they used seaweed to build the nests, the water dripped on the power lines, which then short-circuited with disastrous results. To stop this, the power companies put up platforms that were made for osprey or other birds. Workers then climbed up to put backpacks on the ospreys so that when they flew away they could be tracked. The osprey population on Long Island is rising. In 1992, 226 nests were located. If the ban on DDT continues, no new pollution occurs, nesting platforms are provided, and there is enough food supply to feed all the ospreys, the population should continue to grow and remain healthy.

Peregrine Falcon

3.355 The peregrine falcon is a classical example of a species whose population decreased due to the effects of DDT. The eastern population decline began in the late 1940's, and continued into the early 1960's. The last reported nest site in New York was in 1956 (Bull 1974). During the 1960's, peregrine falcon populations dropped to the point where biologists became concerned about the species' extinction. During this decade DDT and other insecticides were prohibited in the United States and a program of reproduction and protection of natural areas was implemented. A program of captive breeding and release of peregrines began in the 1970's, and the population has begun to recover, but the danger of extirpation has not disappeared. Although now protected throughout the United States, these migrating birds spend the winter in countries that are still using toxic chemical compounds.

Cooper's Hawk

3.356 Populations of the Cooper's hawk were thought to be declining as early as the 1930's. Historically, the Cooper's hawk was considered a nuisance species because of its reputation of preying farmyards for roaming chickens. They were hunted as a result. The species continues to decline today for other reasons, including increased urbanization and loss of suitable nesting habitat.

Northern Harrier

3.357 The northern harrier was considered a common bird throughout New York State in the early 1900's. However, by the mid-1990's, the species' numbers had dropped significantly. Andrle and Carroll (1988) reported that the causes for the decline were unclear, but that the period during which it occurred mirrored other raptor populations that were reduced due to pesticide contamination.

3.358 The northern harrier study conducted by England (1989) on the Jones barrier indicated that predation and human disturbance were the primary causal factors for nest failure. An annual mean of 12 nests were identified during the course of this study, with the greatest nesting density occurring at Oak Beach, and secondly at Captree Island. The study also cited habitat loss (particularly in fresh and tidal wetlands) and increasing human population encroachment on harrier breeding areas as significant factors determining harrier breeding success.

Short-Eared Owl

3.359 While population fluctuations may partially obscure long-term trends, in general, short-eared owl populations have declined in North America since 1900. These declines are very evident in the northeastern states, where short-ears have become one of the rarest and most threatened species. However, similar trends have been reported from Ontario to North Dakota and Colorado. As is true for most grassland birds, habitat loss is believed to be the primary factor responsible for the declines of short-eared owls. Overgrazing may also be a factor, especially in western North America.

Barn Owl

3.360 The common barn owl has a spotty distribution within New York State, which may be partially due to the fact that New York is the northern limit of its breeding range. In general, there has been a decline in the species since the 1950's, when farming activities declined. Meadows were no longer maintained, edge areas were eradicated, and farming practices changed. Recent nest box programs may help this species make a comeback.

Upland Sandpiper

3.361 Large numbers of upland sandpiper were historically known to nest within Hempstead Plains in Nassau County. Total loss of this habitat, wetland draining, and hunting pressure caused a serious decline in the species. Within the same area, the abandoned Mitchel Field Airport boasted seven breeding pairs in the mid 1960's. Today, it is an uncommon species due to the total loss of its habitat across New York State. They are found in upstate regions in farming country, although crop changes from grain to corn have also greatly affected the species.

Vesper Sparrow

3.362 As is true for many grassland birds, the breeding distribution of vesper sparrows has noticeably changed during historic times. During the 19th century, it underwent a marked range expansion into the northeastern U.S. and adjacent Canada, becoming relatively numerous in many areas. This range expansion was in response to deforestation and the prevalence of agriculture in this portion of their range. Since the 1940's, however, many of the farmlands have disappeared, producing a noticeable reduction in vesper sparrow populations throughout the northeast. In eastern North America, populations declined sharply through the late 1970's to very low numbers, followed by fairly stable trends. Several factors contributed to the population decline. Loss of grassland habitat to reforestation and urbanization are major factors, although "clean farming" practices such as the removal of hedgerows and the more frequent mowing of hayfields also have contributed to these declines.

Henslow's Sparrow

3.363 Henslow's sparrow was listed nationally as a species of management concern in 1987 and 1995 by USFWS. The major limiting factor for the Henslow's sparrow is habitat loss. At first, agriculture destroyed this bird's habitat, but it also created a new one, in the form of fallow fields. However, habitat continues to disappear as the use of fallow fields diminishes. In New York State the species has been on the decline since the 1950's. It is considered local in distribution and decreasing in numbers in many areas. Continued loss of wetland habitat is also contributing to this species' decline. Active grassland management is necessary to maintain suitable habitat for Henslow's and other grassland species. Without disturbance (i.e., management), upland grasslands will be invaded and eventually replaced by woody growth, excluding Henslow's from using the habitat. Currently, three management techniques are generally used to prevent woody invasion: spring burning, mowing, and grazing.

Grasshopper Sparrow

3.364 The breeding distribution of the grasshopper sparrow has undergone some dramatic changes during historic times, particularly an eastward range expansion during the nineteenth and early twentieth centuries as deforestation increased the availability of suitable habitats (Andrle and Carroll 1988). In recent decades, however, this sparrow has experienced population declines throughout most of its breeding range. As is true for most grassland birds, habitat loss is the factor primarily responsible for the recent declines in grasshopper sparrow populations. In the north-eastern states, the abandonment of farmlands and subsequent reforestation has caused the greatest loss of suitable breeding habitats. Nests are often destroyed by mowing machines as well. Elsewhere, urbanization and the conversion of grasslands to cultivated crops are the most important factors. An addition, the early cutting of hayfields can result in the abandonment of breeding territories and contribute to the annual fluctuations in abundance in some areas.

Common Nighthawk

3.365 The nighthawk is currently on the decline in New York State, particularly in Westchester County and also in other northern counties. Loss of natural nesting habitat due to increased urbanization and human disturbance is partially blamed.

Northeastern Beach Tiger Beetle (Cicindela dorsalis dorsalis)

3.366 The northeastern beach tiger beetle was once abundant along dynamic, undisturbed sandy beaches of the Atlantic coast and the Chesapeake Bay (Hill and Knisley 1994). According to USFWS, the northeastern beach tiger beetle's historic range included Connecticut, Massachusetts, Maryland, New Jersey, New York, Pennsylvania, Rhode Island, and Virginia. Currently, the beetle is restricted to four states, with several known populations in Virginia and Maryland, two in Massachusetts, and one in Sandy Hook, New Jersey. The northeastern beach tiger beetle was listed as threatened by the U.S. Fish and Wildlife Service in 1990 and is currently listed as eliminated from New York (NYSDEC Division of Fish and Wildlife 1987). The northeastern beach tiger beetle was last reported on Fire Island in the 1920's. The New York Natural Heritage Program's database contains a 1928 northeastern beach tiger beetle account from Fire Island.

3.367 Like the adults, the larval northeastern beach tiger beetles are voracious predators. Larvae are found in burrows in the intertidal zone and above the high tide mark (Knisely and Schultz

1997). The larvae anchor themselves to their vertical burrows with hooks located on the fifth abdominal tergite and wait for prey to pass. The larvae feed primarily on small amphipods. To survive periodic flooding, the larvae plug their burrows with sand and remove the sand when the tide recedes (Knisely and Schultz 1997). The larvae remain in the burrow for two years and begin emerging as winged adults in mid-June with peak emergence between early to mid-July.

3.368 Habitat destruction and loss are the primary reasons for the decline of northeastern beach tiger beetles. The decline of the northeastern beach tiger beetle between 1920-1950 coincides with an increase in recreational activity and development along the Atlantic coast (Knisely and Schultz 1997). The northeastern beach tiger beetle is not found in areas where there is heavy vehicle and pedestrian traffic. Vehicle and pedestrian traffic degrades larval habitat and may interfere with adult foraging and mating behavior (Knisely and Schultz 1997). Shoreline modifications that increase erosion may also effect beetle populations by eliminating favorable habitat. Larvae are typically found on beaches that are 5 meters wide or greater (USFWS 1994).

Significant Habitats of the Barrier Island

3.369 Two community-based habitats on Fire Island have been designated as significant by the New York State Natural Heritage Program: the Maritime Holly Forest, and the Maritime Freshwater Interdunal Swale Community.

3.370 The Maritime Holly Forest is an unprotected community of the barrier island with a global ranking of G1, G2 and a state ranking of S1 (see footer of Table 3-13). This is an old growth forest (200-300 years old) that is situated between the dunes and barrier beach (described in the section on vegetation). American holly is the dominant forest species. This habitat represents a typical Krummholz "crooked wood" environment in which the trees on the dune ridges are typically very gnarled in appearance due to the harshness of the environment.

3.371 The Maritime Freshwater Interdunal Swale Community comprises small patches of unprotected wetlands along low elevation dunes which are scattered within the boundaries of the study area. This community has a global ranking of G3, G4, and a state ranking of S2. This community is described in greater detail in the earlier section entitled "Flora of the Barrier Island."

Anthropogenic Stresses

3.372 Anthropogenic stresses to significant barrier habitats and their supportive species originate mostly from developmental and recreational activities along the coastline. Loss and degradation of habitat due to development and shoreline hardening have been major facilitators in the losses of these significant habitats.

3.373 Summer visitor impacts to the natural resource areas can be considerable, especially along the footpaths of the National Seashore on Fire Island. Dune and interdunal areas can be impacted by visitors who trample the vegetation and thereby destabilize the dune structures.

Rare Plant Species of the Barrier Island

3.374 The species described in this section are those that are likely to inhabit the study area. The status of each species is summarized in Table 3-18, according to New York State Conservation Law Section 9-1503, and the Code of Federal Regulations 50 CFR 17. The following information was obtained from the New York State Department of Environmental Conservation Natural Heritage Program (NYNHP).

Table 3-18

Barrier Island Endangered, Threatened, Rare, and Vulnerable Plant Species

Species Common Name	Species Latin Name	NHP Global Rank	NHP State Rank	New York Stat Status	Federal Status
Seabeach amaranth	*Amaranthus pumilus*	G5	S1	Unprotected	LT
Purple everlasting	*Gnaphalium purpureum*	G5	S1	Rare	NA
Seabeach knotweed	*Polygonum glaucum*	G3	S3	Unprotected	NA
Grassleaf ladies' tresses	*Spiranthes vernalis*	G5	S1	Rare	NA
Retrorse flatsedge	*Cyperus retrorsus*	G5	S1	Unprotected	NA
Pine-barren sandwort	*Minuarita caroliniana*	G5	S3	Rare	NA
Swamp sunflower	*Helianthus angustifolius*	G5	S1	Threatened	NA
Slender marsh pink	*Sabatia campanulata*	G5	S1	Endangered	NA
Rough rush-grass	*Sporobolus clandestinus*	G	S1	Unprotected	NA
Flax-leaf whitetop	*Aster solidagineus*	G5	S2	Unprotected	NA
Collins' sedge	*Carex collinsii*	G4	S1,S2	Rare	NA
Variable sedge	*Carex polymorha*	G2,G3	SX	Extirpated	NA
Slender crabgrass	*Digitaria filiformis*	G5	S2	Rare	NA
Soapwort gentian	*Gentiana saponaria*	G5	S1	Rare	NA
Catfoot	*Gnaphalium Helleri var. micradenium*	G4,G5	SH	No Habitat in State	NA
Round field beadgrass	*Papsalum laeve var. circulare*	G4,TU	S1	Unprotected	NA
Opelousa smartweed	*Polygonum hyperpiperoides var. opelo*	G5	S2,S3	Unprotected	NA
Yellow flatsedge	*Cyperus flavescens var. flavescens*	G5,T	S1	Unprotected	NA
Fewflower nutrush	*Scleraia pauciflora var. caroliniana*	G5, T4	S1	Threatened	NA

Note: See Table 3-13 for explanation of global and state ranking and state and federal status.
Source: NHP, NYSDEC 1999

3.375 The state ranking for plants and significant habitats differs slightly from the ranking of wildlife species. Plant rankings include endangered (E), threatened (T), rare (R), and exploitably vulnerable (V). The NYNHP considers these species likely to become threatened in the near future throughout all or a significant portion of their range within the state if causal factors continue unchecked. A brief narrative is provided for each of the plants listed by the state as "endangered," "threatened," or "rare."

3.376 Two of the eight unprotected species are ranked as important on both global and state levels. These include seabeach amaranth and seabeach knotweed, which are both known to occur within the project area. Seabeach amaranth is an annual plant, typically found on actively accreting beaches. In New York State, it tends to be found away from well-developed and stable dune systems and has an affinity for inlets, storm washouts, and other rapidly eroding or accreting shorelines, sometimes precariously close to the surf. Seabeach knotweed is also found on beaches, but may tolerate more rocky areas.

3.377 Purple everlasting (*Gnaphalium purpureum*) is found in the maritime interdunal swales. Associated species include wormwood (*Artemisia campestris*), slender-leaved goldenrod (*Solidago tenuifolia*), and little bluestem (*Andropogon scoparius*).

3.378 Grassleaf ladies'-tresses (*Spiranthes vernalis*) is found in extensive series of interdunal swales fronted by wide sandy beaches associated with jetties and sand spits. A small population exists in stable, good habitat.

3.379 Pine-barren sandwort (*Minuaria caroliniana*) is found on the backside of primary dunes in open areas next to sandy roads.

3.380 Swamp sunflower (*Helianthus angustfolius*) is the only species with a threatened status that is known to exist within the vicinity of the project. It is found in bog areas and pine barrens of the barrier island.

3.381 Slender marsh pink (*Sabatia campanulata*) is found in small shallow depressions in dunes, some with open cranberry mats and some with shrub thickets. It is often associated with sea pink (*Sabatia stellaris*), large cranberry (*Vaccinium macrocarpon*), and yellow-eyed grasses (*Xyris sp.*) in the maritime interdunal swale. A small population exists within the project area.

3.382 Collins' sedge (*Carex collinsii*) is found in sphagnum bogs in woods and has not been identified within the project area. It was identified in the Town of Islip in 1928.

3.383 Slender crabgrass (*Digitaria filiformis*) has not been identified in the project area and was last identified in the Oakdale vicinity in 1959.

3.384 Soapwort gentian (*Gentiana saponaria*) is typically found in damp meadows. It has not been identified in the project area and was last identified in Oakdale in 1929.

3.385 Fewflower nutrush (*Scleria pauciflora var. caroliniana*) is found in open damps sand areas. It has not been identified in the project area and was last identified in Oakdale in 1928.

3.386 Seven additional rare plant species have been reported by the NYNHP as historically occurring in the wetland areas located on the bay side of the Fire Island Barrier. The status of these species is summarized in Table 3-19 and discussed briefly below.

Table 3-19
Rare Plant Species of the Bay Side

Species Common Name	Species Latin Name	NHP Global Rank	NHP State Rank	New York State Status	Federal Status
Golden dock	*Rumex martimus var. fueginus*	G5, T5	S1	Threatened	NA
Narrow-leaf sea-blite	*Sueda linearis*	G5	S1	Unprotected	NA
Graceful sedge	*Carex venusta var. minor*	G4, T4	1	Rare	NA
Nuttall's Lobelia	*Lobelia nuttallii*	G4, G5	S3	Rare	NA
Small-flowered pearlwort	*Sagina decumbens*	G5	S1	Unprotected	NA
Water pygmyweed	*Crassula aquatica*	G5	S1	Endangered	NA
Slender Blue Flag	*Iris prismatica*	G4, G5	S2	Unprotected	NA

Note: See Table 3-13 for explanation of global and state ranking and state and federal status.
Source: NHP, NYSDEC 1999

3.387 Golden dock (*Rumex martimus var. fueginus*) is found on the beach of the bay side of Fire Island. It was last identified within the project area in 1924.

3.388 Graceful sedge (*Carex venusta var. minor*) is found within channelized streams of pine barren areas and where the marsh is ditched and supports phragmites. This sedge was last identified on Fire Island in 1985.

3.389 Nuttall's lobelia (*Lobelia nuttallii*) is associated with the maple/pitch pine and shrubs grading into the salt marsh ditches. Associated species include: broomsedge (*Andropogon virginicus*), bushy beardgrass (*Andropogon glomeratus*), *Rhynchospora capitellata*, slender-leaved goldenrod (*Solidago tenuifolia*), panic grasses (*Panicum sp.*), lance-leaved violet (*Viola lanceoata*), and swamp dewberry (*Rubus hispidus*). *Nuttal's lobelia* was last identified in Islip in 1991.

3.390 Water pygmyweed (*Crassula aquatica*) is typically found on tidal flats. It was last identified on the Carman's River in 1934.

Unprotected Species of Importance

3.391 There are three species of importance known to occur within the study area that have an unprotected status: narrow-leaf sea-blite, small-flowered pearlwort, and slender blue flag. Narrow-leaf sea-blite (*Sueda linearis*) is typically found on salt marshes and on beaches. Small-flowered pearlwort (*Sagina decumbens*) is found along estuarine dredge spoil shorelines that are typically dry, but experience overwash. This plant is typically associated with sand spurreys (*Spergularia sp.*), docks (*Rumex sp.*), crabgrass (*Digitaria sp.*), and seaside goldenrod. Slender blue flag (*Iris* *prismatica*) is typically found in the open marsh 30 meters from the shrub zone. This population was last identified in Islip in 1991 (USFWS Inventory 1997).

Back Bay Environment

3.392 The back bay environment includes the waters and shores of the Great South Bay, as shown in Figure 3-15.

Submerged Aquatic Vegetation

3.393 Submerged Aquatic Vegetation (SAV) such as seagrass meadows dominated by eelgrass (*Zostera marina*) are abundant from Fire Island Inlet to Moriches Inlet. Typically, large meadows have been identified with extensive shallow flats adjacent to the Otis G. Pike Wilderness Area in the east, although sizeable beds have historically been observed elsewhere along Fire Island (Jones and Schubel 1980; Dennison et. al. 1989; Carpenter et. al. 1991). NPS (1997) confirmed these trends, reporting extensive and dense, albeit patchy meadows in the east, and less dense beds in more westerly areas. In most areas, narrow bands of unvegetated substrate, usually a few meters wide, separate eelgrass from the shoreline, although more quiescent areas support some widgeon grass (*Ruppia maritima*) growth within these bands.

3.394 Jones and Schubel (1980) conducted a study related to the distributions of surficial sediment and eelgrass from Smith Point to Wantaugh State Parkway. This study revealed the following:

3.395 Proceeding northerly across the bay, the sediment grain size decreases (becomes finer). Reportably, areas immediately adjacent to the Fire island Inlet are characterized primarily by sand-size particles (90-99 percent by weight) and up to 6 percent gravel and biogenic material. The northern shoreline of the bay is subject to stronger currents, which result in higher turbidity. The northern portions of the bay are characterized by a higher percentage of silts and clays (20 percent by weight) and a lower percentage of sands (80 percent).

3.396 Total organic carbon (TOC) content was typically 0-2 percent along the southern shoreline.

3.397 The thickest eelgrass beds were found in Bellport Bay, Old Inlet, and East and West Fire Island. Old Inlet had very low TOC, a predominance of sand-sized particles in the substrate, adequate circulation from the channel, and possible occurrence of overwash. East and West Fire Island are situated near Fire Island Inlet and also are subject to adequate flushing from tidal action.

The southern shore of the bay supports eelgrass beds up to depths of 1.8 meters, whereas eelgrass beds along the northern shoreline extend to a depth of 0.5 meters.

Ecological Importance of Eelgrass

3.398 Eelgrass beds are an important resource habitat and have fluctuated in density in this area during this century. These meadows reduce the effects of currents and wave action, stabilize sediments, and have high primary production rates. In addition, they provide food and shelter for a diverse community of bay plants and animals. Several animals of commercial importance are abundant in eelgrass meadows and depend on this habitat as a nursery and adult habitat. Larvae of the bay scallop (*Aequipecten irradians*) depend on dense eelgrass for protection from predators. Winter flounder use eelgrass meadows as nursery habitat. The distribution of major waterfowl feeding and nesting areas closely correspond to the distribution of eelgrass meadows.

3.399 NPS (1997) observed 13 species of fish and 4 species of decapods collected from eelgrass beds of Great South Bay from throw trap samples. Fourspine stickleback (*Apeltes quadracus*) was the most abundant fish species, followed in order by bay anchovy, northern pipefish (*Syngnathus fuscus*), and Atlantic silversides (*Menidia menidia*). Notably abundant were seaboard goby (*Gobiosoma ginsburghi*), *mummichog* or common killifish (*Fundulus heteroclitus*), winter flounder, American eel (*Anguilla rostrata*), and oyster toadfish (*Opsanus tau*). Decapods were dominated by the sand shrimp (*Crangon septemspinosa*), followed by the grass shrimp (*Hippolyte pleurocanthus*), shore shrimp (*Palaemonetues pugio*) and blue crab (*Callinectes sapidus*). NPS also found that marsh station eelgrass beds supported higher abundances of total fishes, but not decapods or total nekton when compared to beach eelgrass stations. Although not documented, several gastropods are likely to use eelgrass habitats within the bay. Those species include alternate bittium (*Bittium alternatum*), common periwinkle (*Littorina littorea*), and crescent mitrella (*Mitrella lunata*), and the common shore shrimp (*Palaemonetes vulgaris*).

Water Quality Criteria Affecting Eelgrass

3.400 Water quality in the 75-mile stretch from Great South Bay (Atlantique Beach) to Moriches Bay (Southampton) is strongly influenced by land-use patterns and development on Long Island and the barrier islands. Mean low water within the estuaries range from approximately 7 feet near the Robert Moses Causeway to approximately 4 feet in Moriches Bay. Navigational channels have been dredged along the intracoastal waterway and between Long Island and the barrier island. Most of these channels average 6-10 feet in depth, but may reach as much as 28 feet in depth. The bays are used primarily for navigation, recreation, and commercial shell fishing.

3.401 Bay water derives primarily from groundwater seepage from Long Island and tidal inflow from the Atlantic Ocean through the inlets. Near the center of Great South Bay, the tidal range is approximately 1 foot. Tidal currents during flood tides generally flow eastward from Fire Island Inlet and westward from Moriches Inlet, reversing direction on the ebb. Areas of Fire Island nearest the inlet receive relatively efficient flushing of pollutants due to tidal action. The NYD estimate is 48 days for flushing of Great South Bay (1972). Throughout most of the bay, circulation is strongly influenced by wind. In Moriches Bay, the wind is capable of preventing the normal reversal of tidal currents between ebb and flood tides.

3.402 The question of how overwashes influence back bay water quality is sometimes raised. Tidal exchange into the back bays is on a twice daily frequency at fixed inlets whereas overwashes occur infrequently and at disparate locations. On a first order calculation, the volume of water exchanged through an inlet such as Fire Island is many orders of magnitude greater than that of water exchanged by overwashes, even if they occur in a given year. Based on this, the water quality impacts of overwashes do not seem to be measurable against the nominal background variation.

3.403 Water quality can affect annual eelgrass productivity. Important parameters include salinity, temperature, turbidity, nitrogen and phosphorous, pH, pesticides, TSS, and light attenuation. Although water quality criteria for eelgrass have not been established for Long Island estuaries, some general information available in the literature applies to eelgrass establishment and persistence. It should be noted that water quality criteria has been established for Chesapeake Bay Estuary and Long Island Sound Estuary. Those criteria are presented in Table 3-20.

Table 3-20
Water Quality Criteria for Chesapeake and Long Island Sound Estuaries

Parameter	Chesapeake Bay	Long Island Sound
Light extinction coefficient (K_D)	1.5	0.7
Total suspended solids (TSS)	15 mg/l	< 30 mg/l
Chlorophyll a	15 ug/l	< 5.5 ug/l
Dissolved inorganic nitrogen (DIN)	< 10 umoles	< 10 umoles
Dissolved inorganic phosphorous (DIP)	0.67 umoles	0.7 umoles
Sediment organic matter	—	< 3%

3.404 In the estuaries around Long Island, eelgrass prefer cooler water temperatures. They typically cannot survive in areas where the water temperature never drops below 20 degrees Celsius and become stressed in northern waters when the temperature exceeds 20 degrees Celsius. Eelgrass beds are typically not found in water depths greater than 15 feet for this geographic region. This is believed to be a function of light penetration necessary for photosynthesis. Eelgrass are found in a variety of substrates, from mud to gravel, and are found in areas of elevated salinity. Cashin Associates (1996) indicates that in the Peconic Estuary, eelgrass beds are typically associated with coarse sand and sandy substrates where salinity ranges from 31 parts per thousand (ppt) to 34 ppt. Eelgrass beds are also typically associated with well-flushed waters.

Macroalgae

3.405 A variety of macroalgae species have been reported in Great South Bay. Koetzner (1963) reported 25 algal species, most notably hollow green weeds (*Enteromorpha sp.*), sea lettuce (*Ulva lactuca*), *Sphacelaria cirrosa*, and barrel weed (*Champia parvula*). As part of a finfish study, Briggs and O'Connor (1971) noted the presence of sea lettuce, *Cladophora sp.*, and delicate ribbon weed (*Punctaria latifolia*) at East and West Fire Islands, near Fire Island Inlet in the west. Dennison et. al. (1989) reported large mats of green fleece in eelgrass beds. NPS (1997) found extensive mats of *Chaetomorpha sp.*, primarily in areas adjacent to marshes in the eastern portion of Great South Bay, and only associated with eelgrass and widgeon grass beds. Eelgrass biomass peaked in June and decreased in most subsequent months.

3.406 NPS (1997) found the following trends in Great South Bay: four-spined stickleback abundance was strongly related to macroalgae biomass during July and August; seaboard goby abundance and macroalgae biomass were positively related from August through October; and populations of sand shrimp (Crangon septemspinosa) were negatively related to macroalgae biomass from July through October.

Phytoplankton and Brown Tide

3.407 As reported by New York Sea Grant (1977 and 1993) the planktonic communities of Great South Bay and New York Bight have been studied extensively since 1912. Phytoplankton diversity is in excess of 115 species in the New York Bight (NYCDEP 1990). Plankton communities in the shallow nutrient-rich waters of Great South Bay support a high level of productivity. In general, blooms occur in midsummer and again in the fall or early winter.

3.408 Typically, species assemblages of phytoplankton are dominated by the following species: *Skeletonema costatum, Eutreptia viridis, Thalassionima gravida, Cylindrotheca closterium, Cycotella sp.*, and *Crytomonas sp.*, as well by as numerous centric diatoms and microphytoflagellates. These small forms represent a very productive marine food chain (Duguay et al. 1989). In most cases phytoplankton biomass is nutrient-limited. Kaufman et al. 1984 reports that in the Great South Bay, phytoplankton are never nutrient-limited. The elements limiting the growth of phytoplankton include nitrogen (NO3, NH4), phosphorus (PO4), and silica (Si). As noted, the biomass of phytoplankton increase in response to the addition of these growth limiting nutrients (D'Elia et al, 1986). NPS (1997) found that phytoplankton biomass (measured as chlorophyll a) was lowest in May, increased in June, and stabilized through October in the Great South Bay.

3.409 Recently (1985 to 1987) dense algal booms called "brown tides" have been observed in Great South Bay and the Peconic Estuary. The species responsible for the "brown tide" blooms is (*Aureococcus anophagefferens*), which is a form of chrysophyte. Phytoplankton densities average in the tens of million cells per liter but approach two hundred million cells per liter during blooms. In general the lowest biomass are encountered during July through October as a result of being "grazed down" by the zoo plankton and ichthyoplankton, and the planktonic comb jelly (Mnemiopsis leidyi). It is presently believed that blooms occur when a significantly dry year follows significantly wet years.

Historic Occurrences and Trends

3.410 Eelgrass beds were significantly reduced in Great South Bay and Moriches Bay in the 1930's due to "wasting disease." Scientists working in the Chesapeake Bay area have suggested that increased turbidity and pesticide concentrations caused by increased agricultural use of shore lands may have led to the decline. The reduction of eelgrass beds within the bays ultimately led to the reduction and disappearance of bay biota. By the mid-1960's eelgrass recovered to such densities that it became a nuisance to people using the bay for recreational purposes. This may have been a maxima reached for eelgrass bed distribution within Long Island Estuaries. Following the initial brown tide blooms in 1995 and 1996, eelgrass bed distribution has significantly declined in Great South Bay and Moriches Bay and has not yet recovered.

3.411 Although the long-term effects of algal blooms are not well understood, the adverse effects of past algal blooms suggests that any further rate of nutrient loading, particularly phosphorous, may be harmful to the ecosystem. The earliest survey of phytoplankton in the Great South Bay was carried out in 1907 and 1908 because of concern that the diversion of Long Island's freshwater supply might affect the production of oysters (Whipple 1912). This survey showed that diatoms were the predominant phytoplankton group, and that there were no major differences in their distribution and density from one area of the bay to another. During the 1930's the phytoplankton population in the bay changed. Instead of being dominated by diatoms, a very small (about 1-2 micromoles in diameter) species of green alga became abundant. These alga (identified by Ryther 1954) had a detrimental effect on the growth and harvest of shellfish. The appearance of these green alga were related to the introduction of excreta to the bay from Long Island duck farms. Their major excretory product, uric acid, was converted to urea by bacteria in seawater.

3.412 The closing of Moriches Bay on May 15, 1951 reduced the already slow flushing of duck wastes from eastern Great South Bay and western Moriches Bay and led to extremely dense blooms of these small-form green algae. These were hence termed the "green tides." The recurrence of the "green tides" for several summers afterwards appeared to depend on the restricted circulation of the inshore bays and the overwintering of large enough seed populations to initiate the next summer's growth, similar to observations of the "brown tide." Effluent from duck farms, which flowed into Great South Bay through creeks, were found to be supplying nitrogenous nutrients and promoting growth of the algae *Nannochloris sp.* and *Strichlococcus sp.*, and these effluents were subsequently restricted (Ryther 1954, 1989). In September 1953, Moriches Inlet was reopened by Hurricane Edna, which led to a reduction in severity blooms, since wastes in the Bay were once again flushed more readily to the ocean. Phytoplankton populations in Great South Bay today are much more in balance with respect to their species composition. The phytoplankton in the Bay are dominated by cryptomonads.

3.413 Most recently the bays have experienced dense blooms of *Aureococcus anophagepherens*. These brown tide blooms began in the summer of 1985. These monospecific blooms markedly reduced the extent of eelgrass beds because of increased light attenuation, and decimated populations of commercially valuable bay scallops since the scallops were unable to graze adequately and consequently starved to death (Cosper et al. 1987). Species observed to coexist when brown tide blooms occur include *Nannochloris sp.* and *Minutocellus polymorphus*. Cosper et al., showed by laboratory experiments that growth of *A. anophagefferens* is related to increases in salinity of embayments (linked to reduced annual rain fall) and is likely conducive to the growth of this species. In addition, growth could be related as well to the presence of organic nutrients and inorganic micronutrients that enter the bays via freshwater runoff or groundwater inputs leading to higher productivity and biomass in near shore areas. It should be noted that water quality is also affected by sewage treatment and the reduction of freshwater inflow from Long Island streams (e.g., Southwest Sewer District). Also, alteration to flushing rates may facilitate the blooms. From experiments, it does not appear that *A. anophagefferens* excretes compounds that inhibit the growth of other phytoplankton commonly found in Long Island embayments.

3.414 In summary, the following quotation is offered: "An emergent theme from many papers is that the convergence of perhaps subtle, but long-term anthropogenic and eutrophication effects with periodic environmental conditions forced by meteorological conditions can result in dramatic phytoplankton blooms" (Cosper et al. 1987).

Back Bay Invertebrates

3.415 The invertebrate communities associated with the back bay waters of the study area (Great South Bay and Moriches Bay) can be divided into four basic groups: 1) the macrobenthic community; 2) the shellfish; 3) the crustaceans; and 4) the sea stars. The macrobenthic community consists of very small organisms (i.e., worms, clams, and crustacean) found living in the bay sediments. The shellfish are considered to be of commercial or recreational importance, particularly the larger species, including the American oyster, hard clam, bay scallop, and whelks. The crustaceans include such species as the blue crab, rock crab, sand's grass shrimp, etc. The sea stars are represented only by Forbe's asterias.

Benthic Invertebrates

3.416 According to New York Sea Grant (1993), the macrobenthic invertebrates fall into readily distinguishable communities; one community is generally associated with high salinities (>28 ppt) near the major tidal inlets (Fire Island and Moriches); the other with lower salinity waters. These communities can be further subdivided based on the presence or absence of submerged aquatic vegetation (principally eelgrass) or can be grouped according to their substrate type (well-sorted sands, fine-grained sands, or silts/clays/clayey silts). These physical parameters will dictate the macrobenthic species assemblages in any particular area.

3.417 In general, Moriches Bay is dominated by the blue mussel (*Mytilus edulis*), the four-eyed amphipod (*Ampelisca abdita*), the polychaete worms (*Heteromastis filiformis*), capitellid thread worm (*Capitalla capitata*), fringed worm (*Tharyx acutus*), lumbreneid thread worm (*Lumbrineris tenuis*), red-lined worm (*Nephtys picta*), clam worm (*Nereis succinea*) and bloodworm (*Glycera americana*). In addition, the small clams gem shell (*Gemma gemma*) and dwarf tellin are also abundant in Moriches Bay.

3.418 Benthic species found in Great South Bay are also dominated by the blue mussel. Dwarf tellin, *Nereis succinea*, gem shell, Nephtys picta, bamboo worms (*Clymenella torquata*) and hard clams (*Mercenaria mercenaria*) are abundant in both bays as well, along with the polychaete worms *Nereis arenaceodonta*, sand-builder worm (*Sabellaria vulgaris*), Dumeril's clam worm (*Platynereis dummerilli*), and opal worm (*Arabella iricolor*). The small clams previously mentioned are also present in Great South Bay in addition to the little surf clam (*Mulinia lateralis*) and veiled clam (*Solemya velum*).

3.419 While there is an overlap in habitat preference by benthic invertebrates, the silty-clay soft bottom areas are clearly dominated by the four-eyed amphipod (*Ampelisca abdita*) and little surf clam (*Mulinia lateralis*). In addition, blood worm (*Glycera americana*), polychaete worm (*Heteromastus filiformis*), capitellid thread worm (*Capitella capitata*), and mudworm (*Polydora ligni*) characterize a muddy substrate.

3.420 Areas of the estuary that support populations of eelgrass have a slightly different benthic community associated with them. Areas of eelgrass support higher numbers of gastropods (i.e., snails), in particular the alternate bittium, common periwinkle, and crescent mitrella. In addition to other invertebrates, such as the common shore shrimp and the isopod (*Idotea baltica*), all of the species previously discussed are likely to be encountered in the eelgrass habitat.

3.421 Species associated with the high salinity (>28 ppt) environment would be dominated by blue mussels, dwarf tellin, red-lined worm (*Nephtys picta*), polychaete worms (*Nereis arenaceodonta*), and Forbes asterias sea stars.

Shellfish

3.422 There is a significant overlap between the previously discussed benthic invertebrates, which include various shellfish species, and this shellfish section. The main focus of this section will be the larger shellfish species (i.e., hard clams, bay scallops, oysters, softshell clams, and whelks). All of these species have at one time or another been considered to be of either commercial or recreational importance.

3.423 The most significant shellfish species discussed here is the hard clam, which has been harvested in Great South Bay since approximately 1870 (NYSDOS/NMFS 1997). The hard clam can be found from sub-tidal waters to 60 feet wherever the salinity exceeds 15 ppt, with the optimum salinity being 24 to 32 ppt. Hard clams can be found in a wide variety of sediment types but show a strong correlation to areas of low silt-clay content, along with the presence of relict oyster reefs and/or deposits of shell fragment (Kassner et al. 1991).

3.424 The distribution of hard clams is patchy at best, with samples ranging from zero to 70 clams per meter square and with a baywide average of 4.02 clams per meter square for all sizing during 1989 (Kassner et al. 1991). Great concentrations appear to be located in the central portion of the bay.

3.425 As with all commercially exploited species, the hard clam population has steadily declined over the past 20 years. Hard clam catches averaged 576,000 bushels/year from 1970 through 1979 but have dropped to 170,000 bushels/year from 1980 through 1989. The hard clam represents 60 percent of the annual seafood harvest (shellfish and finfish) in Great South Bay (NMFS landing data 1990). The remaining species are softshell clam, bay scallop, blue mussel, and blue crab.

3.426 The softshell clam is found from the intertidal to the subtidal zone to a maximum depth of 30 feet. The softshell clam is generally found in lower salinities (a minimum of 5 ppt) and on muddier bottoms than the hard clam.

3.427 The common oyster is usually found in intertidal to subtidal zones at shallow depths. The oyster can be found in salinities from 5-30 ppt, but is intolerant of prolonged exposure to fresh-water or marine salinities (Gosner 1978). The oyster supported a large commercial fishery from the 1870's to the complete collapse of Great South Bay oyster stocks in the early 1930's. The opening of Moriches Inlet increased salinity, which helped increase abundances of the oyster drill, a major predator of common oysters.

3.428 Bay scallops, like the oyster, were part of a large commercial fishery business. The bay scallop can be found from the gulf of Mexico to Cape Cod, from the low tide line down to 50 feet on a variety of bottoms. The life cycle of the bay scallop is closely linked with eelgrass. Bay scallop populations have crashed with the eelgrass blight that began in the 1930's, and in some areas neither grass nor scallops have recovered. Currently, bay scallops do not exist in harvestable numbers in Great South Bay. There has been no sustained fishery for this species for the past 20 years (New York Sea Grant 1993).

3.429 The channeled whelk, when found in significant numbers such as in Long Island Sound, is considered to be a commercially important species. In the Great South Bay it is considered a significant predator of hard clams. The channeled whelk is found in low abundances throughout Great South Bay (New York Sea Grant 1993).

3.430 Two additional gastropod species which are common and abundant in the Great South Bay are the mud dog whelk (*Nassarius obsoletus*) and the oyster drill (*Urosalpinx cenerea*). Both are small snails with a maximum length of 1 inch (New York Sea Grant 1993).

3.431 The mud dog whelk is typically found in the intertidal to subtidal zone in shallow waters with a muddy substrate. This species is a scavenger and will concentrate in great numbers around a dead fish (Gosner 1978).

3.432 The oyster drill can be found in intertidal portions of the bay down to a depth of approximately 50 feet. Oyster drills prefer water with a minimum of 15 ppt.

3.433 This major pest of oysters commonly destroys 60 percent or more of the seed crop in parts of Long Island (Gosner 1978). The oyster drill has been implicated in the collapse of the oyster industry in the early 1930's, following the opening of Moriches Inlet which increased the salinity levels permitting any increase in oyster drill abundance (NYSDOS/ USFWS 1997).

Crustaceans

3.434 The most prominent crustacean in the Fire Island estuary is the blue crab. Over 1.7 million pounds of blue crab worth $1.5 million were landed in New York in 1995 (NMFS statistic 1998). A significant portion of these landing came from the Great South Bay. The other crustaceans of commercial importance are the American lobster, the horseshoe crab (*Limulus polyphemus*), and grass shrimp.

3.435 The American lobster's distribution is limited to the high salinity areas close to either the Fire Island Inlet or Moriches Inlet. The greatest concentration is most likely to be found in the vicinity of the NYSDEC artificial reef located in Great South Bay near Kismet, New York (Briggs and Zawacki 1974). The reef is located in 16-26 feet of water and consists of wood barges, concrete block, tire units, and culvert pipe (Berg 1990). Most of the lobsters found on the reef are either juveniles or sub-adults below harvestable size.

3.436 Nearly 500,000 pounds of horseshoe crabs were harvested in New York in 1995; the catch was worth approximately $49,000 (NMFS Stats 1998). These crabs are harvested primarily for bait in the American eel and channeled whelk fisheries. In general, horseshoe crabs are widely scattered except during spawning season (May/June) when they congregate near intertidal sand flats (New York Sea Grant 1993).

3.437 The small grass shrimp is harvested as a bait in conjunction with the weakfish recreational fishery. Approximately 2,300 pounds of grass shrimp were collected in 1995 (NMFS 1998). A higher abundance of grass shrimp is generally associated with submerged aquatic plant beds in addition to open sandy shallows or clinging to pilings (Gosner 1979). This species can tolerate substantial pollution and is most often found on a substratum rather than swimming free.

3.438 Other crustacean species found to be abundant in the Fire Island estuary include the long-clawed hermit crab (*Pagurus longicarpus*), the lady crab, the rock crab, and the mud crab (*Dyspanopeus sayi*). Both the hermit and lady crab are more abundant in open unvegetated portions of the bay, while the abundance of the rock and mud crab is controlled by the distribution of the vegetation.

Sea Stars

3.439 Only one species of sea star—Forbe's asterias—is found in the Fire Island estuary. In general, this species is found from Maine to the Gulf of Mexico in the intertidal zone down to 150 feet. The sea star can tolerate brackish water to a salinity of 15-20 ppt. They are common in rocky tide pools, near jetties and pilings, but also occur on sandy or stone bottoms (Gosner 1979). The New York Sea Grant study (1993) reported that Forbe's sea star appears to be the most restricted of the high salinity (28 ppt) species. The report indicated that the sea star is limited in distribution to the Fire Island Inlet and channel areas leading from the Inlet.

3.440 Forbe's sea star has been identified as a species that preys heavily on newly settled spats of oysters and hard clam.

Finfish

Resident Species

3.441 A total of 40 fish species have been reported to occur in the Great South Bay (Briggs 1971). Between May 1967 and November 1968, a total of 310 seine hauls were made at paired stations, representing naturally vegetated bottoms and sand-filled bottoms at three sites in Great South Bay on Long Island. A total of 40 species, represented by 1,124,593 individuals, was collected throughout the study program. Table 3-21 lists and enumerates the species. It is possible that the bay supports far more species. The estuarine environment north of Fire Island supports at least eleven known species considered to be year-round residents. The species reported by Brim & Schreiber (1972) were as follows: Atlantic silverside, striped killifish (*Fundulus majalis*), winter flounder, four-spined stickleback, northern pipefish, mummichog, cunner, tautog, sheepshead minnow (*Cyprinodon variegatus*), American eel, and oyster toadfish. One additional fish species was reported to occur in the Great South Bay, the three-spined stickleback (*Gasterosteus aculeatus*). New York Sea Grant (1993) reported the findings of Briggs and O'Connor (1971) and Honlon (1983).

3.442 Most of the year-round residents are closely associated with the eelgrass (Zostera marina) bed found in the estuary. The eelgrass provides protection from predators and severe weather during the winter. The only species not showing a higher faunal density in the eelgrass were the American eel, oyster toadfish, and winter flounder (Briggs and O'Connor 1971).

Table 3-21		
Species and Number of Fish Seined throughout Great South Bay in 1967 and 1968		
Common Name	Scientific Name	Total Number Collected
Atlantic silverside	*Menidia menidia*	647,527
Fourspine stickleback	*Apeltes quadracus*	288,480
Striped killifish	*Fundulus majalis*	89,073
Mummichog	*Fundulus heteroclitus*	56,674
Sheepshead minnow	*Cyprinodon variegatus*	17,471
Northern puffer	*Sphoeroides maculatus*	7,971
Northern pipefish	*Syngnathus fuscus*	4,884
Atlantic needlefish	*Strongylura marina*	2,631
White mullet	*Mugil curema*	2,577
Striped mullet	*Mugil cephalus*	1,796
Threespine stickleback	*Gasterosteus aculeatus*	1,969
Winter flounder	*Pleuronectes americanus*	841
Silver perch	*Bairdiella chrysura*	486
American eel	*Anguilla rostrata*	470
Northern kingfish	*Menticirrhus saxatilis*	344
Rainwater killifish	*Lucania parva*	340
Tautog	*Tautoga onitis*	194
Oyster toadfish	*Opsanus tau*	194
Cunner	*Tautogolabrus adspersus*	143
Atlantic herring	*Clupea harengus*	127
Tidewater silverside	*Menidia beryllina*	125
Bluefish	*Pomatomus saltatrix*	109
Bay anchovy	*Anchoa mitchilli*	40
Atlantic menhaden	*Brevoortia tyrannus*	40
Pollock	*Pollachius virens*	20
Blueback herring	*Alosa aestivalis*	19
Atlantic tomcod	*Microgadus tomcod*	17
Permit	*Trachinotus falcatus*	7
Northern sennet	*Sphyraena borealis*	4
American sand lance	*Ammodytes americanus*	3
Windowpane	*Scophthalmus aquosus*	3
Spotted hake	*Urophycis regius*	3
Alewife	*Alosa pseudoharengus*	2
Gray snapper	*Lutjanus griseus*	2
Grubby	*Myoxocephthalus aenaeus*	2
Black seabass	*Centropristis striata*	1
Smooth trunkfish	*Lactophrys triqueter*	1
Northern searobin	*Prionotus carolinus*	1
Scup	*Stenotomus chrysops*	1
White hake	*Urophycis tenuis*	1
Total Collected		1,124,593
Source: Brim and Schreiber 1972		

Transient Species

3.443 All of the transient fish species reported to occur in the nearshore environment have been reported to occur in the back bay habitat as well. Species include the striped bass, bluefish, weakfish, black sea bass, northern kingfish, summer flounder, windowpane, northern puffer, and Atlantic menhaden. These fish are all important to both the commercial and recreational fisheries. The only dominant transient species which is of no commercial or recreational importance is the bay anchovy, which is considered to be a prime forage species.

3.444 At least 18 of the transient fish species utilize the estuarine environment as a breeding or nursery ground. The eggs of 17 fish species and the larvae of 23 fish have been identified in the Great South Bay (Monteleone 1992). The eggs of the bay anchovy accounted for 96 percent of all eggs identified, and the larvae comprised 69 percent of the catch.

3.445 Most of the fish species identified spawn in the estuary. Larvae and juveniles all develop within the same estuary. Two species spawn in the nearshore and offshore waters with the eggs, larvae, or juveniles transported into the estuary by the currents. Those two species are the Atlantic mackerel and the bluefish. The mackerel spawns in the nearshore area and the eggs are carried into the bay. Bluefish spawn far offshore; eggs hatch and the larvae develop into juveniles by the time they reach the bay (Nyman and Conover 1988).

Seasonal and Long-Term Trends

3.446 Migratory fish species begin moving into the estuary in late April, with numbers peaking in May and June. The same species begins migration out of the bay in September as the water temperature begins to drop; this migration is completed by late November/early December. The most notable exception to this pattern is the winter flounder. A resident population of winter flounder can be found in the estuary, with adults present from September/October to May, and young flounder present all year long. Winter flounder spawning occurs primarily in February through April. The sand lance is another winter spawner with peak activity observed in March through April.

3.447 All other fish species spawning in the estuary begin in April and are completed by August, with the peak beginning in May through July (Monteleone 1992).

3.448 As discussed in the Offshore Finfish Section, and reported by NOAA (1995) and NMFS (1998), the abundance of almost all fish species is currently declining. Over-harvesting by both commercial and recreational fishermen and the loss of intertidal habitat, as well as the cyclic nature of many fish species, are contributing to the decline.

Back Bay Avifauna

Diving Birds

3.449 The bay waters along the Great South Bay shoreline of Fire Island from Fire Island Inlet to Smith Point are considered to have outstanding or high value feeding habitat for diving ducks (USFWS, October 1997). The diving ducks utilize the shallow open water of the bays for feeding. The diving birds found in this study area feed primarily on benthic invertebrates such as clams, mussels, and snails. Of the diving ducks, the most abundant species that were observed by USFWS (October 1997) included greater scaup (*Aythya marila*), common goldeneye (*Bucephala clangula*), and red-breasted merganser (*Mergus serrator*). These three diving birds are all wintering diving species.

3.450 The common goldeneye has a New York State status as a game species, as it is open for hunting during part of the year, and protected for another part of the year. Common loons (*Gavia immer*), red-throated loons (*Gavia stellata*), buffleheads (*Bucephala albeola*), ruddy duck (*Oxyura jamaicensis*), and hooded mergansers (*Lophodytes cucullatus*) are other diving species that over-winter in the study site. Common loons are considered by NYSDEC as a species of special concern (February 1993).

Wading Birds

3.451 Long-legged waders that utilize the study area include herons, egrets, and ibises. These birds are among the most conspicuous and ecologically significant birds of the New York Bight region, according to Howe (1978). These birds obtain most of their food from shallow areas of salt marshes and estuaries. Their diet includes primarily fishes, amphibians, and invertebrates. In the study area, there has been a slight increase in nesting tricolored herons, while there has been a general decline in yellow-crowned night herons (*Nyctanassa violacea*) and cattle egrets (*Bubulcus ibis*) (Cashin 1993).

3.452 The great-blue heron (*Ardea herodias*) and black-crowned night heron (*Nycticorax nycticorax*) are both considered sedentary species. Some of the individuals in the population will migrate, and some will remain year-round in the study area (Bull 1976). The least bittern (*Ixobrychus exilis*) is listed by NYSDEC as a species of special concern and has been observed in the study site.

Waterfowl

3.453 According to the USFWS (1997), the principal uses of the study area for waterfowl are for resting and feeding during fall migration, peaking in November, and for overwintering. The areas within the study that have outstanding or high feeding habitat value for dabbling ducks include Captree Island, the area around East and West Fire Islands, and the Fire Island Wilderness marshes. Among the waterfowl that were observed in the study area, mallards, American black duck (*Anas rubripes*), brant (*Branta bernicla*), and Canada geese (*Branta canadensis*) were the most abundant (USFWS 1997). Black duck, mallards (*Anas platyrhynchos*), and brant are waterfowl species that overwinter in the study area. The black duck is a migratory species that moves south as the bay marshes freeze up. In the past 40 years the American black duck populations have declined dramatically. The North American Waterfowl Management Plan identified the American black duck as a species of immediate international concern.

3.454 The most valuable sections of Great South Bay for dabbling ducks encompass shallow water areas along Fire Island, from the Smith Point Bridge to county-owned lands east of the bridge, and shoals near East Fire, West Fire, Sexton and Captree Islands. Shallow water areas near Ridge, East Fire, West Fire, and Sexton Islands are important feeding sites for Canada geese and for brant. Canadian geese have been defined as having two distinct populations on the study site, one resident and one migratory. The resident population has been considered a nuisance.

3.455 The wetlands of Fire Island and the small islands in Great South Bay are prime hunting grounds for migratory waterfowl under state and federal regulation. Banding studies indicate that the south shore bays of Long Island receive most of the dabbling ducks from the coastal flight and are a wintering ground for many and a resting area for others that continue later further south along the coast (USFWS 1981).

Colonial Waterbirds

3.456 The double-crested cormorant is considered a sedentary resident. Some individuals migrate, while others remain in the study area year-round. Piping plovers and roseate, common, and least terns all utilize the back bay environment to some degree, and are discussed in the Rare and Endangered Species section. Gulls such as the herring and the great black-backed are other species that commonly utilize the back bay area of the study site.

Herpetiles

3.457 Mud turtles are considered to be semi-aquatic, frequently wandering away from water. The preferred habitat includes small ponds and marshes. They have a strong tolerance for brackish water and are often found at the inner edges of tidal marshes. However, this species only exists in low numbers along the south shore barrier islands because it is on the extreme edge of its nominal northern range.

3.458 Diamondback terrapins are much more common on the backbay sides of the barrier islands. They forage in the tidal creeks of marshes and even in the open bays. They feed on marine snails, clams and worms. Typically, diamondbacks come ashore to lay their eggs in June, which hatch out later in the summer.

Back Bay Threatened and Endangered Avian Species

3.459 The back bay habitat contains breeding habitat for many of the rare species that utilize the barrier beach and/or offshore ecosystem, including the piping plover, northern harrier, terns, common loon, and black rail. Discussions of life history, critical habitats, and anthropogenic effects are addressed for all these species in the prior Barrier Island section, with the exception of the black rail, which is addressed below.

Resident

3.460 The great blue heron and the black-crowned night heron are both sedentary resident protected species and are classified in Table 3-22. Unlike endangered or threatened species, protected species have no additional legal protection under the state's Environmental Conservation Law. A segment of the population for both species remains overwinter within the study area. Black-crowned night heron are known to be nesting within the study area. Great blue heron forage for prey along the shorelines; little nesting activity has been reported.

Table 3-22

Threatened and Endangered Resident Wildlife of the Back Bay

Species Common Name	Species Latin Name	NHP Global Rank	NHP State Rank	New York State Status	Federal Status
Great Blue Heron	*Ardea herodias*	G5	S5	P	NA
Black-crowned Night Heron	*Nycticorax nycticorax*	G5	S3	P	NA

Note: Please see Table 3-13 for explanation of rank and status.

Migratory

3.461 Table 3-23 presents the threatened migratory wildlife species known to utilize the back bay ecosystem. Many of the species listed as endangered, threatened, or species of special concern also utilize the barrier beach ecosystem and are repeated in this table. Life history information for these species has been addressed earlier in the Barrier Island section.

Common Loon

3.462 The common loon is classified as a winter migrant throughout the study area. The number of loons observed on Long Island fluctuates from year to year. Bull (1974) notes a greater number of loons observed on Long Island after severe freezes on interior waters. Summering nonbreeders can be seen on Long Island as well. The common loon is a true diving bird, swimming below the surface for fish, their primary food source.

Table 3-23					
Threatened and Endangered Migratory Wildlife of the Back Bay					
Species Common Name	**Species Latin Name**	**NHP Global Rank**	**NHP State Rank**	**New York State Status**	**Federal Status**
Piping Plover	*Charadrius melodus*	G3	S2B	E	LELT
Least Tern	*Sterna antillarum*	G4	S3B	E	NA
Roseate Tern	*Sterna dougallii*	G4	S1B	E	LELTNL
Common Tern	*Sterna hirundo*	G5	S3B	T	NA
Northern Harrier	*Circus cyaneus*	G5	S3	T	NA
Osprey	*Pandion haliaetus*	G5	S4	T	NA
Common Loon	*Gavia immer*	G5	S3S4	P SC	NA
Black Rail	*Laterallus jamaicensis*	G4	S1B	P SC	NA
Least Bittern	*Ixobrychus exilis*	G5	S3	P SC	NA
Double-Crested Cormorant	*Phalacrocorax auritus*	G5	S3	P	NA
Caspian Tern	*Sterna caspia*	G5	S1	P	NA
Gull-billed Tern	*Sterna nilotica*	G5	S1	P	NA
Forster's Tern	*Sterna forsteri*	G5	S1	P	NA
Laughing Gull	*Larus atricilla*	G5	S1	P	NA
American Oystercatcher	*Haematopus palliatus*	G5	S3	P	NA
Saltmarsh Sharp-tailed Sparrow	*Ammodramus caudacutus*	G4	S3	P	NA
Great Egret	*Ardea alba*	G5	S2	P	NA
Great Blue Heron	*Ardea herodias*	G5	S5	P	NA
American Bittern	*Botaurus lentiginosus*	G4	S4	P	NA
Cattle Egret	*Bubulcus ibis*	G5	S2	• P	NA
Common Goldeneye	*Bucephela clangula*	G5	S2	P	NA
Little Blue Heron	*Egretta caerulea*	G5	S2	P	NA
Snowy Egret	*Egretta thula*	G5	S2S3	P	NA
Tricolored Heron	*Egretta tricolor*	G5	S2	P	NA
Yellow-crowned Night Heron	*Nyctanassa violacea*	G5	S2	P	NA
Black-crowned Night Heron	*Nycticorax nycticorax*	G5	S3	P	NA
Ruddy Duck	*Oxyura jamaicensis*	G5	S1	P	NA
Glossy Ibis	*Plegadis falcinellus*	G5	S2	P	NA
Pied-billed Grebe	*Podilymbus podiceps*	G5	S3	P	NA
King Rail	*Rallus elegans*	G4G5	S1	P	NA
Clapper Rail	*Rallus longirostris*	G5	S3	P	NA
American Oystercatcher	*Haematopus palliatus*	G5	S3	P	NA
Black Skimmer	*Rynchops niger*	G5	S2	P SC	NA
Note: See Table 3-13 for explanation of global and state ranking and state and federal status.					

Black Rail

3.463 Due to their secretive nature and small size, little is known of the life history and behavior of black rails. In the late 1960's, four individuals were discovered in Oak Beach Marsh, although no nests were found. During the Breeding Bird Atlas Project in the mid 1980's, several individual singing males were heard within this Long Island Marsh. These birds typically nest in the upper reaches of the high tide line in coastal salt marshes. Black rails need high (damp ground and shallow water) marshes with little annual and/or daily fluctuations in water levels. Nest desertion is common if they are disturbed.

Least Bittern

3.464 The least bittern belongs to the same family as the herons and the egrets. The least bittern nests in marsh environments on Long Island and prefers open canopy wetlands, frequently with cat-tails, in areas in upstate New York. The number of eggs in a clutch varies from 2 to 6. It has been suggested that least bitterns can have two broods in one season. Although historic records seem fairly complete, current data is scarce for this species. The Breeding Bird Atlas found few confirmed breeding sites on Long Island. Within the study area, possible breeding sites were noted.

Anthropogenic Stresses

Common Loon

3.465 Typical of many of the species discussed, hunting pressure was the major cause of historical declines in populations. Upstate lakes and ponds were common hunting grounds in the mid-1800's. More recent threats include acidification of lake habitat and resulting decreased food availability, predators raiding nest sites, and abandonment of nests caused by human disturbance.

Black Rail

3.466 New York is the northern limit of the black rail's range. This elusive bird is difficult to find, which contributes to its rare status. In the late 1930's, the creation of mosquito ditches and DDT spraying may have impacted the existing population of black rail on Long Island, but this has not been confirmed. In other states, the causes of decline of this species fall into three basic categories: habitat loss, predation, and contamination. Currently the species is confined to mostly pristine remnants of historical tidal marshlands, mainly along the large tributaries. There is no evidence that black rails recolonize restored marshes for breeding.

Least Bittern

3.467 The main factor for the decline in the numbers of least bitterns is loss of habitat due to the drainage of wetlands. Natural succession, or the natural filling in of wetlands, has also been a cause of habitat loss. Human disturbance during the nesting period is a second important limiting factor. Recreational water boats which create high waves can also adversely affect the reproductive success of least bitterns. Human-related mortality can be divided into two parts, both related to the fact that least bitterns are partially nocturnal: some birds are killed by cars, and many birds run into utility lines or buildings. Mercury contamination may be a problem for least bitterns as well, especially those in the Great Lakes area; this is presently under study. New York is the northern limit of this species' range (Andrle and Carroll 1988).

Sea Turtles

3.468 In general, the occurrence of sea turtles in the oceanic environment are juvenile specimens. There are four species of sea turtles that occur seasonally in the waters in the vicinity of Long Island, though they never come ashore, according to Sadove and Cardinale (1993). The two most abundantly observed species in past studies include the Kemp's ridley (*Lepidochelys kempi*) and the loggerhead sea turtle (*Caretta caretta*). The three other species of sea turtles that have been observed in this study area, though to a much lesser degree, include the green sea turtle (*Chelonia mydas*), and the leatherback sea turtle (*Dermochelys coriacea*), and the hawksbill sea turtle (*Eretomochelys imbricata*).

3.469 The hawksbill sea turtle is rare and probably only an anomalous visitor to the study area. Studies have demonstrated that the New York Bight is an important developmental habitat for the highly endangered Kemp's ridley, as well as a major feeding area for leatherback, green, and loggerhead sea turtles. Additional reports (Morrcale, Meylan, Sadave and Standora 1992, Morrcale and Standora 1988, 1989, 1990, 1991 and 1992) all clearly indicate that the ultimate destination of sea turtle migration are the waters of Peconic Bay, NY. The waters south of Long Island are only briefly passed through during migration. While sea turtles have been known to occur in the waters surrounding the study area, their nesting has been documented only as far north as New Jersey (NRC 1990).

3.470 These sea turtles begin arriving in the waters surrounding the study area in June and July and remain several weeks. The sea turtles have been reported to leave the waters surrounding the study area by late fall because of the decreasing temperatures. It has been shown by the Okeanos Ocean Research Foundation and the Return a Gift to Wildlife Program that the three sea turtle species mentioned above are capable of exhibiting very high growth rates while in New York. This has been attributed to the vast amount of available food resources in the area. Kemp's ridley and loggerheads feed primarily on benthic crustaceans, while green sea turtles feed on eelgrass and algae. All sea turtles found in the waters surrounding the study area have been found to feed on submerged aquatic vegetation including green fleece, sea lettuce, and eelgrass.

3.471 Table 3-24 lists the sea turtle species expected to utilize the back bay waters of the study area, and provides the State, Federal and Natural Heritage Program rankings. A discussion of the life history information for each species and anthropogenic effects also follows.

Table 3-24					
Sea Turtles of the Back Bay					
Species Common Name	Species Latin Name	NHP Global Rank	NHP State Rank	New York State Status	Federal Status
Loggerhead Sea Turtle	*Caretta caretta*	G3	SZN	T	LT
Green Sea Turtle	*Chelonia mydas*	G3	SZN	T	LELT
Leatherback Sea Turtle	*Dermochelys coriacea*	G3	SZN	E	LE
Kemp's Ridley Sea Turtle	*Lepidochelys kempi*	G3	SR	T	LT
Hawksbill Sea Turtle	*Eretmochelys imbricata imbricata*	G3	SR	E	LE
Note: See Table 3-13 for explanation of global and state ranking and state and federal status.					

Loggerhead Sea Turtle

3.472 Numerous studies have been conducted documenting the abundance and distribution of the loggerhead sea turtle. The loggerhead sea turtle has a similar distribution pattern to that of the Kemp's ridley, with a somewhat greater number of individuals found in the New York Bight.

3.473 Extensive ground and aerial surveys as recently as 1990 put loggerhead nest estimates at 50,000-70,000 per year in the southeastern U.S. These numbers may not include the abundance of juvenile turtles based on their small size, as well as individuals that swim below the surface and are missed during counting performed by aerial surveys. An estimated 14,000 females nest in the southeastern U.S. each year. This number represents approximately 35-40 percent of the world population of loggerhead turtles. It is assumed that hatchlings live out their "lost years" in rafts of sargassum and/or debris in open ocean drift lines. They remain part of this drifting community and grow to 40 or 50 cm carapace length. They then migrate to the shallower coastal waters, which become their foraging habitat.

3.474 In the study area, the loggerhead turtle is present only for brief periods during migrations to and from the preferred foraging areas of Long Island. Two groups are represented in the area. One group consists of juveniles that are found in the Peconic Bay and Long Island Sound. The second group is found off the south shore of Long Island up to forty miles offshore (Morrcale, Meylan and Bauman 1989).

3.475 Subadult and adult loggerheads primarily feed upon bottom dwelling invertebrates. The loggerhead has been shown to feed on an array of crab species, particularly horseshoe, green and portunid crabs. Loggerheads sometimes scavenge fish or fish parts, but they are not considered fish eaters.

Green Sea Turtle

3.476 Green sea turtles are found in the Atlantic Ocean, the Gulf of Mexico, the Mediterranean Sea, the Indo-Pacific region, and along the Argentine coast. They stay in coastal waters, bays, lagoons, and estuaries where they feed on sea grasses and algae. Females often come ashore to nest several times in a season, but wait two or three years before nesting again. Green turtles nest only at night and can be frightened away by lights or movement. After depositing about 100 eggs, the female returns to the sea, leaving the eggs to incubate during the next two months. Once out of the nest, the hatchlings race to the water and swim constantly for the next 36 to 48 hours. They are then probably carried by currents to favorable areas in the open ocean, where they grow for several years until they join adult and juvenile turtles at the coastal feeding grounds.

3.477 Within the study area, the green sea turtle is found within primarily the Peconic Bay and Long Island Sound from June through October (Morrcale et al. 1989). During the months of November and December, stray individuals have been recovered, but do not survive well in the frigid waters. The green turtle feeds on sea grasses primarily. While in the open ocean, young green turtles are probably carnivorous and feed on invertebrates such as jellyfish. The macroalgae, sea lettuce and green fleece serve as the primary food sources for juvenile and adult green sea turtles in the study area, and probably dictate their distribution to an extent; however, a detailed study of their feeding habits does not exist. Green turtles of a wide range of sizes and assumed ages have been found. Up to 100 individual green turtles have been observed in a single season (Morrcale, Meylan and Brumann 1989).

Leatherback Sea Turtle

3.478 The leatherback is the largest living turtle. The Leatherback turtle's range extends from Cape Sable, Nova Scotia, south to Puerto Rico and the U.S. Virgin Islands. Critical habitat for the leatherback includes the oceanic waters located between mean high tide and a 600-foot depth offshore. Leatherback sea turtles nest south of the study area, from Georgia to the U.S. Virgin Islands.

3.479 In the New York Bight, leatherback juveniles and adults are the most commonly observed sea turtle found in our area from May through November. Although they utilize the offshore region within the study area, they are not found within the back bay areas. They commonly feed on jellyfish and ctenophores. It is estimated that 500-800 individuals visit the region annually (Sadove and Cardinale 1993).

Kemp's Ridley Sea Turtle

3.480 The Kemp's ridley sea turtle is the smallest of all extant sea turtles. The major nesting beach for Kemp's ridleys is on the northeastern coast of Mexico. The species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals are sometimes found on the eastern seaboard of the United States.

3.481 Within the New York Bight, the Kemp's ridley sea turtle is considered an abundant turtle. They utilize offshore areas and primarily Peconic Bay areas. While the majority of the individuals are reported from the Long Island Sound and Beconic Bay region, a few individuals have been reported from Great South Bay. These individuals have been cold-stunned individuals found in the winter months (Morrcale et al. 1992). All the Kemp's ridley sea turtles that have been discovered in the waters surrounding the study area have been juveniles of 2-5 years of age. Essentially, they utilize the area for development and growth time. It has been reported (Sadove and Cardinale 1993) that some individuals actually double their weight while in local waters. Evidence from the Okeanos Foundation indicate that these turtles remain only one season and do not return. They feed on spider and green crabs while foraging. They are in the study area typically from June through October. Population estimates are 100-300 individuals per season.

Anthropogenic Stresses

3.482 A major reason why marine turtles throughout the world are in danger is the continuing loss of nesting habitat. Egg poaching, artificial lighting along beach areas, beach armoring (e.g., jetties and groins), beach nourishment, beach erosion, beach cleaning, and predators are major threats to the nesting beach. It is believed that marine turtles have an extremely high affinity for their nesting on beaches primarily south of North Carolina and within the Gulf of Mexico, and therefore the loss or reduction of even a single nesting beach within the region can have serious effects. The nesting of sea turtles along the south shore of Long Island is not applicable to the study area as the most commonly observed sea turtles are juveniles well below the breeding age. In addition, the sea turtles are only briefly migrating through the prime regions of Long Island Sound and Peconic Bays.

3.483 With the exception of the leatherback, marine turtles live most of their lives in fairly shallow coastal waters. This makes them vulnerable to a myriad of other threats. The most serious threat to turtles is the incidental taking by commercial fishing operations. In some parts of the world, turtles are still hunted, both for food and for their shells. For example, shrimp trawlers without turtle excluder devices (TED) trap and drown sea turtles. Gill nets also snare turtles, and frequently are not pulled soon enough to free the turtles before they drown. Although turtles can remain underwater for long periods, they need to return to the surface to breathe. A trapped turtle will struggle, significantly reducing its oxygen supply and shortening the time it has before it needs to reach air. Shrimp and gill nets simply are not removed from the water soon enough to save most trapped turtles. Dredging can also cause a negative impact to habitat and result in the incidental injuring or killing of sea turtles.

3.484 Ingestion of marine debris by turtles is considered another common threat. Because they tend to spend the early part of their life in large seagrass patches, accumulating areas of garbage are attractive to the turtles as a food source. Some forms of plastic and other man-made materials resemble food closely enough to fool even a mature turtle. It is After they are ingested, these materials may be toxic and obstructs the stomach and prevents the turtle from receiving nutrition from real food, often leading to mortality.

Loggerhead Sea Turtle

3.485 The loggerhead was listed in 1978 as a federally threatened species and it is considered "vulnerable" by the International Union for the Conservation of Nature. NMFS approved and distributed a final recovery plan for loggerhead sea turtles in the Atlantic Ocean in 1991. Recent population studies have concluded that the number of females that nest in the southeastern U.S. is continuing to decline. The U.S. federal government has listed the loggerhead as endangered worldwide. The loggerhead shares the same threats that menace all marine turtles. Because such a significant percentage of the world's loggerhead population lives in the Gulf of Mexico and southwest Atlantic waters, shrimp fishing, gill netting, and activities associated with offshore oil and gas exploitation are particularly dangerous to this species.

Green Sea Turtle

3.486 NMFS approved and distributed a final recovery plan for green sea turtles in the Atlantic Ocean in 1991. NMFS has made a major effort to reduce green turtle mortality in shrimp trawl fisheries by implementing regulations requiring the use of TEDs. Many of the other tasks identified in the recovery plan have been initiated in the last several years.

Leatherback Sea Turtle

3.487 Leatherbacks are subject to many pressures as described above. Leatherbacks become entangled in longlines, fish traps, buoy anchor lines, and other ropes and cables. This can lead to serious injuries and/or death by drowning. The setting of "large mesh nets suitable for turtling" is common in the waters of Puerto Rico. Although the practice was outlawed in 1984, it still continues. The nets are intended for hawksbills and green turtles, but leatherbacks occasionally become entangled.

3.488 Leatherback turtles eat a wide variety of marine debris such as plastic bags, plastic and styrofoam pieces, tar balls, balloons and plastic pellets. Effects of consumption include interference in metabolism or gut function, even at low levels of ingestion, as well as absorption of toxic byproducts. NMFS is currently analyzing stranding data and available necropsy information to determine the magnitude of debris ingestion.

3.489 It is estimated that before the implementation of TEDs, the offshore commercial shrimp fleet captured about 640 leatherbacks a year. Of those captured, approximately 160 died, and many others were injured as a result of the difficulty of handling such a large animal on the deck of a shrimp boat. The use of TEDs is not expected to reduce leatherback captures and mortality significantly, because TEDs are generally incapable of passing adult leatherbacks through the exit opening.

3.490 Leatherbacks are vulnerable to boat collisions and strikes, particularly when in waters near shore. It is not known if open ocean collisions with large ships occur. In 1992, a Recovery Plan for leatherback turtles in the U.S. Caribbean, Atlantic Ocean, and Gulf of Mexico was in place by NMFS.

Kemp's Ridley Turtle

3.491 The Kemp's ridley was listed as endangered throughout its range on December 2, 1970, and its status has remained unchanged. The Kemp's ridley population has declined since 1947, when an estimated 42,000 females nested in one day, to a current nesting population of approximately 500. Since 1978 the number of nests has declined at a rate of approximately 14 nests per year. Numbers continue to decline despite protection of the Kemp's ridley primary nesting beach. The decline of this species is primarily due to human activities including collection of eggs, fishing for juveniles and adults, killing adults for meat and other products, and direct take for indigenous use. In addition to these sources of mortality, Kemp's ridleys have been subject to high levels of incidental take by shrimp trawlers which is believed to have adversely affected recovery. NMFS approved and distributed a final recovery plan for Kemp's ridley sea turtles in 1992.

CULTURAL RESOURCES

Introduction

3.492 In 1997, a cultural resources survey of the Atlantic Coast of Long Island from Fire Island Inlet to Montauk Point was prepared by John Milner Associates, Inc. (referred to as JMA 1998) for the Reformulation Study. The survey identified known cultural resources and located potentially sensitive areas that might require additional investigation. The Area of Potential Effect (APE) or study area consists of beaches and dunes shoreward of existing structures and roads, or, where there were no roads or structures, the ocean side of the dunes. The proposed project would have no effect on lands behind the dunes and beaches. The APE is characterized by wide sandy beaches and dunes (sand mounds and hills shaped by the wind). There are also fill areas created by the placement of dredged material or sand. The paragraphs which follow first describe the environmental setting, the prehistory, and history of the APE, then identify resources, and finally assess potential effects.

Environmental Setting

3.493 Late Pleistocene and Holocene Environment. During the Late Pleistocene most of eastern North America was covered by the continental Laurentide ice sheet. The Late Wisconsinan glaciation reached its peak position between 21,000 and 18,000 years before present (BP). From 18,000 to 14, 000 BP, the position of the ice fluctuated, until it began to recede after 14,000 BP. Numerous moraines, including the Harbor Hill Moraine and the Ronkonkoma Moraine, were formed by the recession of the glacier. These moraines located along Long Island's north shore mark changes in the glacier's position. Streams deposited sand and gravel into outwash plains, such as those found between the Ronkonkoma Moraine and the Atlantic Ocean and between the Harbor Hill and Ronkonkoma Moraines (JMA 1998). In addition to the uplands created by these moraines, other habitable landscapes existed including stream terraces, poorly drained back swamps, and low lying floodplains, all of which sustained diverse biotic communities (JMA 1998).

3.494 At the maximum extent of the Wisconsinan glaciation, the coastline was as far as 100 miles east-southeast of the present Long Island south shore, and sea level was about 430 feet below the current level. By 4,000 years BP, the combination of the melting glacier and isostatic rebound brought sea level to about 16 feet below the current level. Previously dry areas along the coastline that may have been inhabited were inundated. Pollen and sediment samples taken from peat layers deposited in fresh to brackish water near the coastline indicate that modern coastal and estuarine conditions existed along the Long Island coast by 2000 years BP. By this time, many of the earlier streams had become drowned valleys, with alluvial landscapes and low lying glacial till uplands submerged beneath brackish waters (JMA 1998).

3.495 As a result of these coastline changes and sea level rise, the current dunes and beaches lie on top of surfaces that were once interior, non-coastal, terrestrial environments. The preservation of archaeological sites representing the occupation and use of these environments depends upon how the overlying sediments were deposited and how the erosional processes acted upon these surfaces. Landforms and environments that were buried gradually and not subjected to coastal erosion as sea level rose are more likely to have been buried intact. Marsh peat, which is periodically uncovered by severe storms along the beaches or from underwater near shore area, are probably overlying other deeply buried surfaces that may contain early to middle Holocene deposits (JMA 1998).

Prehistoric Culture Context

3.496 The prehistory of eastern North America is divided by scholars of the subject into three major temporal categories, Paleo-Indian (ca. 12,000 BC to ca. 8,000 BC), Archaic (ca. 8,000 BC to 1,000 BC), and Woodland (ca. 1,000 European Contact). Each period is associated with a particular set of adaptive and subsistence strategies closely related to changes in the environment. It is likely that many early sites, dating from the Paleo-Indian period through the Middle Archaic period (ca. 3,000 BC), were probably inundated as sea level rose. Many of these sites were located along early rivers, estuaries, and portions of the coastline that are now submerged. By the beginning of the Late Archaic period, the sea level and the location of the coastline were at approximately current levels (JMA 1998).

3.497 Sites dating to the Paleo-Indian through the Middle Archaic period are significant and have the potential to provide information on post-glacial environments as well as individual and group adaptations to these environments. Changes in the environment and the development of new technologies (e.g., changes in projectile points and ceramics) may have affected the primary subsistence resources exploited by people and prompted shifts in settlement patterns (JMA 1998).

3.498 In the Late Archaic (3,000 to 1,500 BC) the rich oak forests in the region provided expanded subsistence resources. Groups could hunt deer, elk, raccoon, and other smaller mammals, as well as birds, turtles, fish, and shellfish. Late Archaic sites in the project vicinity have been identified in the back bay along the Great South Bay, the coastal marsh of Mecox Bay, interior uplands, coastal uplands/wetlands, and interior uplands/wetlands (JMA 1998). The Terminal Archaic (ca. 1,500 to 1,000 BC) subsistence strategies demonstrate a change to a riverine focus in conjunction with technological innovations (e.g., the use of soapstone vessels and a shift to broad-bladed projectile points) as evidenced in the artifact assemblages (JMA 1998). Terminal Archaic sites have been identified in the project vicinity along the coastal uplands.

3.499 The Woodland Period (ca. 1,000 BC European Contact) is characterized by more secure subsistence economies, which involved horticulture in many places, as well as long-distance trade and communication and the appearance and use of ceramic vessels (JMA 1998). Although no Woodland period sites have been found along Fire Island, a number of sites have been identified in the back bay and marshy areas along Great South Bay (JMA 1998).

Historic Cultural Context

3.500 The European colonists of Suffolk County were primarily British. However, a number of Dutch settled in the western portion of the country (JMA 1998). The first European resident owner of Fire Island was William Tangier Smith. In 1693, he acquired 40 square miles of Long Island including all of Fire Island as well as the Great South and Moriches Bays from the Native Americans (JMA 1998). After Smith's death his family retained ownership over most of the eastern end of Fire Island (JMA 1998). In 1753, the town of Brookhaven purchased much of the property between the town's eastern boundary and Long Cove, while the Smith family kept most of Fire Island east of Whalehouse Point. By 1910, the Smith descendants sold three quarters of the remaining property along with the manor house and grounds at Smith Point. When the last Smith descendant died, ownership of the house and the surrounding 27 acres was given to the town of Brookhaven for use as a park (JMA 1998). In 1964, all remaining dwellings in this area were razed, and the land became part of the Fire Island National Seashore (JMA 1998).

3.501 From the late 18th to the mid-19th century, Brookhaven residents used the western portion of Fire Island for cattle grazing, harvesting of salt hay, fishing, and hunting. There were few permanent structures, although small shacks were built along the beach to provide shelter and supplies for shipwreck victims.(JMA 1998).

3.502 With the growth of the Port of New York and New Jersey, shipping along the Atlantic shoreline of Long Island, a major transportation route, increased. Vessels passing by the study area were involved in international and coastal trading as well as fishing. Transatlantic packet ship trade between the United States and Europe also carried passengers and goods in the first few decades of the 19th century, using both steam ships and sailing vessels. Later, merchant ships with iron hulls and steam engines were used for transatlantic voyages, and four-masted schooners were used for coastal trading. The volume of shipping traffic to and from the Port of New York combined with a number of topographic factors, such as a dangerous undertow, offshore bars, and the absence of easily accessible channels, made the south shore of Long Island a hazard to navigation. Vessels were often wrecked and buried along the barrier islands or were sunk offshore (JMA 1998).

3.503 The first lifesaving stations were authorized by Congress in 1847. Prior to this time, wrecked or stranded vessels were unlikely to receive help from the shore, and survivors would not find shelter or supplies if they were able to reach the beach (JMA 1998). In 1949 a coalition of New York merchants, shipowners, and underwriters, concerned with the increasing number of maritime disasters along the coast, sponsored the construction of life saving stations on Long Island, including a station at Fire Island. These stations were later incorporated into the U.S. Life Saving Station Service (JMA 1998).

3.504 In 1854, fourteen additional life saving stations were built on Fire Island and Long Island (Blue Point, Long Hill, Point O' Woods, and other locations) to reduce the distance between stations. Several fatal Atlantic Coast wrecks during the winter of 1870-1871 prompted the construction of new stations at Tiana, Quogue, Blue Point, Lone Hill, Fire Island, and other locations. These stations were designed to accommodate a live-in keeper and a crew of six (JMA 1998). During the 20th century, the number of life saving stations was gradually reduced, and, as a result, most stations were converted to other uses, abandoned, or demolished.

3.505 Long Island grew as a summer vacation destination partially as a result of increased accessibility due to the construction of the Long Island Railroad (LIRR). Begun in 1834, LIRR was originally intended to be a route from New York to Boston, using steamboats from Greenport to Stonington, Connecticut and then rail to Boston. The goal was a government contract to carry mail between New York and Boston. When the contract was given to another rail-steamer line, LIRR was left as a local line that extended down the center of the Long Island (JMA 1998). Construction of the South Shore branch to Patchogue in 1869 made Fire Island more accessible and allowed New Yorkers to vacation on eastern Long Island. Hotel owners and the railroad actively advertised the desirability of vacationing on the Long Island coast. By the beginning of the 20th century, automobile traffic was able to reach the south shore of Long Island via bridges and an easy connection to the Long Island Motor Parkway. Completion of the Southern State Parkway improved automobile accessibility in the 1920's (JMA 1998).

3.506 The first major hotel on Fire Island was the Surf Hotel built by David Sammis, who purchased a number of shares on Fire Island in the mid-19th century (JMA 1998). When completed, the hotel had a three-story main building with covered walkways leading to cottages. In the 1890's, it was bought by New York State for use as a quarantine facility, which was opposed by local residents. The state, instead, leased the hotel to a number of private innkeepers until the property became part of the state park, and the hotel was removed. The early success of the Surf Hotel, however, inspired the construction of others along the coast (JMA 1998).

3.507 The Great Partition of 1878 opened the land along the west end of Fire Island to the development and creation of individual communities. The Chautauqua Assembly, a social movement that emphasized the importance of general education, developed the community of Point O' Woods in 1894. The Assembly acted as landlord and sold shares. Purchase of the shares allowed the owner to lead building lots. Throughout the 20th century, the Point O' Woods Association has permitted only limited development of the area. Other villages that developed along Fire Island in the late 19th and early 20th centuries include Oakleyville, Lonelyville, Cherry Grove, Ocean Bay Park, Water Island, Fire Island Estates, Saltaire, Fair Harbor, Seaview, Ocean Beach, Kismet, and Fire Island Pines. Davis Park, Ocean Ridge, and Dunewood, the youngest communities were established in the 1940's and 1950's (JMA 1998).

Existing Conditions

Terrestrial Archeological Sites

3.508 A review of the site files of the New York State Museum and the New York State Office of Parks, Recreation and Historic Preservation identified a great number of archaeological sites in the vicinity of the study area. Most of these sites are situated in the back bay areas of Great South Bay or the interior uplands of the Long Island south shore. Thirteen historic-period sites have been identified on Fire Island. These sites include remains of life-saving stations, refuse middens and stratified deposits, a farm boundary, and the remains of recreational facilities and residences. However, only two sites, A103-05-000605 and A103-02-1579, are located on the ocean side of the barrier island in the APE. Site A103-05-000605 is the remains of a recreational facility built for handicapped children in the early 20th century, which was destroyed by the Hurricane of 1938. Site A103-02-1579 consists of the remains of structures used by the Coast Guard from the mid-19th century to the early 20th century (JMA 1998). Both these sites are considered potentially National Register-eligible.

Drowned Terrestrial Archaeological Sites

3.509 Prehistoric archaeological sites dating to the Late Archaic period and later may have been preserved behind the barrier beach systems. These sites were occupied after the rate of post-glacial sea level rise slowed, and productive coastal environments developed. Evidence of early coastal adaptations dating to the Paleo-Indian and Early and Middle Archaic periods, which are rare, could be buried under the barrier beach. These sites are at risk of exposure to coastal erosion. In the near shore zone, any preserved sites are likely to be located along former valley margins. Any sites that were situated at higher elevations would probably have been eroded, and the associated archaeological materials associated with them would have been dispersed from their original context (JMA 1998). The potential for these buried deposits along Fire Island is relatively high. However, areas of high potential are probably localized and can only be defined with additional investigation consisting of mechanical coring and geomorphological analysis.

National Register of Historic Places Site

3.510 The Fire Island Light Station is the only property within the APE that is listed on the National Register. Established in 1827, it remained in use until its deactivation in 1973. The current brick tower was built by 1858. The Fire Island Light Station was important in guiding transatlantic steamers to New York Harbor and as a departure point for those vessels on their European runs. In the Fire Island National Seashore and owned by NPS, it is leased to the Fire Island Lighthouse Preservation Society. Archaeological investigations within the bounds of the light station have identified the remains of the original light tower (JMA 1998; NPS 1994; Holland 1989).

Other Architectural Resources

3.511 The resort architecture of summer cottages and large estates along the ocean side of the south shore represent a number of architectural styles. The earliest summer houses, dating to the late 19th and the early 20th centuries, were designed in the Stick Style, which is characterized by the use of exterior, applied horizontal, vertical and diagonal boarding on the interior of a wood frame house (JMA 1998). By the 1920's, summer residences changed from modest shingled cottages to large estates, representing a variety of architectural styles, built primarily for the upper class (JMA 1998). After World War II, much of the south shore was rediscovered by artists and waves of urban residents looking for beach houses, which brought Modernist architectural style to the south shore (JMA 1998).

3.512 A reconnaissance survey of architectural resources resulted in the identification of a number of buildings and structures that can be associated with either the resort/vacation or maritime contexts of the project area. For the purpose of this survey, the APE included properties visible from the beach. A number of structures, each more than 50 years of age, which may possess the requisite characteristics and integrity to be eligible for the National Register were identified (JMA

1998). They are the Robert Moses State Park Tower; approximately ten houses in the communities of Corneille Estates, Ocean Bay Park, Seaview, Cherry Grove, and Fire Island Pines; the former Point O' Woods Life Saving Station; and the community of Point O' Woods (JMA 1998).

Maritime Resources

3.513 Although fishing and fish processing continue to be a significant part of the Suffolk County economy, many of the former fishing facilities within the project area have been displaced for resort and vacation uses (JMA 1998). There are, however, submerged maritime resources (shipwrecks) associated with the historical development of the Port of New York located in the waters along Long Island's Atlantic Coast. Research has documented more than 450 shipwreck losses and accidents since the 16th century. Although many wrecks have not been located or identified, the periodic appearance of timbers exposed or washed up on the beach indicates a potential for wrecks to be located along the Fire Island coast. To identify these resources, a survey along the tidal zone during low tide utilizing a hand-held magnetometer and a near-shore remote sensing survey using a side scan sonar will be completed (JMA 1998).

3.514 A remote sensing survey of the proposed borrow site, utilizing a side scan sonar and magnetometer, identified seven possible cultural resources (PCR). Five of the PCRs were found to be magnetic anomalies without any associated sonar target. One PCR is a side scan sonar target. However, this target might be a scour mark from a fishing trawler. It is located adjacent to a magnetic anomaly, which may indicate that the target is a PCR (Reiss 1996).

FUTURE BASELINE CONDITIONS IN THE PROJECT STUDY AREA

3.515 The preceding sections address existing conditions in the study area. However, since impacts of a project will occur in the future, it is important to understand those background actions and trends that may alter existing conditions. This section provides a brief overview of actions and trends relevant to the study area and proposed project that may influence future baseline conditions in the affected environment. As discussed below, a number of government actions focused on coastal processes and protection will be going forward in the near future. None of these addresses the specific needs of the FIIP and so would not change the underlying problems encountered in the study area. No major changes in land use patterns are anticipated in future baseline conditions.

Federal Government Actions

3.516 The proposed project is situated between two projects currently being proposed by NYD, which is coordinating proposals to perform maintenance dredging at two locations, Fire Island Inlet and Moriches Inlet. The placement of dredged material from Fire Island Inlet will be on the south shores of Robert Moses State Park and Gilgo State Park. The material from Moriches Inlet will be placed on the southeast corner of the Great South Beach in Smith Point County Park. The dredged material from both locations will be compatible for beach replenishment. Without these dredging projects, the continued shoaling of existing channels would occur, eventually causing diminished accessibility to water transportation services in the area. Within the next two years, the NYD will also be dredging 7 to 11 spot locations in the Great South Bay for navigational purposes.

3.517 In addition, several other federal projects are located along the Atlantic and south shore coast of Long Island. The four civil projects within close proximity to FIIP are: 1) Shinnecock Inlet Navigation Project, 2) the Westhampton Interim Project, 3) the Moriches Inlet Navigation Project, and 4) the West of Shinnecock Project.

3.518 The Breach Contingency Project would continue to be in force throughout the study area. Under the BCP, breach closure would be initiated at the State's request within 72 hours of termination of the particular storm event. The Otis G. Pike Wilderness Area would be monitored for indications of natural breach closure. If natural closure does not occur in the Wilderness Area, or if there is an increase in tidal ranges within the Great South Bay that can potentially flood developments on the south shore of Long Island or Fire Island, the breach would then be closed under the provisions of the BCP. Fill placed to close a breach will match existing shoreline profiles of the corresponding bays to the north and the Atlantic Ocean to the south. Berm width would be at least 150 feet with a maximum elevation of 9 feet NGVD between the back bay and the Atlantic Ocean. The fill areas would blend into existing topography west and east of the breach fill areas and fill grain size will be compatible, if possible, with the grain size of the existing beach at the breach site.

3.519 Fill will be obtained from several possible sources including NEPA-approved upland sand sources, federally created stockpiles, SEQR- or locally approved stockpiles created by the State or local municipalities throughout the barrier island system, and/or hydraulically dredged from one of the following locations:

a. USACOE Atlantic Ocean Borrow Areas.

b. The federally authorized intracoastal waterway.

c. The federally authorized channels of Fire Island, Moriches, and Shinnecock Inlets.

d. Existing channels maintained by Suffolk County.

e. Harbor or channel areas maintianed by local municipalities.

3.520 At the direction of the U.S. Congress, the U.S. Army Corps of Engineers has initiated the South Shore of Long Island, New York Embayment Restoration Study. The study area encompasses a 155-acre embayment area along the south shore of Long Island between the island proper and its fronting barrier islands, extending approximately 70 miles from East Rockaway Inlet to Shinnecock Inlet. The purpose of the study is to determine whether federal projects have caused or contributed to the degradation of the ecosystem of the embayment area (including its habitats, water quality, and other related environmental features), and identify a possible plan of improvement which assesses whether federal participation in a follow-up feasibility study is warranted. Approximately 14 sites have been selected for evaluation and found to warrant potential federal participation in the development of restoration alternatives including, salt marsh restoration, sea and shore bird habitat restoration, shellfish restoration, shoreline protection, submerged aquatic vegetation restoration, and estuarine pond restoration. Approximately 80 additional sites are being evaluated for possible selection, of which approximately 20 sites will join the initial 14 sites for further development.

3.521 The USACOE NYD has permitting responsibility for work in navigable waters and in wetlands, and all local and state actions in navigable waters and wetlands require USACOE permits. The 91 permits granted along the Atlantic Coast east of Fire Island Inlet from 1991 to mid-1999 encompass a variety of activities from decks and pilings for individual to major transatlantic submarine cables. About a quarter of these permits were for activities located wholly or partially in the study area and 20 of these were for storm damage protection. Most actions involved beach renourishment and fill. Some, however, were for structural features, such as breakwaters and revetments. It is anticipated that in the future baseline conditions, the NYD will continue to grant permits for actions that meet the requirements of the permit program.

New York State Actions

3.522 The New York State Department of State (DOS) is investigating the possible use of sand bypassing at Shinnecock Inlet. The type of bypassing operation has not been determined. If implemented, it could be a fixed plant on the updrift side of the inlet, or it could be a floating plant that could be moved from place to place. If the floating plant is selected, the ebb shoal (offshore shoal of sand that is formed by the ebb or falling tide) would be the source of the sand. If the fixed plant is chosen, the filet of sand that forms behind the updrift jetty would be the source of the sand. According to NYSDOS, the purpose of the sand bypassing projects is to mitigate downdrift erosion caused by the disruption of longshore coastal processes by inlet stabilization and the reestablishment of the longshore transport of sand west of the associated inlets.

3.523 For the Shinnedock Inlet Sand Bypassing Project (which is awaiting final permit approval), NYSDOS is proposed a semi-fixed sand bypassing plant on the east side of the inlet, annual dredging of approximately 130,000 cubic yards of sand from the updrift area east of the inlet, and the pumping of this material westward via a pipeline, to Tiana Beach and adjacent areas where it will be placed between mean high and low waters.

3.524 NYSDOS, in cooperation with local governments, is developing the South Shore Estuary Comprehensive Management Plan (CMP). The South Shore Estuary is a 50-mile stretch of bays, rivers, and wetlands. The purpose of the CMP is to protect the natural, recreational, and economic resources of the estuary. The two-phase CMP first focuses on describing existing conditions and, second, evaluates issues, problems, and opportunities and develops recommended actions to ensure that the estuary is improved and protected.

3.525 The Long Island State Park Commission operates Robert Moses State Park on the western end of Fire Island. The Commission has no plans to change or expand the operations or facilities at that park beyond normal maintenance and programming.

3.526 NYSDEC has proposed implementing setback lines that are authorized under the Coastal Erosion Hazard Area Act. The setback lines would be another land use control that would prohibit or restrict building in areas that are prone to erosion damage, except for infill buildings. These setback lines have been proposed for a number of years and have not been implemented. The time of implementation is scheduled for 1999.

Municipal Actions

3.527 Municipal actions currently taking place are FEMA related. Programs administered by FEMA include the Hazard Mitigation Grant Program (HMGP) and the National Flood Insurance Program (NFIP). All of the study area communities participate in the NFIP, which provides Federally backed blood insurance to communities that adopt and enforce floodplain management regulations. FEMA also administers the Flood Mitigation Assistance (FMA) program, which provides grants to communities for projects that reduce the risk of flood damage to structures that have flood insurance coverage. This funding is available for mitigation planning and the implementation of mitigation measures.

3.528 FMA-funded mitigation plans identify actions, such as floodproofing or buyouts, to be taken to mitigate future storm damages. A community must receive approval for its mitigation plan to be eligible for FMA project grant monies. On the barrier island, the Village of Ocean Beach has recently reeived FEMA approval for its mitigation plan, while the Village of Saltaire is currently in the plan development process. On the mainland, the Villages of Amityville and Lindenhurst have received approval for their mitigation plans. Due to limited program funding for mitigation projects, it is not anticipated that FMA projects will result in substantial damage reduction over a 6 year interim project life.

3.529 No major projects are currently planned in the towns of Islip and Brookhaven, according to the town planning departments. There is active planning in Patchogue to bring a greater mix of uses to the waterfront, reduce flooding problems, and increase public access. Several small-scale residential subdivisions and retail developments are planned, and construction is taking place at a moderate pace.

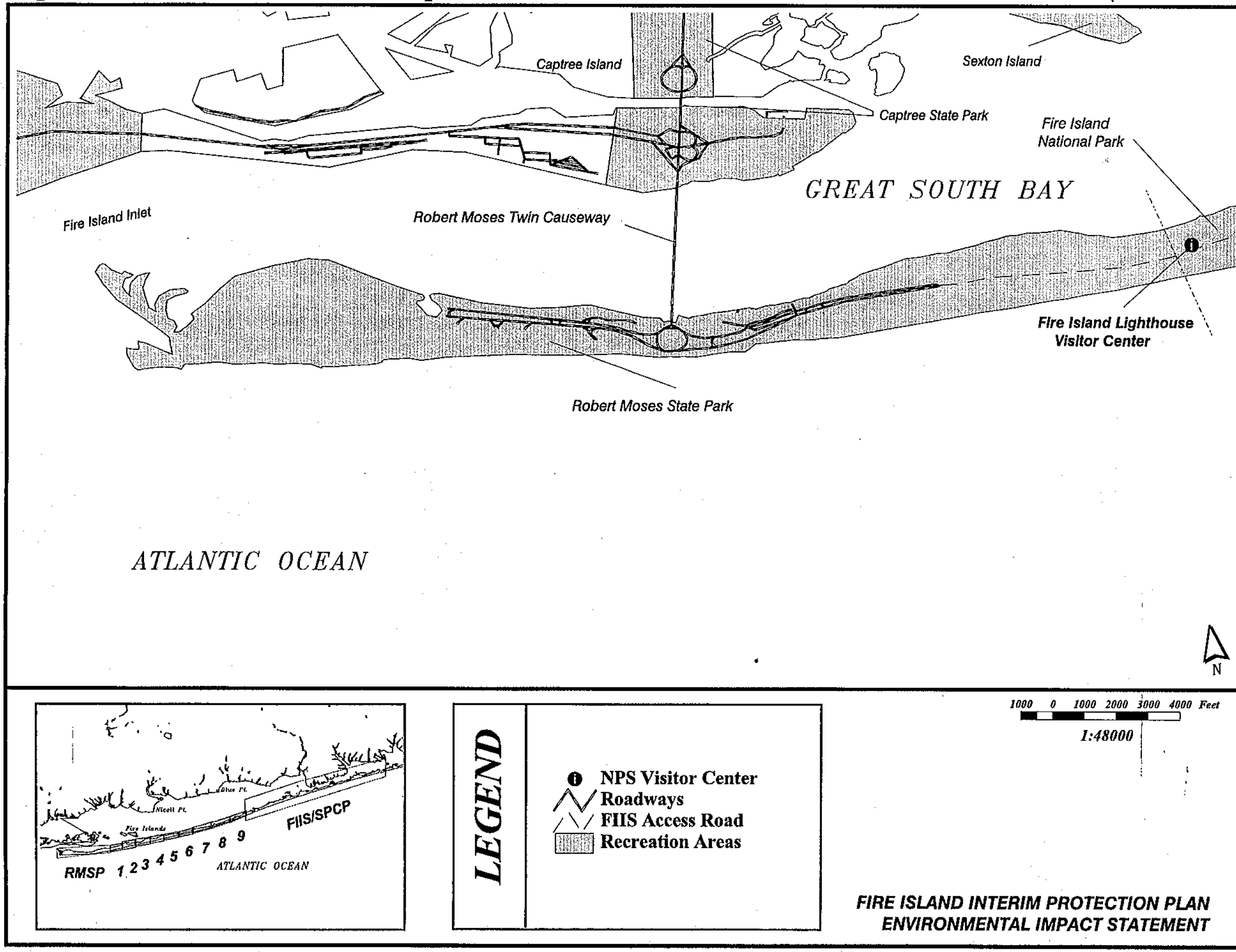
Private Actions

3.530 In the past, the towns and erosion control districts on the island implemented beach fill at selected locations on Fire Island. These groups assess its members for special fees to pay for the construction work. There are no hard plans at the current time to place more beach fill, but the towns have indicated that they would undertake future projects as the needs dictate. In addition to beach nourishment activities, local communities also participate in beach scraping projects, where fill is relocated from a berm of sufficient height and width and is reconfigured as a dune.

3.531 As discussed in Chapter 4 under A. No Action Alternative, infill development of ocean-front lots on Fire Island is expected to continue at the current rate.❖

Figure 3-1 General Land Use Map

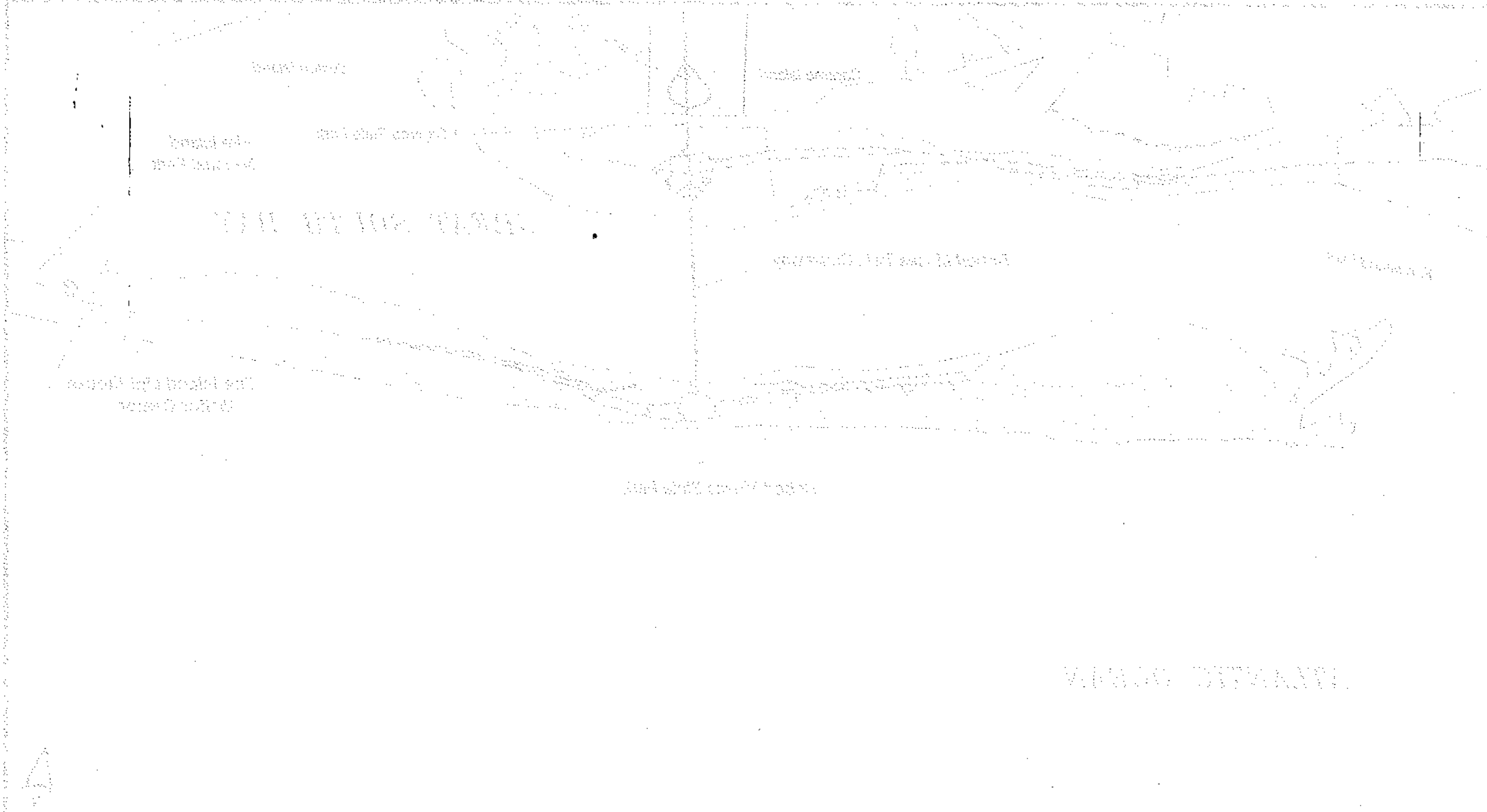
Robert Moses State Park (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

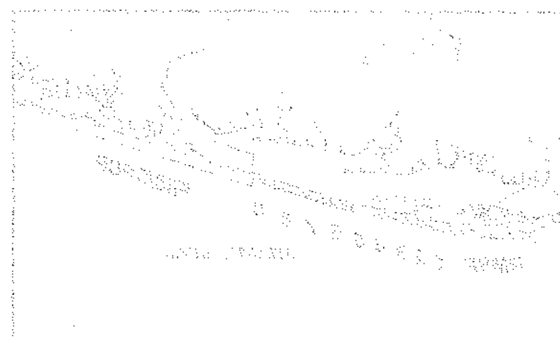
Figure 2-1 General Land Use Map

Robert Moses State Park (refer to inset)



LEGEND

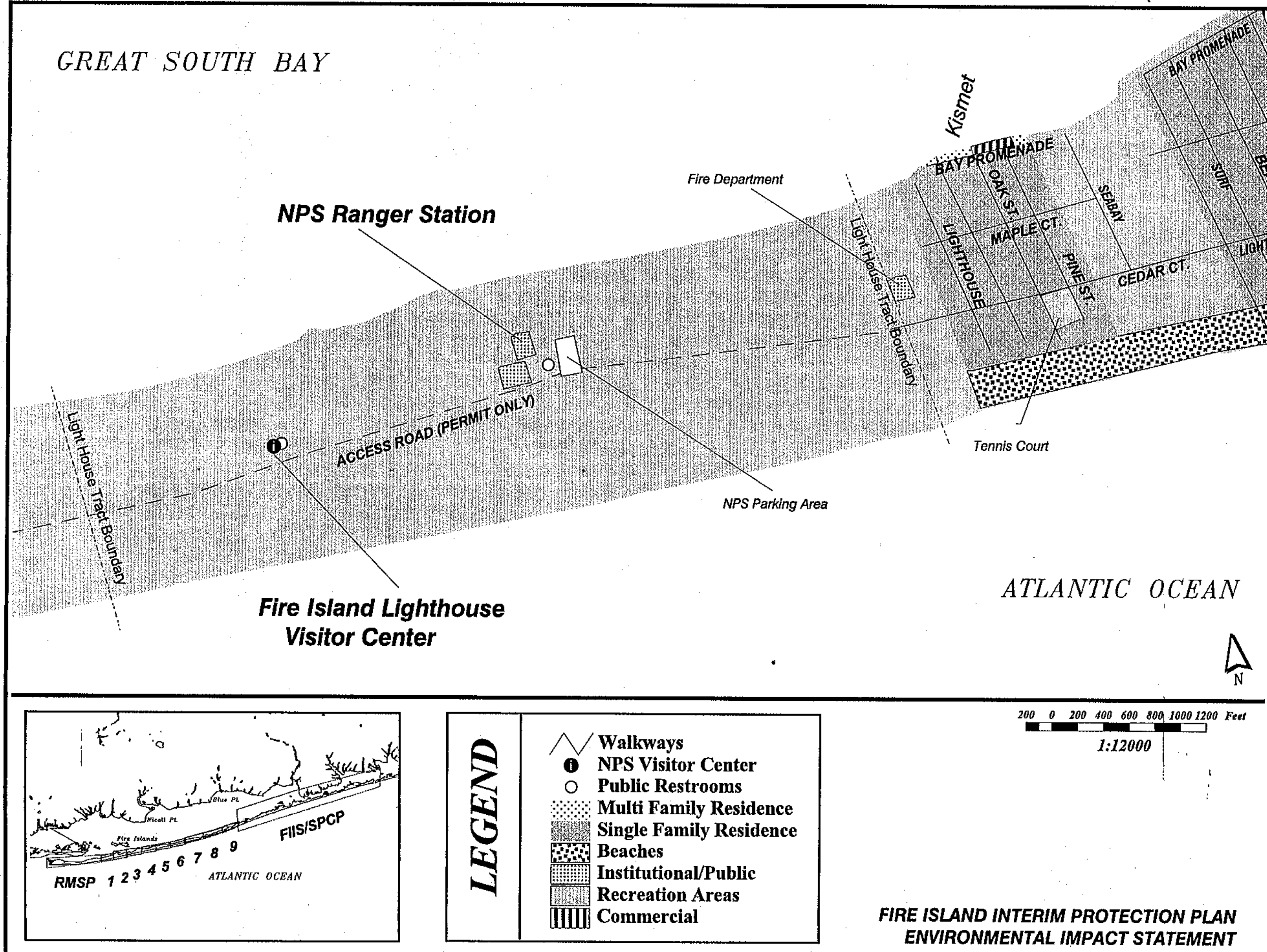
NPS Visitor Center
Roadways
FINS Access Road
Recreation Areas



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

Figure 3-2 General Land Use Map

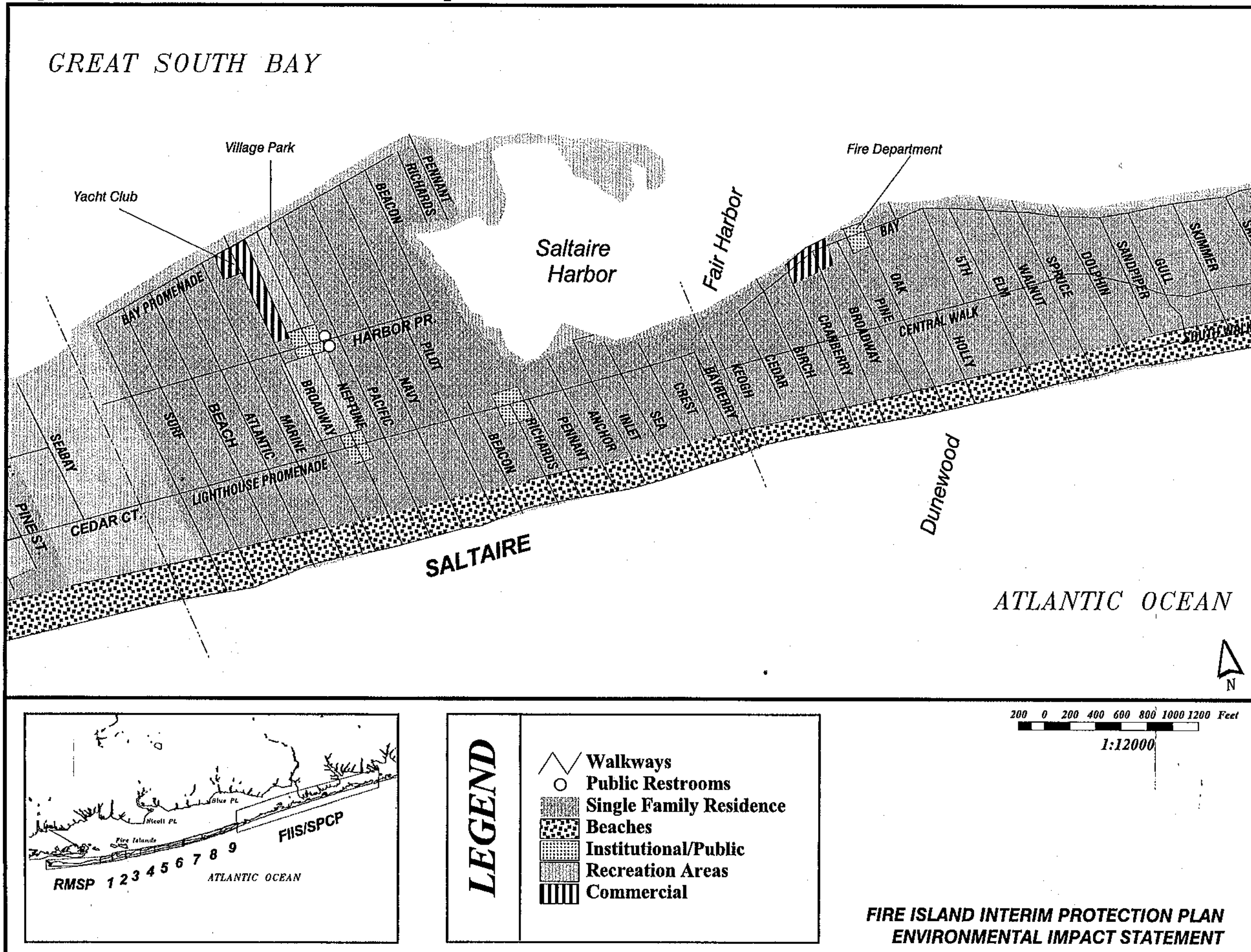
Area 1 (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

Figure 3-3 General Land Use Map

Area 2 (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

Figure 3-3 General Land Use Map

Area 2 (refer to inset)

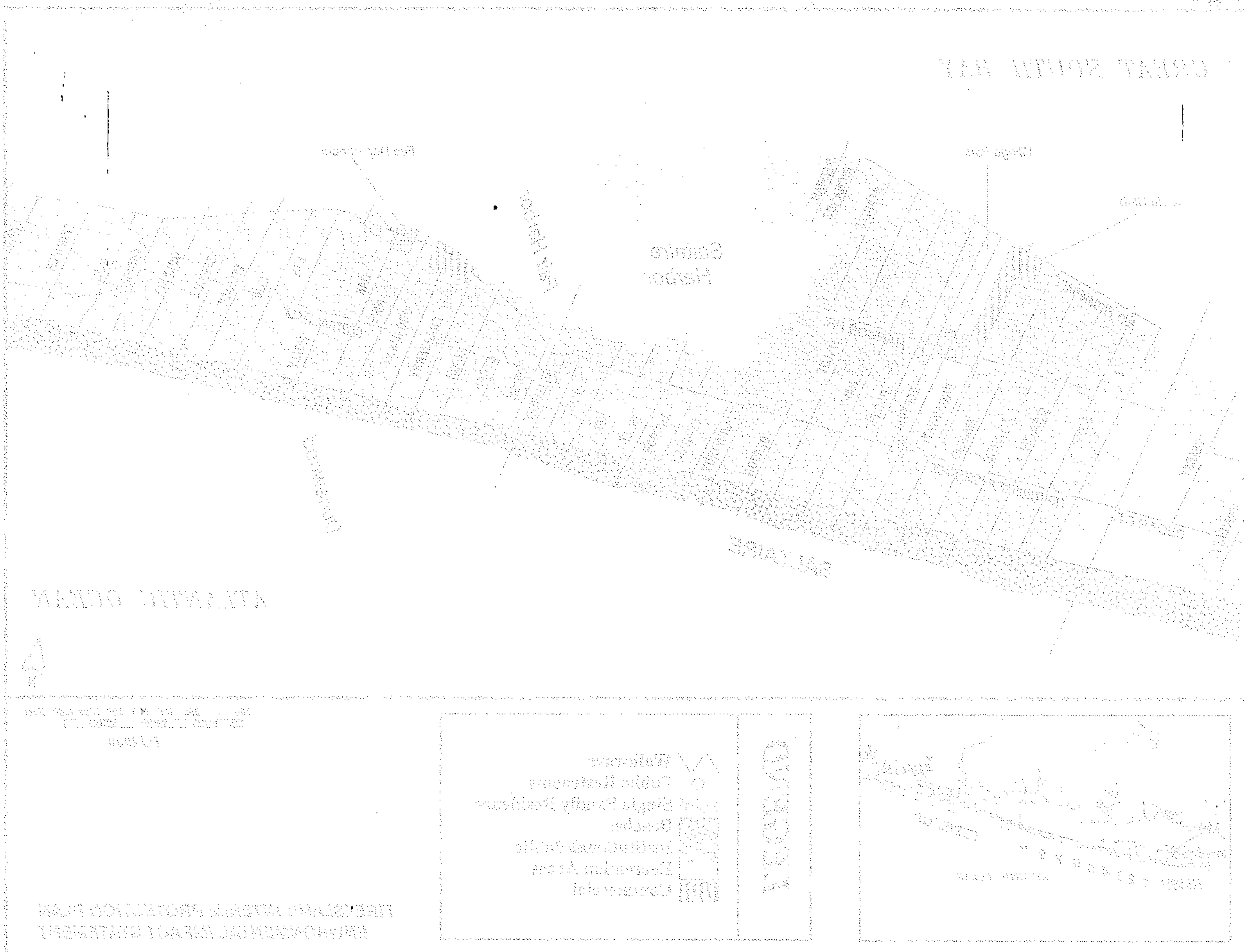
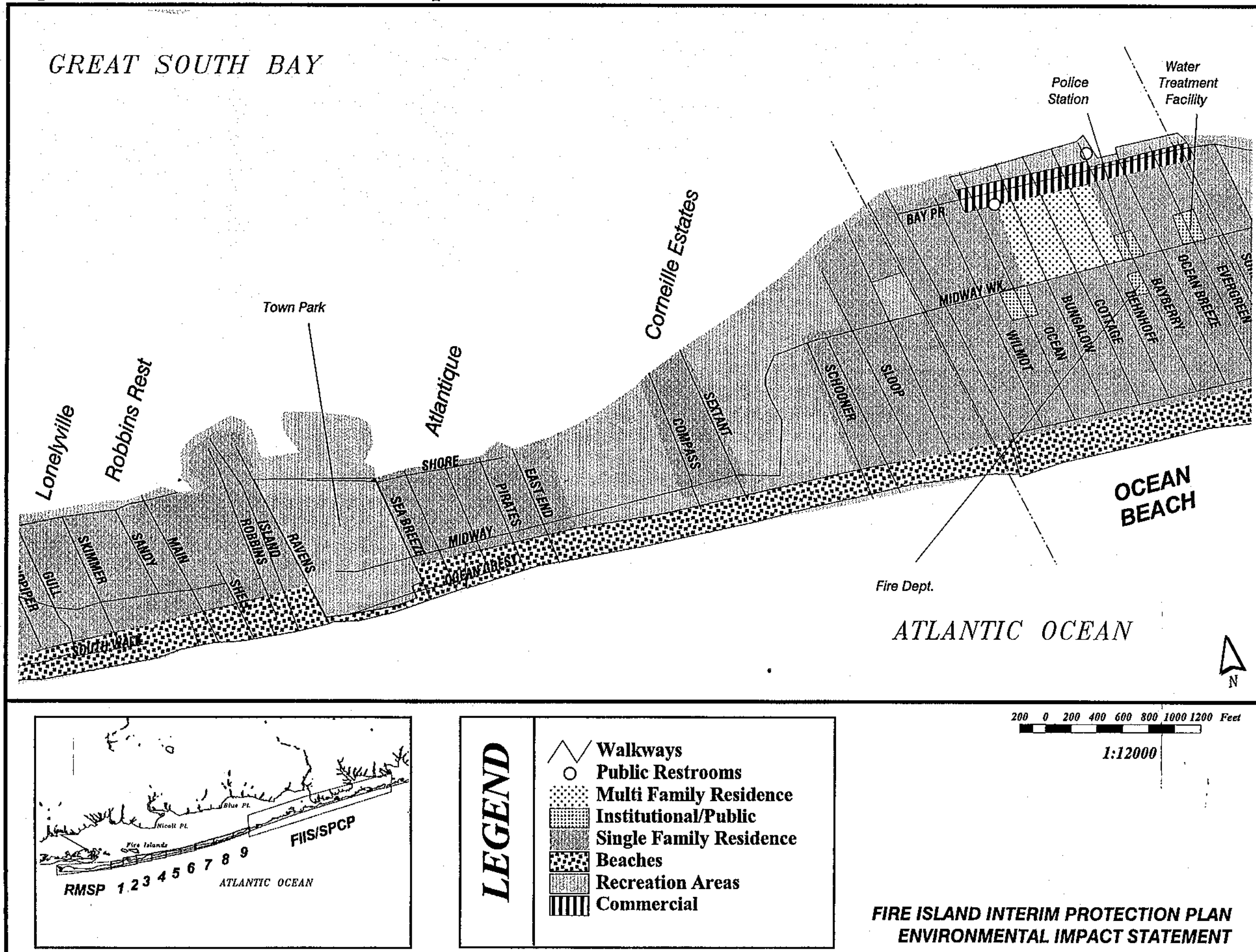


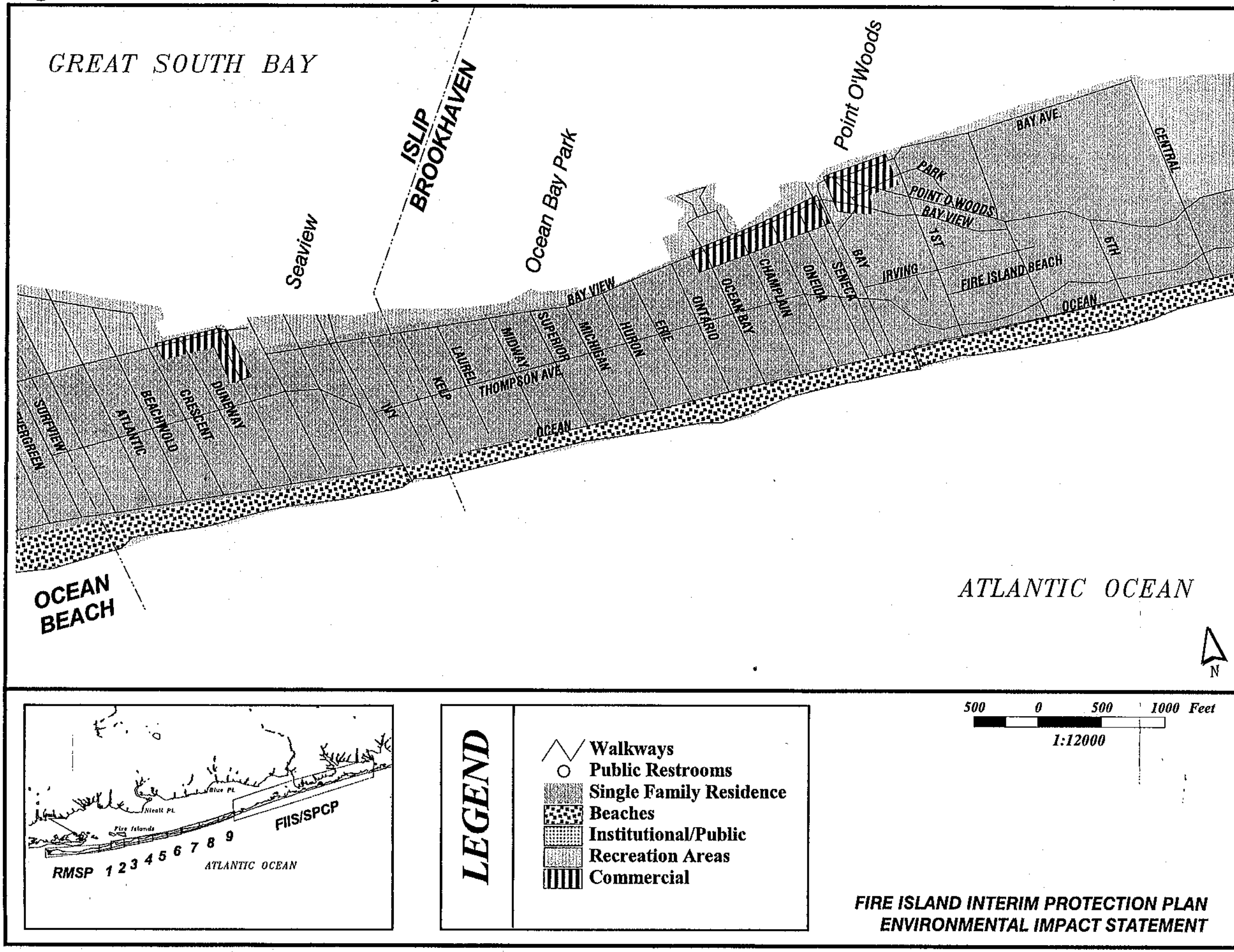
Figure 3-4 General Land Use Map

Area 3 (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

Figure 3-5 General Land Use Map — Area 4 (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
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Figure 2-5 General Land Use Map

Area 4 (Atlantique)

FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

LEGEND

- Walkways
- Public Restrooms
- Single Family Residence
- Beaches
- Institutional/Private
- Recreation Areas
- Commercial

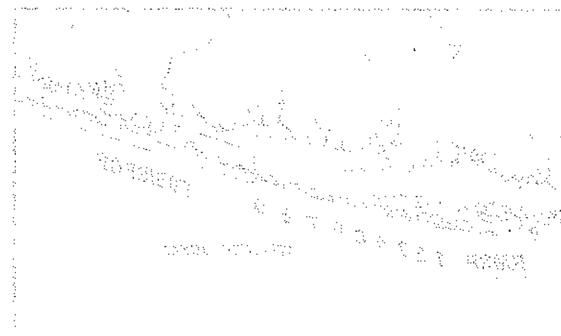
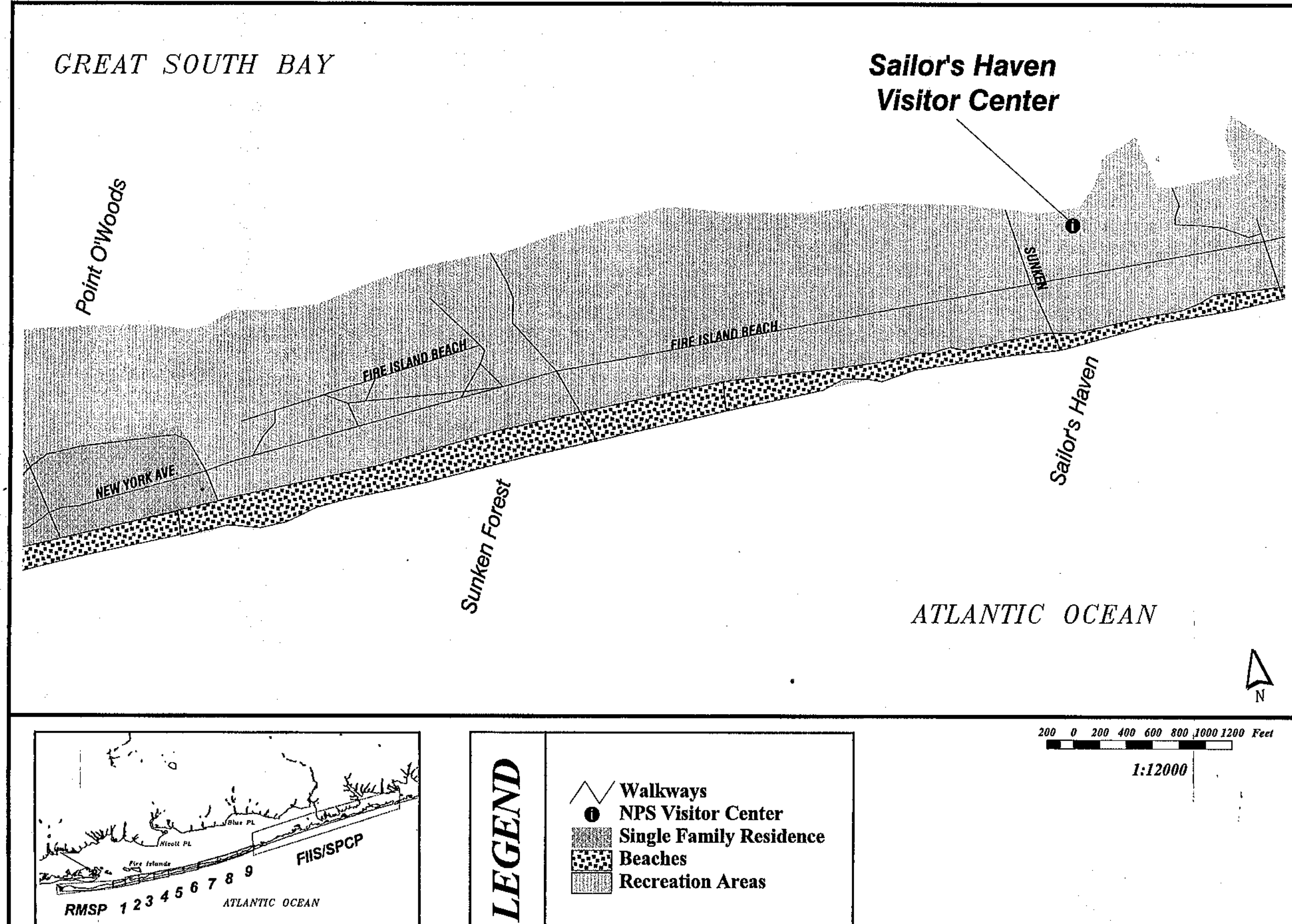


Figure 3-6 General Land Use Map

Area 5 (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
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Figure 3.4 General Land Use Map

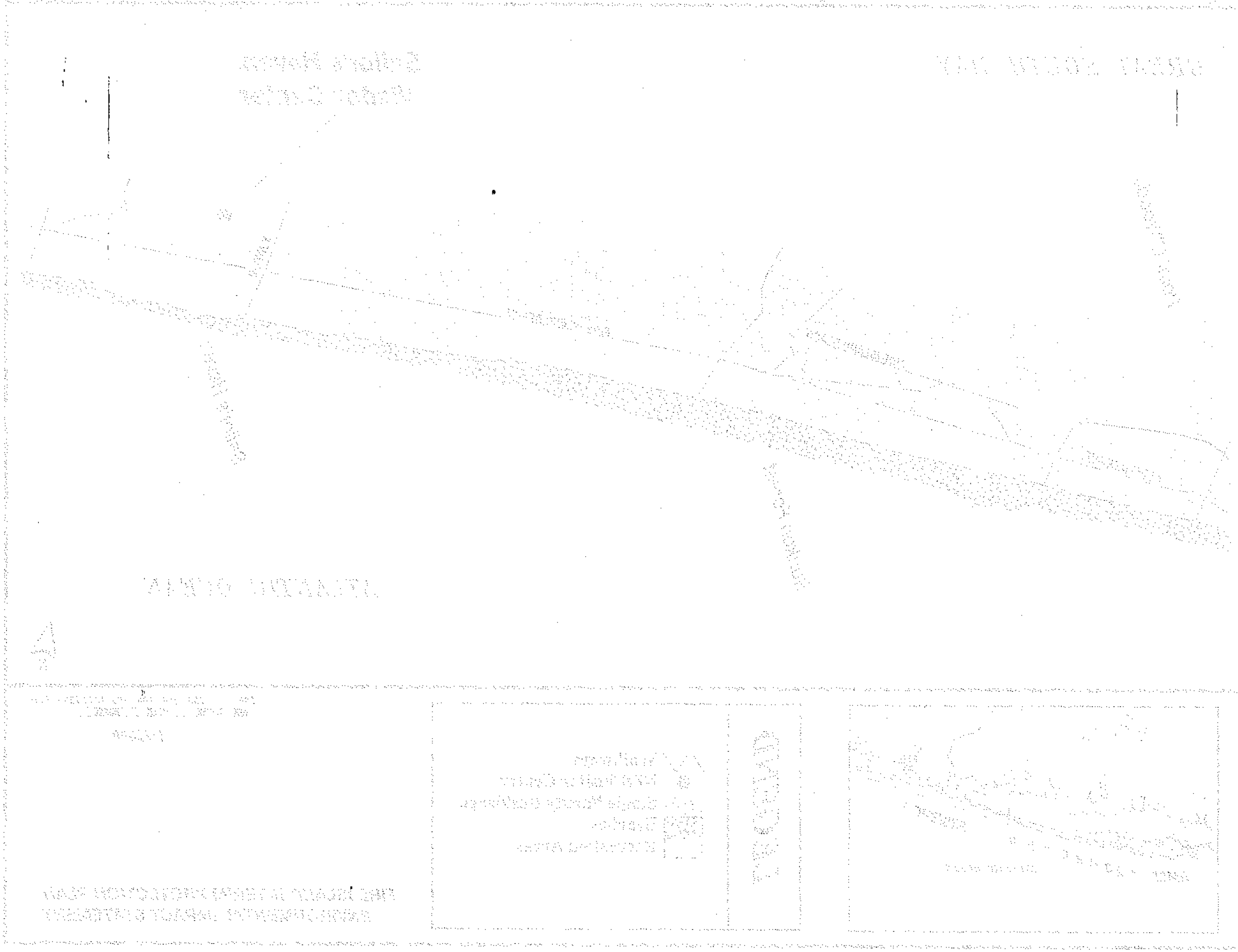
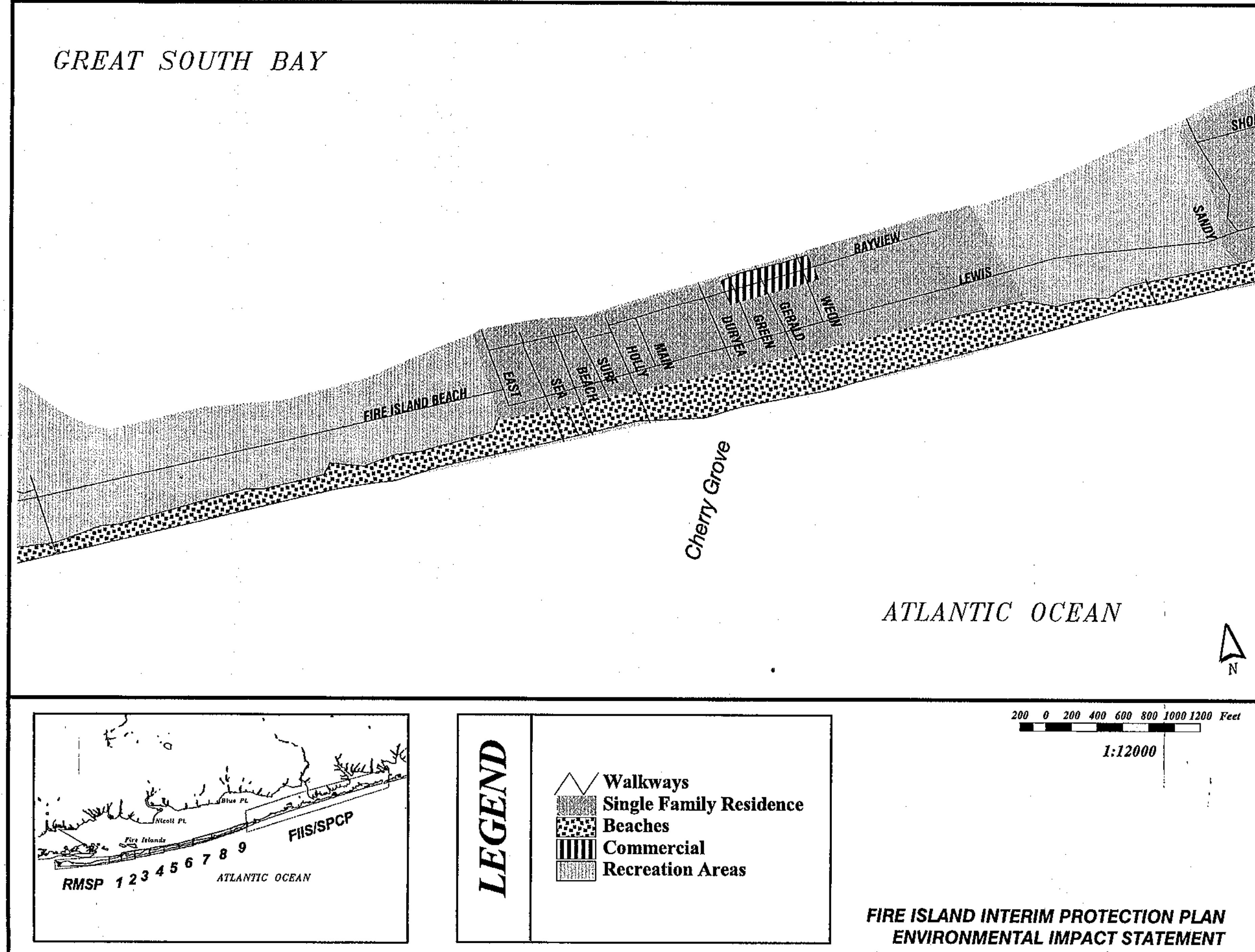


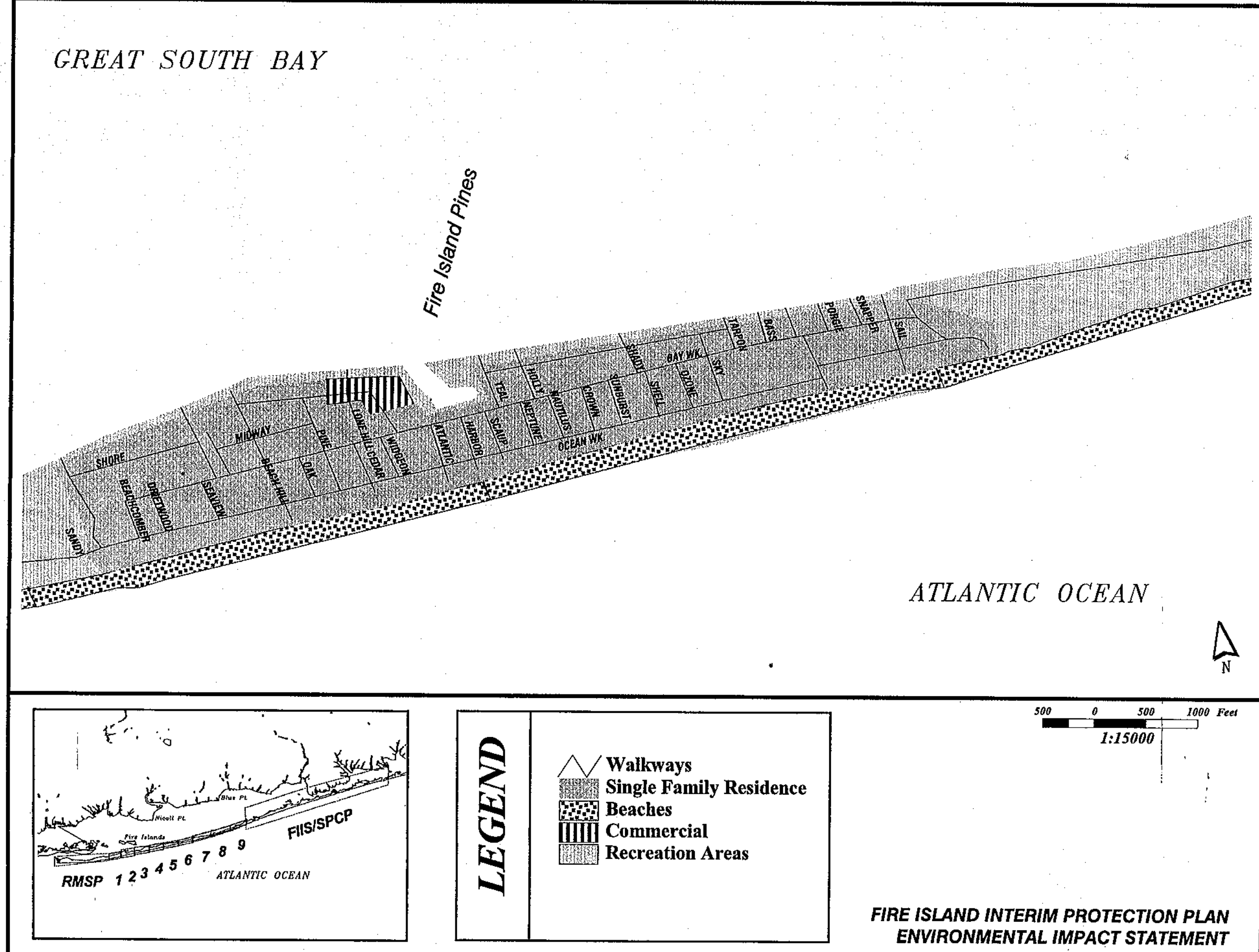
Figure 3-7 General Land Use Map

Area 6 (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

Figure 3-8 General Land Use Map **Area 7** (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
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Figure 3-8 General Land Use Map

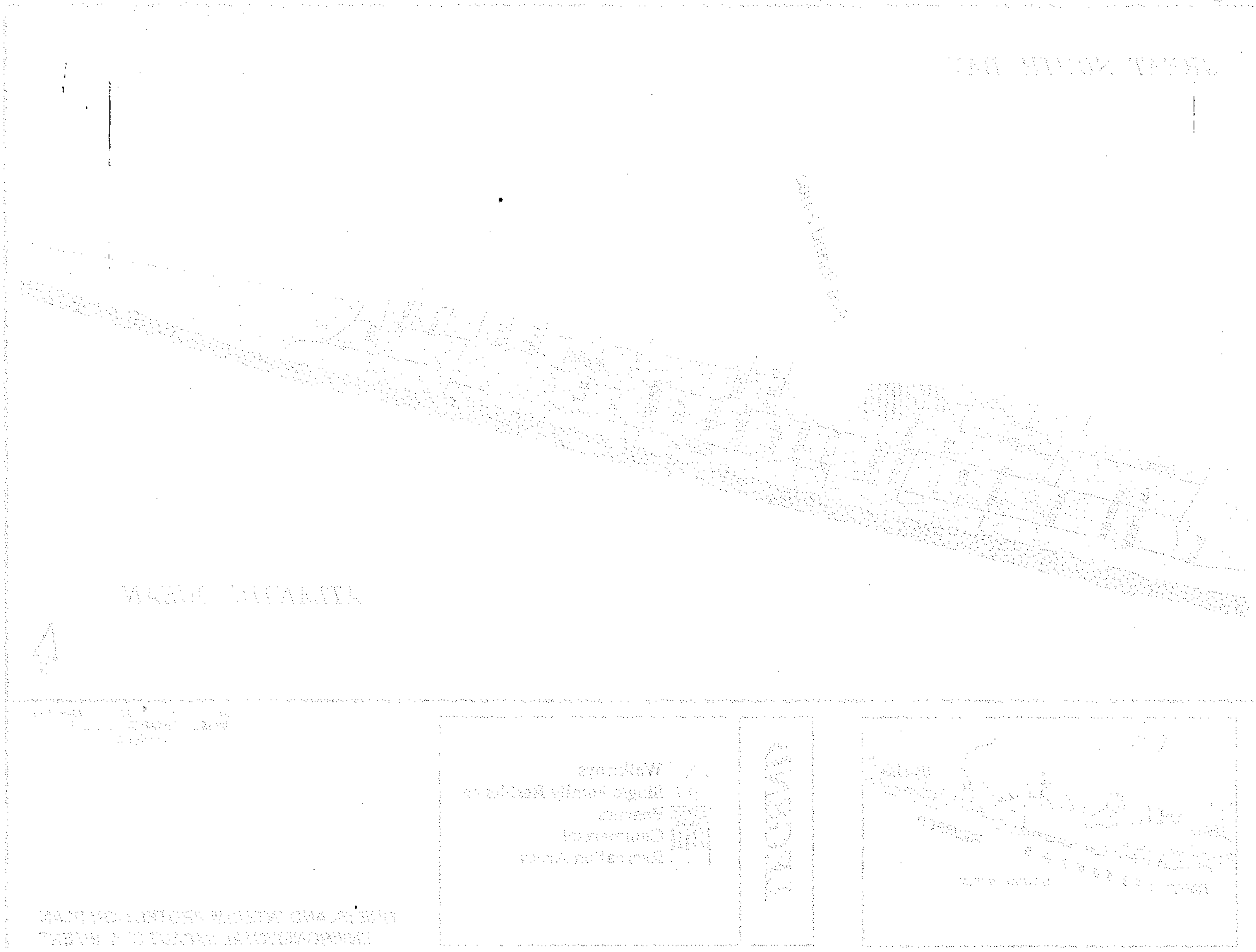


Figure 3-9 General Land Use Map **Area 8** (refer to inset)

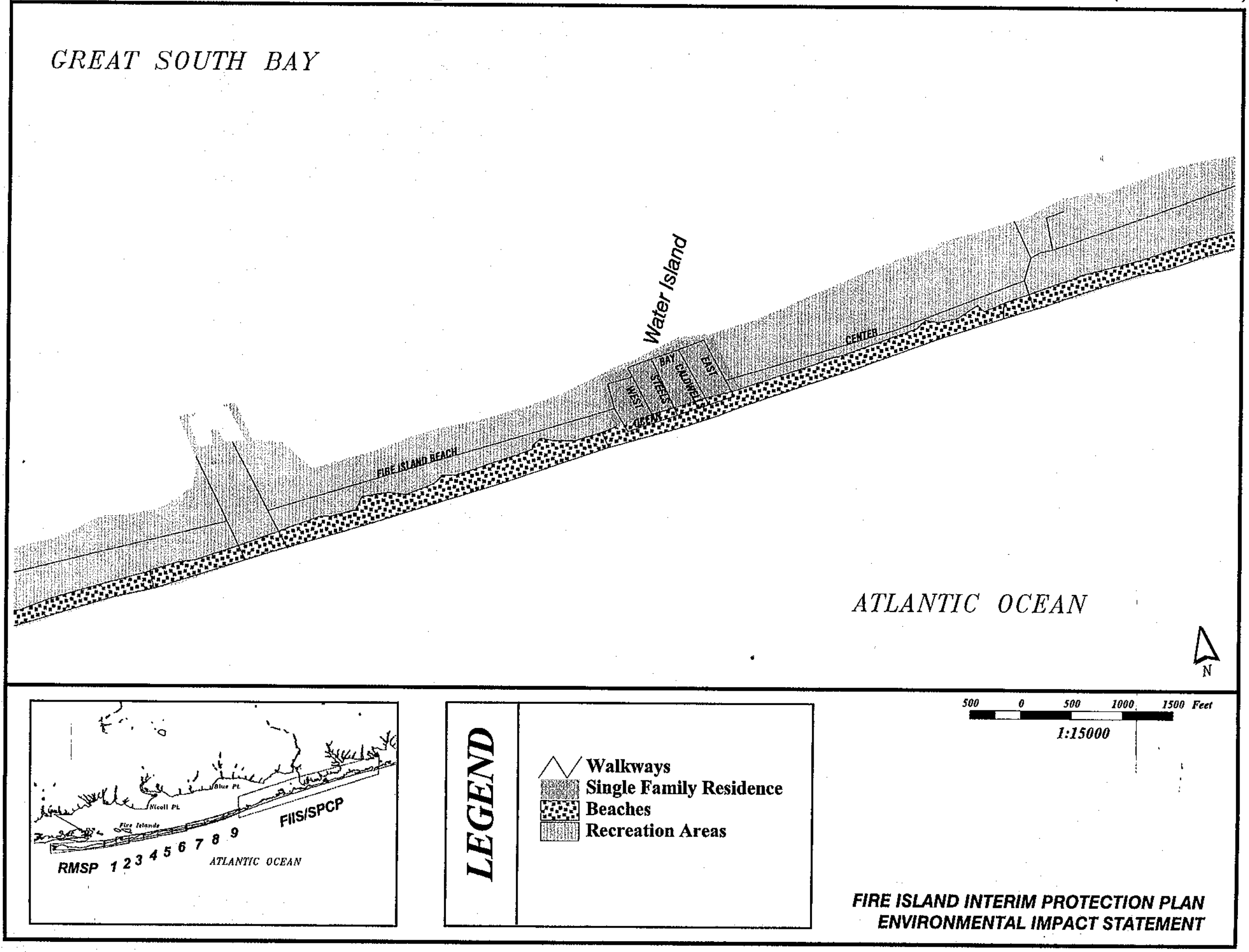


Figure 3-9 General Land Use Map Area 3 (refer to inset)

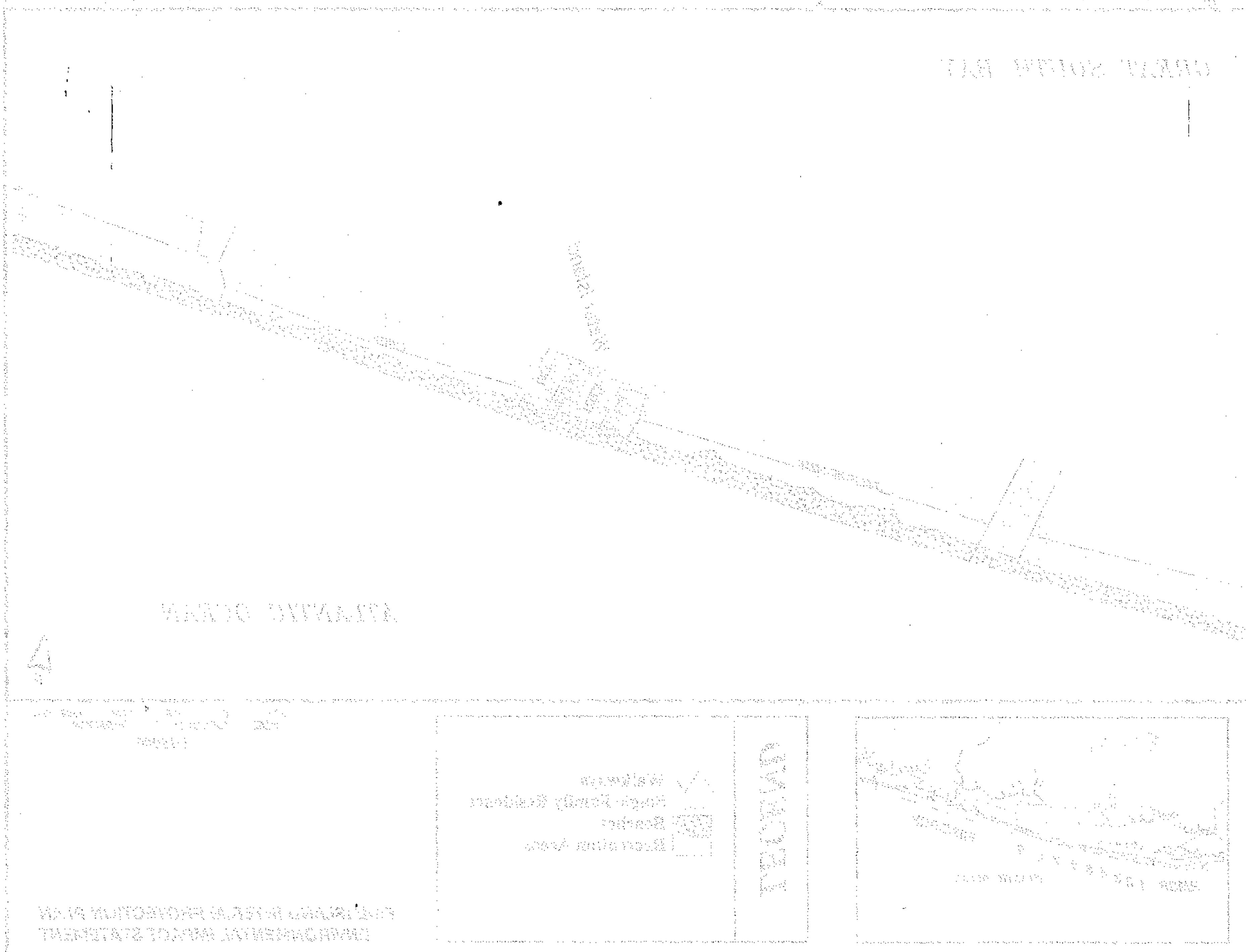
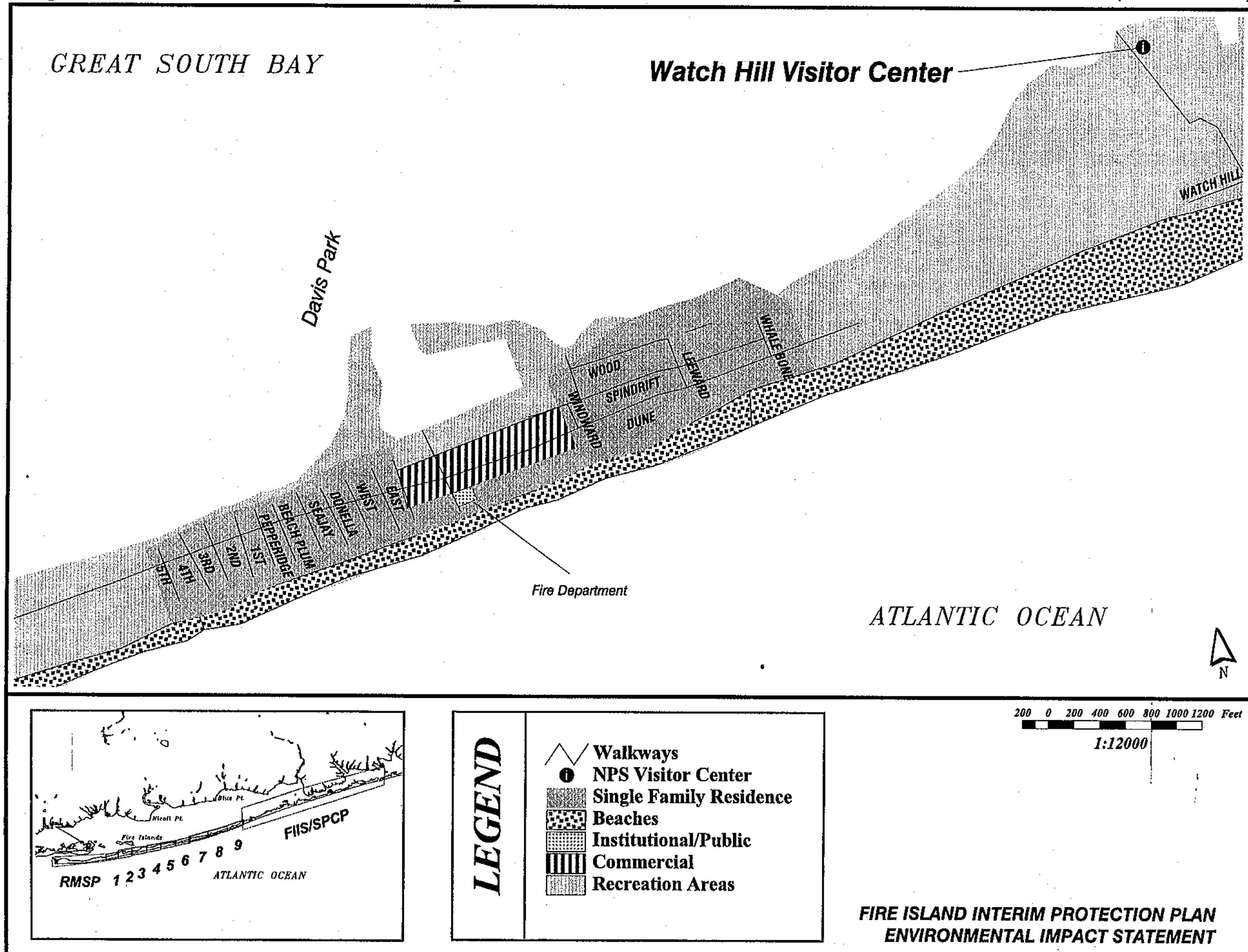


Figure 3-10 General Land Use Map

Area 9 (refer to inset)



FIRE ISLAND INTERIM PROTECTION PLAN
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Figure 3-11 General Land Use Map

FIIS/Smith Point County Park (refer to inset)

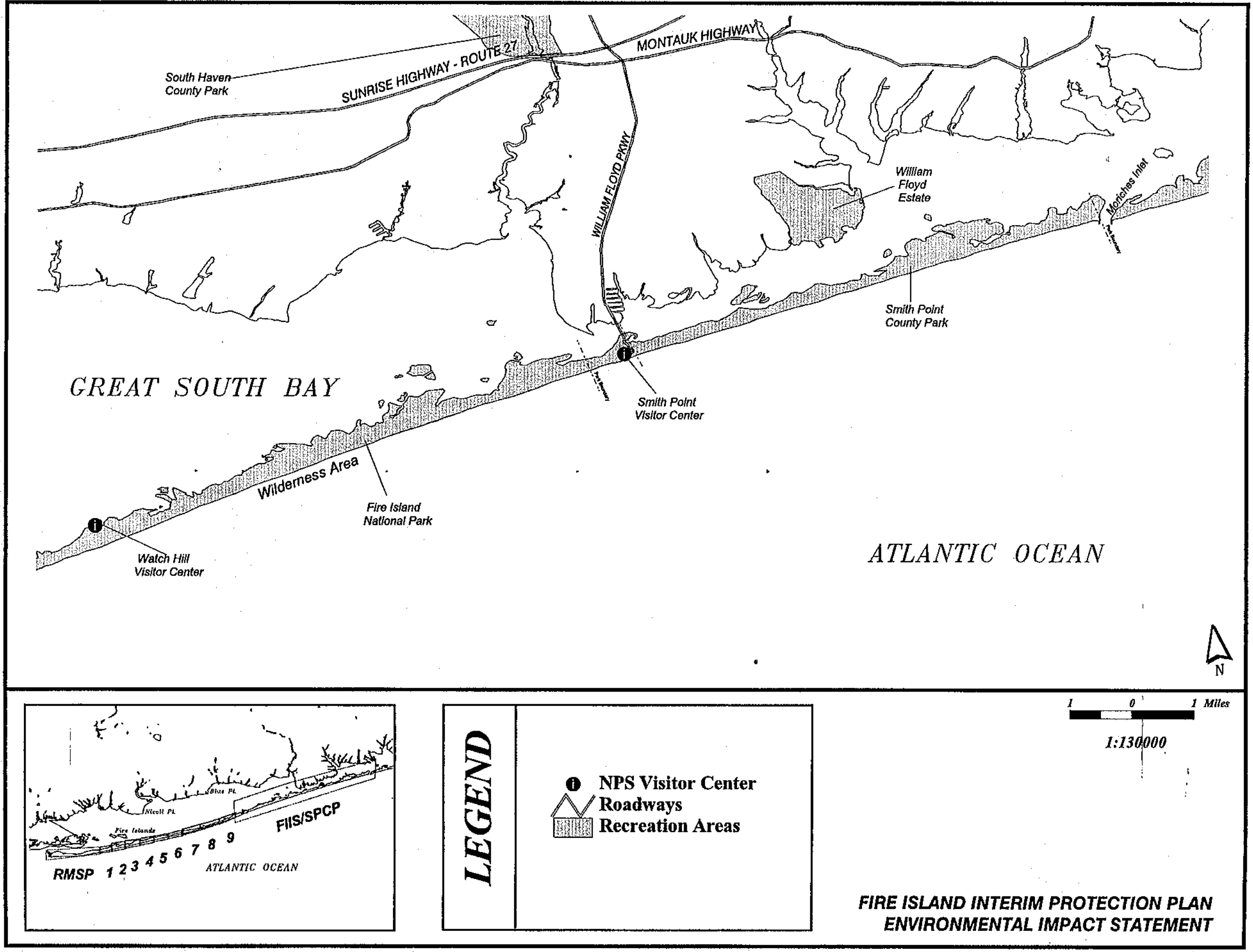

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Figure 3-11 General Land Use Map

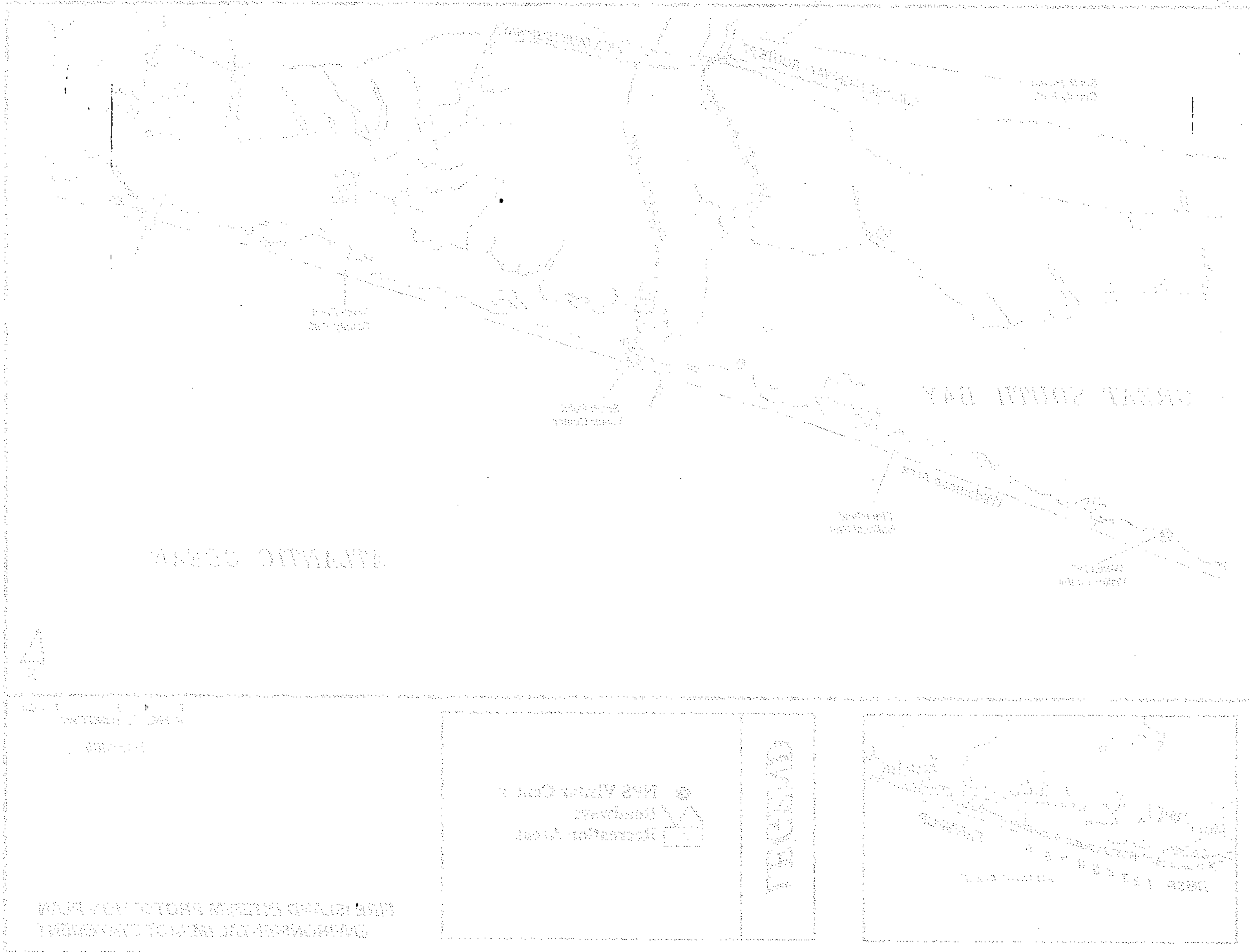
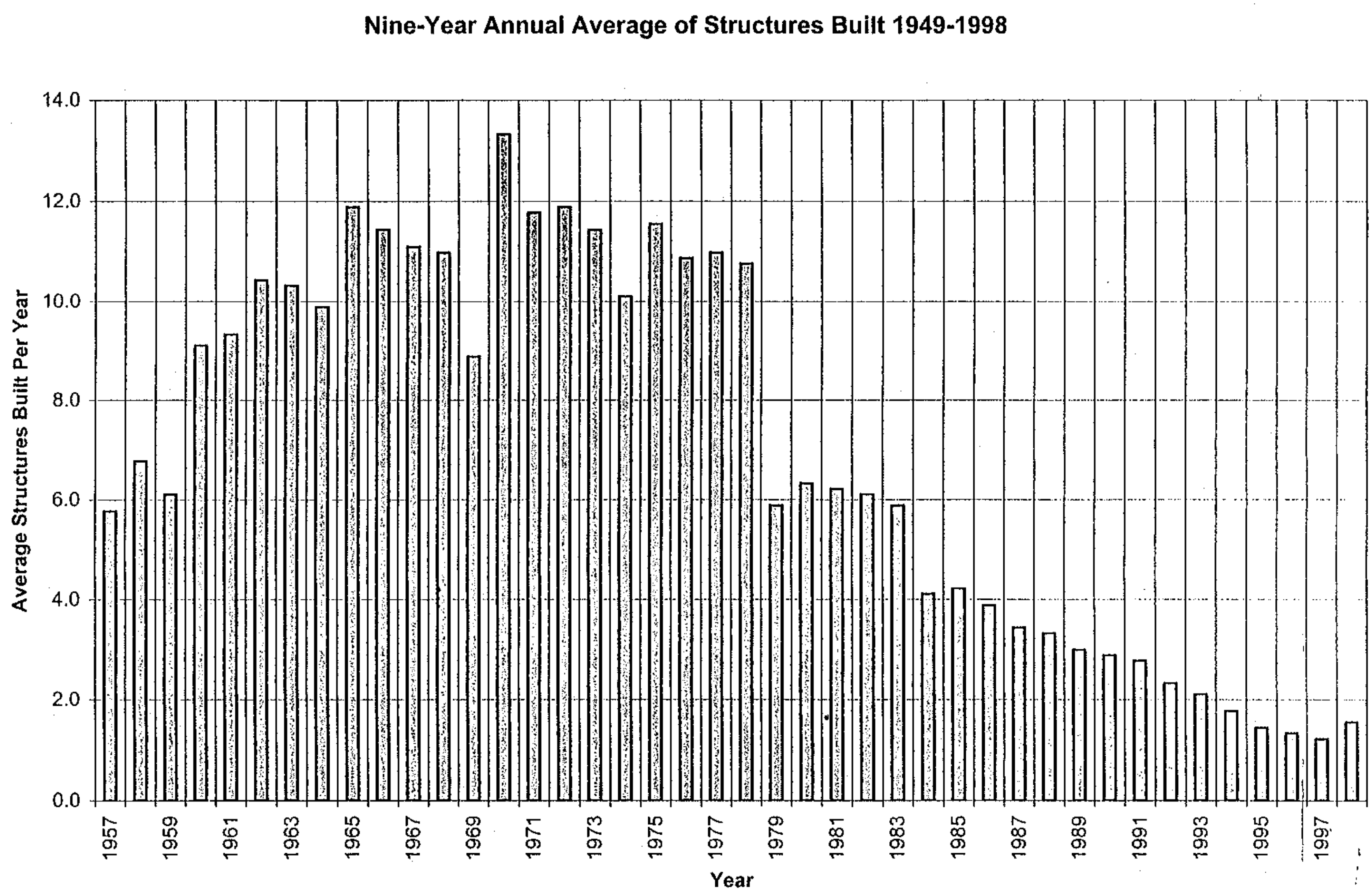


Figure 3-12 Fire Island Coastal Erosion Hazard Area Construction Trends



FIRE ISLAND INTERIM PROTECTION PLAN
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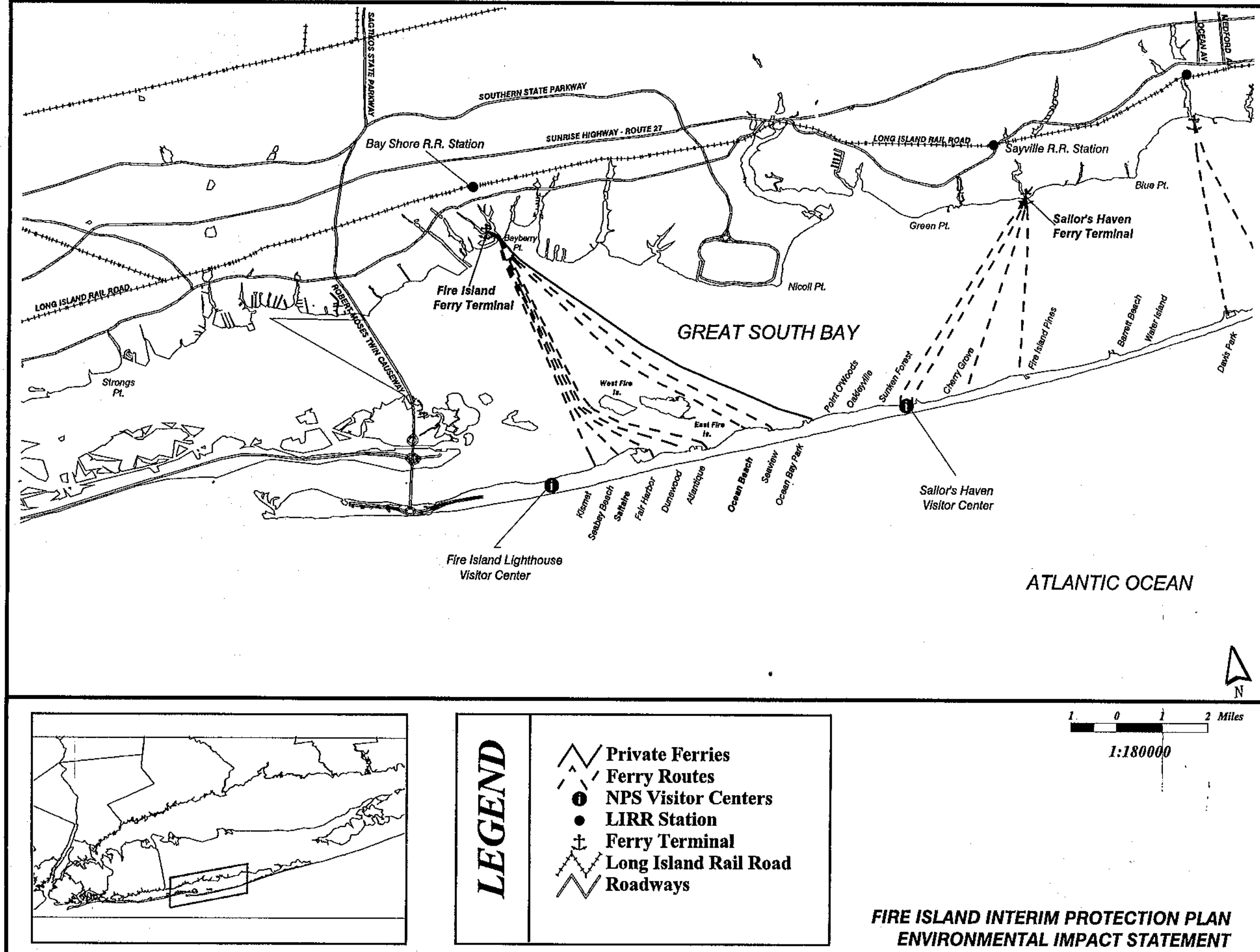
Figure 3-13 Transportation Features of the FIIP Study Area

WESTERN Extent



FIRE ISLAND INTERIM PROTECTION PLAN
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Figure 3-13 Transportation Features of the FIIP Study Area

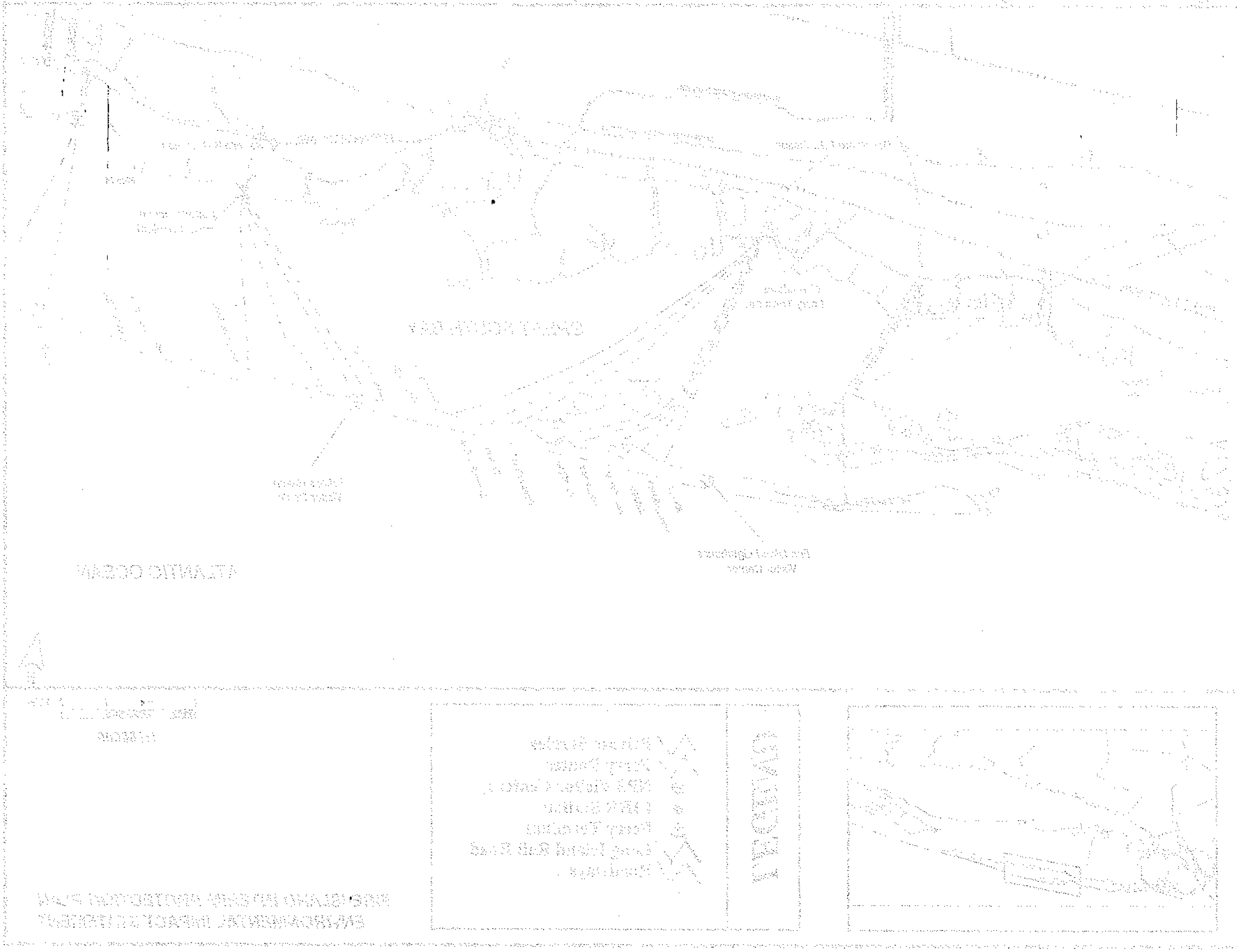
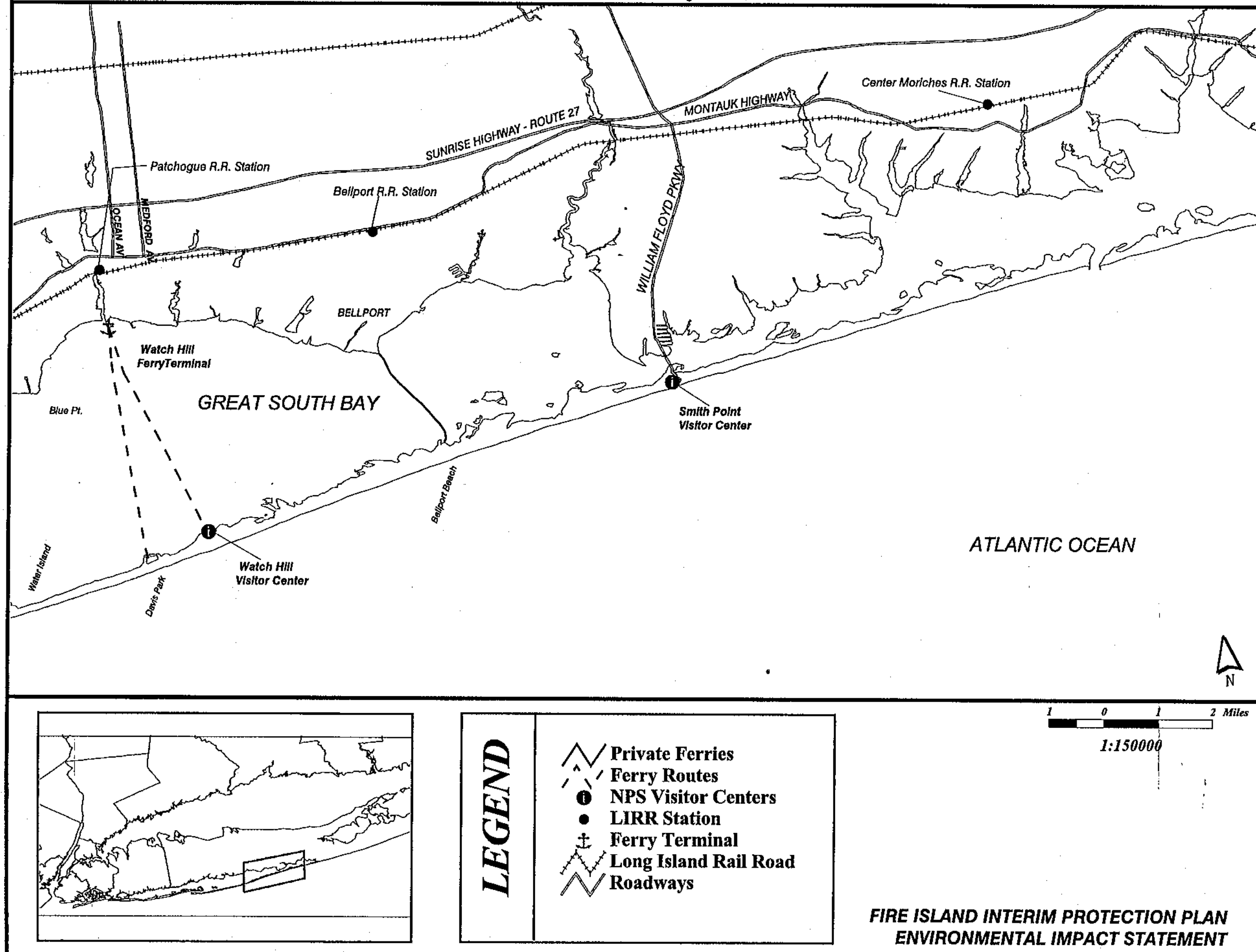


Figure 3-14 Transportation Features of the FIIP Study Area

EASTERN Extent



FIRE ISLAND INTERIM PROTECTION PLAN
ENVIRONMENTAL IMPACT STATEMENT

Figure 3-15 Natural Resource Study Zones

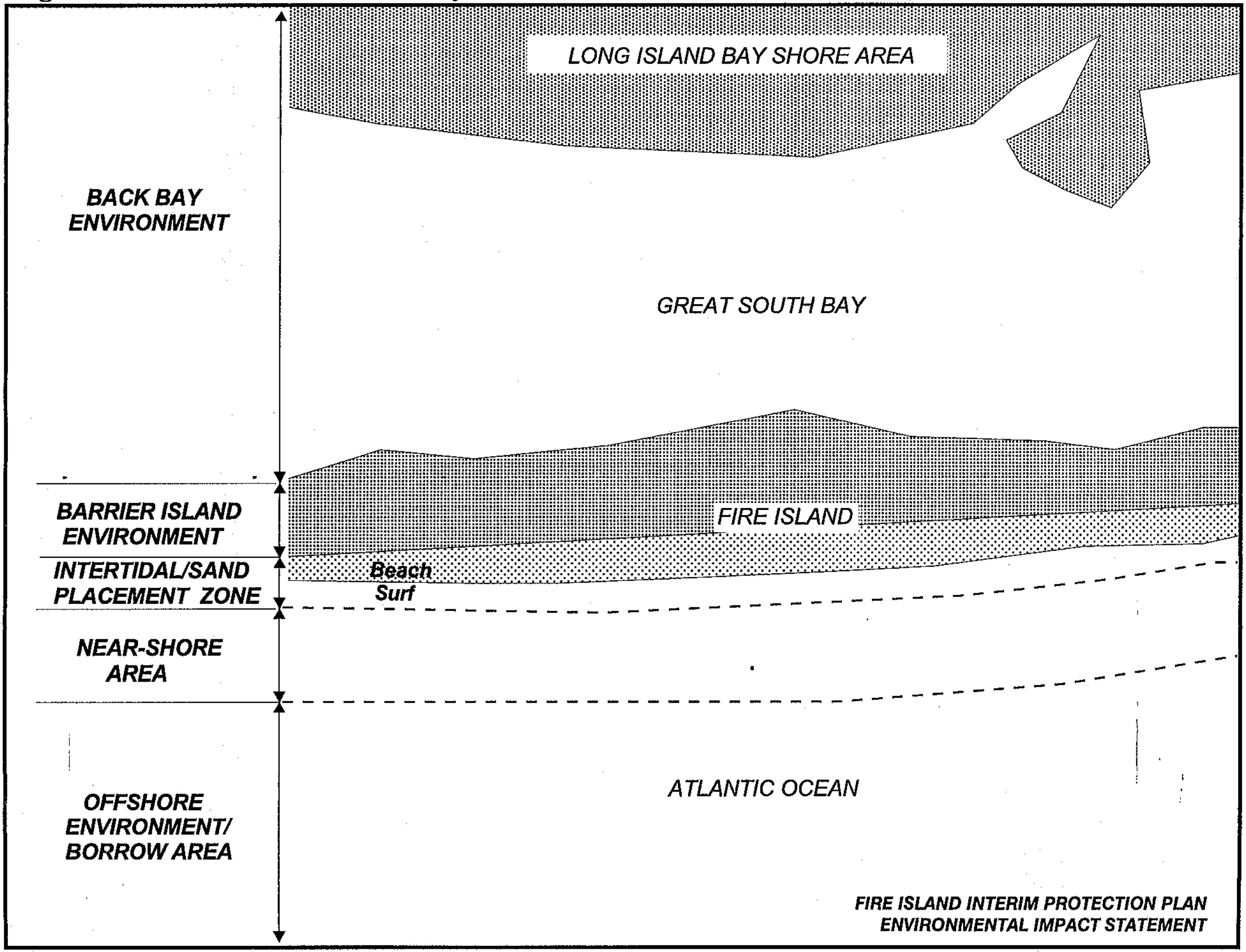
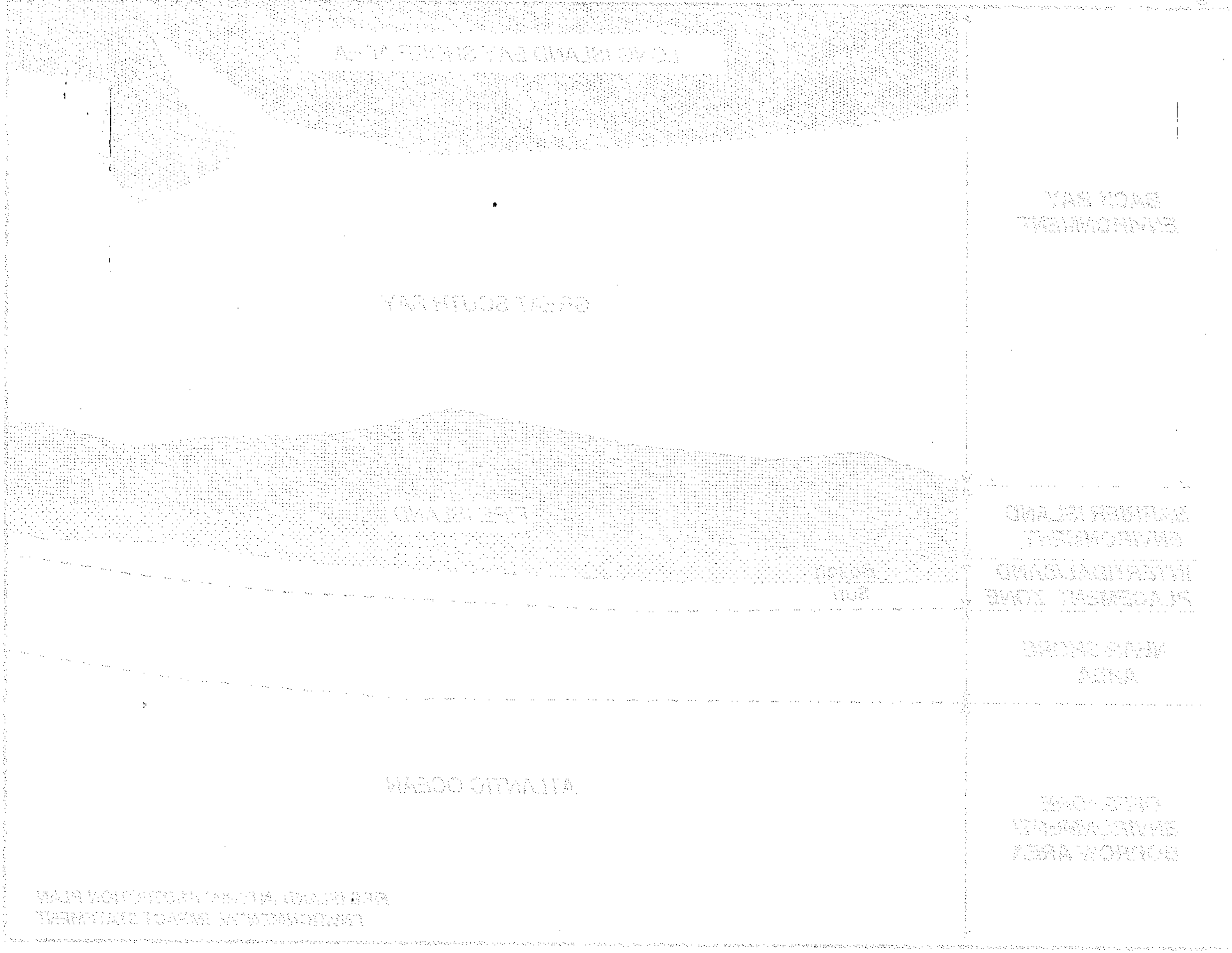


Figure 3-15 Natural Resource Study Zones



4.00 ENVIRONMENTAL IMPACTS

4.01 Each of the three project alternatives described in Chapter 2 are examined ~~in this~~ chapter for their potential to generate impacts on the human and natural environment. The alternatives are the No Action Alternative, the Fire Island Inlet FIIP (FIIP) or Preferred Alternative, and the Modified Authorized Plan. The alternatives are also assessed for their potential cumulative effects on environmental resources in combination with other actions and conditions. Measures to minimize the impacts of project alternatives are presented, followed by a discussion of the use of resources and environmental trade-offs associated with the project.

A. NO ACTION ALTERNATIVE

OVERVIEW

4.02 The No Action scenario does not imply no action, but rather represents a continuation of the status quo. This alternative assumes that all actions other than the FIIP that are currently planned or ongoing, including the Breach Contingency Plan (BCP) will continue to be carried out, as discussed in Chapter 3, Future Baseline Conditions in the Project Study Area.

4.03 As described in the Main Report, under the No Action Alternative, it is anticipated that the pattern of highly variable shoreline change will continue and, without additional protection of vulnerable areas this change will periodically expose back shore areas to storm waves and overwash and will increase potential for breach formation. Although it is likely that existing conditions would be exacerbated under the No Action Alternative, the coastal modeling and damage assessment conservatively assumed that conditions would be similar to that of today—that is, that there will be an estimated 10 percent chance of a breach forming in any one year and that more than 3,100 structures on Fire Island and nearly 12,000 on the bay shore would be at risk of damage from the 44-year frequency storm used in the damage analysis and coastal modeling.

4.04 The impacts of the No Action Alternative on the human environment, natural resources and cultural resources are discussed below, along with the alternative's potential for cumulative impacts in the study area.

HUMAN ENVIRONMENT

4.05 In general, the No Action Alternative would continue and possibly worsen the physical problems that affect the human environment of the study area today. With large but relatively common storm events, the area's land uses will be affected by storm damage, recreational opportunities may be lost, the largely water-based transportation system will be interrupted, and economic activity and utility services could be disrupted, as discussed below.

Land and Water Uses

Residential and Commercial Uses

4.06 Under the No Action Alternative, beach change and erosion would continue in the study area, particularly in the areas proposed for interim renourishment. This would result in reduced beach frontage on Fire Island, increased potential for structural damage and loss of homes and businesses on Fire Island and along the bay shore, and lost recreational opportunities for visitors and residents who rely on the beaches for their recreational experiences. Should the barrier island breach, business and residential structures located in the area of the breach and in low-lying areas near the bay shore would experience increased flooding and tidal surges potentially leading to extensive damages to the structures and their contents as well as possible utility service interruptions.

Recreational Uses

4.07 Given the increased future vulnerability to breaching, sections of public beaches could be temporarily lost and/or difficult to reach in portions of the study area, resulting in lost recreation opportunities for beachgoers. Furthermore, ferry facilities, roadways, and parking areas used by beachgoers may be damaged or rendered inaccessible due to a breach of the barrier island and flooding of the bayshore. Please refer to the Main Report for more details.

Water Uses

4.08 Under the No Action Alternative the adverse effects of storm events are expected to increase, creating adverse impacts on recreational and commercial boating in the Great South Bay. Breaches could form and major overwash could occur, possibly filling channels and preventing navigation in certain areas. Existing current and wave patterns could be changed and disrupted, leading to dislocated fishing and shellfishing grounds. As discussed above, some docking facilities could be damaged. Recreational boating, which is in great demand in the Great South Bay, would suffer from losses at existing marinas, and ferries would not be able to operate as they do under current conditions.

Land Use Regulations and Oceanfront Development Activity

4.09 As discussed in Chapter 3 and the Draft Decision Document, NYSDEC through CEHA provides control over development in the area seaward of a line drawn 25 feet landward from the landward toe of the primary dune. This has reduced the number of developable lots in the coastal erosion hazard area to only those that can be considered "infill," i.e., the property is flanked on either side by houses. As of 1998, there were an estimated 35 properties of this type.

4.10 Over the nine years 1990 through 1998, the annual average construction rate for buildings in the proposed coastal erosion hazard area was 1.6 (see Table 4-1). This is considered a reasonable indicator of demand in the near future. At this rate, in the nine years from 1998 to 2007, which covers the time frame for the implementation and life of the FIIP, some 14 to 15 additional oceanfront units would be built across the island.

Transportation

4.11 Under the No Action Alternative, construction and utility traffic on Fire Island could be significantly affected if a breach and/or flooding washed out portions of the "Burma Road." In addition, parking areas and access roads at Robert Moses and Smith Point Parks could be inundated, preventing access to those parts of the barrier island. The water access could be adversely affected if docking facilities on the bay side were damaged by a breach. However, it is unlikely that all docking facilities would be rendered unusable, and Fire Island could continue to be accessed via water, albeit at a reduced level.

4.12 Fire Island protects the south shore communities of Long Island's bay shore. Under the No Action Alternative, if a breach were to occur, low-lying areas would experience increased inundation and tidal impacts that could wholly or partially obstruct portions of the road network in those areas. Buses, taxis, and other autos using low-elevation roadways that could be inundated would be adversely impacted.

4.13 In addition, the structures and parking areas associated with waterfront ferry facilities would also experience increased flooding and potential structural damage if a breach were to occur.

Table 4-1
NINE-YEAR MOVING AVERAGE ANNUAL STRUCTURES BUILT IN CEHA

	Units/Structures Built in CEHA		
Year	Per Year	9-Year Moving Annual Average	Annual Average Percent Change
1949	2		
1950	12		
1951	1		
1952	5		
1953	5		
1954	4		
1955	13		
1956	0		
1957	10	5.8	
1958	11	6.8	17.3%
1959	6	6.1	-9.8%
1960	28	9.1	49.1%
1961	7	9.3	2.4%
1962	15	10.4	11.9%
1963	3	10.3	-1.1%
1964	9	9.9	-4.3%
1965	18	11.9	20.2%
1966	6	11.4	-3.7%
1967	8	11.1	-2.9%
1968	5	11.0	-1.0%
1969	9	8.9	-19.2%
1970	47	13.3	50.0%
1971	1	11.8	-11.7%
1972	4	11.9	0.9%
1973	5	11.4	-3.7%
1974	6	10.1	-11.7%
1975	19	11.6	14.3%
1976	2	10.9	-5.8%
1977	6	11.0	1.0%
1978	7	10.8	-2.0%
1979	3	5.9	-45.4%
1980	5	6.3	7.5%
1981	3	6.2	-1.8%
1982	4	6.1	-1.8%
1983	4	5.9	-3.6%
1984	3	4.1	-30.2%
1985	3	4.2	2.7%
1986	3	3.9	-7.9%
1987	3	3.4	-11.4%
1988	2	3.3	-3.2%
1989	2	3.0	-10.0%
1990	2	2.9	-3.7%
1991	3	2.8	-3.8%
1992	0	2.3	-16.0%
1993	1	2.1	-9.5%
1994	0	1.8	-15.8%
1995	0	1.4	-18.8%
1996	2	1.3	-7.7%
1997	1	1.2	-8.3%
1998	5	1.6	27.3%

Source: Allee King Rosen & Fleming, Inc. 1999, from Tax Assessor's records, Towns of Islip and Brookhaven.

Economic Activity

4.14 The No Action Alternative would have a significant adverse impact on the commercial enterprises in the project area. As discussed above, there are numerous businesses on Fire Island and on the bay shore, including restaurants, bars, marinas, and other commercial enterprises, and they would all have decreased activity during and following storm events. The shellfishing industry would continue to be subject to disruption from potential damage to boats and docks. For a more detailed analysis of economic impacts, please refer to the Cost Appendix (Volume II) of this report. The No Action Alternative would not provide the protective benefits achieved through beach nourishment. Physical damage to businesses on both Fire Island and the bay shore as well as lost revenues would have negative economic and fiscal impacts on these commercial operations.

Utilities

4.15 In the event that the barrier island breaches, the provision of utility services is likely to be interrupted (particularly electric and phone services), resulting in down-line customers losing utility services or necessitating the expensive repair/relocation of the utilities to service them. Underground sanitary sewage systems serving Fire Island could also be rendered inoperable during flooding events.

Environmental Justice

4.16 Executive Order 12898, entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," requires that the potential for disproportionate adverse impacts on low income and minority populations be identified and addressed. Conditions with the No Action Alternative would be similar to existing conditions and so the alternative not have a disproportionate adverse impact on these populations.

NATURAL RESOURCES

Introduction

4.17 Since most of the potential impacts are due to breaching or overwash, this section starts with an overview of breach events. The Fire Island barrier is particularly vulnerable to breaching (U.S. Army Corps of Engineers [USACOE] 1996b). Breaching refers to the condition where severe overwashing forms a new inlet which permits the exchange of ocean and bay waters under normal tidal conditions. Under this No Action Alternative, it is assumed that shoreline erosion will continue, and that at some indeterminate time the Fire Island barrier will be breached and a new inlet created.

4.18 The "standard breach" includes two scenarios: 1) the initial breaching event that would result from a winter storm (northeaster), or 2) a summer tropical hurricane. In both cases, it is likely that the breach would rapidly develop into an opening with a width of 1,000 feet and a depth of 10 feet, based upon projected growth rates derived in the Breach Contingency Plan (BCP.)

4.19 This analysis also assumes that any new inlet resulting from a breach occurring along the Fire Island barrier, exclusive of the Fire Island National Seashore (FIIS) Federal Otis G. Pike Wilderness Area, will be sealed within three months pursuant to BCP that is currently in place. Thus, all the disturbances related to the breaching event, inlet formation, and closure would be temporary (with the exception of physical changes, such as alterations to the bottom topography in the vicinity). The short-term nature of such an event is described by the U.S. Fish and Wildlife Service (USFWS 1995): "The effects of a breach . . . will be short-term in any event, primarily because ecological succession will occur following the disturbance . . . the breach will be closed and the bay will eventually return to its prebreach environmental condition."

4.20 The vegetative communities found in the (human) communities are unlikely to have much influence on breach resistance as they are mostly ornamental species. Possible exceptions are Fire Island Pines and Saltaire which have moderately well developed overstories and may have marginally more resistance to scouring of sand substratum.

4.21 Based on modeling efforts, the NYD has identified 14 locations within the study area where breaches are likely to occur, and rated these (low, moderate, high) as to their relative potential to form permanent inlets (USACOE 1996a), shown in Table 4-2. The ratings are based on an assessment in the BCP (USACOE 1995) and reflect current physical conditions including island width and potential overtopping water flow rate.

Offshore Environment/Borrow Area

4.22 In the No Action Alternative, there would be no positive or negative impacts to the offshore and nearshore environment that differ in any way from current conditions (and presumably ongoing human activities).

Table 4-2 Likely Locations of Breaches	
Approximate Location	**Rating**
Saltaire	Low
Fair Harbor	Low to Moderate
Atlantique	Moderate
Ocean Bay Park	Low
Sailor's Haven Visitors' Center	Low
Cherry Grove	Low
Fire Island Pines	Low
Barrett Beach	Moderate to High
Water Island	Moderate to High
Davis Park	Low
Long Cove	Low
Old Inlet	High
Smith Point County Park (2 locations)	Moderate
Source: USACOE 1996a.	

Offshore Area Invertebrates

Macrobenthic Invertebrates

4.23 Under the No Action Alternative, no sand will be harvested from the offshore borrow site. The macrobenthic invertebrate community will therefore remain in its present state with seasonal fluctuation, as is typically observed in benthic communities.

Shellfish

4.24 As is the case with the macrobenthic invertebrates, the shellfish beds will remain unaffected by the No Action Alternative. As stated in the Affected Environment section, it is anticipated that the surf clam would be the dominant species in the habitat associated with the borrow area; however, it is uncertain whether sea scallops and ocean quahogs currently exist there. Surf clam populations would still be subject to seasonal fluctuation, impacts due to a severe coastal storm, and the pressure of commercial harvesting.

Squid

4.25 In the event that squid currently utilize the borrow area, it is likely that they will continue to do so under the No Action scenario. Unlike the other invertebrate species, squid are pelagic and not bound to the site. Squid abundances are expected to continue to fluctuate seasonally in response to fishing pressure and naturally occurring variations in year classes and migration patterns.

Crustaceans

4.26 Similar to squid, the larger crustaceans are mobile, and populations are expected to shift in response to variations in temperature, abundance of food, or other conditions specific to their life cycle. Under the No Action scenario, the larger crustaceans (i.e., sand shrimp, rock crabs, spider crabs, lady crabs, and to some extent lobsters) will continue to utilize the waters offshore from the project site. With the exception of lobsters, overall crustacean abundances are expected to fluctuate primarily in response to seasonal changes. Lobsters may be considered only transient users of the offshore waters, due to their normal seasonal migration between the offshore and inshore waters. In addition, lobsters are the only crustaceans in the offshore waters that are subject to commercial harvest. Thus, lobster abundances will be controlled by the combined effect of natural seasonal population changes and the commercial take.

Offshore Area Finfish

Resident Species

4.27 Under the No Action scenario, resident finfish species will continue to utilize the waters in the vicinity of the borrow area, similar to current conditions. Abundances are expected to fluctuate seasonally and in response to commercial and recreational fishing pressures.

Transient Species

4.28 Similar to the resident finfish species, transient species are expected to continue utilizing the borrow area in whatever capacity they currently do. Population fluctuations are expected to be greater for transient fish species as compared with resident species. This is partially due to the lack of bottom structure (which typically attracts and holds fish to a given location), and the migratory nature of the species. Transient species generally pass through the area during migration or in search of food.

Off-Shore Area Marine Mammals

4.29 This No Action Alternative is not likely to have any significant impact on the marine mammals that currently utilize the waters offshore from the project area, since this condition represents a continuation of the status quo. However, the occurrence of a breach may provide at least temporary benefits to the bottle-nosed dolphin, harbor seals and hooded seals (all of them resident species). A breach through the barrier could temporarily deliver a more diversified food supply (e.g., finfish, shrimp and other crustaceans which normally remain in the bay waters) to dolphins and minke whales occupying the ocean waters closer to the barrier. The larger whale species (northern right, finback and humpback) are not likely to be affected because they generally remain much farther offshore. Seals could also possibly benefit from the additional shoal areas created by the breaching process. The seals would use this habitat as haulout areas.

Offshore Area Avifauna

4.30 The truly pelagic species are not likely to be affected by the No Action Alternative, because their use of the project area is limited to feeding and resting activities. However, the non-pelagic birds (gulls, terns, and cormorants) may be affected by a breach resulting from this scenario.

4.31 The impacts of a breach resulting from this No Action Alternative are likely to be beneficial for the avifauna utilizing the offshore areas. The temporary formation of ebb tidal deltas resulting from a breach may provide additional resting/roosting areas for gulls and terns. If such deltas are created as a result of a summer storm and are large enough to be exposed at low tide, these may prove even more valuable as feeding and rearing areas for young birds that are learning to fish. They may also be used as staging areas by congregating terns prior to migration. Although the habitat may initially appear suitable for nesting by gulls and terns, oceanic shoals are not generally considered permanent, and any nesting attempts may prove to be unsuccessful.

Off-Shore Area Threatened and Endangered Wildlife Species

4.32 The Endangered Species Act (ESA) of 1973 mandates the protection from extinction of uncommon or threatened wildlife and plant species. Section 7(a) of the ESA requires federal agencies to evaluate their actions with respect to any listed or proposed species or listed/proposed critical habitat. Section 7(a)(2) of the Act requires federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or will result in the destruction or adverse modification of its critical habitat. The responsible federal agency must enter into formal consultation with the USFWS or National Marine Fisheries Service (NMFS) if it determines that its action may affect a listed species or its critical habitat (USACOE 1998).

4.33 No additional action (outside of current emergency breach closure activities approved under the BCP) is proposed under this No Action Alternative. Therefore, this scenario will continue the current level of protection that is afforded for rare and endangered species occupying the project area.

Resident Wildlife

4.34 As mentioned previously, the formation of ebb tidal deltas resulting from a breach may slightly benefit the sedentary population of double-crested cormorants by providing additional isolated nesting areas. It is not likely that cormorants would use such shoals for breeding purposes, because of the ephemeral nature of ebb shoals and the lack of vertical structure. Double-crested cormorants typically select coniferous or deciduous trees on protected sites to build their nesting platforms (Andrle and Carrol 1988).

Migratory Wildlife

4.35 As presented in the Affected Environment section, there are at least 11 rare migratory bird species that may utilize the waters offshore from the project area. As discussed previously, this No Action scenario is expected to have little beneficial to no impact on these species. The terns (least, roseate, common, black, Foster's, gull-billed, and Caspian) may make use of ebb tidal deltas for resting if they are present during the season when the species are found in the area. The common loon and black rail will likely be unaffected, while the cormorants may be slightly benefited by the occurrence of the oceanic shoals.

Sea Turtles

4.36 The No Action Alternative is not likely to have a significant impact on sea turtles that currently utilize the waters offshore from the project area, since this condition represents a continuation of the status quo.

Near Shore Area

Near Shore Area Invertebrates

4.37 The instability of the near shore environment affects the macrobenthic invertebrates, the larger shellfish species, and the larger crustacean species equally. All will continue to be found in the high energy environment associated with the nearshore areas, under the No Action scenario. The diversity and abundance of individual species will change in accordance with seasonal conditions and typical life cycle fluctuations.

Near Shore Area Finfish

4.38 Given the instability of the near shore environment, all finfish species are best regarded as transient. Seasonal variations will be the greatest during the spring and fall migrations. The seasonal passage of finfish through the project area will not be altered under the No Action scenario.

Intertidal Zone

Intertidal Zone Invertebrates

Benthic Invertebrates and Shellfish

4.39 The intertidal environment is almost totally dominated by macrobenthic invertebrates, which can include several very small shellfish species (e.g., Tellina clams). The large bivalves (e.g., surf clams, sea scallops, ocean quahogs) are not typically found in the intertidal environment. Under this No Action Alternative, the macrobenthic invertebrates will continue to exist in the intertidal environment in varying degrees of diversity and abundance, as dictated by seasonal fluctuations and occurrences of coastal storms.

Crustaceans

4.40 Most crustaceans present in the intertidal zone are exceptionally small and fall into the category of macroinvertebrates, with the exception of the lady crab. Lady crabs are considered seasonally abundant in the intertidal zone, with densities fluctuating based on numerous variables. Like the macrobenthic invertebrates, the lady crab will continue to utilize this habitat under the No Action scenario.

Barrier Island Environment

4.41 Under the No Action scenario, there would be continuing shoreline erosion and a strong possibility of a breach or overwash occurring during a tropical or extra-tropical storm. The immediate effect of such an event generally entails direct burial or destruction of the existing vegetative communities. The extent of this destruction would depend on the width of the breach or overwash fan. The avifauna and mammals dependent on the impacted habitats would be displaced or eliminated in the immediate area of any overwash or breach.

4.42 Ebb and flood tidal deltas, overwash fans, and sand spits are commonly created by breach and overwash events. After breach inlet closure, the sediment that has accumulated in the ebb tidal delta is generally reworked by waves and reintroduced into the littoral drift, while the sediments deposited into the flood tidal deltas typically remain in place and serve as the substrate for future wetlands and eelgrass beds (Cashin Associates 1993). According to the NYD BCP (1996), a general increase in species diversity and numbers often follows such environmental perturbations. Many wildlife and plant species are particularly attracted to these early successional habitats and physically dynamic areas. Such areas provide loafing, foraging, and nesting habitat for several species of shorebirds (USFWS, June 1995). Additionally, the areas on the barrier where over-wash/breaching events are most likely to occur are typically characterized by low elevation dunes and interior areas, and gently sloping beaches. These areas are favored by piping plovers and their broods in search of easy access to the bayside mud flats to feed (Cashin Associates 1994). Other flora and fauna considered protected, threatened, or endangered by New York State utilize the same environments. The flood tidal deltas created by past breaching events, and the dynamic sand spits and flats typically found near the bay inlets, provide suitable habitat for seabeach amaranth, seabeach knotweed, and a variety of shorebirds, including least and roseate terns.

4.43 The seasonality of breach or overwash occurrence may limit the extent of the impact to the local ecology. For instance, most overwash events occur during northeaster (fall and winter) storms when the piping plovers have migrated elsewhere. In addition, the loss of beachfront habitat (e.g., Tiana Beach, a New York State Department of State [NYSDOS] Designated Significant Fish and Wildlife Habitat) may negate the beneficial impacts of overwash habitat creation. Should the breach occur in the spring or summer due to a storm, the destruction of shorebird nests by wind and flooding would be a more negative impact than any presumed short-term overwash habitat gain. Similarly, low-lying degraded beaches are also at risk of experiencing a significant overwash due to much smaller storm events, and in turn threatening any shorebird nesting activities.

Flora of the Barrier Islands

4.44 The No Action scenario will not result in any direct impacts on barrier island vegetation. However, the project area will be indirectly affected if breach and overwash events are allowed to continue. The impacts of such an event will vary based upon the area affected, the type of vegetative community that is covered by deposits or lost by the storm, the depth of the deposit, and the season of occurrence.

Dune and Swale Community

4.45 By nature, the primary dune supports a pioneer community that is dependant upon or well adapted to changing substrate conditions. Dune grass relies on a steady supply of fresh sand to maintain vigor. Codominant species, such as beach pea and seaside goldenrod, tend to invade the dunes once the beach grass has become established. Thus, the primary dune vegetation is typically well adapted to and maintained by overwash events. Preliminary findings of a study currently being conducted by the NYD examining the impacts of historical breaches/overwash events on barrier island vegetation indicate that the beach grass-dominated community is the first to become established following an overwash event.

4.46 The swale and lee-side of the primary dune which is generally covered with maritime shrub species is more susceptible to burial; however, it is still characterized by species which are generally tolerant of salt spray. An evaluation of vegetation and elevation records showed that shrub communities did not recover from overwash burial; however, some individual plants were able to survive partial burial (Nauset Spit, Massachusetts, Zaremba and Leatherman 1984). Thus, the impacts of overwash on the dune and swale community will vary based upon the vegetation that is affected. Impacts on the beach grass community are not expected to be significant, and it is likely that the vegetation will recover fairly quickly (between 1 to 3 years) following such an event. The greatest change would be associated with a breach, where total loss of the dune and swale community structure might occur. Some of this loss may be buffered by the revegetation of flood tidal deltas that are created by the breach.

Maritime Forest Community

4.47 As described in the Affected Environment Section, the Maritime Forest community is characterized by later successional tree species. Ecological stability and protection from environmental extremes (wind, drought stress, etc.) have been essential factors in the development of such woodland communities. Thus, this cover type generally occupies the portions of the barrier which are fronted on the ocean side by a well-developed dune system, a high and wide beach profile, or some combination of both. This reduces the likelihood that a breach or severe overwash would occur in these areas. However, if such an event does occur, either adjacent to or through an established forest community, it is likely that all or a substantial portion of the woodland will be lost. The immediate effect would be direct destruction of the individual trees which are buried or eroded away. Over time, the canopy trees adjacent to those initially destroyed (and for some indeterminate distance leeward) will become stressed (due to increased exposure, insects, disease, etc.) and eventually die. Associated secondary impacts would also occur to the wildlife species which are dependant upon this woodland habitat.

4.48 The ultimate vegetative structure of such an affected area will be governed by the type and depth of substrate left (in the wake of the overwash or breach closure activities) and the type of oceanfront protection provided under the BCP. Such a damaged woodland community is not likely to become reforested naturally without extensive mitigation. If sandy substrates remain, the affected area will probably revert to an earlier successional habitat type (beach grass or phragmites-dominated grassland or maritime shrubland).

4.49 Regarding the potential for a breach occurring and scouring out or otherwise damaging a maritime forest community, the probability is low. The only significant maritime forest is the Sunken Forest located between Point O' Woods and Cherry Grove. The primary and secondary dunes fronting the forest are high and well developed and therefore unlikely to be breached, even in a severe storm. In Table 4-1, the breach rating for this location is given as "low."

Planted Exotic Lawn/Shrub

4.50 The construction of homes, infrastructure, and institutional buildings is the development matrix around which landscaping was established. It is anticipated that the impacts to human life and property resulting from a breach or overwash event would be the primary concern of the agencies, and that impacts to site landscaping would be insignificant in comparison. Ornamental and cultivated landscape plants and turfgrasses would generally be more susceptible to damages resulting from burial or destruction by breaches/overwashes than indigenous vegetation. Thus, it is highly likely that damaged landscaped areas will recolonize with a suite of more native and opportunistic plant species, including phragmites.

Barrier Island Intertidal Marshes

4.51 In early reports by Leatherman and Allen (1982, 1985, 1989), it was noted that the majority of the marsh islands and backbarrier marshes in Shinnecock Bay and Great South Bay developed on old flood tidal deltas created by former inlets (Cashin Associates 1993). However, these same major storm events could also damage existing tidal marshes. In the event of a breach or major overwash, sands transported to the northern shoreline of the barrier island are likely to scour or smother the intertidal marsh grasses. The results may be temporary or permanent, depending on the size of the breach and the length of time until closure. In a study of the tidal wetland trends in Shinnecock Bay from 1974 to 1995, NYSDEC found that extensive wetland areas were buried by overwash caused by the December 1992 northeaster (Fallon and Mushacke 1996). The NYSDEC report also suggested that since the event occurred during the dormant period for tidal marsh grasses, rapid removal of the overwash deposits may have allowed the wetland to recover naturally. However, no wetland recovery contingency plan was in place prior to the storm event to facilitate that action.

4.52 The following discussion was extracted from the USFWS Coordination Act Report for the BCP (June 1995). "Alterations of sedimentation and current patterns and rates, as well as tidal levels, due to a breach or new inlet may affect salt marsh development. Overwash events are also an important mechanism affecting salt marsh development. An evaluation of aerial photography and vegetation and elevation records showed that backbarrier salt marshes exposed to frequent overwash or strong bayside currents did not support salt marsh vegetation (Nauset Spit, Massachusetts, Zaremba and Leatherman 1984). In general, recovery of major low and high salt marsh plant species (i.e., *Spartina alterniflora* and *S. patens*, respectively) depended on the degree of burial and marsh elevation prior to burial. Salt marsh plants which experience deep burial (>33 cm) did not recover. Rather, those areas were recolonized by beach grass.

Wildlife Usage

4.53 The impacts on barrier island vegetation resulting from breaches/overwash events will also have a secondary impact on the wildlife species which normally utilize these communities. Predatory species may selectively benefit from the vegetational changes which may temporarily displace prey species typically found in their previously undisturbed communities. Such changes will also likely benefit the wildlife species which utilize earlier successional habitats (i.e., terns, plovers, and other shorebirds) for feeding or nesting areas. Damages to the maritime shrub and forest communities may negatively impact the migratory passerine (perching bird) species which rely on these areas to supply the necessary protective cover and food supplies during migratory passage through the project area.

Barrier Island Avifauna

Resident Species

4.54 The resident population of herring and great black-backed gulls will likely benefit from the impacts associated with breaching and overwash events. Both species favor nesting on isolated grassy beach areas, which may result from flood delta deposition and barrier island overwash deposits. In addition, both species are keenly adapted to foraging for food scraps which may result from storm damages and for preying upon other shorebirds which may attempt to nest in the new overwash and delta deposits.

4.55 The resident waterfowl populations of Canada goose, black duck, and mallard are likely to remain unaffected by the No Action Alternative and potential breach/overwash events. Although these birds primarily seek coastal and brackish tidal marshes for breeding, their habitat is not particularly limited to the project area; they will utilize the entire bay complex for loafing, feeding, and rearing young.

Migratory Species

4.56 As discussed in the Affected Environment Section, numerous species of shorebirds forage along the beaches, marshes, and intertidal flats of the project area from spring through fall. While breaches and overwash deposits may temporarily disrupt feeding patterns for shorebirds, they will likely result in a net increase in available shallow water foraging habitat over the long term. Since there may be no net increase in area of vegetated salt marshes (due to wetland burial and scour balanced against new marsh creation), there is not likely to be any associated benefit to shorebirds which utilize this habitat for breeding (e.g., American oystercatcher).

Raptors

4.57 Considered as a whole, the habitat changes resulting from barrier breaches/ overwash events are likely to benefit the raptorial birds. As discussed earlier, the temporary displacement of small mammals from previous habitat areas, coupled with increased exposure in sparsely vegetated areas, makes prey species particularly vulnerable to foraging raptors. Thus, a breach or overwash event occurring during peak raptor migration periods would temporarily increase the raptor forage base. The conversion of more heavily vegetated shrubby or wooded areas to more grassland-dominated cover will also selectively favor the raptors that prefer hunting over open country, including the buteo hawks (red-tailed), the northern harrier, the kestrel, the peregrine falcon, and many owls (short-eared, barn, and saw-whet). Since ospreys feed exclusively on fish, the occurrence of a breach or overwash is not likely to affect this species. The various accipiter hawks (goshawk, Cooper's, and sharp-shinned) that may frequent the project area during migration will either remain unaffected or lose a portion of their foraging base which is typically associated with woodlands or heavily vegetated habitats.

Passerine Species

4.58 As discussed in Chapter 3, the project area is extensively utilized by passerine birds, particularly during the spring and fall migration periods. The burial or loss of back dune and swale vegetation, shrub thickets, and woodlands could significantly affect the ability of the affected area to protect and support these birds. What impact an event such as a breach or major overwash would have on passerine species cannot be quantitated absent specific knowledge regarding the size and duration of the breach and the specific types of vegetative communities removed.

Barrier Island Wildlife

Large Mammals

4.59 The No Action scenario could exacerbate the current problems associated with whitetail deer overpopulation on the Fire Island barrier. Since deer are fairly good swimmers and capable of traversing open water, they will not become isolated by barrier island breaches. However, they prefer to move within or proximal to well vegetated areas and may tend to avoid wandering into fully exposed overwash or breach areas. This may limit their feeding activity to the remaining vegetated portions of the barrier. Deer are also likely to be particularly attracted to foraging on the open edges of the shrubby habitat where new succulent vegetation is emerging. This selective feeding behavior can significantly affect the rate of re-vegetation in the overwash or breach closure areas.

4.60 If the overwash or breaching event occurs during the winter and destroys a winter bedding area or food source, the deer population may become concentrated in the remaining woodland areas, thereby increasing grazing pressure on the adjacent vegetative communities. A concomitant severe winter could potentially translate into increased deer mortality or into decreased reproductive success the following spring; however, damage to the vegetative community may have already taken place.

Small Mammals

4.61 The small mammal populations are likely to shift in response to the habitat changes induced by a breach or significant overwash event. As mentioned earlier, mammals that are not fatally injured by the event may be displaced to outlying areas, thus increasing intra-specific competition for limited cover and food resources. It is probable that the additional animals will fall prey to raptors or other predators until the populations level out to match the remaining available habitats. Concurrently, there may be an opportunistic increase in rodent populations that are capable of expanding into the new or enlarged grassland habitats.

Feral Species

4.62 The No Action scenario is not likely to produce any significant change in the current feral dog and cat populations. These animals would be expected to continue to prey on wild species as well as scavenging for food scraps in dumpster areas.

Herpetiles

4.63 Of the nine reptile and amphibian species indicated as occupying the project area, only the spotted turtle is likely to be significantly affected by a breach/overwash event. This species prefers freshwater marshes, a habitat which is fairly limited on the Fire Island barrier. Should a breach occur in proximity of a known population, this turtle may be cut off from either its freshwater source or breeding habitat. It is also possible that a breach could create new herpetile habitat for species that prefer saltwater marshes. The new, early successional habitat created by a breach or overwash would most likely not be utilized by any of the herpetiles found in the project area.

Insect and Arachnid Fauna

4.64 There is a paucity of published literature dealing with the effects of shoreline erosion (whether human induced or natural) on beach insect and arachnid fauna. However, it is likely that severe erosion and/or a breach would result in the direct loss of burrowing species and beach habitat. In the event that significant overwash deposits are delivered to the back bay and cover adjacent wetland areas, a negative impact to additional insect habitat is likely.

4.65 New bare sand habitat created by a breach or overwash would probably be utilized by beach wrack amphipods and spiders, among other faunal types. This might be somewhat beneficial to avian species feeding upon these forms.

Threatened and Endangered Barrier Island Wildlife Species

4.66 The No Action scenario will continue the level of protection that is currently provided to rare and endangered wildlife species which may utilize the project area, since no additional federal action is proposed.

Resident Wildlife

Barn Owl

4.67 The No Action scenario may result in a slight beneficial impact on resident barn owls. As described previously, the net result of a breach/overwash event is the likely conversion of shrub thickets and woodland habitats into earlier successional grassland habitats. This could provide expanded habitat potential for the barn owls' preferred prey rats and mice. In addition, the demise of standing trees, as might be expected if the breach or overwash was to occur through the maritime forest, would provide increased nesting potential for resident barn owls.

Migratory Wildlife

Piping Plover

4.68 As discussed in Chapter 3, the federally endangered Atlantic Coast population of piping plovers has been well documented as utilizing several locations on the Fire Island barrier for nesting (NYSDEC, Long Island Colonial Waterbird and Piping Plover Surveys). Elias-Gerken (1994) studied piping plover use in the project area to identify any discernable trends in habitat suitability. She determined that certain habitat elements were lacking (ephemeral pools for feeding). This, coupled with the scarcity of open/sparsely vegetated sites, rendered much (approximately 80 percent) of the FIIS unsuitable for breeding habitat. The presence of open vegetation (median cover of 10 percent) was determined to be an important habitat element to support foraging piping plover chicks, in the absence of ephemeral pools and when easy access to bay mudflats is restricted. Thus, suitable habitat is limiting piping plover numbers on the Fire Island barrier. Elias-Gerken further suggested that storm-maintained, early successional stage habitats, such as is created by overwash fans, provide optimal breeding conditions for piping plovers.

4.69 If a breach is closed or an overwash area is formed the winter prior to the shorebird breeding season (April 1-July 1), piping plovers (in addition to other shorebirds) will immediately use the newly altered area for foraging. Gently sloping overwash fans that extend into the back bay marshes provide prime foraging habitat. Due to routine dynamic changes in washover or breach areas, the vegetation typically remains sparse. This provides optimal nesting habitat. The insects associated with the sparse vegetation (i.e., common ants and flies) also provide a food source for the foraging shorebirds (USACOE 1996). However, shorebirds that utilize washover areas for nesting may also be subject to increased predation, and to nest failure due to subsequent washovers at the same location.

4.70 In 1999, piping plover nests were observed at Water Island, Old Inlet; Democrat Point, and Smith Point (in front of Pattersquash Island). As noted in Chapter 3, these are not long-established breeding areas. Piping plovers have historically nested in a variety of locations across the length of Fire Island.

4.71 Plover breeding and nesting season falls between the spring and fall hurricane seasons. Given the existing and projected conditions of the without project condition of the project area, the potential for breaching could result from events ranging from storm events with a return period of 5 to 10 years. These events could include minor storm conditions, including those resulting from near misses of Atlantic Ocean hurricanes, in addition to extratropical events. It is difficult to account for seasonality of the potential for breaching, as well as the potential for breaching disturbance. Examples of such storms include Hurricanes Felix and Louis in the summer of 1996 and the recent April 23, 1998 storm, all of which resulted in serious, overwash events.

4.72 In direct contrast to the benefits derived from overwash deposits, a barrier island breach and continued beach erosion could have negative impacts on piping plovers. A breach occurring during the nesting season could result in the direct loss of eggs, and mortality of chicks and/or adults. Flood tidal deltas resulting from a breach may provide additional foraging areas for piping plovers. However, this benefit must be weighed against the loss of beachfront nesting habitat. Continued erosion of the beach and fore-dune can create erosion scarps, thereby degrading existing or other potential plover habitat.

4.73 Given the existing and projected "without project" condition of the project area, the potential for breaching could result from events ranging from storm events with a return period of 5 to 10 years. These events could include minor storm conditions including those resulting from near misses of Atlantic Ocean hurricanes in addition to extratropical events. It is difficult to account for seasonality of the potential for breaching and the potential for breaching disturbance. Examples of such storms are Hurricane Felix and Louis in the summer of 1996 and the recent April 23, 1998 storm. All of these storms resulted in serious overwash events.

Roseate, Least, and Common Terns

4.74 While roseate terns prefer breeding on moderately vegetated sandy deposits in isolated island colonies, least and common terns utilize similar nesting habitat as piping plovers. Thus, the positive impacts of improved nesting potential on overwash deposits, breach closure areas, and sand spits are very similar for all of these species.

Osprey

4.75 Ospreys within the project area typically nest on man-made elevated platforms or at the tops of dead trees. In addition, this species feeds exclusively on fish. Neither the nesting or feeding habitats for ospreys are likely to be affected by the No Action Alternative.

Peregrine Falcon and Cooper's Hawk

4.76 Both the peregrine falcon and Cooper's hawk utilize the project area primarily during fall migration. The No Action Alternative is thus not likely to affect either of these raptor species, except for the indirect benefits associated with increased prey availability potentially resulting from habitat changes, as discussed earlier.

Northern Harrier, Short-Eared Owl, and Upland Sandpiper

4.77 The northern harrier, short-eared owl, and upland sandpiper are all species which utilize grassy marsh or dune areas for nesting as well as feeding. While disturbance to existing nest sites by overwash or breaching will be detrimental, the net result of maintaining open grassy habitats would serve to perpetuate these species within the project area.

Vesper, Henslow's, and Grasshopper Sparrow

4.78 These three sparrow species generally make use of the open country associated with cultivated farmlands, hayfields, and pastures. Only the grasshopper sparrow has been identified as a probable breeder in the project area. This species' use of the barrier island is likely to be more incidental, and limited to the stabilized secondary dune and swale or interior grassland areas. Thus, the No Action Alternative is likely to have a slightly beneficial impact (as any action which perpetuates grassland coverage would) on this species' use of the project area.

Common Nighthawk

4.79 While the common nighthawk may nest on sand dunes, its use of the project area for breeding is unconfirmed, and is probably limited to migration periods. Thus, the No Action Alternative is likely to have a minimal impact on this species.

Significant Habitats of the Barrier Island

Maritime Holly Forest

4.80 As described earlier in the Affected Environment Section and by Reschke (1990), the integrity of this old-growth forest community is extremely dependant upon the protection from wind, overwash, and salt spray afforded by the primary oceanfront dune system. If this first line of defense is deteriorated or damaged by a breach or significant overwash event, it is likely to result in significant impacts to this globally rare and state endangered habitat.

4.81 As discussed earlier, the only significant maritime forest is the Sunken Forest located between Point O' Woods and Cherry Grove. The primary and secondary dunes fronting the forest are high and well-developed and are therefore unlikely to be breached, even in a severe storm. Based on the results of modeling efforts, the breach rating for this location is given as "low" (see Table 4-1).

Maritime Freshwater Interdunal Swale

4.82 These low-lying moist habitats nestled between the primary and secondary dunes provide a refuge for various songbirds, small mammals (cottontails, rodents, etc.), and amphibians (Fowler's toad). They also support several of the individual rare plant species reported as occurring within the project area. The integrity of this plant community is also tied to the protection afforded by a well developed dune system. However, this community is well adapted to slight habitat modifications (shifting sands and fluctuating moisture conditions) which naturally occur within the dune complex. The dynamic nature of this community is thus not likely to be negatively affected by infrequent minor washover events. Major storm-induced changes, such as heavy overwash deposition or complete loss of the habitat through breaching, would, however, significantly impact this state imperiled community and the rare plants associated with it.

<u>*Rare Plant Species of the Barrier Island*</u>

Seabeach Amaranth and Seabeach Knotweed

4.83 As discussed in the Affected Environment Section, seabeach amaranth and seabeach knotweed have an affinity for dynamic shoreline systems, and are typically associated with actively accreting beaches and sand spits. These species are threatened by destruction and adverse alteration of their habitat. While continued beach erosion and barrier island breaching (as might occur under the No Action scenario) may initially destroy existing specimens, seabeach amaranth and seabeach knotweed would likely re colonize sandy washover areas that are devoid of other vegetation. Overwash sands from the foreshore area may also expose existing seed banks of seabeach amaranth in both the foreshore area and back bay elevated overwash areas.

4.84 Unrestricted recreational use of beaches is also known to threaten populations of seabeach amaranth. Pedestrian activity typically occurs during the active growing season for amaranth; however, individual plants are not generally damaged by foot traffic because most people will walk around any plant when observed. Off-road vehicle (ORV) use during the growing season could have significant adverse effects if the vehicles are not routed around the plants. The stems of the plants are brittle and can be easily broken, thereby reducing the potential seed production or killing the plant entirely. The impacts are not as significant if ORV use takes place during the dormant season, unless it degrades or alters the physical aspects of the habitat (USACOE 1998).

Other Rare Plant Species

4.85 Several of the rare plants listed in the Affected Environment Section have not recently been reported as occurring in the project area. Golden dock, graceful sedge, and Nuttall's lobelia have been historically reported as occurring within or bordering the back bay wetland areas. If present, these species could experience an impact by major overwash deposits that may smother the tidal marshes fringing the bay side of the barrier. A breach through their supporting wetland area could destroy any existing plants, but the formation of new flood tidal deltas may also create additional potential habitat for these species. It should also be noted that breaches and washes are part of the natural system dynamics. There is sometimes a potential for breaches and overwashes to create new conditions under which these species could be established (see the discussion, above).

4.86 According to the NYSDEC Natural Heritage Program (NHP) files, water pygmyweed, Collins' sedge, slender crabgrass, soapwort gentian, and fewflower nutrush were all historically identified as occupying the Long Island mainland south shore marshes. Therefore, these species are not likely to be significantly impacted by the No Action scenario or any potential breach/overwash event that might occur.

4.87 Purple everlasting, grassleaf ladies' tresses, pine-barren sandwort, and the slender marsh pink are all associated with the dunes and interdunal swales of the project area. The impacts to these species resulting from the No Action Alternative would be similar to that described above for the Maritime Interdunal Swale Community.

4.88 Swamp sunflower is associated with the freshwater bogs and pine barrens of the project area. These ecotypes are found within the Maritime Forest Community, and particularly within the Sunken Forest. As discussed earlier, this cover type generally occupies the portions of the barrier which are fronted on the ocean side by a well developed dune system, a high and wide beach profile, or some combination of both. This reduces the likelihood that a breach or severe overwash would occur in these areas. However, if such an event does occur, it may significantly alter the habitat, rendering it unsuitable for swamp sunflower growth.

Back Bay Environment

4.89 Under the No Action Alternative potential breaches or the formation of temporary inlets would continue to impose both positive and negative impacts on the natural resources of the back bay. The magnitude and extent of these impacts (both positive and negative) would depend on the size and location of the breach, the degree of associated diversity, and the shoaling within the back bay area. The negative effects may include increased tidal prism, washover, and an increase in shellfish predators. The positive impacts may include increased bay circulation, reduced bay water residence times, and potentially improved habitat conditions for benthic invertebrates, finfish, and migratory shorebirds. These positive and negative effects would occur as a result of one or more of the following changes:

a. Increased normal and storm tidal ranges within Great South Bay and/or Moriches Bay, which would increase temporary scouring of the back bay shoreline;
b. Decreased flow velocities within Fire Island Inlet with a concomitant increase in inlet shoaling potential;
c. Changes in current regimes and salinity levels within Great South Bay and/or Moriches Bay, which may influence the distribution and abundance patterns of benthic fauna and other organisms;
d. Decreased residence times and increased flushing rates within Great South Bay and/or Moriches Bay, which may lead to improved water quality conditions that would promote accelerated clam growth, decreased "small form" algae populations, and dispersion of phosphorus and nitrogen loadings (Cashin Associates 1993); and (5) creation of new subtidal and intertidal areas (e.g., flood tidal deltas, sand spits, back barrier flats, and salt marshes).

4.90 These possibilities are derived from models that have been proposed by Moffatt and Nichol (1994) and Pritchard and Gomez-Reyes (1986). However, these models have been designed to show the impacts of breaching over a longer time period than would be expected to occur in the case of a Fire Island overwash/breach. Pursuant to the approved BCP, any breach would be repaired within three months. This could potentially enable the back bay area to recover with minimal biological impacts resulting from the breaching event.

4.91 There is potential, however, for the formation of a temporary breach or overwash event to cause the elimination of productive wetland and eelgrass habitats through burial by overwash sediments, or changes in sedimentation and/or current regimes. It was reported by Fallon and Mushacke (1996) that more wetlands were destroyed in Shinnecock Bay within a few hours during the December 1992 northeaster storm than in several decades of human activity. The biological implications of the loss of wetlands would include the loss of potential fish nursery habitat and the many other functions that wetlands serve. The biological implications associated with the loss of eelgrass beds would include the loss of potential nurseries for shellfish, loss of finfish habitat, and the loss of many other functions provided by eelgrass habitats. These dynamic systems, over a long period of time (possibly hundreds of years), could provide areas for development of new eelgrass beds or marsh areas. The potential for wetland losses due to breach or overwash events was discussed previously (see Section 3.00, "Barrier Island Intertidal Marshes"), and a discussion of the potential for destruction of eelgrass habitats due to these same events is provided in the following subsection.

Anticipated Back Bay Salinity Changes

4.92 Salinity in the back bays is influenced primarily by tidal exchange and by freshwater inflow which is itself determined by groundwater flow rates, rainfall, stream flow, and stormwater runoff. Salinity increases in eastern Great South Bay, Moriches Bay, and Shinnecock Bay were reported in response to the opening of Moriches Inlet in 1931 and again in the early 1950's (USFWS 1995).

4.93 Under pre-breach conditions, the shallow estuarine waters of Moriches Bay warm up rapidly, as compared with the ocean. This warming action provides optimal temperature and salinity conditions (24-26 parts per thousand [ppt]) for the growth of hard clams. Observations following the 1980 Moriches Breach showed that before the breach was closed (within one year), parts of the eastern bay (far from the breach opening) retained a salinity of 26 ppt, and clams in this region displayed growth rates approximately three times greater than those in the western part of the bay (under direct influence of the breach), where salinity had risen to 30 ppt. After the breach was closed, the salinity of the western portion of the bay returned to 25 ppt (USACOE 1996).

4.94 Salinity and tides were measured in Moriches Bay following the 1992 breach at Westhampton Beach, a.k.a. Little Pikes Inlet (Conley 1994). Measurements were continued through the closure of the breach in September 1993 and finished in January 1994. At the peak of inlet development, an additional 30 percent of the ocean tidal range was afforded access into the bay. This increase in bay tidal range resulted in an increase of salinity within the bay (Conley 1994). However, salinity gradients were not found to be constant throughout Moriches Bay; an increase in salinity was noted at Speonk Point located directly north of the new inlet, yet no change was recorded at Forge Point near the western end of Moriches Bay (USFWS 1995).

4.95 According to New York Sea Grant (New York Sea Grant 1993), the salinity of Great South Bay prior to 1991 ranged from 26 ppt in the western portion to 23 ppt in the eastern portion. Bokuniewicz and Schubel (1991) reported the average salinity in Great South Bay as 26 ppt. Salinity readings in Great South Bay were taken by the National Park Service (NPS) from May through October 1995 at several beach and salt marsh sampling locations from Talisman in the west to Old Inlet in the east. Salinities ranged from 27.3 to 31.0 ppt at the beach sampling stations and from 26.9 to 30.4 ppt within the marshes (NPS 1997).

Back Bay Submerged Aquatic Vegetation (SAV)

Eelgrass

4.96 Earlier studies of the distribution and abundance of eelgrass (Zostera marina) in the south shore bays were conducted by Jones and Schubel (1978 and 1980) and Greene et al. (1978). These studies showed that most of the eelgrass beds were located in the southern part of Great South Bay. The maps of eelgrass distribution and density included in the 1980 Jones and Schubel report indicate that the nearest eelgrass beds to the Fire Island Inlet were identified approximately 1 nautical mile northeast of the tip of Captree Island, or 5 nautical miles east of the tip of Democrat Point. In addition, eelgrass beds surrounding the inlet appeared to be concentrated to the northeast of protective land masses, such as the West and East Fire Island complex, and the Captree and Sexton Island complex. These demographic locations correlated fairly closely to water depths of 1½ meters or shallower.

4.97 The presence of eelgrass beds in close proximity to the Fire Island barrier was recently verified by an NPS study (1997) of the estuarine resources associated with the FIIS. Large, dense eelgrass meadows with extensive shallow flats were found adjacent to the Otis G. Pike Wilderness Area. Beds appeared less dense in the westerly areas near Watch Hill, and more dense (although further offshore) in the easterly areas near Old Inlet. Thus, the sand delivered to the back bay by a substantial barrier washover or breaching event could smother any adjacent beds of submerged aquatic vegetation (SAV). Scour of the back bay marshes and eelgrass beds may also result from a barrier island breach.

4.98 A current NYD study is examining changes to vegetation based on historic breaching and overwash events at the following four locations: the recent (1992-1994) overwash deposits at Old Inlet, Smith Point south of Pattersquash Island, and the area located between the Ponquogue Bridge and Shinnecock Inlet; and the breach closure at Pikes Beach. Preliminary findings of field investigations conducted in 1998 at these four locations support this claim. The underwater edge of the transported sediment deposits was distinct at all locations, and SAVs were noticeably lacking at all sites except the bay waters behind Pikes Beach. Dense eelgrass beds surrounded the overwash deposit at Smith Point, while only isolated strands were found within the deposit area.

4.99 It should be noted that the overwash/vegetative survey described above was qualitative in nature, in that the data came from aerial overviews and general ground truthing, not specific transects and quadrats. Despite this, the association between lack of eelgrass and past breaches and overwashes seems clear.

4.100 Turbidity is expected to increase during the ebbing tide as overwash sediments are moved throughout the bay, establishing new shorelines, shoals, and islands. Light is most likely the primary limiting environmental factor influencing the distribution of seagrass meadows in Great South Bay. As a result, increased suspended sediment concentrations due to a breach or new inlet may reduce irradiance levels and negatively impact eelgrass growth (USFWS, June 1995).

4.101 Depending upon the season of occurrence and the length of time that a breach remains open, the temporary salinity increases may also affect eelgrass vigor and the competition between seagrasses and seaweeds in the bay. As discussed earlier, salinities in the range of 26 to 30 ppt in Great South Bay would approximate "normal" conditions without a breach. Salinities in the range of 32 ppt and greater, due to ocean mixing through a breach, may stress eelgrass beds. However, as discussed in the Affected Environment section, healthy beds of eelgrass were reported tolerating salinities of 31 to 34 ppt in the Peconic Estuary. It would appear that several different factors working concurrently, including salinity levels, would affect a change in eelgrass growth and vigor.

4.102 Eelgrass meadows may not be capable of reestablishing in the wake of a breach due to increased deeper water habitat. According to the NPS study of estuarine resources of the FIIS (1997), 13 species of fish and 4 species of decapods were collected from the eelgrass beds sampled. The four-spined stickleback was found to be the most abundant fish species, followed in order by the bay anchovy, northern pipefish, and Atlantic silversides. New York Sea Grant (1993) also indicates that juvenile tautog and cunner depend strongly on eelgrass habitat as shelter and/or nursery. Thus, these species could experience the most adverse impact due to the loss of eelgrass meadows. Such a loss would also affect bay scallops and the waterfowl which feed upon these meadows or the fish they harbor.

4.103 Historically, eelgrass beds within Great South Bay and Moriches Bay have established on top of flood tidal deltas. This process is a natural part of the system, and it is therefore expected that eelgrass beds would establish on newly formed tidal deltas. The newly formed shoals colonized by eelgrass may partially compensate for those beds destroyed by the breach. Although overwashes and breaches may remove or cover areas of SAVs, new benthic habitat would be created as part of normal ecological change in this dynamic system.

Macroalgae

4.104 As discussed in the Affected Environment section, 25 species of macroalgae have been reported in Great South Bay. Overall, members of the *Phylum Chlorophyta* or green algae were principally represented, followed by the red algae (*Rhodophyta*). As presented in the SAV study for the Peconic Estuary (Cashin Associates 1996), green algae as a group are typically associated with shallow water and higher intertidal zones, whereas red algae are generally less light dependant and typically occupy deeper water areas. The deposition of overwash sediments into the back bay wetland areas may favor the growth of sea lettuce and other green algae. As mentioned in the 1997 NPS report, quiescent areas subject to increased sedimentation are probably more conducive to drift macroalgae accumulation. "This in turn can lead to reduced eelgrass biomass and area . . ." In the wake of a breach which may create deep water pockets, the red algae group may be favored. In either case, if existing eelgrass beds are damaged by such a storm event, it is likely that the seaweed, green fleece (Codium fragile), may gain a competitive advantage over eelgrass re-establishment into the scoured areas, as suggested in the Peconic SAV study (Cashin Associates 1996).

Phytoplankton and Brown Tide

4.105 As discussed in the Affected Environment section, phytoplankton blooms generally occur in the midsummer and again in the fall or early winter. Nutrient loading of nitrogen, phosphorous, and silica may enhance phytoplankton growth. The increased flushing rate associated with a new inlet (or breach), may create better water quality conditions (USFWS, June 1995). Ryther (1954) reported that poor water quality conditions in Moriches Bay, resulting from an invasion of "small form" phytoplankton species, improved in response to the opening of a new inlet in December 1951. A breach will, at least temporarily, increase tidal exchange between the ocean and bay, thereby potentially reducing the concentrations of dissolved nutrients that may have built up in the back bay waters. Subsequently, this may reduce the potential for phytoplankton blooms to occur in the bay system.

4.106 Although several causal factors are suspect and have been studied extensively by the Suffolk County Department of Health Services (SCDHS), NYSDEC, and the U.S. Environmental Protection Agency (USEPA), the mystery of the brown tide blooms still cannot be fully predicted or explained. A winter breach is not likely to affect any change in the levels of *Aureococcus anophagepherens,* since the brown tide blooms generally occur in the summer. According to the SCDHS, a summer breach through the Fire Island barrier is likely to reduce the potential population increase of *A. anophagepherens* in the immediate area of the breach; however, it may not affect the back bay waters closer to the Long Island mainland (Nuzzi, November 19, 1998). In contrast, however, based upon laboratory experiments conducted by Cosper et al. (1987), *A. anophagepherens* growth may be stimulated by bay salinity increases, such as would occur as a result of a barrier island breach.

Back Bay Invertebrates

4.107 The following discussion was largely extracted from the USFWS Coordination Act Report for the BCP (USFWS, June 1995). Changes in the physical properties of the back-barrier bays may have a significant impact on the benthic resources. The distribution of shellfish and benthic invertebrates is very sensitive to salinity. Optimum salinity for embryonic, larval, and veliger growth and survival may be compromised or improved upon as salinity increases in an estuary system. In addition, increased salinity may favor the introduction of certain invertebrate species which may serve as competitors or predators of resident back bay shellfish species. An increased flushing rate associated with breach and/or inlet creation can also improve water quality conditions. A breach can also influence sedimentation and erosion rates. Such physical disturbance of the bottom sediments from a breach can result in the destruction of individual benthic organisms and communities through burial and suffocation, and cause major alteration of habitat.

4.108 A number of studies have been undertaken on the biology of the hard clam (*Mercenaria mercenaria*) in Great South Bay and Moriches Bay, due to its importance as a recreational and commercial fishery resource. As a result of its significance, the potential positive and negative effects of breaches or new inlet formation on the distribution, growth, reproduction, development, predation, and competition of hard clams are discussed below. While the hard clam is an important resource, other shellfish and invertebrate species are also found in the back-barrier bays and are important food sources for migrating and resident waterfowl and shorebird species, as well as indicators of the general ecological "health" of the bay. A general discussion of the potential impacts due to a breach on those species is also provided below.

Benthic Invertebrates

4.109 Physical disturbance of the bottom sediments from natural or manmade events can result in destruction of individual benthic organisms and communities (e.g., through burial, suffocation, etc.), and may cause major alteration of habitat. Following a large disturbance, an orderly sequence of species replacement occurs (termed succession), beginning with the colonization of the affected habitat by species with high reproductive and colonization potential (termed fugitive or opportunistic species). Over time, these opportunistic species decline due to several factors which may include competition or predation, and are replaced by later successional stage species known as equilibrium species (USFWS, June 1995).

4.110 Biological field studies examining the effects of breaches and inlets on bay ecology in the study area are few. Cerrato (1986) collected seasonal data on benthic species between May 1981 to May 1982. This period followed the closure of a breach which occurred just east of Moriches Inlet in January 1980 and represented the first major recruitment period after closure of the breach. Efforts to close the breach were initiated in October 1980 and the work was completed by mid-December 1980 (Cerrato 1986). In his study, Cerrato (1986) reported high average seasonal abundances (3 to 5 times higher than reported earlier by O'Connor [1972] for Moriches Bay) and diversity of benthic fauna in Moriches Bay. A downward trend in opportunistic species was reported by Cerrato (1986) during his sampling period. This trend typically indicates that the community is undergoing a period of succession or recovery from a recent environmental disturbance. Cerrato (1986) assumed that the causal disturbance was the opening and subsequent closure of the Moriches breach in 1980. Benthic communities appear to recover fairly quickly from episodic events, such as a breach or washover, provided that the disturbance is short term in nature (Cerrato, Personal Communication, April 1999).

4.111 Benthic species which presently occur in the inlet environments will likely occur in the vicinity of a breach or new inlet (New York Sea Grant 1993). Greene (1978) grouped benthic species of the south shore bays into higher (>28 ppt) and lower (<28 ppt) salinity assemblages corresponding to proximity to the inlets. Higher salinity species in the Great South Bay include the blue mussel (*Myrilus edulis*) and tellin clam (*Tellin agillis*), the polychaetes, *Nephtys picta* and *Nereis arenaceondonsa*, and the hermit crab, *Pagurus longicarpus*, lady crab (*Ovalipes ocellarus*), and the starfish (*Asterias forbesii*). Lower salinity assemblages are characterized by the following species: *Mercendaria mercanaria, Mulinia lateralis, Busycorypus canalicularum, Sabellaria vulgaris, Trichobranchus glacilis, Retusa canaliculata*, and *Corophium rubercularum* (New York Sea Grant 1993).

Shellfish

4.112 Many back bay areas are presently either completely closed or seasonally closed to shellfish harvesting by the NYSDEC. These closures are usually based upon elevated fecal coliform levels which are primarily attributed to septic discharges (such as sewage treatment plant outfalls, commercial or residential septic system failures, waterfowl concentration areas, or marinas). Such discharges generally occur in back bay waters in close proximity to the Long Island mainland. These waters are less prone to flushing (water exchange) than those at or near the inlets.

4.113 It has been postulated that the occurrence of a breach or new inlet would improve circulation within the bay, thus increasing the flushing rate and thereby improving the water quality to a point where formerly closed areas could be re-opened for shellfish harvesting. Breaches occur very infrequently; if a breach were to occur under the No Action Alternative, it would be repaired within three months pursuant to the approved BCP (USACOE 1996). The long-term water quality conditions in the bay are not likely to be significantly altered by the short-term opening of a new inlet. Rather, bay water quality is expected to improve gradually independent of the No Action Alternative, as a result of wastewater treatment plant upgrades, improved septic system efficiency and improved municipal collection and treatment systems, and implementation of best management practices to help reduce nutrient and coliform loadings into the bays.

4.114 Adult hard clams can tolerate a wide range of salinities, from brackish to nearly oceanic. Salinity tolerances for optimal larval clam development falls within a much narrower range, between 20 to 27.5 ppt. Salinities associated with inlets and a potential breach are higher, and therefore could negatively impact juvenile clam development. Hard clam abundance is primarily controlled by sediment type, rather than salinity levels. Hard clams generally prefer a sand to muddy sand substrate (Gosner 1978). Kasner (1994) confirms this and additionally states that old relic oyster bars support the highest hard clam densities in Great South Bay. EEA (1997) conducted a hard clam survey of Jamaica Bay, New York and found few, if any, hard clams near the inlet. To the contrary, clam densities were found to increase at greater distances from the inlet.

4.115 If a breach occurs within this section of the barrier, water temperature and salinity could change significantly from current conditions because of the proximity to the new inlet. Cooler ocean waters, ranging from 4 to 21 degrees Centigrade (USFWS 1981), infiltrating into bay water, which ranges from 0 to 30 degrees Centigrade, could improve temperature conditions for hard clams. Hard clam growth is optimal at 20-23 degrees Centigrade.

4.116 Biological communities are structured in relation to the influence of salinity. Many studies have shown that higher salinities, in concert with lower temperatures, have had negative impacts on hard clam growth and productivity. The increased influx of cooler, higher salinity water would affect the nature of the estuarine phytoplankton community and would thus alter a vital food source for many of the estuarine filter-feeding organisms, including shellfish. Any bay salinity changes would disrupt the existing estuarine habitat for fish and shellfish. Ocean water intrusion could therefore have a significant impact on present commercial and recreational finfish and shellfish distributions (USACOE 1996).

4.117 Bay salinity levels have a major affect on hard clam distribution (as well as most invertebrate species), with the upstream penetration of hard clams limited by lower salinity. Throughout the coastal waters of the northeast, adult and larval hard clams have been observed in salinities ranging from 15 to 35 ppt. USEPA (1982) found hard clams in a wide range of salinities in Great South Bay.

4.118 Optimum salinity for embryonic, larval, and veliger growth and survival ranges from 20 to 27.5 ppt. Greene (1978) showed higher growth rates of individual clams taken in the vicinity of Fire Island Inlet as compared to clams monitored in the bay. These rate increases were attributed to increased food levels and dissolved oxygen concentrations. However, other physical and geological factors such as salinity and substrate type could not be ruled out as contributing factors to higher growth rates (Cashin Associates 1993).

4.119 Increases in tidal exchange may affect sedimentation and erosion rates and patterns in the back bay. Increased sedimentation and erosion may elevate suspended sediment concentrations, leading to decreases in the filtration rates of hard clams. In studies of simulated storm event conditions where suspended sediment concentrations reached 193 mg/l, filtration and shell growth rates of hard clams were decreased. While very low suspended sediment concentrations (5 mg/l silt) were shown to have no effect on hard clam filtration rates, relatively higher silt concentrations (20 mg/l and 40 mg/l) were found to directly cause reductions (by 31 percent and 52 percent, respectively) in particle filtration rates (USFWS 1995).

4.120 An increase in salinity may favor the introduction of certain invertebrate species which may compete with the larval and adult hard clams for space, food, and oxygen on a small scale. Potential competitors of the hard clam in the Great South Bay include the gem clam (*Gemma gemma*), soft clam (*Mya arenaria*), blue mussel (*Myrilus edulis*), slipper shell (*Crepidula fornicata* and *C. convexa*), filter feeding echinoderm (*Sclerodacryla briaerus*), razor clam (*Ensis-direcus*), and false quahog (*Pitar morrhuana*) (USEPA 1982).

4.121 USEPA (1982) indicated that increases in salinity levels in Great South Bay may also cause an increase in the distribution and abundance of certain hard clam predator species, including the whelks (*Busycon canalicularum* and *B. carica*), moon snail (*Polinices duplicatus*), calico crab (*Ovalipes occelarus*), oyster drills (*Eupleura caudasa* and *Urosalpinx cinerea*), and hermit crab (*Pagurus longicarpus* and *P. pollicaris*) which prey on larval and adult hard clams. In the above study, predator species for which little or no changes in distribution and abundance were expected included starfish (*Asterias forbesi* and *A. Vulgaris*), mud crab (*Dyspanopeus sayi*), and blue crab. Most of these species are limited in their range by lower salinities, but effects of other environmental factors are also important and must be considered. Salinity tolerance of a species can vary in relation to temperature, species acclimation, and species stage of development or age (USEPA 1982). For example, USEPA (1982) reports that salinity and temperature are the primary environmental characteristics influencing starfish abundance in the Great South Bay.

Crustaceans

4.122 As stated in the Affected Environment Section, the back bay environment supports a variety of crustacean species, many of which are extremely small and fall into the macrobenthic invertebrate category. Some of the more common larger crustaceans include the blue crab, American lobster, horseshoe crab, and grass shrimp, all of which are commercially or recreationally harvested to some degree.

4.123 The horseshoe crab and grass shrimp are harvested for bait: the horseshoe crab for eel and whelk pot bait, the grass shrimp for weakfish bait. The blue crab is harvested both commercially and recreationally for food. American lobsters may be present in the back bay in limited numbers; these consist primarily of juveniles and subadults that fall below the legal minimum size for harvesting. The distribution of adult lobsters is limited to the inlets, where suitable bottom structure (e.g., jetties or artificial reefs) may be found.

4.124 American lobsters migrate into the bay waters from the ocean through the inlets. Female blue crabs migrate from the bay waters to the ocean in the late summer to spawn. Horseshoe crabs and grass shrimp are present in the bays year-round, and are not directly influenced by the inlets.

4.125 If a breach were to occur under the No Action Alternative, it is likely that blue crabs and lobsters would utilize it while the inlet remained open. However, the current ocean access points are not considered to be a limiting factor to the larger crustaceans discussed. These species will continue to utilize the bay. Abundances will fluctuate in response to the commercial and recreational harvest of the species, seasonal migratory patterns, and natural life cycle variations.

Sea Stars

4.126 Sea stars are predators of various shellfish species, including hard clams and bay scallops. Sea star use of the back bay environment is generally restricted to the vicinity of the inlets, where salinities are greater than 28 ppt. In the event that a breach takes place under the No Action scenario, sea stars are not likely to become established within the back bay waters, because the inlet will only remain open for a relatively short period of time (3 months). After breach closure, salinities will readjust to pre-breach conditions, thereby making the bay waters unsuitable for perpetuation of this species.

Back Bay Finfish

4.127 The finfish of the back bay environment consist of a mixture of resident (i.e., sticklebacks, killifish, pipefish, etc.) and migratory species (i.e., bluefish, weakfish, striped bass, summer flounder, etc.), that completely utilize all of the available habitats (i.e., vegetated bottom, sand bottom, etc.) found in the bay in varying degrees. Under the No Action scenario, the finfish species currently found within the back bay will continue to thrive, with varying degrees of fluctuation due to factors beyond the control of this project.

4.128 In the event of a breach, finfish are not expected to be significantly affected. The inlet channel would temporarily provide habitat for certain species, especially bluefish, and the newly established intertidal habitat would provide nursery grounds for small baitfish. Generally, unvegetated bay bottom is the preferred habitat of most benthic fishes. New York Sea Grant (1993) speculated on the potential impacts that a breach would have on finfishes of Great South Bay. They suggested that slight variations in salinity would probably have little effect on the major fishes of the bay since most of the resident and migratory fish are euryhaline and are able to withstand a wide range of salinities (New York Sea Grant 1993).

4.129 Changes in sedimentation patterns which result in the formation of sandy bottom habitats may be beneficial to some species, such as the American sandlance (*Ammodytes americanus*), winter flounder, Atlantic silverside, and killifish. Loss of back bay vegetated wetlands due to a breach may represent a loss of spawning habitat for certain finfishes (e.g., sticklebacks); however, other species may be attracted to the newly created sandy habitats (USFWS 1995).

Essential Fish Habitats

4.130 National Oceanic and Atmospheric Administration (NOAA) and the Mid Atlantic Fisheries Management Council (MAFMC) have identified and proposed for federal designation the most significant and imperiled areas for marine organisms as "Essential Fish Habitats" (EFHs). This designation helps to focus protection and habitat enhancement strategies in all future fishery management plans (NOAA Internet home page, October 5, 1998).

4.131 On April 29, 1999, the Secretary of Congress approved these EFHs, thereby officially designating all mapped areas as shown in the 1998 proposed Amendments to the Fishery Management Plans developed by the MAFMC. Pursuant to the 1996 Amendments to the Magnuson-Stevens Fishery Conservation and Management Act, such designation requires that all federal agencies consult with NMFS on any federal actions that may potentially adversely impact an EFH.

4.132 EFHs include "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity." Several of the Fishery Management Plans have recently been completed. The available plans were reviewed to determine whether the project area lies within or contiguous to any area proposed for designation as an EFH, and what management recommendations were included. The Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (MAFMC et al., October 1998c) identified SAV and macroalgae beds as Habitat Areas of Particular Concern (HAPC) for summer flounder, because of their ecological importance as feeding habitat and shelter from predators. The plan further defines the proposed HAPC designation as "all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations within the adult and juvenile summer flounder EFH" as HAPC. A breach or significant overwash resulting from the No Action scenario could threaten current SAV and eelgrass beds, thereby potentially impacting summer flounder (as well as other marine organisms that are dependant upon this habitat type).

Back Bay Avifauna

4.133 The Threatened and Endangered birds are discussed earlier in this chapter. For discussions of the piping plover; roseate, least, and common turns; osprey; peregrine falcon; Cooper's hawk, northern harrier, short-eared owl, upland sandpiper, vesper, and the Henslow's and grasshopper sparrows, please see discussion of "Barrier Island Avifauna."

Diving Birds

4.134 The diving birds are generally found utilizing the back bay waters for feeding during the winter. Their primary food source includes small bait fish, crustaceans, and benthic invertebrates. The No Action alternative will not directly affect use of the back bay by diving birds. However, secondary impacts may result due to a breach/overwash event. The occurrence of a winter breach could reduce the likelihood of surface ice formation, allowing the birds to remain active over a greater area of the bay. The deposition of overwash and creation of flood tidal deltas could reduce the available foraging habitat for diving birds.

Wading Birds

4.135 Wading birds will feed within the intertidal marshes and utilize the well-vegetated dredge spoil and back bay marsh islands for roosting and nesting. The least bittern will nest within the reedy fringes of the intertidal marsh. West Inlet Island has historically been used as a breeding and roosting area by great and snowy egrets and glossy ibises. The small baitfish typically found in the back bay area, including Atlantic silverside and mummichog, make up the dominant food source for the most species of wading birds.

4.136 The No Action Alternative will not directly impact the wading birds. However, an overwash which covers the back bay intertidal marshes may temporarily reduce the available feeding habitat for most waders, or could potentially impact nesting sites for least bitterns. The impacts of a breach could be either positive or negative, depending upon the season and location where the breach occurs. The formation of flood tidal deltas caused by a breach may, over time, naturally succeed to a shrub thicket, thereby providing additional roosting and nesting habitat.

Waterfowl

4.137 The No Action scenario will have both positive and negative impacts on waterfowl use of the back bay area. Major waterfowl feeding areas generally correspond to eelgrass beds in the Great South Bay. Brant are particularly dependant upon eelgrass, their primary food source. If eelgrass beds are either smothered or scoured due to an overwash or breach event, the waterfowl which forage in these areas will likely relocate to other vegetated bottom areas. A breach may also result in the loss of quiet water habitat, and a major overwash event will induce changes in the shoreline vegetative community structure. These impacts are expected to adversely affect the habitat for waterfowl.

4.138 The waters of Great South Bay and Moriches Bay also serve as significant wintering waterfowl areas. As mentioned earlier, the occurrence of a winter breach may reduce the likelihood of surface ice formation, allowing the birds to remain active over a greater area of the bay.

Colonial Waterbirds

4.139 The impacts of this No Action Alternative on least, roseate, and common terns and piping plovers were discussed earlier in the Barrier Island Rare and Endangered Wildlife Species Section. Breach formation could have both positive and negative impacts on shorebirds. Many migratory shorebirds rely on the back bay environment for feeding and roosting. Least, roseate, and common terns, black skimmers, American oystercatchers, herring, and black-backed gulls all utilize the back bay islands within the project area for nesting (NYSDEC Long Island Colonial Waterbird and Piping Plover Surveys 1989-1996). The increased daily tidal prism that would be associated with creation of a new temporary inlet due to a breach, could have a negative impact on shorebirds that are nesting on back bay dredge spoil and marsh islands. Scouring and destruction of intertidal marshes would also be negative, but the creation of additional shoal areas would be positive. The timing of a breach could obviate most adverse impacts, since a winter breach (due to extratropical storms) would occur when the migratory shorebirds were elsewhere. A summer (tropical) storm would physically create new habitat, but may also directly destroy nests and fledglings. The sandy shores and shallow bottom areas created by overwash events would likely be readily used by shorebirds as foraging areas (USFWS June 1995).

4.140 Wintering gulls and cormorants are not likely to be significantly affected by a winter breach, since they would be free to move about the barrier island and back bay areas. However, the creation of flood tidal deltas by the breach may benefit these species by providing additional loafing areas and potentially new breeding habitat over time.

Avian Resident Species

4.141 According to the Atlas of Breeding Birds in New York State (Andrle and Carroll 1988) the great blue heron fishes in the back bay marshes throughout the year strictly as a visitor, and breeds elsewhere. Overwash deposits that may bury and breaches that may scour wetland areas will also provide shallow water feeding areas for this species. The net result of the No Action Alternative may be no significant impact on this species.

4.142 The black-crowned night heron is known to breed within the project area in mixed-species heronries or maritime shrub communities (Andrle and Carroll 1988). This species typically fishes at low tide in the mud flats and shallow tidal creeks (Bent 1963). A major overwash or breach event could significantly impact both the breeding and nesting habitats for this species.

Avian Migratory Species

4.143 The common loon may visit the bay waters of the project area during the winter to feed upon fish, shellfish, and crustaceans; however, it characteristically never comes ashore (Bent 1986). The No Action Alternative and any associated breach/overwash is thus not likely to affect this species.

4.144 The black rail and the least bittern may feed and nest within the upland fringe of the intertidal marsh (Bent 1963). A major overwash or breach event could significantly impact the breeding and nesting habitats for both of these species.

Back Bay Herpetiles

Sea Turtles

4.145 Of the five species of sea turtles discussed in the Affected Environment Section, only three have been reported as utilizing the back bay waters of the project area to feed, namely the Kemp's Ridley, loggerhead, and green sea turtle (Sadove and Cardinale 1993). Typically, none of these species come ashore in the project area to nest. The green sea turtles feed primarily on eelgrass, green fleece, sea lettuce, and other algae. The loggerhead and Kemp's Ridley prey upon crabs, which are likely to occupy the shallows within or adjacent to the eelgrass beds. Hence, any destruction of the eelgrass beds resulting from a breach or significant overwash event may secondarily affect the feeding habitat for these species.

Cultural Resources

4.146 The No Action Alternative could potentially adversely affect archaeological, historic-architectural, or maritime resources in the Area of Potential Effect described in Chapter 3. Adverse impacts on archaeological resources from both the prehistoric and historic periods could result from the No Action Alternative. As a result of this alternative, continued erosion could expose prehistoric land surfaces that may contain the remains of the area's early inhabitants. A breach in the barrier island and lack of stabilization could permit wave, wind, and other actions to cause irreversible damage and loss to archaeological sites in breach areas. Unknown archaeological resources—including sites located beneath the barrier islands or shipwrecks buried in the nearshore area—could be uncovered, damaged, or destroyed as a result of a breach.

4.147 The Breach Contingency Plan outlines a process for treatment of archaeological sites in accordance with Section 106 of the National Historic Preservation Act, to avoid adverse impacts on such resources. Exposed sites or wrecks located adjacent to a breach would be investigated prior to sand placement to avoid adverse impacts from use of heavy equipment, as well as from the placement of sand over such resources. If peat layers preserving prehistoric land surfaces are exposed, surveys by trained personnel would be conducted to the extent feasible under conditions at that time. The investigation would determine if a site is potentially eligible to be listed on the National Register of Historic Places; if sand placement would have an adverse impact on the archaeological resources; and if additional studies would be required. The results of the investigation would be coordinated with NYSHPO. If the site is eligible for the National Register and would be impacted by sand placement, then the alternative of avoidance of the site would be explored. If avoidance is not feasible, then the Advisory Council on Historic Preservation (ACHP) and SHPO would be advised and a plan for the documentation of the eligible properties would be developed and undertaken prior to fill of the breach.

4.148 To avoid impacts on cultural resources located within offshore borrow area, the borrow areas would require a remote sensing survey-including side scan sonar, magnetometer, and sub-bottom profiling-to determine if there are any potential National Register of Historic Places-eligible remains of shipwrecks. All work would be coordinated with SHPO. All targets identified by this survey would be avoided during dredging, if feasible. If avoidance is not feasible, then the targets would require additional investigations in the form of underwater archaeological surveys to determine which targets are the remains of wrecks and their National Register eligibility. A plan for documentation of all National Register-eligible wrecks would be developed and implemented in coordination with ACHP and SHPO. Stabilization may serve to protect archaeological sites from destruction or irreversible damage.

4.149 This plan would become operative if a breach occurred and the breach was not filled using emergency authorization within 30 days of the occurrence of the disaster or emergency. However, archaeological sites located at the breach would likely be destroyed when the breach was created and therefore, the No Action Alternative could result in the loss of archaeological resources. In addition, archaeological resources could be adversely impacted if it is necessary for the New York District to undertake emergency measures within 30 days of the occurrence of a disaster or emergency. For those emergency actions that are undertaken soon after the occurrence of the emergency, a waiver will be sought from either SHPO, the Advisory Council, or the Secretary of the Interior, in accordance with current federal regulations.

B. PREFERRED ALTERNATIVE/INTERIM PROJECT

4.150 The purpose of the beach nourishment alternative is to provide interim storm damage protection until the potential implementation of the Fire Island Inlet to Montauk Point (FIMP) Reformulation Study findings. As described in Chapter 2, this alternative would place sand and raise the dune and beach elevations in the developed areas only. In conformance with GMP objectives in the FIIS, minimal sand would be placed on major federal lands in the FIIS and no sand would be placed in the Otis G. Pike Wilderness Area. The direct impacts of this Preferred

Alternative would be the deposition of beach fill on the placement area and the immediate, if temporary, protection of structures from storm damage. Indirect effects would include a change in coastal processes and erosion potential that would reduce the possibility of overwash and breaching and related storm damage. The estimated number of homes vulnerable to storm damage on Fire Island would be reduced to 2,844, compared with more than 3,100 under the No Action Alternative. The number of structures open to storm damage on the bay shore would be reduced to 10,553 compared to the nearly 12,000 under the No Action Alternative, and the flood levels at the affected structures would be reduced compared with the No Action Alternative. The remaining 10,500 structures would benefit from the reduced risk of flood damage.

4.151 The deposition of beach fill and related indirect physical effects of the Preferred Alternative would affect the human environment and natural resources in a number of ways, as discussed below.

HUMAN ENVIRONMENT

Land and Water Uses

4.152 Under the FIIP, beach erosion on Fire Island would be greatly reduced in the areas proposed for renourishment. The placement of beach fill in the designated areas would protect the residential, recreational, and commercial uses up to a 44-year storm event. Implementation of the beach nourishment alternative would enable residents and businesses to remain in the area, while also affording increased protection to the communities along the bay shore. Due to the reduced likelihood of breaching and inundation of the bay shore, residential, recreational and commercial structures are much less likely to be damaged or destroyed, access to homes businesses is less likely to be interrupted, and utility service is less likely to be disrupted.

4.153 However, during construction, a certain amount of short-term disruption is unavoidable. This would primarily include access to the beach, interruption of pedestrian routes along the beach, and noise from trucks and other heavy machinery. It is unlikely that work would coincide with peak recreational season or weekends. The construction effort with the greatest concentration of trucks would be the transfer of sand from a stockpile near Point O' Woods to eroded areas along the beach. This would take place weekdays over a period of six weeks in October and November.

Land Use Regulations and Oceanfront Development Activity

4.154 As discussed above, the CEHA law will remain in place to limit new development within the primary dune area. Although the Preferred Alternative would in some areas extend the primary dune seaward, so that the landward toe of the dune would also move seaward, NYSDEC will not alter the coastal erosion hazard area as now mapped. Thus the Preferred Alternative will have no effect on land use regulation.

4.155 There is some concern that the Preferred Alternative, by providing temporary protection could increase homeowner confidence and induce growth in the coastal erosion hazard area—that is, the current rate of construction of infill sites over the next nine years would increase from an annual average of 1.6 per year (as discussed previously in the No Action Alternative Section). As shown on Table 4-1, above, the greatest change in the annual rate of construction (nine-year average) over the last several decades is 50 percent. Given the increasingly limited number of available developable lots, such a jump on construction rate is unlikely, particularly for a temporary project. Nonetheless, if the current construction rate were to increase by 50 percent over the next nine years, by 2007, the end of the temporary project's life, some 22 units would be built, amounting to 7 to 8 more than that of the No Action Alternative, dotted throughout the built portion of the island. In addition, a permit for construction in the CEHA can only be granted after an environmental review that demonstrates no significant impact on natural protective coastal features. Thus, in the unlikely event that an increase in demand for new construction would result from the Preferred Alternative, the effect would not be significant.

Transportation

4.156 Under the FIIP, adverse effects to traffic, transportation, access, and circulation that are expected under the No Action Alternative would be reduced. Storm-related disruption to the existing road network and boat access to Fire Island would be reduced.

Economic Activity

4.157 Overall, FIIP is expected to reduce the cost of damages to non-shorefront and shorefront structures by more than $11 million per year. When other factors are considered, such as recreational usage, the total benefits are expected to total more than $13 million per year. Detailed costs and benefits are discussed in the Draft Decision Document and its Cost Appendix.

4.158 With the Preferred Alternative, the extent of storm damage on Fire Island and in bay shore communities would be reduced. Thus, access to businesses would be less likely to suffer directly through structural damage or indirectly through interruption of access or utility service.

Utilities

4.159 With the interim storm damage protection project, storm-related disruption to utility service would be reduced.

Environmental Justice

4.160 Executive Order 12898, entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," requires that the potential for disproportionate adverse impacts on low income and minority populations be identified and addressed. The three identified areas of low income and minority populations lie along the bayshore in the area subject to flooding. The Preferred Alternative would improve conditions in these areas and therefore would not have a disproportionate adverse impact on these populations. Short-term construction effects would be limited to Fire Island and areas that do not contain concentrations of low-income, minority populations.

NATURAL RESOURCES

Introduction

4.161 This discussion examines the impact of the Preferred Alternative on natural resources related to the construction of dunes and the placement of sand on designated beaches. Beach nourishment will generally occur on the ocean side of the populated Fire Island community areas. The Draft Decision Document and Engineering Appendix provide additional construction details. The sand for the constructed dunes and beach areas will be provided from an offshore borrow area located approximately 1.5 miles to the southeast of Great South Beach.

4.162 The anticipated date of construction has been scheduled for the fall of 2001, and is expected to last for a duration of approximately 24 months. For the purposes of this discussion, it was assumed that beach nourishment activities would be completed initially and then immediately followed by dune construction, wherever applicable. In addition to USFWS' Section 7 formal consultation concerns, FIIS has approved an Endangered Species Habitat Management Plan that will restrict construction activities between March 1st through September 1st in the year 2000 (NPS 1998). It is assumed that 2001 and beyond would have the same restrictions. Due to the safety concerns and higher costs associated with work performed in the late fall and winter months, construction will most likely occur sometime during the piping plover breeding and seabeach amaranth growing seasons. It may be possible to initiate the work in July, after plover nesting areas have been established and identified.

Offshore Environment/Borrow Area

4.163 Under the Preferred Alternative, approximately 7.7 million cubic yards of medium grain sand would be hydraulically dredged from a borrow area approximately one-half to two-miles off shore in water depths of 30 to 60 feet. The total borrow area under consideration is approximately 3,000 acres, although only a small fraction of this area would actually be mined. The dredge would extract the upper layers of sanding creating a shallow, wide depression, no more than 20 feet below existing grade. All non-mobile organisms in the extracted sand would be eliminated. Mobile organisms (both finfish and invertebrates) can usually avoid the cutter head and escape (USACOE 1996). Coring studies have shown that the sands at these depths are generally uniform, so that the new exposed sediment layer would be amenable to recruitment and reestablishment of benthic invertebrates. It is estimated that benthic organisms would recolonize within a period of 12 to 18 months (Naqvi and Pullen 1982). Impact issues addressed below include direct mortality, loss of habitat, alteration to the physical environment, and potential changes to feeding behavior.

4.164 NYD has already characterized the macrobenthic community associated with the proposed borrow location in two recent studies conducted from 1996 to 1998. These studies, however, do not address the distribution and abundance of larger and more mobile species (e.g., surf clams, squid, and finfish). One of the major issues of concern raised at interagency meetings is the potential for finding squid eggs attached to the substrates within the borrow area. A finfish trawl survey was initiated during April of 1999 for the West of Shinnecock Interim Project, which is considered a comparable borrow area. The study was designed by NYSDEC and NYD in compliance with the NYSDEC Water Quality Certificate for the West of Shinnecock Interim Project. The study is designed to collect finfish and invertebrates (i.e., squid and squid eggs) in the borrow site over a 12-month period. In addition, the District will survey surf clam densities in the borrow area in conjunction with NYSDEC's ongoing surfclam monitoring program. A FIIP borrow area monitoring program (similar to the West of Shinnecock program) is currently being developed by NYD in conjunction with NYSDEC.

Offshore Area Invertebrates

Macrobenthic Invertebrates

4.165 As previously stated, the Interim Project will result in the removal (and likely destruction) of all the macrobenthic organisms from the borrow area. Re-colonization of the borrow site after dredging is expected to be fairly rapid, since the borrow site is located in a relatively shallow, high energy environment. The re-colonization of marine sediments by benthic organisms following dredging operations has been shown to follow a distinct pattern of ecological succession. The species with the strongest colonization and reproductive capabilities appear first. Over time, other highly competitive species return (Cerrato 1986).

4.166 The proposed borrow area was surveyed during the spring and fall from 1996 to the time of this DEIS (RMC Environmental Services 1996, and B.A. Vittor & Associates 1998). Both studies clearly indicate that the macrobenthic community associated with the proposed borrow area is already dominated by species with strong colonization and reproductive abilities. These species are generally the first to colonize areas of disturbed habitat. Disturbed habitat includes not only the area of active dredging, but also areas affected by storm waves, strong longshore and rip currents, and tidal scour. These opportunistic organisms are comprised mostly of small, tubiculous, opportunistic polychaetes and amphipods. These species are discussed in detail in Chapter 3.00, "The Affected Environment."

4.167 As stated in the BCP, benthic communities should re-establish in approximately 12 to 18 months (Naqvi and Pullin 1982). The recovery of benthic macrofauna (those animals 0.5 millimeter in diameter or larger) after beach nourishment varies from one site to another. Studies completed in the 1970's indicate that when beach nourishment ceases, the recovery of benthic macrofauna is rapid and complete recovery may occur within one or two seasons. The ability of macrofauna to recover is due to: (a) their short life cycles, (b) their high reproductive potential, and (c) the recruitment of planktonic larvae and motile macrofauna from nearby unaffected areas (Naqvi and Pullen 1982).

4.168 A study conducted by Woodward-Clyde Consultants (1975) determined that dredging may lower the productivity of a borrow area, reducing the usefulness of the site for the production of fish and shellfish until a suitable community is re-established in the borrow area. This report also indicated that the interim benthic community occupying the dredged site during re-establishment provides a substantial short-term food source for many benthic fish species.

4.169 The potential for oxygen deprivation problems in borrow areas is a concern. Reduced water circulation and increased siltation and sedimentation of fine material can lead to hypoxic or anoxic conditions that may be lethal to organisms utilizing a borrow area. These adverse impacts have been found to be minimal in areas with strong currents where oxygen can be quickly replenished (Tubeville and Marsh 1982). As noted also in paragraph 4.163, the project design contains engineering controls to alleviate the potential for oxygen deprivation problems by eliminating small deep borrow pockets. Please refer to the Draft Decision Document for more discussion of this issue.

4.170 Another potential impact to the macrobenthic community is the suspension of sediment particles which will increase the turbidity of the water and possibly blanket and suffocate additional benthic communities down current. This condition is not expected to occur at the borrow area, since the sediment from the borrow site has been determined to consist of 95 percent sand. Sand particles suspended by dredging are relatively dense and fall quickly back to the bottom (Woodhead 1992). During core exploration of the FIIP borrow area, sediment types found to be present on the surface of the benthos were found to be of comparable type and sediment size to sands found up to 20 feet below the benthic surface. (See the Draft Decision Document and its Borrow Area Appendix for more details.)

4.171 Many macrobenthic invertebrates found in this environment are used to periodic burial, and are capable of escaping. Through laboratory experiments it was determined that species such as the red-lined worm (*Nephtys incisa*) and the clam (*Mulinia lateralis*) are able to reach the surface through 21 centimeters (8.25") of sediment, and the mud worm (*Streblospio benedicti*) is capable of escaping through 6 centimeters (2.4") of sediment (Saloman et al. 1982). Many other macrobenthic species are expected to be able to do the same.

Shellfish

4.172 Many shellfish species are very small and are included with the macrobenthic invertebrates (e.g., the dwarf tellin and the clam—*Mulinia lateralis*). This section deals primarily with the larger and commercially important species, such as the surf clam, sea scallop, and ocean quahog. Both the sea scallop and ocean quahog prefer deeper and cooler waters than those encountered at the borrow site, and are best considered peripheral species. Thus, any project impacts would only likely affect the surf clam.

4.173 Surf clams are abundant along the entire south shore of Long Island and are likely to inhabit portions of the borrow area. However, given the patchy and variable distribution of this species, a site-specific survey will be required to confirm the actual distributions in the borrow area prior to construction to verify the existence of surf clams and to avoid potential disturbances, if any significant standing stocks are found.

4.174 While the borrow areas will be deeper after construction, surf clams are known to inhabit substrates as deep as 100 feet. This depth is well below any planned or even possible dredging depth, so clam recolonization after construction should not be hindered by depth consideration.

4.175 As previously described, the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) amendments of 1996, NMFS in coordination with NOAA and MAFMC, have identified aquatic habitats along the Atlantic coast which are critically important to finfish, shellfish, marine mammals, and sea turtles. These "Essential Fish Habitats" (EFH), afford these areas increased protection from adverse impacts potentially associated with any federal action.

4.176 As defined in section 3 (10) of the Act, EFHs include "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity." Several of the Fishery Management Plans have recently been completed, containing maps and management recommendations for the EFHs (MAFMC et al. 1998), and distributed publicly. These were reviewed to determine whether the project area lies within or is contiguous to any designated EFH.

Atlantic Surf Clam and Ocean Quahog

4.177 The highest concentrations of surf clams have been found at depths less than 60 feet along Long Island. Ocean quahogs are generally found at depths ranging from 25 to 800 feet, but are primarily concentrated at depths of 82 to 200 feet. New York State would like to consider all waters of the Atlantic Ocean under state control as EFH for surf clams and ocean quahogs. Based upon a review of the boundaries for these species According to the Atlantic Surf Clam and Ocean Quahog Fishery Management Plan (MAFMC et al. 1998), it appears that an EFH for these species may be situated within the project boundaries. This will be confirmed upon coordinated review with the NMFS. The Fishery Management Plan also states that the more eastern parts of Long Island do not presently support significant surf clam or ocean quahog harvests. However, both of these species do exist and could represent areas of potential harvest in the event that successful reproduction occurs and the population increases in the project area. The MAFMC recommends against beach nourishment in surf clam and ocean quahog EFHs, because of the resultant substrate alteration. The recommendations further state that "best-engineering and management practices (e.g., seasonal restrictions) should be employed for all . . . in-water construction projects" and that "mitigating or compensating measures should be employed where significant adverse impacts are unavoidable. Project proponents should demonstrate that project implementation will not negatively affect surf clams and ocean quahogs, their EFH, or their food sources." The potential impacts of the Interim Project on the Surf Clam and Ocean Quahog EFH will be more clearly defined during the NMFS review of the project. Any required mitigation will also be determined at that time.

Squid

4.178 The south shore of Long Island has been identified as a potential breeding habitat for the long-finned squid by the NMFS. Long-finned squid have become an important commercial species which partially supports an inshore dragger fleet. If the Interim Project were to have any impact on this species, it would not occur to the adult or juvenile squid (which are highly mobile and capable of avoiding the area during the active dredging period), but to the demersal egg clusters which may have been attached to the bottom substrates in the borrow area.

4.179 It has yet to be determined that long-finned squid do utilize the offshore borrow area as a nursery ground. This will be verified by NYD proposed fishery sampling program. Special emphasis will be placed on the May through June sampling period when the squid should be laying eggs. Egg clusters will be collected with an otter trawl.

4.180 The available MAFMC Fishery Management Plans were reviewed to determine whether the project area lies within or contiguous to any designated EFH, and what management recommendations were included pertinent to the Interim Project. These findings are summarized as follows.

Long-Finned Squid

4.181 "Pre-recruits," or animals smaller than 8 cm, are generally collected from shore to depths of 700 feet. "Recruited" animals larger than 8 cm are able to move further offshore, and are therefore collected from the shore out to 1,000 feet in depth.

Short-Finned Squid

4.182 Both pre-recruits and recruits are generally collected from the shore out to depths of 600 feet. However, according to Gosner (1979), the range for short-finned squid generally lies north of Cape Cod, and long-finned squid typically replace this species in more southerly waters. Thus, short-finned squid are not expected to be present in significant numbers within the project area.

4.183 Although generally considered as pelagic, schooling species typically found across the continental shelf and slope, both the long-finned and short-finned squid are also located in state waters. Amendment 8 to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan (MAFMC et al. 1998) has not allocated an EFH in state waters (estuaries) for these two species. However, the MAFMC anticipates that an EFH will be designated in state waters by the next round of FMP Amendments, when all state data will be consistent and available electronically for comparison. The 1988 Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan further indicates that an EFH for long-finned squid pre-recruits may be situated within the project boundaries. This will be confirmed upon coordinated review with the NMFS, and any required mitigation will be determined at that time

4.184 It has been recently discovered that the life span of these squid species is less than one year, according to the Atlantic Mackerel, Squid and Butterfish Fishery Management Plan (FMP) (MAFMC et al. 1998). The existing stock is extremely vulnerable, because only a single cohort is available at any time.

4.185 Some prey items for these squid, such as menhaden, are estuarine-dependent. Based on this and other considerations, the FMP recommends that threats to estuaries, inshore areas, and water quality are priority concerns for long- and short-finned squid. Water dependent activities that may adversely affect the potential EFH for these species should be designed using environmentally sound engineering and BMPs to avoid or minimize those impacts. Since the FIIP seeks to protect the back bay estuary area from significant overwash and breaching events, it is likely to protect the squid prey species.

Crustaceans

4.186 Similar to the macrobenthic invertebrates (which includes the smaller arthropod species), the larger crustaceans (e.g., sand shrimp, rock crab, and lady crabs) will be completely eliminated from the borrow area by the mining of the sand. Once the active dredging is complete, these larger crustaceans will begin to move back into the borrow area. The re-establishment of these species is anticipated to take much longer than the macrobenthic organisms, which have adapted to high energy areas through the dispersion of a large number of eggs and shortened life cycles.

4.187 The current usage of the borrow site by large crustaceans has yet to be determined. The proposed NYD sampling program includes a by-catch study for American lobsters to ascertain their utilization of the offshore borrow area and vicinity. The preferred habitat of adult lobsters includes some form of hard bottom structure (i.e., rocks, rubble, reef, or wrecks) to utilize as cover, or a soft mud that is suitable for burrowing. Juveniles also require some form of cover (rocks, rubble, or an old shell bed) for protection from predators. Given the anticipated sandy conditions expected to be encountered, it is extremely unlikely that a substantial number of lobsters will be present in the borrow area. All of these elements (i.e., rock, hard structure, soft mud) would typically be excluded when selecting suitable borrow material for use in the beach nourishment and dune construction portion of the Interim Project.

4.188 Commercial crab fisheries exist in the waters off the barrier beaches for blue crabs, horseshoe crabs, rock crabs, green crabs, jonah crabs, hermit crabs, and lady crabs. Although these fisheries are relatively small and impacts on overall species abundance due to activities in the borrow area would be expected to be slight, data and impacts are assessed for these species. Although not a true crab, horesehoe crabs in particular have been assessed as overfished or in danger of being overfished, and a regional fishery management plan is currently being developed for this species. The plan is expected to include a quota management system to reduce mortalities through harvest. Although juveniles may tend to stay inshore in more shallow waters, adults move to deeper water and exhibit offshore-onshore migration patterns.

Offshore Area Finfish

4.189 Dredging directly affects fish populations by (1) displacing them from the dredging operation site; (2) potential for loss of demersal finfish eggs; and (3) loss of food source for finfish. In addition, it is possible that if excavated borrow areas become too deep, it could create anaerobic conditions. As indicated in studies by Woodhead and McCafferty (1986), borrow areas and channels often contain higher levels of fish than adjacent shoals, indicating that properly designed borrow areas do not demonstrate adverse impacts to resources once the immediate construction period is over (USFWS 1995). The project design has engineering controls to create wide, shallow dredging takes, rather than creating deep holes, thus minimizing the potential for anoxic conditions.

4.190 To validate the impact assessment, verify existing conditions, and analyze the rate of recovery, NYD has proposed to conduct a one-year finfish survey prior to the onset of dredging. Monthly samples of finfish will be collected at the proposed borrow area and nearby reference site. Samples will be collected utilizing an otter trawl. These samples will be collected in conjunction with macrobenthic invertebrate sampling and lobster collection. As a result of these combined studies, it will be possible to determine what species are present in the borrow area, their potential use of the site (i.e., feeding), and what time of the year they are likely to be present. This would apply to both resident and migratory finfish species.

4.191 As described in the earlier Offshore Shellfish subsection, NOAA is currently considering federal designation of EFHs for those waters determined to be the most significant and imperiled for finfish. The goal of the MAFMC is to preserve all of the available or potential natural habitats for the fish species with identified EFHs by encouraging the management of conflicting uses to assure species access, and by maintaining high water quality to protect migration, spawning, nursery, overwintering, and feeding areas. It is important to note that the EFHs have only been loosely defined, and that federal designation is still pending. The available MAFMC Fishery Management Plans were reviewed to determine whether the project area lies within or is contiguous to any designated EFH, and what management recommendations were pertinent to the Interim Project. These findings are summarized as follows.

Summer Flounder

4.192 Summer flounder eggs are found between October and May, with the heaviest concentrations occurring 9 miles off the shore of New Jersey and New York. Eggs are most commonly collected at depths of 30 to 360 feet. The MAFMC found that all inshore waters of New York are important habitat for the summer flounder for all age classes (eggs, larvae, juveniles and adults). The Long Island south shore embayments were found to be especially important. The EFH also incorporates these brackish to saltwater estuaries and bays (state waters) for summer flounder, juvenile and adults. There are many gaps in our understanding of the ecology of summer flounder. Because it is such a highly migratory species and occurs everywhere throughout its range, knowledge of its life history and habitat requirements can vary regionally. What affects this species in one area can easily cause repercussions in the population of another area. Once their habitat preferences are defined, their critical habitats can be more thoroughly delineated and mapped. The Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (MAFMC et al. 1998) also identified SAV and macroalgae beds as Habitat Areas of Particular Concern (HAPC) for summer flounder, because of their ecological importance as feeding habitat and shelter from predators.

Scup

4.193 According to the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (MAFMC et al. 1998), nearly all of the mid-Atlantic coastal waters have been included in the EFH for scup juveniles and adults. Scup have been found to be particularly concentrated at the eastern end of Long Island in the nearshore waters around Montauk Point. The EFH for adult and juvenile scup also extends into saltwater estuaries and bays (state waters); however, no HAPC has yet been assigned for this species. The MAFMC report (1998) states that water quality impacts on estuaries and other inshore waters are a priority concern for scup EFHs.

Black Sea Bass

4.194 According to the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (MAFMC et al. 1998) it appears that the project boundaries coincide with an EFH for both adult and juvenile black sea bass. The MAFMC (1998) did not assign any HAPC for this species within project waters. Adult black sea bass are typically found associated with hard structures (e.g., jetties) at the major inlets along the south shore of Long Island. Juveniles, however, are typically found in an array of sheltered habitat types, such as eelgrass beds and sandy or rocky bottom areas.

The specific wintering areas of 1- and 2-year old juvenile black sea bass in the Middle Atlantic Bight are unknown; some may remain in estuaries, and others may move to coastal or inner shelf clam beds. Thus, the Fisheries Management Plan (FMP) states that "specific recommendations are difficult to assess." The impacts of the Interim Project on the Black Sea Bass EFH will be examined and defined upon coordinated review with NMFS.

Bluefish

4.195 Both juvenile and adult bluefish are common in Long Island waters, and the project area is included within the EFH, according to the Bluefish Fishery Management Plan (MAFMC et al. 1998). Juvenile bluefish (ranging from 1 inch in length and up) use virtually every cove, embayment, and creek mouth to the first impassible barrier on Long Island. Adult bluefish seasonally occupy all tidal waters as described above. The FMP recommends that beach nourishment in the bluefish EFH should only be considered when an acceptable source of borrow material is identified. The impacts of the Interim Project on the Bluefish EFH and any required mitigation will be further defined upon NMFS coordinated review.

Atlantic Mackerel and Butterfish

4.196 According to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (MAFMC et al. 1998) the project area has not been proposed as an EFH for Atlantic mackerel or butterfish, therefore there is no issue associated with the project for these species.

Offshore Area Marine Mammals

4.197 The marine mammals that may move through the offshore areas and proposed borrow area location (northern right, finback, minke, and humpback whales, bottle-nosed dolphin, and harbor and hooded seals) are not likely to be affected by the Interim Project. This is primarily due to the fact that these species are highly mobile and feed upon prey species that are also pelagic. Given the slow-moving nature of a dredging vessel and dredging operation, it seems likely that any marine mammals would be able to avoid the borrow site during active dredging periods.

4.198 The finback, humpback, and right whales are listed as state and federally endangered species. The occurrence of whales in the borrow area, if any, is expected to be very low. With the exception of the minke whale, most of the whales are likely to occur further offshore than the southernmost extent of the borrow pit. All have limited potential to enter the project area during the spring and fall migration periods; however, the amount of time that a whale would spend in the study area would likely be very brief. If necessary, work could be stopped while whales were near the borrow area.

Offshore Area Avifauna

4.199 Most of the offshore pelagic species belong to the family *Alcidae* (i.e., puffins, razorbills, murres, etc.) and are considered to be rare to uncommon winter visitors to Long Island waters (Levine 1998). These species are not typically encountered within 35 to 40 miles of the shore. Random sightings of these species from land generally occur after an easterly storm event. The species that occasionally use the project area will not be affected by the presence of a dredge at the borrow site. These birds utilize miles of ocean, and their habitat will not be limited by the dredge.

4.200 The other dominant avian groups expected to utilize the offshore environment belong to the family Laridae (i.e., gulls, terns, etc.). These species utilize the shoreline for nesting, but forage offshore on large schools of bait fish species (i.e., herring, sand lance, etc.). These avian species are constantly on the move in search of the bait fish. The temporary presence of the dredge on the borrow area will not impact utilization of the offshore waters by these species. The increase of ocean beach habitat created by the proposed beach nourishment would also benefit these species (the least terns in particular) by providing new nesting areas.

Threatened and Endangered Wildlife Species

4.201 The Endangered Species Act (ESA) of 1973 mandates the protection from extinction of uncommon or threatened wildlife and plant species. Section 7(a) of the ESA requires federal agencies to evaluate their actions with respect to any listed or proposed species or listed/proposed critical habitat. Section 7(a)(2) of the Act requires federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of its critical habitat. The responsible federal agency must enter into formal consultation with USFWS or NMFS if it determines that its action may affect a listed species, or its critical habitat (USACOE 1998).

4.202 NYD had initiated Formal Consultation with USFWS on July 16 1998 and prepared a Biological Assessment (BA) (see Appendix E) that describes the potential direct and indirect impacts on two federally listed threatened species, namely the Atlantic coast population of piping plover and seabeach amaranth. A revised BA dated June 1999 was prepared to reflect project modifications. Since these species primarily utilize the barrier island, they are discussed in detail in later sections.

Resident Wildlife

4.203 The sedentary population of double-crested cormorants may utilize the off-shore area in the vicinity of the borrow site for feeding. However, the dredging activities proposed by the Interim Project are not likely to affect this species, because the birds are freely mobile and can fish in other oceanic waters away from the active dredging area.

Migratory Wildlife

4.204 There are at least eleven (11) rare migratory bird species that may utilize the waters offshore from the project area, as presented in the Affected Environment section. The Interim Project is likely to have little to no impact on certain species (such as the common loon, double-crested cormorant, and black rail), while it may benefit other species, such as the terns (least roseate, common, black, Foster's, gull-billed, and Caspian). The common loon may frequent the project area during the winter to rest and feed, when active sand mining takes place under the Interim Project. However, similar to the cormorants discussed earlier, the feeding habitat for these birds is not restricted to the project area. Thus, the Interim Project is not likely to affect this species.

4.205 Black rail use of the project area is likely to be very limited, if it occurs at all, and is associated with nesting activities in vegetated salt marshes. Due to their seasonal use and nesting habitat preferences, which lie outside the construction window and area of potential disturbance, no impacts are expected to occur to this species by the Interim Project.

4.206 Terns typically return to Long Island to nest nearly one to two months after the piping plovers, in early May (NYSDOS 1991). This may be outside the active construction period of the Interim Project. If not, tern use of the offshore environment for feeding is not likely to experience a negative impact from the dredging operations because these species will seek schools of baitfish elsewhere along the coast. To the contrary, the Interim Project may result in an overall benefit to common and least terns, in particular, by providing wider and more stable high beach and dune areas for nesting.

Atlantic Sturgeon

4.207 The results of the West of Shinnecock Inlet fishery survey, presently ongoing, clearly indicates that the borrow area is rarely utilized by migratory sturgeon as only one was captured out of 30,000 fish in the first six months. Based on this, impacts on this species at the FIIP borrow area due to the project seems unlikely.

Sea Turtles

4.208 There is a potential for endangered Kemp's Ridley, leatherback, and hawksbill sea turtles, and threatened loggerhead and green sea turtles, to be present in the vicinity of the project borrow area during the summer and early fall months. Hopper dredges used during dredging operations in the Interim Project may result in incidental taking and mortality of sea turtles, particularly the Kemp's Ridley and loggerhead turtles (NMFS and USFWS 1991). Direct observations of sea turtles by Morreale and Burke (undated), indicate that juveniles generally attempt to flee once they visually recognize an approaching boat. Since the dredging equipment is slow-moving, turtles may be expected to avoid the active area altogether. However, some sea turtles may become entrained or impinged.

4.209 NYD has had formal consultation with NMFS so that if hopper dredges are utilized between mid-June to mid-November, a monitoring plan will be implemented that places NMFS-approved observers on board the dredges to determine if sea turtle takes occur. The above condition will be placed in the Project Plans and Specifications and the construction contract to comply with the NMFS agreement.

4.210 The Riverhead Foundation for Marine Research and Preservation (RFMRP) directs an active marine mammal and sea turtle stranding program on the eastern end of Long Island. According to RFMRP, a green turtle attempted to nest on the ocean beach in Amagansett (approximately 40 miles east of the project area) during the summer of 1998. The nest, however, was destroyed during a storm and no eggs were ever recovered (Durham, November 18, 1998). This was an extremely unusual event, since green sea turtles have only been recorded as nesting as far north as North Carolina (NYSDEC, Undated).

4.211 Juvenile Kemp's Ridley, loggerhead, and green sea turtles have been well documented as utilizing the nearshore coastal waters and estuaries on Long Island. Adult sea turtles are rarely found in close proximity to the coastline. An occasional adult loggerhead, leatherback, or green sea turtle may be encountered; however, they are typically utilizing waters 40 miles or more offshore (Morreale and Burke, Grey Lit; Sadove and Cardinale, December 1993). Therefore, the nesting attempt may be considered an anomaly. It is highly unlikely that beach nourishment activities proposed under the Interim Project will cause an impact to the beachfront breeding habitat for sea turtles.

Species Recovery Plans

Loggerhead Turtle

4.212 The "Recovery Plan for U.S. Population of Loggerhead Turtles" raises concerns about the direct destruction of marine habitat and the incidental take of individual animals. Since the project area does not lie within the breeding range for this species, the Recovery Plan does not call for any additional actions to be taken in regard to the proposed beach nourishment activities. Additionally, the Interim Project does not involve dredging or the disposal of dredged material in the back bay that might otherwise cause destruction of SAV beds. However, the Recovery Plan does recommend "observer coverage and appropriate screening on all hopper dredges to document take and associated mortality" and to conduct all dredging activities "during times of lowest turtle densities" (NMFS and USFWS 1991). The Interim Plan proposes to conduct sand mining during the season when sea turtles are least likely to be encountered, and the New York District will provide monitors on board the dredges, as discussed earlier.

Kemp's Ridley Sea Turtle

4.213 Incidental take would be the only concern pertinent to the Interim Project that is raised by the Recovery Plan. There are no direct negative impacts of beach nourishment in the project area that are considered by the Recovery Plan. Nesting occurs at a single locality on the east coast of Mexico; therefore, potential destruction of nesting habitat by the Interim Project is not an issue of concern. As discussed in the Affected Environment Section, Kemp's Ridleys occur primarily in bay waters. Since the Interim Project limits bottom and beach alteration to the ocean side of the barrier, no adverse impacts are anticipated for the Kemp's Ridley. The Interim Project, therefore, complies with the recommendations of the Species Recovery Plan (USFWS & NMFS 1992).

Leatherback Sea Turtle and Hawksbill Sea Turtle

4.214 The Endangered and Threatened Species Recovery Program: Report to Congress (USFWS 1992) does not provide any specific recommendations or restrictions on beach nourishment practices in New York to protect these sea turtles and their habitat. Presumably, this is due to the fact that documented nesting of these sea turtles has occurred only as far north as New Jersey. The Preferred Alternative does however, include provisions to reduce the incidental take of sea turtles, as described above for the loggerhead sea turtle.

Near-Shore Area

4.215 The near-shore area is the high energy surf zone, which extends from the surf line to a depth of 18 feet below mean low water. The near-shore zone extends from the surfline to a depth of 18 feet. Impacts would be related to sand placement in the near shore zone and turbid runoff and sand displacement from the intertidal zone. Sand will be hydraulically transported and deposited at the high energy surf zone. From there it will be naturally distributed along the beach via long shore transport. Impacts would include burial of organisms and temporary increases in water turbidity (Naqvi and Pullen 1982). Similarly, the turbidity plume created by sand displacement and runoff would not vary greatly from existing turbidity in this dynamic area (USFWS 1995).

4.216 Out of 31 linear miles of near shore zone along Fire Island's Atlantic shore, approximately 11 miles would be subject to sand placement. A total of approximately 519 acres of near shore environment would be affected by direct sand placement. Locations within the project area where sand would be placed within the near shore area and the approximate coverage is summarized as follows:

Location	Sand Placement Area
Robert Moses State Park	31.4 acres
Kismet to Point O' Woods	268.5 acres
Point O' Woods to Watch Hill	167.1 acres
Smith Point County Park	52.1 acres

4.217 Specific conditions and organisms affected in the near shore zone are discussed below. Direct burial impacts are discussed in the section, "Intertidal Zone."

Near-Shore Invertebrates

Benthic Invertebrates

4.218 Based on the results of a study conducted by the NYD in similar ecosystems between Asbury and Manasquan on the New Jersey shore (USACOE 1998), it is anticipated that the species most likely to experience an impact by the Preferred Alternative would be the polychaete worms, such as *Magelona papillicornis*, small clams (e.g., dwarf tellin), and other species generally associated with the near-shore area. The increased turbidity and potential burial of benthic invertebrates due to the settlement of suspended sediments are likely to be the primary impacts associated with beach placement activities. This is not expected to cause a significant impact on the benthic invertebrates, because most of the placement material is expected to consist of medium grain sands which will drop out of suspension rather quickly, limiting the area and duration of disturbance. Secondly, it has been determined in the laboratory (Blake, N.J. et al. 1996) that many macroinvertebrates are capable of reaching the surface after being covered up by 8.25 inches of sediment. This may be considered typical for any organism that is well adapted to the shifting sands of a high energy environment. If any benthic colonies are lost, they are expected to recolonize very quickly. Saloman et al. (1982) reports recoveries in 9 to 12 months off Panama City, Florida. Re-colonization of the near-shore project area is likely to require 12 to 18 months, as stated for the borrow area.

Shellfish

4.219 The shellfish (exclusive of macroinvertebrates) most likely to be encountered in the near-shore environment of the project area is the surf clam. No direct impacts on shellfish in the near-shore area, such as in the borrow or placement areas, are anticipated to occur as a result of the Interim Project. The increased turbidity and sediment plume down drift from the placement area is the only indirect impact expected.

4.220 As previously stated, it is anticipated that the placement material will consist primarily of medium grain sands that will drop out of suspension quickly. Any potential burial is expected to be extremely minor and easily overcome by shellfish species that are well adapted to a high energy environment. Furthermore, the long shore currents are expected to move any suspended material along the shoreline rather than transporting it offshore and into the near-shore environment.

Crustaceans

4.221 The larger crustacean species dominating the near-shore environment will be the lady crab and, to a lesser degree, the rock crab. Unless some form of bottom structure (i.e., wreck, rock pile, shell bar, etc.) is present within the project area, it is extremely unlikely that any American lobster will be present. All of these crustacean species are sufficiently mobile to avoid areas of undesirable conditions potentially caused by any incidental increase in turbidity which might irritate their gills. The project impacts will be reduced by the timing of sand placement activities which primarily occur from late fall through early spring, at a time when most of the larger crustaceans occupy deeper, warmer waters off-shore.

Near-Shore Finfish

4.222 Finfish are highly mobile and capable of avoiding the construction area during periods of active disturbance, then returning to the area after the disturbance has ceased. All of the finfish species that are likely to occur in the near-shore project area during the active construction period would be considered migratory. It is anticipated that the resident species (e.g., blackfish, window-pane, and little skate) will leave the near-shore project area prior to disturbance at the placement area, because they typically undergo a short migration to off-shore warmer waters during the winter months. Finfish abundances are expected to be lowest from December through March when water temperatures are at a minimum. This would include both migratory species and year-round resident species. Resident species will migrate offshore as water temperature drop below the normal requirements. Commercially important cold water species (such as Atlantic cod or silver hake) are not expected to be encountered in significant numbers in the near-shore habitat due to drastic reductions in population size (U.S. Department of Commerce, January 1995).

Intertidal Zone

4.223 The intertidal zone extends from the low tide line to above the high tide line. In this area, the hydraulically transported sand will be placed directly atop the existing beach. During the placement activities, bulldozers and backhoes will be used to shape the sand into the design profile. The widening of beach and heightening of dune will take place only in developed areas. There will be limited sand placement on major federal lands, and none in the Otis G. Pike Wilderness Area. Out of 31 linear miles of intertidal zone along Fire Island's Atlantic shore, there will only be about 11 miles of sand placement, including approximately 1 mile each in Robert Moses State Park and Smith Point County Park, 7.9 miles in sections in front of the Fire Island villages and communities, and 1.3 miles portions of the FIIS. Added dune length as a result of sand placement will be as follows:

Location	Added Dune Length
Robert Moses State Park	0 feet
Kismet to Point O' Woods	24,659 feet
Point O' Woods to Watch Hill	11,908 feet
Smith Point County Park	0 feet

4.224 In the area from Point O' Woods to Watch Hill, only 3,244 feet of added dune length will be within the limits of the FIIS. The remaining 8,664 feet of added dune length will be in Community Districts.

4.225 A total of approximately 240 acres of on-shore and intertidal environment would be affected by direct sand placement. Locations within the project area where sand would be placed within the on-shore and intertidal zones and the approximate coverage is summarized as follows:

Location	Sand Placement Area
Robert Moses State Park	23.0 acres
Kismet to Point O' Woods	96.0 acres
Point O' Woods to Watch Hill	94.7 acres
Smith Point County Park	25.4 acres

4.226 The use of heavy equipment required for beach nourishment activities, and the associated sand compaction, may also temporarily impact the beach habitat. This may have short-term effects on upland beach vegetation, but should not exceed the current impacts associated with long-term off-road recreational vehicle use (USACOE 1996). No discernable impacts due to equipment operation were observed at the western Fire Island communities in 1992, which experienced a high level of vehicle traffic during beach nourishment activities.

4.227 Non-mobile organisms in the affected portions of the island's intertidal zone would be buried and eliminated. Mobile organisms, such as birds and sand crabs, would be able to avoid direct effects in most cases. Many of those mobile organisms that were buried would be able to work their way back to the surface. Impact issues addressed below include direct mortality, loss of habitat, alteration to the physical environment, and potential changes to feeding behavior.

Intertidal Zone Invertebrates

Benthic Invertebrates

4.228 The vast majority of macrobenthic organisms currently utilizing the intertidal area will be eliminated as a result of the physical disturbances. As discussed earlier, however, some organisms (i.e., *Nephtys incisa* and *Streblospio benedicti*) are capable of burrowing through several inches of fill material.

4.229 EEA, Inc. (1998) recently completed a study of macrobenthic organisms occupying the ocean beaches and back bay areas associated with West Hampton Interim Plan in the West Hampton Interim Project, located to the east of the FIIP area. This study compared the types of macrobenthic invertebrates which were collected from the beach placement area to those collected up-drift on an unnourished beach (control station). Breach closure occurred during the winter of 1997/1998 and samples were collected less than six months later during April and May 1998. The species diversity was found to be similar between the protected and control areas. The nemertean, oligochaeta, and nematoda worms were found to be the dominant macrobenthic species in both areas. Although the blue mussel made up a significant percentage of the abundance, it is not likely an endemic species to the open sand beach habitat. Species density at the control beach was 78.8 organisms/m^2, while density at the placement area was considerably lower, at 43.2 organisms/m^2.

4.230 Physical disturbances of the bottom sediments from natural or man-made events can result in the destruction of benthic organisms (e.g., through burial, suffocation, etc.), and may cause major alteration of habitat (Cerrato 1986). Following a large scale disturbance, an ordered sequence of species succession occurs, beginning with the colonization of the affected habitat by species with high reproductive and colonization potential. In a comparative study of nourished and unnourished beaches conducted by Reilly and Bellis (March 1983), it was found that the speed of benthic recovery was largely dependant upon recruitment from pelagic larval stocks; species that were unable to recover through this means returned to the disturbed areas more slowly.

4.231 The following discussion is excerpted largely from the USFWS Coordination Act Report (June 1995) for the BCP. The recovery of benthic macrofauna (those animals 0.5 millimeter in diameter or larger) after beach nourishment varies from one site to another. Studies completed in the 1970's indicate that when nourishment ceases, the recovery of benthic macrofauna is rapid, and complete recovery may occur within one or two seasons. The ability of macrofauna to recover is due to: (a) their short life cycles, (b) their high reproductive potential, and (c) the recruitment of planktonic larvae and motile macrofauna from nearby unaffected areas (Naqvi and Pullen 1982).

4.232 Meiofauna (animals smaller than 0.5 millimeter in diameter and equal to or larger than 0.062 millimeter in diameter) tend to recover very slowly from a major disturbance, perhaps due to their slow reproduction, limited ability to migrate, and highly specialized adaptations to a restricted environment (Navqi and Pullen 1982). However, meiofaunal recovery can be rapid following minor disturbances (Naqvi and Pullen 1982). In effect, biota associated with beach ecosystems are accustomed to change, and most members are capable of escaping from mechanical filling events. Moreover, the migration of adult or larval organisms from adjoining sides of nourished areas is a common occurrence, as these species look to establish themselves in open niches.

4.233 Re-colonization of the sediments would begin almost immediately; densities would remain low, but the establishment of new benthic communities should be completed in 12 to 18 months (USACOE 1996). Until re-colonized, this food source would be temporarily unavailable to the shorebirds utilizing the area. The south shore of Long Island has approximately 130 miles of sand beach habitat and associated intertidal habitat. The benthic invertebrates found throughout the study area are not unique to the region.

Shellfish

4.234 As discussed previously, surf clam is the only shellfish species of concern. The surf clam has the potential to occur from the lower intertidal zone to an approximate 100-foot depth in the subtidal zone (Gosner 1978). Thus, the sand placement activities would only affect surf clams at the extreme inshore limit of their range. It is therefore unlikely that a significant portion of the surf clam population negatively affected by the placement of sand along the beaches.

Crustaceans

4.235 The only large crustacean species that would potentially experience an impact from the sand placement would be the lady crab. Lady crabs can inhabit sandy bottoms up to the high water line during the warmer months of the year (Gosner 1978). Typically, lady crabs undergo an inshore/offshore migration as the seasons change. If sand is pumped onto the beach while lady crabs are inshore, it is likely that some individuals would experience a negative impact, while others would be able to avoid the area. This is expected to be a minimal impact as lady crabs and their food sources are likely to quickly invade the new habitat after beach nourishment activities are complete. Therefore, little to no impact is anticipated to occur to this intertidal crustacean species.

Intertidal Zone Finfish

4.236 Motile organisms, such as fish, appear to be the least affected by beach fill activities because they are able to move to avoid disturbances, and can then return to the area when conditions are suitable again. Non-motile species may be fatally buried or subject to increased turbidity; however, such organisms are generally adapted to a highly turbid near-shore environment (USFWS 1995).

Intertidal Zone Marine Mammals

4.237 Harbor and hooded seals typically utilize the intertidal zone for haul-out locations that is, areas where the animals emerge from the water to rest on land. During the winter and early spring, the seals will tend to frequent the lower energy environment on the back bay side of the barrier. Haul-out locations in the vicinity of the project area are typically isolated and consist of rocky or other "structured" environments, such as the rock jetties located at Shinnecock Inlet. However, Conner (1971) mentions that harbor seals have historically made use of marshes, beaches, and sandbars on the south shore of Long Island. There are no known beach haul-out locations within the project area.

Intertidal Zone Insect and Arachnid Fauna

4.238 Sand deposition associated with the Interim Project would bury insects and spiders that are presently inhabiting the intertidal zone and the wrack line. Insect larval stages would be the most vulnerable to burial. Sand deposition would likely inhibit normal larval activity or result in injury or death. Sand deposition would also render the insects of the intertidal zone and wrack line temporarily unavailable to other insects and shorebirds who depend on them as a food source.

4.239 Although there is little published information on the effects of beach nourishment on insect and arachnid fauna, it is likely that insects would begin re-colonization almost immediately. The insects found in the project area are ubiquitous on the south shore of Long Island. Given the high mobility of adult insects and the ubiquitous nature of beach insects, there is no dearth of source populations for re-colonization.

Intertidal Zone Rare Plant Species

4.240 As discussed previously in the Affected Environment Section under Rare Plants of the Barrier Island, two species in particular depend on the dynamic beachfront habitat, and other sandy deposits that typically result from overwash and breaching events. These sediments provide substrate for seabeach amaranth and seabeach knotweed germination. Since the FIIP will reduce the likelihood of breach formation (and subsequent development of potential habitat for seabeach amaranth and seabeach knotweed), and involves the movement of construction vehicles and placement of fill material within a zone of potential growth for these species, these species are likely to experience a negative impact from the project.

4.241 Seabeach amaranth is federally listed as a threatened species. Pursuant to Section 7 of the Endangered Species Act, NYD has prepared a BA which addresses both the direct and indirect potential impacts of the Interim Project on this species. Highlights of this report are presented as follows. It is important to note that existing flood tidal deltas, overwash fans, and sand spits will not be used as a source of fill for the FIIP. Rather, NYD proposes to use an offshore borrow pit as the source for all the sand required for beach nourishment and dune construction, which will serve to minimize impacts on any species currently lying in the seed bank or occupying these areas.

Potential Direct Effects of Proposed Action on Seabeach Amaranth

4.242 The following discussion is largely excerpted from the New York District Biological Assessment prepared in support of the proposed project (USACOE 1998). Direct sand placement onto the plant species will result in mortality, with no chance of seed production. This could have a significant impact on the local population. Trampling by workers or construction equipment could also directly destroy the plants. Beach slope is another critical factor for seabeach amaranth habitat selection and use. It is important not to engineer a slope greater than what is exhibited at seabeach amaranth locations, if present. In order to maintain existing habitat, the slope of the placement material must be consistent with the current habitat.

4.243 The FIIP will also indirectly impact the seabeach amaranth by limiting new potential habitat areas. Overwash areas have been identified as being primary habitat for the seabeach amaranth. Since it is an opportunistic annual species, seabeach amaranth will colonize suitable habitat when it becomes available (i.e., washovers). Stabilizing potential breach locations would reduce the extent and frequency of overwashes, thereby limiting new habitat areas for seabeach amaranth. However, it has been observed on previous occasions that after episodes of USACOE beach nourishment, the seabeach amaranth population has increased (USACOE 1999).

4.244 NYD has proposed a management plan aimed at reducing the potential impacts on seabeach amaranth.

Intertidal Zone Avifauna

4.245 Perhaps the greatest disturbance of beach filling is to nesting shorebirds that may be onsite or on beaches adjacent to such an operation. Least terns and piping plovers commonly nest in the project area. According to the USFWS, the proposed project is likely to adversely affect the piping plover. USFWS is currently preparing a report to assess potential impacts to plovers. Conducting a beach fill operation outside of the least tern and piping plover nesting season is the easiest way to avoid adverse impacts to these species (USFWS 1995).

4.246 However, if sand placement occurs during the least tern nesting season (approximately April 15 to September 1), least terns may be precluded from nesting in adjacent areas due to disruptive construction activity. If project construction activities are conducted during the least tern nesting season (approximately April 15 to September 1), their courtship, nesting, and brood rearing activities may be directly and adversely affected. The operation of dredging equipment immediately adjacent to a shoreline that is used by terns as a courtship, nesting, and brood rearing area has the potential to disturb terns to the point where they may not successfully nest and fledge young. Dredging equipment that is operated immediately adjacent to tern habitat may preclude terns from using the habitat entirely, forcing them to seek appropriate habitat elsewhere. Operation of machinery used to move dredge pipeline and to grade the nourished beach can greatly disturb terns, their nests, and can endanger the lives of chicks. In addition, the actual placement of sand within a known nesting area can adversely affect the quality of the currently existing least tern nesting substrate (USFWS 1995).

activities should not be scheduled if such activities would preclude their nesting. When construction activities do occur, shore birds may avoid the active construction site temporarily. Given the miles of adjacent shoreline and tidal flats, the availability of habitat is not a limiting factor and this temporary effect would not be significant.

4.248 Creating additional beach width and elevation would provide more habitat for the plovers and terns. However, this may have little positive impact on their long-term success because they currently do not lack shorefront habitat. The nourished beach, however, may decrease flooding (due to the increased elevation) of the shorebird nests during the hurricane season, and this may provide some real but unmeasurable benefit. Nourishment of the beach will prevent or greatly lessen overwash and subsequent destruction of the existing beach grass and associated communities.

4.249 Recent work within the Village of West Hampton Dunes has produced no noticeable short-term negative impacts on piping plover breeding biology or foraging ecology. The result of this project has, however, increased suitable piping plover nest habitat. Indirect activities (redevelopment of houses and infrastructure) associated with filling activities have started to affect habitat suitability and carrying capacity (Houghton et al. 1999). However, FIIP will not produce a measurable increase in development, so no impacts to piping plover habitat associated with the 6-year project are anticipated.

4.250 With the incorporation of appropriate buffer zones and high quality monitoring and management, the District was able to complete certain beach and groin construction activities during the piping plover breeding season with very minimal disturbances to plovers (Houghton et al. 1999) and no significant impact.

Barrier Island Environment

4.251 The barrier island study area extends from the primary dune line landward to Fire Island's shoreline on Great South Bay. The project will not directly affect this zone. However, indirect effects may occur, because the higher dune and wider beach will lessen the frequency of overwash, may prevent breaching, and, to a lesser extent, could alter the pattern of wind-driven salt deposition on the interior of the barrier island. As is the case with the intertidal zone, these effects would be limited to several discrete areas summing to 11 miles out of a total length of 31 miles. Nearly all of these locations would be in the developed portions of the island; minimal amounts would be in the federally protected portions of the FIIS. Impact issues addressed below for these relatively limited areas include loss of habitat, alteration to the physical environment, and potential changes to feeding behavior.

Barrier Island Flora

4.252 The construction of beach fill and enhanced dunes will also effectively enhance the protection afforded to those upland vegetative communities located behind the primary dune where it is raised measurable by the Preferred Alternative. These particular vegetative communities would likely experience a slight decrease in wind speed and a concomitant reduction in potential wind shear from the offshore winds. Thus, the delivery of salt particles, by wind as well as through direct overwash, may be modified slightly where the beach is widened and dune height is raised. Such actions may encourage the growth of certain back-dune woodland plant species and reduce the current environmental stress on those woodland communities that are located behind the proposed dune construction.

4.253 Construction activities are likely to be concentrated between the upper beach and intertidal zone, thus posing a potential threat to plant species currently occupying this area. Damages to existing vegetation can be minimized by confining vehicle traffic to designated travelways, staying a minimum of 20 feet from the toe of any existing dune (whether vegetated or not), utilizing the same wheel ruts created by earlier vehicles, and provide adequate visual barriers around rare plant species as a warning to avoid traversing the area. In addition, vehicle passes which traverse the dunes in a manner perpendicular to the shoreline should be avoided wherever possible, or aligned in such a way that they avoid prevailing wind directions to prevent future blowouts.

4.254 The following narrative is largely excerpted from the H.W. Art (1971) report that describes the importance of atmospheric salts in defining the maritime communities of the Fire Island barrier. This is provided as a framework to properly assess the impacts of the Interim Project on the barrier island flora. Art states that "with increasing proximity to sea coasts there is generally an increase in the quantity of chemicals contained in precipitation, not only chloride, sodium, and sulfate, but also nitrogen, magnesium and in some locations calcium and potassium. In coastal areas, the atmospheric load of oceanic salts is so great as to cause the restriction and zonation of ecosystems."

4.255 Winds along the Atlantic coast are predominantly from the north during the winter months, while during the summer months they are predominantly from the south and west. The Fire Island barrier also experiences onshore winds during the spring and summer. According to Art (1971), these onshore winds are primarily responsible for the production of salt spray aerosols.

Salt spray aerosols are formed by the evaporation of droplets ejected form the sea surface by the bursting of air bubbles. Wind speeds in excess of 7 m/sec. cause whitecaps to form on the ocean, which greatly enhances the formation of salt spray aerosols. Wind speed, which increases with height above ground, is greatest at the windward crests of the dunes and lowest in the wind shadows just leeward of the dune crests. The salt spray aerosol concentration also rises with increasing wind speed, and is highest closest to the ocean and in areas of high topographic exposure (Art 1971).

Dune and Swale Community

4.256 Changes to the dune and swale community that may be induced by the Interim Project are difficult to predict. This is due to the fact that the vegetative patterns which appear in the dune and swale community are governed by a complex of environmental gradients rather than a single factor, such as salt spray (Art 1971).

4.257 Beachgrass plays a prominent role in the development of dune and swale topography. Wind speeds at or above 4 m/sec. will transport sand grains. When winds of this speed or greater encounter barrier island vegetation, they may slow down and deposit their load of sand around the bases of the plants. "As the process is repeated, the height of the dunes increases . . . to an equilibrium height dependant upon the characteristics of the sand, the intensity of winds, the biologic limits of the vegetation, and the frequency of storms" (Art 1971).

4.258 The seaward face and crest of the primary dune, where salt spray deposits and sand movement are greatest, is typically dominated by beachgrass. Beachgrass root growth is stimulated by sand burial; thus, activities that stabilize the substrate will lead to decreased beachgrass vigor. This phenomenon is readily apparent in natural systems on the lee side of the primary dune, where beachgrass abundance generally decreases as the abundance of woody species increases. Augmentation of the existing dune may slightly modify the localized wind patterns and salt spray deposition.. The beachgrass community will likely establish on the foredune and crest of the new/enhanced dunes. Beachgrass covering the former foredune areas (considered back-dune after project completion) may dwindle and eventually be outcompeted by woody vines and shrubs.

4.259 Woody shrub species (such as beach plum, bayberry, and poison ivy), which generally occur on the leeward slope of the primary dune and throughout the secondary dune system, also exhibit a limited capacity to respond to periodic sand burial. However, these species are more highly susceptible to salt spray injury than beachgrass and, therefore, typically remain out of immediate exposure to winds coming off the beach. Increasing the effective height of the foredune may allow these woody shrub species to establish at slightly higher elevations on the lee side of the primary dune as well as on the secondary dunes.

4.260 Art (1971) conducted vegetative transects across the Fire Island barrier and found that the percentage of vegetative cover and species diversity generally increased with distance from the ocean. In a similar fashion, slight increases in percent cover and species diversity are likely to be induced by the construction of an engineered beach and a heightened dune. This change is expected to be most significant in the more protective "shadow zones" that create favorable micro-climates for species that are less tolerant of salt and wind. This effect is likely to particularly favor the swale communities.

4.261 Beach heather is a species that pioneers onto bare sands in blowouts and other erosional areas. The total area covered by this species, as well as others typically associated with blowout areas (i.e., seaside goldenrod, sand jointweed *[Polygonella articulata]*, tall wormwood [*Artemisia caudata*], and panic grasses [*Panicum sp.*]) is likely to be reduced over time as a result of the increased erosion protection afforded by the FIIP.

Maritime Forest Community

4.262 No direct placement of fill will take place near this community; only indirect placement would occur through littoral drift. As discussed in the No Action Alternative, the integrity of this community requires protection from extreme environmental stresses. The FIIP may increase protection to any woodland areas located north of the existing dune line. In addition, the micro-climate changes (i.e., reduction in wind speed and subsequent drying effect) anticipated for the lee side of the primary dune may promote establishment of woody growth in areas not currently supporting such habitat. Drastic community shifts, such as the conversion from grasslands to woodlands, are not expected to occur, because the process of natural succession is slow (particularly in the relatively harsh coastal environment) and is not likely to produce noticeable changes over the short duration of the FIIP.

4.263 Art (1971) states that the "vertical growth of the Sunken Forest is severely restricted by the shearing effects of the salt-laden winds. Leeward of the secondary dune, the canopy rapidly assumes a relatively uniform height of 5.5 to 7.0 meters. The tops of the trees that are subjected to the shearing action of the salt-laden winds develop a smooth, closed canopy. Thus, the height of the trees is ultimately determined by the height of the secondary dune which governs flow patterns." Heightening the primary dune may raise the effective elevation at which wind-shearing takes place. However, this may not affect any change on the maritime forest community, because the existing trees may have undergone irreversible physiological conditioning to withstand these conditions, such as shutting down potential apical growth on the exposed tips of the branches. In addition, the closed canopy produced by years of growth under wind-shear may effectively block sunlight from the forest floor, thereby maintaining the status of the forest and barring future succession.

Planted Exotic Lawn/Shrub

4.264 The landscape plantings associated with the developed portions of the barrier island (i.e., maintained residential communities and park properties) are likely to benefit from the FIIP. This is due primarily to the fact that the back-dune and upland areas will become more stable as a result of the dune enhancement activities scheduled for the beachfront. Establishing a wider and slightly higher dune elevation along the south shore is likely to cause a reduction in wind shear and aeolian salt deposition on vegetation growing lower than the effective height of the dune, especially immediately behind the dune crest. This could benefit turf grasses that are not highly salt tolerant, as well as ornamental shrub and tree species. It is not likely to create a competitive advantage for non-native species over indigenous vegetation, however, since the overall growing conditions on the barrier will remain relatively harsh, and the duration of the FIIP is relatively short.

Barrier Island Intertidal Marshes

4.265 Breach events which lead to the formation of inlets can create suitable habitat for marsh vegetation to colonize. The flood tidal deltas that form under these conditions were reported by Leatherman and Allen (1982, 1985, 1989) to have caused the development of the majority of the marsh islands and back-barrier marshes in Shinnecock Bay and Great South Bay. However, unabated breach or major overwash events may also cause existing marsh areas to be covered with sediment (as discussed previously in the No Action Alternative section). Depending upon the thickness of the deposit, these overwash areas may become re-colonized by upland vegetation (such as beach grass), and ultimately result in a loss of salt marsh habitat. At the time of this report, NYD was consulting with other involved agencies about possible mitigation efforts in case there is a loss of habitat.

4.266 Since the FIIP would decrease the possibility of a breach or overwash event, the probability of losing existing marsh habitat due to storm surges would decrease, as would the probability of forming new tidal marshes. The reduced likelihood of inlet formation is also likely to translate into reduced formation of flood tidal deltas and potential tidal wetlands habitat. Thus, the FIIP is likely to result in no net change to the total vegetated wetland area.

4.267 The 1997 NPS study of estuarine resources of the FIIS states that "well-developed or developing salt marshes are in those areas where shoreline structures effectively reduce currents and water flow, and where sedimentation rates exceed those of coastal submergence."

Barrier Island Avifauna

Resident Species

4.268 Herring gulls and great black-backed gulls are the two primary species that are found in large concentrations along the south shore of Long Island. While both species would benefit from a breach that would create potential nesting habitat, the increase in dune width and a more established beach front offered by the FIIP would also result in additional potential nesting habitat.

4.269 Both gull species are expected to continue to thrive under the Interim Project. Beach nourishment will provide a readily available food source in the form of macrobenthic invertebrates, shellfish, and crustaceans that are pumped onto the beach with the sand. This will be welcome during the winter, when food is typically scarce.

4.270 The resident waterfowl populations of Canada goose, black duck, and mallard are likely to remain unaffected by the Interim Project. Although these birds primarily seek coastal and brackish tidal marshes for breeding, their habitat is not particularly limited to the project area; they will utilize the entire bay complex for loafing, feeding, and rearing young.

Migratory Species

4.271 The numerous species of shorebirds which currently utilize the beaches, marshes, and intertidal flats from spring to fall will continue to do so under the Interim Project. With the possible exception of dunlins, greater yellowlegs, and sanderlings, the majority of the shorebirds are away from the project area during the winter when most of the active construction is scheduled to take place. Similar to the gulls, the sanderlings are also likely to benefit from the improved feeding opportunities associated with the placement of dredged material on the beach, which would supply polychaete worms and shellfish in easy reach. The dunlins are more likely to frequent the sand spits and inlets, as would the back-bay marshes and the greater yellowlegs during the winter construction period. These species, therefore, are not expected to be affected by the FIIP.

Raptors

4.272 This avian group is most likely to experience an impact by any reduction in breaching and overwash events. Raptors are predominantly sight hunters, requiring sparse amounts of vegetation to spot their prey and make a successful hunt. By reducing the potential for breaches and overwashes, natural succession of the barrier island will tend toward a more heavily vegetated shrubby or wooded environment, thereby providing a greater percentage of protective cover for small mammal and passerine prey species. The most affected species are likely to be the red-tailed hawk, falcons (kestrel, merlin, and peregrine), the northern harrier, and many owls (short-eared, barn, and sawwhet). The various accipter hawks (sharp-shinned, Cooper's, and northern goshawk) and the red-shouldered hawk, are better adapted for hunting in the wooded environment and less likely to be affected by the change in habitat.

4.273 The Endangered and Threatened Species Recovery Program: Report to Congress (USFWS 1992) does not raise any issues of concern or provide any specific recommendations or restrictions that pertain to the proposed Interim Project.

Passerine Species

4.274 This avian group is dominated by the wood warblers, vireos, and sparrows that heavily utilized the coastal habitat during migration periods. The Long Island barrier islands are the first land some of these species hit after migrating over the ocean. The increase in woody vegetation (associated with the stabilization of the upland environment) will greatly enhance the food and cover value of this habitat for these species, which feed by day and migrate by night.

4.275 Some of the passerine species that favor grassland habitats (such as vesper and grass-hopper sparrows) might be precluded from the use of the barrier because of the successional woody growth. However, the savannah sparrow, which inhabits the dunes and back dune communities, will probably not be negatively affected by the FIIP since this habitat is unlikely to change significantly over the next 6 years. The other grassland sparrows, along with other grassland species (i.e., bobolink and Henslow's sparrow), are likely to confine their use of the barrier island strictly to migration periods.

Barrier Island Wildlife

4.276 The FIIP will provide a more stable upland environment, which will facilitate the natural successional process. However, given the harsh coastal environment of the Fire Island barrier, it is likely that succession will proceed at an extremely slow rate, never progressing over the next 6 years beyond a woody-shrub/woody-tree thicket habitat.

4.277 Most of the species that inhabit the project area (as discussed in Chapter 3) are extremely adaptive and will adjust accordingly. A discussion of how this succession will affect the major wildlife classifications follows.

Barrier Island Large Mammals

4.278 Whitetail deer inhabit the Fire Island barrier at numbers far above the carrying capacity of the habitat. Although temporary, the Preferred Alternative would provide a more stable upland environment in those areas where the dune height would be raised measurably. This would very slightly improve the habitat for deer, offering improved browse and a bit more protective sanctuary from the harsh coastal conditions.

4.279 As stated in Chapter 3, NYSDEC has recognized the deer over-population issue and has attempted to control the population by allowing a controlled hunt. However, public opposition has historically thwarted these attempts. In response to the deer overpopulation problem, the Humane Society of the United States (HSUS) has implemented a birth control program that involves administering vaccines to free-ranging animals. To the extent that the upland habitat is enlarged, the deer will expand their current range, possibly making it more difficult for the HSUS volunteers to administer the yearly follow-up inoculation, thereby limiting the effectiveness of the current sterilization program. However, since the locations affected are limited to small vegetated areas near those dunes slated for increases in elevation and the project will only be implemented for 6 years, this effect will not be significant.

4.280 Given the total lack of predators and the unwillingness to permit any form of harvest, the whitetail deer population will continue to expand and increase the threat of Lyme disease, with or without a temporary storm damage protection project, thereby increasing the health risk to the Fire Island residents an park visitors. The state deer control programs are strictly wildlife management issues that should be controlled independent of the proposed temporary beach nourishment project.

Small Mammals

4.281 The vast majority of the small terrestrial mammals (e.g., moles and shrews, meadow vole, white-footed mice) are extremely adaptive and can utilize a variety of habitats which include grasslands, old fields (meadows invaded by vines and shrubs), thickets, and fresh and tidal wetlands. The mature forest lacking understory (groundcover) growth is the habitat least utilized by these mammals. One species that exhibits a strong preference for grassland habitats (i.e., dune grass, old field, and spartina marsh) is the meadow vole, but this species will utilize shrubby thickets as well. The Preferred Alternative is likely to induce a modest habitat change on the island interior area, towards a more wooded, shrubby environment. The dune and intertidal marsh areas would remain unchanged. Any dramatic shift in vegetative patterns on the Fire Island barrier would require significantly more time than the 6-year lifespan anticipated for the Interim Project.

4.282 The more aquatic species (e.g., muskrat, mink, etc.) will continue to utilize the saltmarsh habitat as they currently do, with little or no change to the population. The larger carnivore species (i.e., red fox and raccoon) are both extremely adaptive species and are also expected to continue to thrive on the island.

4.283 Roosting habitat for bats, other than man-made structures (i.e., house eaves and attics), is currently in limited supply on the island. Bats that currently use these areas will continue to do so, and the bats that forage on insects over the dunes and marshes during migration will, too. Undesirable alien species, such as the Norway rat and house mouse, which became established nearly two centuries ago (Connor 1971), will also continue to utilize the various habitats found along the outer beach.

Feral Species

4.284 A feral population of domestic cats and dogs has become established on the Fire Island barrier. The FIIP will have no impact on these species. Populations are expected to increase through wild breeding and the release of new individuals each year by homeowners. As previously stated, these feral animals pose a serious threat to native wildlife species, and particularly to ground-nesting birds, such as the piping plover. This problem will continue and result in greater losses of native wildlife if left unaddressed.

Herpetiles

4.285 The FIIP will provide a more stable environment for the nine reptile and amphibian species discussed in the Affected Environment Section as occupying the project area. Their populations are expected to remain stable or increase slightly due to the habitat protection afforded by the Interim Project.

Insect and Arachnid Fauna

4.286 Impacts to insect and arachnid fauna are only anticipated in the intertidal zone, not on the barrier island.

Threatened and Endangered Barrier Island Wildlife Species

Resident Wildlife

Barn Owl

4.287 Natural succession of the project area into a more woody-shrub/woody-tree thicket habitat would decrease the value of the area for use by barn owls. This species requires open areas to hunt, and typically abandons old fields as they become predominantly woody (Andrle and Carroll 1988).

Migratory Wildlife

4.288 NYD has determined that the Atlantic Coast population of piping plover and seabeach amaranth occur in and adjacent to the proposed project area. NYD has prepared a BA for the piping plover and seabeach amaranth, and initiated Formal Consultation with USFWS on July 16, 1998. The BA also outlines protective measures and a coordinated survey/monitoring protocol to ensure the safety of these two species. The substantive portions of the BA have been integrated into this impact analysis. Please refer to the appendices of this Environmental Impact Statement (EIS) for the details of the required NYD involvement relating to the protective measures.

4.289 In addition to the formal consultation concerns of USFWS regarding Section 7 of the ESA, FIIS has implemented an Endangered Species Habitat Management Plan that restricts beach driving from April 1 through July 15, 1998; and extends these restrictions from March 1 through July 15 , and March 1 through September 1 in 1999 and 2000, respectively (NPS 1998). Because of the safety concerns and higher costs associated with work performed in the late fall and winter months, construction will most likely occur sometime during the piping plover breeding and seabeach amaranth growing season (April to August). It may be possible to schedule the work to initiate in July, after plover nesting areas have been established (NYD 1998).

4.290 The NYSDEC Natural Heritage Program and/or the NYSDEC Long Island Colonial Waterbird and Piping Plover Surveys have identified at least three locations within the project area where piping plovers occur, or have historically established nests along with least terns. These areas have been identified as the ocean beaches in front of Fair Harbor, the Sunken Forest, and Fire Island Pines. The area in front of both Fair Harbor and the Fire Island Pines is scheduled for both beach nourishment and dune construction. Both areas are also residential developments. Only limited dune development will take place at the eastern and western most extent of the Sunken Forest, to gradually taper the ends of the enhanced dune away from the adjacent residential communities.

4.291 Piping plovers that utilize the barrier beaches along Long Islands south shore between Moriches and Shinnecock Inlets show a distinct preference for nesting in overwash areas and foraging in ephemeral pools (Elias-Gerken 1994). This does not apply to the species as a whole. Berger (1987) documented piping plovers nesting on the beaches of Brigantine, New Jersey, where no washovers have occurred; there, the highest nesting success occurs with the plovers that nest closest to the dunes and vegetation, farthest from the water, and closest to a tern colony. Nests are typically situated in a flat area, with approximately 5 to 20 percent shell cover. Piping plovers also have high success rates in Massachusetts, where no overwashes occur. The success of these birds, as well as birds from western Long Island and New Jersey, was determined to be dependent upon the presence of a thick wrackline (Elias-Gerken 1994). The beaches in the Westhampton area have the sparsest wrackline of all the areas surveyed.

4.292 A review of the literature regarding the selection of nesting sites for piping plovers focuses mainly on the percentage of vegetation, percentage of shells, and grain size. These documents rarely mentioned the preferred gradient for shore-nesting birds. The only references to beach slope are generally qualitative and describe the area as "flat," not at the bottom of troughs or top of peaks, but generally on flat land (Burger 1987). Least terns found in the same areas will nest on the slopes of the slight ridges (Burger 1990). It would appear that the best approach for providing a final grade on the nourished beach face to encourage piping plover nesting would be to mimic the beachslope associated with a nearby nesting area, providing the best possible local conditions.

4.293 In general, for all of Long Island, a slow but steady increase of piping plovers has been noted from 1985 to 1996 by the NYSDEC Long Island Colonial Waterbird and Piping Plover Survey (1996). The study states that piping plovers showed an apparent increase between 1985 and 1989, but thereafter, estimates have remained steady. The trends on Fire Island appear to be consistent with the rest of Long Island. The number of piping plovers on Fire Island appears to be consistently low, representing from 1.9 to 7.5 percent of the total population. Much larger concentrations were reported to occur to the west along Jones Island and the Rockaways, to the east along Southampton Beach, on the north shore of Long Island, and on the easterly North Fork. Numbers fluctuated greatly from year to year and from location to location, with no apparent pattern. This apparent lack of consistency makes it very difficult to assess impacts on piping plovers along Fire Island.

4.294 Piping plover productivity within the Westhampton area in 1997 was higher than the 0.8 to 1.24 chicks/pair needed to maintain a stationary population. (USACOE 1998). Productivity dropped during 1998 to 0.79 chicks/pair in the Village of West Hampton dunes, falling to just—

below the criteria establish for a stationary population. This was consistent with the overall population for the United States and Canada reported by the USFWS (1998). In 1999, productivity increased to 2.11 chicks per pair. This can be attributed to successful protective measures. These include symbolic fencing and active on-site monitoring of the nesting and foraging areas. Human disturbance issues within the Village likely will increase.

Piping Plover Status within the FIIP Project Area

4.295 Piping plovers utilize the habitat found at the FIIP study area, although it is not a major nesting area. One nest consisting of four eggs was identified near the Old Inlet area (USACOE 1998). In 1999, piping plover nests were observed at the following locations on Fire Island: Water Island (brood subsequently moved to Long Cove); Old Inlet; and Smith Point (in front of Pattersquash Island). Only the Water Island location is in or near the Preferred Alternative's sand placement zone, and the construction plan would avoid activity in the identified piping plover nesting area during breeding season.

4.296 Stabilizing the eroding beaches under the Preferred Alternative may have a positive effect on maintaining or increasing suitable shoreline nesting or feeding habitat in the long term (USACOE 1998). Potential temporary adverse impacts to piping plover habitat could result from the proposed filling activities. The sand would be moved through hydraulic pipeline that would extend from the dredging site across the inlet and nearshore. Placement may temporarily decrease the habitat quality of the piping plover's food source (macro invertebrates), resulting in a decrease in the value of the foraging habitat until the newly placed beach is stabilized and its faunal community restored. Potential newly hatched and older plover chicks feeding along the shoreline in the vicinity of the placement area (if nesting were to occur nearby) could experience an impact. However, during the breeding season, construction activities will be restricted to areas that have not been known to historically support a viable piping plover population. No sand would be placed on or near known nesting locations.

4.297 Beach slope is also a critical factor for piping plover habitat selection and use. It is important not to design a slope greater than the piping plover can utilize. In order to maintain existing habitat conditions, the slope of the placement material will be consistent with adjacent existing beaches that contain successful brooding areas (USACOE 1998). Concurrent with developing a plan for storm damage reduction, it is possible to include features within the plan specifically to promote the advancement of threatened and endangered species. These measures can be undertaken without negatively affecting project functioning and are intended to improve the nesting and foraging habitat for species such as the piping plover. The exact nature, location, and sizes of these measures are currently being conducted with the USFWS through the biological assessment process, the National Park Service, and Suffolk County and New York State. Possible measures could include actions to promote creation of ephermal pools, optimizing vegetation coverage for endangered species use, as well as other management actions.

4.298 The increasing of barrier island height and width may be either beneficial or detrimental to piping plovers. A stabilized beach should result in longer-term protection of habitat currently being lost to storm-induced erosion. A potential adverse consequence is that early successional habitats formed by way of overwash activities will be decreased due to the reduction of overwashes (USACOE 1998). However, as described in the Draft Decision Document, east of Watch Hill sand placement would be limited to a small feeder breach in Smith Point County Park. Thus, for a large portion of plover habitat, there would be no effect from overwash reduction.

4.299 In the severely eroded areas, there is the potential for an increase in number of breeding pairs due to the increase in berm width, which will reduce the probability of piping plover habitat loss through major hurricane or major storm activities. Concurrently, the increased berm width may provide habitat for predatory species and result in an increase in vegetation establishment (USACOE 1998).

4.300 NYD in cooperation with USFWS Long Island Field Office and the U.S. Geological Survey Biological Research Division (USGS/BRD) is designing, constructing, verifying and applying a Habitat Suitability Index (HSI) model for the Atlantic Coast population of piping plovers on Long Island. The HSI model will assist in the management and impact assessment of the piping plover, so that appropriate compensation, if required, may be more consistently determined for any unavoidable losses of plover habitat that may result from project activities.

4.301 NYD acknowledges that the FIIP, as a component of the overall Fire Island Inlet to Montauk Point, NY Reformulation Study, will work with the USFWS-LIFO office to facilitate and advance a Long-Term Regional Comprehensive Plan for piping plover management within the overall Fire Island Inlet to Montauk Point, New York Reformulation Study area. NYD will be the lead in facilitating this multi-agency effort and will also assess other project authorities to determine whether this effort can be extended to include beaches west of the FIMP Study Area within an integrated management plan. The development of a comprehensive regional plan for the FIIP and other pending projects along the south shore of Long Island that will not jeopardize the piping plover will consider:

The identification of areas where natural barrier beach process can continue.
Efforts to artificially create and maintain high quality piping plover habitats.
The minimization of direct disturbance to plovers breeding on stabilized beaches.
The reduction of project-induced effects of increased recreational disturbance.

Roseate, Least, and Common Terns

4.302 The placement of sand on the barrier beach has the potential to benefit both the least and common terns which show a distinct preference for nesting on open shorelines, barrier beach dunes, and dredge spoils where the vegetation accounts for less than 10 percent of the ground cover (Andrle and Carroll 1998).

4.303 Approximately 65 percent of all common tern colonies nest on salt marsh islands (Andrle and Carroll 1988), and for the past 10 years roseate terns have been nesting exclusively on a back-bay island (NYSDEC Piping Plover and Colonial Waterbird Surveys 1989-1996). Roseate terns usually nest in association with common terns, in areas of slightly denser vegetative cover (80 percent). The FIIP seeks to protect the barrier and back-bay areas from extensive erosion, and as such, would enhance protection of the back-barrier islands. Roseates may also benefit from a reduction in breach or washover events, which would allow beachgrass and other herbaceous vegetation to fill in. Conversely, the decrease in potential breaches may result in a reduction of the specialized feeding habitat provided by tidal rips, sandbars, and bay inlets (Andrle and Carroll 1988) that roseate terns require. Thus, the overall impact of the Interim Project on roseate terns is unclear.

Osprey

4.304 Ospreys within the project area typically nest on man-made elevated platforms or the tops of dead trees. In addition, this species feeds exclusively on fish. Neither the nesting or feeding habitats for ospreys are likely to be affected by the Interim Project.

Peregrine Falcon and Cooper's Hawk

4.305 Both the peregrine falcon and Cooper's hawk utilize the project area primarily during fall migration. The Cooper's hawk is an accipiter, with shorter wings and a long tail. It is well adapted to hunting in thicker cover than other (buteo) hawk species. The natural succession which favors woody shrub and vine thickets will not prevent the Cooper's hawk from hunting. The peregrine falcon feeds primarily on avian species which it catches on the wing. The successional growth is likely to increase the number of passerine species which this falcon eats. The Interim Project is therefore likely to either continue the status quo or slightly benefit these raptor species.

Northern Harrier, Short-Eared Owl, and Upland Sandpiper

4.306 The northern harrier, short-eared owl, and upland sandpiper are all species which utilize grassy march or dune areas for nesting and feeding. Of the three, only the northern harrier has been identified as a probable breeder on Fire Island in the *New York State Breeding Bird Atlas* (Andrle and Carroll 1988). The other two species may be present during migration, utilizing the area for resting and foraging. The Interim Project would not likely substantially affect these species. Although the project would improve conditions for succession from grassland to thicket habitat in three locations where salt deposition is reduced, the 6-year duration of the project and the limited area would mitigate against a significant change.

Vesper, Henslow's, and Grasshopper Sparrow

4.307 These three sparrow species generally make use of the open country associated with cultivated farmlands, hayfields, and pastures. Only the grasshopper sparrow has been identified as a probable breeder in the project area. Their use of the barrier island is likely to be more incidental, and limited to the stabilized secondary dune and swale or interior grassland areas.

4.308 The interim project seeks to temporarily stabilize the shorefront environment, thereby reducing disruption and allowing the continuity of on-going natural succession of the upland habitats. However, as noted above, the 6-year project duration and limited areas affected would result in minimal change. Grasshopper sparrows have very specific requirements for nesting habitat, which include open spaces between clumps of grasses and nearly total lack of sapling or shrub coverage. Habitat changes which reduce open space and promote sapling growth (greater than 35 percent coverage) will cause grasshopper sparrows to abandon the area (Bent 1968). Given the minimal changes in vegetation from dune construction, it is unlikely that the Preferred Alternative would reduce the potential for nesting by grasshopper sparrows. However, all three species are likely to continue utilizing the barrier as a stop-over during spring and fall migration.

Common Nighthawk

4.309 While the common nighthawk may nest on sand dunes, its use of the project area for breeding is unconfirmed, and is probably limited to migration periods. Thus, the Interim Project is likely to have a minimal impact on this species.

Species Recovery Plans

Piping Plover

4.310 Since piping plovers are known to nest in and near the project area, there is concern as to the compliance of the Interim Project with the Species Recovery Plan. The 1996 Revised Recovery Plan suggests that the "breeding season" is not the only time of concern for piping plovers; rather, the whole period from territory establishment through fledging is seen as necessary for habitat protection (Revised Piping Plover Recovery Plan 1996). The main food source (macro-invertebrates) of the piping plover would be temporarily affected by the proposed beach nourishment. The Atlantic Coast Piping Plover Recovery Team also discourages beach and dune stabilization projects, since these could result in a reduction of suitable nesting habitat (1996). The No Action Alternative would allow breach and overwash events to continue unabated, which could also result in an increased loss of eggs or chicks.

4.311 The objective of the Revised Recovery Plan is to ensure the long-term viability of the Atlantic Coast piping plover population in the wild, thereby enabling the de-listing of this species from the Federal List of Endangered Species (50 CFR 17.11, 17.12). The Revised Recovery Plan identifies numerous action items to help achieve the Plan's objectives. Among these, pertinent to the Interim Project are as follows:

Monitor the status and management of Atlantic Coast Piping Plovers;
Maintain natural coastal formation processes that perpetuate high quality breeding habitat;
Discourage interference with natural processes of inlet formation migration and closure;
Discourage beach stabilization projects; and
Compensate for disruption of natural processes, create and enhance nesting and feeding habitat, especially in the vicinity of existing stabilization projects, by:

a. encouraging deposition of dredged material to enhance or create nesting habitat;
b. discourage vegetative encroachment at nesting sites; and
c. draw down or create coastal ponds to increase available feeding habitat.

4.312 However, during the breeding season, construction activities will be restricted to areas that have not been known to historically support a viable piping plover population.

Least Tern

4.313 The Least Tern Recovery Plan states that if sand placement occurs during the least tern nesting season, least terns may be discouraged from nesting in or near the study site due to disruptive construction activity. The period of concern for the least tern is identified as mid-March through the end of August (USFWS 1992). The FIIP will conduct the bulk of active construction during the winter and early spring in order to minimize impacts on beach nesting shorebirds. However, some disturbance may extend into the early spring due to unforseen delays in the mid-winter dredging operation. NYD will provide monitors to observe tern behavior in the vicinity of operations.

Roseate Tern

4.314 Roseate tern nesting occurs predominately on islands (approximately 40 percent nest on Great Gull Island). Alteration of the beach environment within the project area would, therefore, have no direct negative impact on nesting habitat, according to the Roseate Tern Recovery Plan (USFWS 1989).

Significant Habitats on the Barrier Island

Maritime Holly Forest

4.315 Since the Maritime Forest Community primarily occupies the portions of the barrier which are already fronted on the oceanside by a well developed dune system, a high or wide beach profile, or some combination of both, the Interim Project is not likely to affect this community. However, shifting the placement of an enhanced dune could minimize impacts to this globally rare and state endangered Maritime Holly Forest.

Maritime Freshwater Interdunal Swale

4.316 The integrity of this plant community, as discussed in the No Action Alternative section, is also tied to the protection afforded by a well-developed dune system. As this habitat is well adapted to slight habitat modifications, it would continue to tolerate some degree of sand shifting and moisture differences under the Interim Project. The provision of a larger, more extensive foredune fronted by a nourished beach under the FIIP will enhance the present habitat and provide greater protection for this state-imperiled community and the rare plants associated with it, as compared with the No Action Alternative.

Rare Plant Species of the Barrier Island

Seabeach Amaranth and Seabeach Knotweed

4.317 The potential impacts of the Interim Project on these two species are discussed in the earlier section on Rare Plant Species in the Intertidal Zones.

Other Rare Plant Species

4.318 As discussed in the No Action Alternative, only historic occurrences of golden dock, graceful sedge, and Nuttall's lobelia have been reported for the project area. Since these species are generally associated with back-bay wetland areas, the increase in erosion protection provided by the Interim Project is likely to benefit these species indirectly, by protecting their preferred habitat.

4.319 Collins' sedge, water pygmyweed, slender crabgrass, soapwort gentian, and fewflower nutrush were all identified in the NHP files as historically occupying the Long Island mainland south shore marshes. The Interim Project is not likely to affect any significant change to the wetland habitats on the south shore of the mainland; thus, no impacts to these species are anticipated.

4.320 Purple everlasting, grassleaf ladies' tresses, pine-barren sandwort, and the slender marsh pink are all associated with the dunes and interdunal swales of the project area. As stated in the previous discussion of Dune and Swale Community, the Interim Project is likely to favor the growth and perpetuation of rare plants associated with the swale community.

4.321 As discussed in the No Action Alternative, swamp sunflower is associated with the freshwater bogs and pine barrens of the project area. These ecotypes are found within the Maritime Forest Community, and particularly within the Sunken Forest. As discussed earlier, this cover type generally occupies the portions of the barrier which are fronted on the ocean side by a well developed dune system, a high and wide beach profile or some combination of both. The Interim Project does not propose to alter any beachfront areas which already have an adequate profile to limit the frequency of overwash or breaching events. No direct impact this species, or indirect affects on its habitat are expected.

Back Bay Environment

4.322 The back bay extends from the bay shore of Fire Island to the shoreline of Long Island, including the mouths of tributary creeks, thus including the entire Great South and Moriches Bays. The Preferred Alternative would not directly affect this zone. However, indirect impacts could occur from a reduction in ocean overwash to the bay and in the formation of even temporary breaches, which would otherwise allow surges of ocean water into the bay. The discussion below addresses the effects of the reduction in overwash and breaches on the marshes, submerged aquatic vegetation and the ecology of the back bay.

4.323 The overall impact of the Interim Project on the back bay environment is expected to be positive. The reduced possibility of a breach or significant overwash event would protect the quiet water habitat for eelgrass beds and other SAV growth, shellfish beds, and nursery habitats for finfish. As a result, a stable food supply would be available for benthic invertebrates, waterfowl, migratory shorebirds, and wading birds. The bay tidal prism will also remain essentially unchanged; therefore, tidal wetlands are expected to remain close to their current size and density. The likelihood of further scouring of the productive tidal wetland areas would be reduced as well.

4.324 Although there are several ecological benefits associated with increased erosion protection, there is also a detrimental aspect of reducing the delivery of sand, either over-barrier or into flood tidal deltas. Certain rare plants, such as seabeach amaranth and seabeach knotweed, thrive on such fresh, bare sandy deposits. In addition, several shorebirds are attracted to the sparsely vegetated conditions these deposits provide for colonial nesting and congregating prior to migration. However, the birds utilizing these areas will also be highly vulnerable to predation due to the lack of protective cover.

Back Bay Submerged Aquatic Vegetation (SAV)

Eelgrass

4.325 The densest eelgrass beds are found in the western part of Great South Bay, where a high degree of tidal flushing occurs due to the proximity of Fire Island and Jones Inlets. This results in waters that are relatively clear, allowing for more light transmission for eelgrass growth.

4.326 In contrast, an indirect effect of the reduction in frequency of breach or overwash events may affect the frequency or duration of algal blooms, such as brown tide. Brown tide has been shown to cause a decrease in the biomass of eelgrass in Great South Bay by decreasing light penetration through the water column (Dennison et al. 1991). The 1997 NPS study of estuarine resources of the FIIS suggests that quiescent back bay waters are more conducive to drift macroalgae accumulation, which can in turn lead to reduced eelgrass biomass and area. However, as discussed in the No Action Alternative, it appears that several different factors working concurrently will affect a change in eelgrass growth and vigor. At the very least, the Interim Project is expected to continue the status quo for these factors, and may potentially benefit the eelgrass beds.

Macroalgae

4.327 Microalgae "blooms" have occurred historically in the back bay waters, and were generally attributed to high nutrient concentrations; such as the *Cladophora gracilis* blooms that occurred in Great South Bay in the 50's and 60's due to duck waste loadings. In addition, during the brown tide blooms of 1985 through 1986, large free-floating populations of green fleece (*Codium fragile*) and the red algae *Gracilaria* were observed in Great South Bay in areas where the eelgrass had died off (New York Sea Grant 1993).

4.328 The interim project will serve to maintain the quiescent nature of the back bay waters, thereby favoring the growth of SAVs. However, the Interim Project will have no control over outside forces such as excess nutrient loadings and other environmental factors, and the current fluctuations in macroalgae populations are therefore expected to continue. The present mix of macroalgae species is also expected to remain essentially the same, with a possible slight increase in representation by the green algae group.

Phytoplankton and Brown Tide

4.329 Great South Bay is one of the most productive bays in the world, due in part to the abundance of nutrients. However, while nutrients are indeed necessary for sustaining such high productivity, their form and amount can alter phytoplankton population structure (Dennison et al. 1991). Nitrogen, phosphorus, and silica may enhance phytoplankton growth. The exchange of water between Great South Bay and the ocean is important in flushing pollutants out of the bay. Thus, the processes affecting this flushing rate are crucial to determining the water quality of the Bay.

4.330 The closing of Moriches Inlet during the brief period between 1951 and 1953 reduced circulation in Great South Bay and contributed to noxious algal blooms. With the flow of Moriches Inlet restricted, the growth of "small form" algae population blooms supported the growth of the worm coral (*Hexagonus hydroides*), which encrusted the exterior of the living oyster shells. These algal blooms also diminished visibility in bay waters to the point that fish could not see well enough to capture their food, which led to a decline in fish landings from the bay when these algae were present (Cashin 1993).

4.331 Brown tide is different from other blooms, because it is composed of extremely high numbers of a single species. As discussed in the Affected Environment Section, *Aureococcus anophagefferens* has been identified as the algal species responsible for this bloom. The westward extent of the brown tide bloom is probably influenced by the circulation of waters moving through

Jones and Fire Island Inlets. It is important to keep in mind that the lack of a breach or overwash event is not the primary causal factor triggering a phytoplankton or brown tide bloom event. Long-term climatological trends and short-term meteorological events are two prevailing environmental factors that may lead to a bloom (Siddall 1987).

4.332 The interim project will reduce the possibility of a full barrier island breach and formation of a temporary inlet. However, the two major inlets (Fire Island and Moriches) and the present degree of tidal flushing are expected to remain the same. Since many of the factors that affect the existing water quality work independently of the interim project, it is not likely that the interim project will directly induce a phytoplankton bloom. However, since tidal flushing has been identified as a major factor in the occurrence of phytoplankton blooms, the probability of a bloom occurring may be greater under the interim project, as compared to a potential breach event under the No Action Alternative.

Back Bay Invertebrates

Benthic Invertebrates

4.333 The interim project is not expected to have an effect on the macrobenthic communities that are currently established in the back bay environment. Most of the species present are extremely adaptable and capable of adjusting to naturally induced impacts, such as coastal storms and severe winters. The lack of breaching or overwashing will permit the macrobenthic community to undergo a natural succession, with the end result being a more diverse and complex benthic community centered around larger and more long-lived species.

Shellfish

4.334 The shellfish species of primary commercial and recreational importance in the back bay are the hard clam and the bay scallop. Both species can utilize a variety of habitats from the low tide line down to about 50 or 60 feet on bottoms that range from vegetated (i.e., eelgrass) to sand or muddy sand, with salinities down to 15 ppt (Gosner 1978). Both species are presently in a state of severe decline. Bay scallops have not been present in harvestable numbers for at least 10 to 15 years, and hard clams support only a very small local fishery.

4.335 Hard clams appear to be somewhat pollution-tolerant based on the numbers observed in waters closed by NYSDEC to shellfish harvesting. Thus, water quality is not perceived as the primary causal factor for the decline. Rather, over-harvesting of the species is believed to be a major contributing factor. The over-harvesting of many finfish and shellfish species has been clearly documented by NOAA and NMFS (U.S. Department of Commerce 1995).

4.336 The back bay environment is currently stable, with little change expected to occur if overwashes and breaches are limited and/or prevented. Populations of the various whelks (channeled and mud-dog) are expected to remain unchanged. In the event that bay salinities were to decrease through the lack of tidal exchange, species such as the soft-shelled clam (*Mya arenaria*) and common oyster (*Crassostrea virginica*) would benefit. While both species show a preference for higher salinities, both can tolerate salinities to a low of approximately 5 ppt. In contrast, predatory species such as oyster drills and starfish would benefit from higher salinities, above 15 ppt (Gosner 1978).

Crustaceans

4.337 With the possible exception of the American lobster and green crab, most of the crustacean species currently utilizing the back bay habitat (i.e., blue crabs, horseshoe crabs and grass shrimp), are not dependent upon the occurrence of a breach or overwash event to sustain their population levels.

4.338 Juvenile and sub-adult American lobsters generally migrate from the ocean to the bay through the inlets. Adult lobsters prefer the higher salinities associated with ocean waters, and typically remain in close proximity to the inlets, utilizing bottom structure (e.g., jetties and artificial reefs) found in the area. Lobsters are expected to continue to utilize this habitat if the conditions remain unchanged under the Interim Project.

4.339 The green crab occupies habitats similar to the American lobster. The green crab is also generally associated with bottom structure, such as found in the intertidal zone under stones or in pools, and in crevices in sea walls and jetties. It can tolerate salinities as low as 6 ppt, but is typically found at higher salinities near inlets. The Interim Project (and the reduced likelihood of a breach or overwash event) is not expected to have an impact on this species. The green crab has recently become exploited by the fishing trade for use as blackfish bait. Over-harvesting of this species, as well as others, is expected to be more detrimental than any impact associated with the Interim Project.

Sea Stars

4.340 As discussed in the above shellfish section, several shellfish predatory species show a distinct preference for increased salinity. The starfish is one of them. In the event that breaches are reduced, the spread of sea stars will remain restricted to the higher salinity waters generally associated with the inlets.

Back Bay Finfish

4.341 All of the migratory finfish species that utilize the back bay environment must enter and exit through Fire Island or Moriches Inlet. The inlets do not limit the number of individuals utilizing the bay. Therefore, reducing the potential for breaching compared with the No Action Alternative would have no effect on finfish.

4.342 Some finfish species concentrate in the inlets (i.e., striped bass, bluefish and summer flounder), because inlets tend to concentrate bait fish, and the swift currents associated with an inlet disorients the smaller and weaker fish, making them easier prey for their predators. However, the formation of inlets does not directly affect the life cycles of these species. They only concentrate various fish species, making them easier to catch by fishermen. The present situation has remained nearly stable for the past 50 to 60 years. The completion of the Interim Project is not expected to have a significant impact on the finfish species that currently utilize the bay.

4.343 As described earlier, SAV beds are extremely important in the life cycles of many finfish and shellfish species. In the case of Great South Bay, eelgrass is the primary form of SAV. Eelgrass provides a sanctuary for development of larval and juvenile fishes (e.g., blackfish, four spine stickleback, and winter flounder), as well as providing a rich food source (i.e., macroinvertebrates) for these species. In addition, as mentioned in the No Action Alternative, SAV and macroalgae beds have been identified by the MAFMC as HAPC for summer flounder, due to their importance in providing feeding habitat and shelter from predators. The protection afforded to the back bay SAV beds by the Interim Project will likely benefit summer flounder and the other finfish species that utilize this habitat.

Back Bay Avifauna

Diving Birds

4.344 The FIIP alternative will not directly affect use of the back bay by diving birds. In contrast to the No Action alternative, indirect effects may occur from the decreased chance of a breach or overwash event. The FIIP would protect the quiescent nature of the back bay, which encourages use by overwintering birds. However, this quiet water becomes more susceptible to surface ice formation, which would decreases the area of activity for diving birds.

Wading Birds

4.345 The Interim Project would not have a direct impact on the wading birds. Since the Interim Project will decrease the possibility of a breach or overwash event, the back bay intertidal marshes that the wading birds feed on would be less susceptible to being eroded, flooded, or covered.

Waterfowl

4.346 The FIIP would protect eelgrass beds from a breach or overwash event, as discussed in the Submerged Aquatic Vegetation section. As many of the major waterfowl feeding areas generally correspond to eelgrass beds in the Great South Bay, the FIIP would have a positive effect. The FIIP would also continue the existence of important quiet water habitat for waterfowl.

Colonial Waterbirds

4.347 The impacts of the FIIP on least, roseate, and common terns and on piping plovers were discussed earlier in the Back Bay Threatened and Endangered Wildlife Species Section. The FIIP would have both a negative and positive indirect impact on colonial waterbirds; the net result is likely to be no significant change in either the use of the area by waterbirds or the amount of available habitat. The FIIP will protect the back bay dredge spoil and marsh islands by reducing the probability of a breach or overwash event and thereby continuing the current daily tidal prism. Many of the migratory shorebirds that rely on back bay dredge spoil and marsh islands for nesting would therefore benefit from the Interim Project. However, the Interim Project would not create new habitat in the form of overwash deposits and/or flood tidal deltas, as compared with the No Action Alternative. This would be considered a negative impact.

Back Bay Threatened and Endangered Wildlife Species

Avian Resident Species

4.348 As previously stated in the No Action Alternative, both the great blue heron and black-crowned night heron are common wading bird species in the project area. Only the black-crowned night heron breeds in the project area, utilizing red-cedar or pitch pine- scrub oak woodlands, or in maritime shrublands of mixed poison ivy, greenbrier, sumac, and cherry (Andrle and Carroll 1988). The great blue heron breeds further north in New York State. The great blue heron feeds primarily on small fishes in the shallow backbay waters of the project area.

4.349 Stabilization of the shoreline under the Interim Project will permit the eventual development of more shrub-thicket habitat which will be beneficial to the black-crowned night heron. Since the great blue herons forage in still, slow moving waters typically found in the back bay (and not associated with inlets), they will benefit as well.

Avian Migratory Species

4.350 The common loon typically winters along the Long Island coast and is most numerous from November until April, but can be observed before and after these dates (Levine 1998). Common loons can be found near the greatest concentrations of fish are (in most cases around inlets or near shore waters). The Interim Project would limit the creation of new inlets. However, this is not expected to affect the species, because common loons are mobile and can locate schooling fish in all waters.

4.351 The black rail is primarily a southeastern species peripherally located at the extreme northern limits of its range, and the least bittern is uncommon to rare in New York State. Both species are reported to nest in the saltmarsh associated with the back bay environment. The Interim Project will help temporarily maintain a more stable environment, permitting both species to continue utilizing the habitat at their current level.

Sea Turtles

4.352 Three of the sea turtle species mentioned in the Affected Environment Section utilize the back bay area for foraging, primarily during the warmer months of the year. These three sea turtles are the loggerhead, green, and Kemp's Ridley sea turtles. The Interim Project could have a slight positive effect on the sea turtles occurring in the back bay. The Interim Project serves to maintain the protective function of the barrier island by reducing the potential for a breach. This will preserve the quiescent nature of the back bay waters, thereby ensuring a protective and productive habitat for juvenile sea turtles. By reducing the possibility of a breach or overwash event, the Interim Project would in turn reduce the possibility of eelgrass-related damages. This will benefit sea turtles, since eelgrass is one of the principal food items for the green sea turtle, and eelgrass beds provide habitat and food for many of the prey species of the loggerhead and Kemp's Ridley sea turtles.

CULTURAL RESOURCES

Terrestrial Archaeological Sites

4.353 Of the documented archaeological sites located in the vicinity of Fire Island, only two—both from the historic period—are in the Area of Potential Effect (APE). As described above, they are an early 20th century recreational facility and the mid-19th century U.S. Coast Guard complex.

Both are located on dunes bordering Great South Beach and both are potentially eligible for listing on the National Register of Historic Places. However, as a result of the dynamics of beach and dune migration and the lack of stable surfaces, the potential is low for other preserved, good-context archaeological deposits within the beaches or dunes of Fire Island (JMA 1998). The placement of sand in the vicinity of these potentially eligible is not expected to have a significant adverse impact on them.

Drowned Terrestrial Archaeological Sites

4.354 The potential for buried prehistoric deposits does exist in the APE. Sand placement would not disturb the sites buried under the barrier island or in the near shore zone. The use of sand fill may help to protect these sites from being exposed and destroyed (JMA 1998). Therefore the proposed project is not expected to have an adverse impact.

National Register of Historic Places Site

4.355 The Fire Island Light Station is the only National Register-listed site in the APE. The lighthouse has always been located on a sand beach. Maintaining the sand beach would retain the same context and would not be an adverse impact.

Other Architectural Resources

4.356 The architectural resources identified as being potentially National Register-eligible exist in environmental settings that are subject to change due to coastal storms. They are also in manmade environments that have been altered over the years with new structures and changes to existing structures. None would be directly affected by the placement of sand. In providing storm damage and beach erosion controls, the proposed project would protect these resources and would not have an adverse impact.

Maritime Resources

4.357 The placement of sand in the near shore tidal zone has the potential to impact any potentially significant submerged cultural resources (shipwrecks) within the area of placement. Dredging directly around the possible cultural resources (PCRs) could disturb or even destroy these shipwrecks, and that would be considered a significant adverse impact. To avoid adverse impacts, buffer zones would be created within a 150-foot radius around the PCRs, and the dropping of anchors or dredging would be prohibited in the area of PCRs. If project plans change or avoidance of the PCRs materially reduces the amount of useable sand, then the PCRs would be inspected and evaluated to determine what they are and if they are eligible for the National Register (Reiss 1996).

C. MODIFIED AUTHORIZED PLAN

4.358 The Modified Authorized Plan, like the Preferred Alternative, proposes beach renourishment, but differs from the Preferred Alternative in its scale. The primary impact would be placement of sand, but more sand would be involved, with greater dune and beach berm heights. Because of the higher profile of dune and berm, it is more likely that some of the sand tapers would extend into major federal lands and other more natural portions of the FIIS.

4.359 Benefits under the Modified Authorized Plan would be greater than those of the Preferred Alternative, commensurate with its greater scale. It would protect against a larger storm event (greater than 100-year frequency). For a comparable comparison to the Preferred Alternative, the number of structures that would be at risk from the 44-year frequency storm would be 2,487 on Fire Island and 6,839 on the bay shore compared to 2,844 and 10,553 for the Preferred Alternative, respectively. Overall, the impacts of the Modified Authorized Plan Alternative would be similar to those of the Preferred Alternative, since the basic action—placement of sand—is the same, the analyses that follow address only the differences. It should be noted that the Modified Authorized Plan would be inconsistent with the GMP. Under this plan, the dunes would be higher and construction would take place in the Otis G. Pike Wilderness Area, and other federal tracts of land.

HUMAN ENVIRONMENT

4.360 The Modified Authorized Plan Alternative would protect the barrier island and the communities on the bay shore from excessive storm damage and, in so doing, would benefit the human environment of the study area, as described under human environment impacts of the Preferred Alternative. Natural Resource

NATURAL RESOURCES

4.361 From a natural resources perspective, the impacts related to the Modified Authorized Plan and the FIIP are nearly identical, except for scale. Overall, the Modified Authorized Plan will be larger, with the designed beach and footprint of the dune covering a greater area than the FIIP. The quantifiable physical differences between the two projects are summarized in Table 4-3.

Table 4-3 Comparison of Interim and Modified Authorized Plans		
Alternative	FIIP	Modified Authorized Plan
Dune elevation	15 to 18 feet	20 feet
Berm elevation	9.5 to 11 feet	14 feet
Dune length	36,000 feet	64,240 feet
On-shore intertidal placement	240 acres	673 acres
Near-shore coverage	519 acres	1,078 acres
Length of fill placement	11.3 miles	23.4 miles
Initial nourishment	7.7 million cubic yards	18.5 million cubic yards
Re-nourishment	2.8 million cubic yards	4.8 million cubic yards
Annual breach probability	1 in 44	>1 in 200
Source: USACOE 1999.		

4.362 Under this Alternative, impacts on natural resources would be similar to, but greater than those of the Preferred Alternative/Interim Plan. The amount of material taken from the borrow area would be nearly double that of the Preferred Alternative, so the area affected would be proportionally larger or perhaps deeper. However, although more benthic invertebrates, shellfish, crustaceans, and finfish would be affected, the recovery time of about 12 to 18 months would be the same.

4.363 Because of the greater dune and berm elevations, the taper would extend farther into the FIIS and some 23.4 miles of the intertidal zone would be subject to sand placement—a much wider area of effect than the Preferred Alternative. Thus the short-term effects of burial and habitat disruption would be felt over a much wider area.

4.364 Similarly, the indirect effects associated with the near shore, barrier island, and back bay areas would be similar but of a larger scale. The length of near shore area subject to increased turbidity and sedimentation would be approximately twice that of the Preferred Alternative. The diminution of wind-driven sand particle deposit inland of the dune would occur over a wider and, because of the difference in dune height, deeper area than that of the Preferred Alternative and related succession of grassland to thicket would be initiated over a wider area. In the back bay, the changes of overwash or breach during the 6-year life of the Modified Authorized Alternative would be less than 1 in 200. However, since this reduction is not considered to be adverse to the ecosystem of the bay, as discussed under the analysis of the Preferred Alternative/Interim Plan, it would not be adverse under the Modified Authorized Alternative.

CULTURAL RESOURCES

4.365 The cultural resources assessment of the Preferred Alternative/FIIP concluded that the placement of sand would not affect any of the identified resources in the Area of Potential Effect.

This conclusion holds for the Modified Authorized Alternative, which differs from the Preferred Alternative only in the amount of sand placed.

D. CUMULATIVE EFFECTS OF PROJECT ALTERNATIVES

4.366 A cumulative impact is the impact on the environment that results from the incremental impact of an action when it is added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7). The Council on Environmental Quality (CEQ), in its January 1997 document, "Considering Cumulative Effects Under the National Environmental Policy Act," recommends four steps in scoping for cumulative effects:

- Step 1: Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.
- Step 2: Establish the geographic scope for the analysis.
- Step 3: Establish the time frame for the analysis.
- Step 4: Identify other actions affecting the resources, ecosystems, and human communities of concern.

ISSUES

4.367 The potential cumulative effects issues associated with the FIIP alternatives are limited. For the No Action Alternative, these would relate to the continuation of erosion and storm damage in the study area and its effects primarily on human resources. For the Preferred Alternative/ Interim Plan, which is temporary and reversible, issues would arise mainly from the use of the borrow areas in conjunction with other borrow area activities and the potential cumulative impact on the species that live and feed there. The Modified Authorized Alternative issues would be the same; however, there would be more potential for cumulative effect, since it is a larger project.

GEOGRAPHIC SCOPE/IMPACT ZONE

4.368 The geographic scope of the cumulative analysis ("impact zone") encompasses the south shore of Long Island, New York, an approximately 122-mile-long shoreline from Montauk Point to the east and Breezy Point to the west. The assessment is limited to this region because the prevailing force which influences coastal features on Long Island and FIIP is the littoral drift that generally flows in an east to west direction. The drift initiates at Montauk Point and generally flows westward. The influence of the east to west littoral drift diminishes west of Breezy Point because of the mixing of currents associated with the Upper and Lower New York Bays. This impact zone is also appropriate for consideration of aquatic resources, given the very limited anticipated effects of the temporary project, as discussed above in section 4.B.

4.369 The impact zone is located along the southern limits of Queens, Nassau, and Suffolk Counties, New York, in the Atlantic Coastal Plain. Long Island is part of the Cretaceous and Tertiary Coastal Plain that extends along the entire Atlantic Coast south of New England. Sediments consist of Upper Cretaceous and Pleistocene sands, gravel and clays. The impact zone consists of barrier beaches and mainland shoreline (in the eastern portion). Six inlets are present along the south shore of Long Island, each inlet being maintained by the NYD.

4.370 As listed in the Ecological Communities of New York State (NYSDEC New York Natural Heritage Program 1990), the impact zone is located in the coastal lowland ecozone within marine and terrestrial systems. The communities present within the impact zone include:

- Marine Subtidal.
- Marine Deepwater Community—Open ocean areas below lowest tide levels.
- Marine Intertidal.
- Marine Intertidal Gravel/Sand Beach—Areas washed by rough, high-energy waves that are well drained at low tide.
- Marine Rocky Intertidal—Rocky shores washed by rough, high-energy waves.
- Marine Cultural.
- Marine Submerged Artificial Structure/Reef—Artificially introduced structure sub-merged in marine waters that provide habitat for marine fauna.
- Marine riprap/artificial shore—Constructed marine shore composed of broken rock, stones, wooden bulkheads, and concrete.
- Terrestrial Open Uplands.
- Maritime Beach—Sparsely vegetated area on unstable sand, gravel or cobble ocean shores above mean high tide where the shore is modified by storm waves and wind erosion.
- Maritime Dunes—Areas dominated by grasses and low shrubs that occur on active and stabilized dunes.

- Maritime Shrubland—Shrubland areas that occur on dry seaside bluffs and headlands that are exposed to offshore winds and salt spray.
- Maritime Heathland—Dwarf shrubland areas that occur on rolling outwash plains and moraines near the ocean and within the influence of offshore winds and salt spray.
- Maritime Grassland—Grassland areas that occur on rolling outwash plains near the ocean and within the influence of offshore winds and salt spray. The grasses have greater than 50 percent cover.

TIME FRAME FOR CUMULATIVE ANALYSIS

4.371 The time frame for the cumulative analysis need not be extensive for a reversible, temporary action like the proposed project. The analysis considers some factors leading up to existing conditions and addresses those few aspects of the project that could affect resources beyond the project's 6-year life. However, given its limited time space and the nature of its activities, the project's influence is not expected to extend far outside this time frame. Subsequent longer-term programs to reduce storm damage, which may be undertaken independently following this project's 6-year life, will be subject to their own environmental assessment and review.

ACTIONS AND ACTIVITIES RELEVANT TO THE CUMULATIVE EFFECTS ASSESSMENT

4.372 The other actions that could combine with the No Action, Preferred or Modified Authorized Alternative to generate cumulative effects are generally limited to those ongoing and proposed efforts to address coastal resource issues. This component of the analysis is discussed first, followed by the assessment of potential cumulative effects of the No Build and Preferred Alternatives, respectively.

4.373 A number of projects and other actions are in force or proposed in the cumulative effects that could in combination with the proposed project, affect coastal resources in the study area. Federal activities which occur along the south shore of Long Island include beach nourishment/storm protection projects and maintenance activities associated with navigation channels/inlets. The majority of these projects have had a project life of 50 years. This analysis therefore assumes that the project life of federal activities on the south shore of Long Island is 50 years. Although the scope of this analysis is limited to federal activities, State and local activities occur which also impact affect the south shore of Long Island. These activities include, but are not limited to, a sand by-passing project, a jetty expansion project, an estuary management plan, and land use controls.

Federal Actions

Federal Beach Nourishment Projects

4.374 Beach nourishment projects are becoming increasingly common in coastal areas as areas of development become vulnerable to forces of erosion and accretion. Beach nourishment projects, supported by various federal, state, and local agencies as well as private organizations and individuals have been implemented by interests along the Atlantic Coast since the 1920's. Federal projects in the cumulative effects impact zone are described below.

Coney Island

4.375 The Coney Island project is located approximately 40 miles west of FIIP. The completed portion of the project involved the widening of the existing beach with the placement of hydraulic fill for a distance of approximately 15,550 feet between Beach 42nd Street and Corbin Place. The project also required the extension of the West 37th Street groin. The sand source of the beach widening was a borrow area located off-shore approximately 2 miles south of the project area. Following initial construction, the project plan requires four subsequent renourishments over 50 years using a total of approximately 6.24 million cubic yards of material.

East Rockaway

4.376 The East Rockaway project is located approximately 30 miles west of FIIP. This currently authorized beach restoration/nourishment project will continue through the year 2004. Two nourishment cycles remain (at 3-year intervals) for 6.2 miles of shore between Beach 149th Street and Beach 19th Street of Rockaway Beach. A total of approximately 1,750,700 cubic yards of sand from two offshore borrow areas would be used for beach nourishment. However, reevaluation is being considered to identify alternatives that would reduce the quantity of renourishment material required.

Long Beach Island

4.377 The Long Beach Island Storm Damage Reduction Project is located approximately 20 miles west of FIIP. This is a beach nourishment and groin construction/rehabilitation project. Beach nourishment would require an offshore borrow area located approximately 1.5 miles south of the project area. Initial construction, which should occur in 1999, and four renourishments over

50 years would require 28.24 million cubic yards of material. Sixteen existing groins will be rehabilitated, and six new groins will be constructed.

The Reformulation Study

4.378 The FIIP is located within the Reformulation Study limits. The Reformulation Study is being conducted to develop a plan seeking to provide long-term reduction of storm damage along the south shore of Long Island from Fire Island Inlet to Montauk Point (83 miles total). Alternatives being considered include: no action; removal/modification of existing structures; buy-out plan/non-structural measures; sand by-passing; beach restoration/nourishment; groins; revetments; seawalls; break waters; ring levees; tidal gates; and various combinations of the above. The study is currently in the feasibility phase with a DEIS scheduled to be completed by 2002. In addition to the FIIP considered in this EIS, the following interim projects are associated with the Reformulation Study project area:

The Westhampton Interim Project

4.379 Located 30 miles west of the FIIP area, this project provides interim storm damage protection via modification of the groin field and periodic beach nourishment in Westhampton. Initial construction has been completed. Renourishment, involving approximately 1.1 million cubic yards of sand from offshore borrow areas, is expected to occur every 3 years.

West of Shinnecock Inlet Interim Project

4.380 This proposed storm damage reduction project recommends periodic beach renourishment in an area next to Shinnecock Inlet that is susceptible to breaching and overwashes. A draft Environmental Assessment (EA) has been prepared for this interim project and is being reviewed. It is expected to be publicly available in 1999.

Breach Contingency Plan

4.381 This interim project establishes a procedure for the rapid closure of breaches on the barrier islands, including Fire Island. The plan calls for the initiating of closure efforts within 72 hours of a breach occurring and for completing closures within three months. This plan has been approved and is available for implementation from Fire Island Inlet to Southampton, New York. Initial fill material may be trucked in, but larger and longer duration breaches would use material dredged from either bay channels or offshore borrow areas.

South Shore Embayment Restoration Study

4.382 At the direction of the U.S. Congress, the U.S. Army Corps of Engineers has initiated the south shore of Long Island, New York Embayment Restoration Study. The study area encompasses a 155-acre embayment area along the south shore of Long Island between the island proper and its fronting barrier islands, extending approximately 70 miles from East Rockaway Inlet to Shinnecock Inlet. The purpose of the study is to determine whether federal projects have caused or contributed to the degradation of the ecosystem of the embayment area (including its habitats, water quality, and other related environmental features), and identify a possible plan of improvement which assesses whether federal participation in a follow-up feasibility study is warranted. Approximately 14 sites have been selected for evaluation and found to warrant potential federal participation in the development of restoration alternatives including, salt marsh restoration, sea and shore bird habitat restoration, shellfish restoration, shoreline protection, submerged aquatic vegetation restoration, and estuarine pond restoration. Approximately 80 additional sites are being evaluated for possible selection, of which approximately 20 sites will join the initial 14 sites for further development.

Maintenance of Federal Navigation Channels

4.383 The following navigational channels/inlets are maintained by dredging and include a by-passing component whenever possible:

- Rockaway Inlet
- East Rockaway Inlet
- Jones Inlet
- Fire Island Inlet
- Moriches Inlet
- Shinnecock Inlet

4.384 Bypassing practices introduce sediment from the inlet system to the littoral drift, but are neither sufficient for, nor designed to provide specific storm damage protection levels for areas down-drift of the inlets.

USACOE Permit Program

4.385 All federal, state, local and private actions involving work in navigable waters or wetlands that do not qualify under the Nationwide Permit program require individual permits from the

USACOE. In the cumulative effects impact zone the NYD issues permits to qualifying applications. These include actions similar to those of the proposed project, such as dredging, sand placement and beach nourishment, as well as other activities aimed at storm damage protection, such as revetments, bulkheads and breakwaters. Most of the actions discussed below are subject to the permit program, but NYD does issue permits for individual and smaller local actions. In the past nine years, NYD has issued some 91 Atlantic Coast permits between Fire Island Inlet and Montauk Point.

State Actions

4.386 NYSDOS is currently evaluating two projects in the vicinity of Shinnecock Inlet: construction of a semi-fixed sand bypassing plant, and modification of the western jetty of the inlet by adding a spur. The proposed sand bypassing plant would transport approximately 130,000 cubic yards of sand annually from the east side of the eastern jetty of Shinnecock Inlet to a location 7,000 feet west of the inlet. The proposed modification of the western inlet jetty would involve the construction of a 300-foot-long spur that would extend westward off the tip of the jetty. According to NYSDOS, the jetty spur would capture sand currently being deposited in the western ebb shoal area of the inlet, causing sand to reverse fill from the spur back to the beach area west of the inlet. These projects are currently in the preliminary planning stages.

4.387 NYSDOS, in cooperation with local governments, is also developing the South Shore Estuary Comprehensive Management Plan (CMP). The south shore estuary is a 50-mile stretch of bays, rivers, and wetlands. The purpose of the CMP is to protect the natural, recreational, and economic resources of the estuary. The two-phase CMP first focuses on describing existing conditions and, second, evaluates issues, problems, and opportunities and develops recommended actions to ensure that the estuary is improved and protected.

4.388 NYSDEC has proposed implementing setback lines that are authorized under the Coastal Erosion Hazard Area Act. The setback lines would be another land use control that would prohibit or restrict building in areas that are prone to erosion damage, except for infill buildings. These setback lines have been proposed for a number of years and have not been implemented. The time of implementation is scheduled for late 1999 or early 2000.

Other Governmental Actions

4.389 The Villages of Ocean Beach and Saltaire, located on Fire Island within the Town of Islip, have proposed to prepare and implement a Flood Mitigation Plan consistent with the National Flood Insurance Program. These plans would enable the villages to receive funds from FEMA

Flood Mitigation Assistance Program. The program is precautionary rather than disaster-related assistance. The villages, which are both located within 100-year flood plains, seek to lessen the economic impacts of flooding on residents, to identify funding sources for this purpose, and reduce flood disaster preparedness (insurance) and recovery costs. The Village of Ocean Beach has an approved Flood Mitigation Assistance Program as of November 1998. The Village of Saltaire has submitted an application and is awaiting approval of a similar plan. In both villages, the potential for future damage to property is extremely high.

4.390 No major projects are currently planned in the towns of Islip and Brookhaven, according to the town planning departments. There is active planning in Patchogue to bring a greater mix of uses to the waterfront, reduce flooding problems, and increase public access. Several small-scale residential subdivisions and retail developments are planned, and construction is taking place at a moderate pace.

4.391 The Town of Southampton is developing a Local Waterfront Revitalization Plan. The plan, which is currently in draft form, focuses on promoting research to study the marine ecosystem in Southampton, restoring degraded waterfront areas, managing protected areas, encouraging sustainable development and pollution abatement, modifying policy design and regulatory frameworks, and providing public outreach services.

4.392 The Town of Southampton has also initiated a study to update and amend Section 138, "Coastal Erosion Hazard Areas," of the Town Code. The objective of the code revisions is to identify a range of coastal protection approaches that could be employed to manage the Town's Atlantic Ocean shoreline, possibly including soft and hard structural techniques, setbacks, alternative building code requirements, and a National Shoreline designation. This analysis is in the preliminary development phase.

4.393 Suffolk County periodically dredges local channels for maintenance purposes. This dredging is conducted under permits issued by the U.S. Army Corps of Engineers and NYSDEC. The dredging takes place mostly in the bays and not on the open Atlantic Ocean coast. The dredged materials are used as beach fill whenever the materials are suitable, and the placement is cost effective.

CUMULATIVE IMPACTS OF THE NO ACTION ALTERNATIVE

4.394 Under the No Action Alternative, the processes that were set in motion as the study area developed over the past century will continue. That is, the variable and sometimes severe erosion of the barrier island from storm events acting on conditions that have been altered by human intervention will persist, adding to the sum of damage to the human environment of past decades. Similarly, bayshore communities will continue to be vulnerable to flooding from the cumulative effects of the loss of wetlands through development and the weakening of the barrier island in its ability to keep storm surges out of the bay. This will have an ongoing, cumulative effect on the area's recreational resources and its economy. The cycle of annual economic loss through storm damage will continue to mount up, adding to the cumulative effect on use of natural and non-renewable resources for salvage, repair, and reconstruction.

4.395 With the No Action Alternative, nearshore and offshore borrow areas would still be used for ongoing federal and state projects which could have a cumulative impact on these borrow area resources as well as local efforts. As discussed above, about 2.3 percent of the available acreage would be disturbed over the 50-year life of these projects. In any one year, the disturbance would be far less. It has been shown that these borrow areas can quickly recolonize after the disturbance. Because of the low percentage of disturbance and the recolonization potential, no cumulative impact from these projects is expected. While the borrow areas would be physically changed, natural forces are constantly moving sand and changing the form of the sea bed. Therefore, these cumulative physical changes are not considered to be impacts.

4.396 Noise and air emissions are restricted to the construction site and occur only during the construction period. None of the projects would cause noise or emissions during the operational period. The dredging is offshore, away from sensitive noise receptors, and would not have an impact. The main cause of noise during the placement is the operations of the bulldozers. This source is short-term and no long-term noise impacts would occur..

4.397 According to NYSDEC, Suffolk County is severe non-attainment for ozone. New York City and Westchester and Nassau Counties are also non-attainment for this pollutant. The construction projects would not occur at the same time and the main emission of concern from heavy construction equipment is particulate matter, not ozone precursors. Therefore, the cumulative impacts from the emissions are not expected to cause air quality violations.

CUMULATIVE EFFECTS OF THE PREFERRED ALTERNATIVE/INTERIM PROJECT

Overview

4.398 The Preferred Alternative will partially break the cycle of storm damage in the study area that has built up over the years under the cumulative effect of natural processes acting on an environment altered by human intervention. The additive damages to homes, businesses, the area's recreational resources and its economy will be reduced. The use of natural and non-renewable resources in the salvage, repair, and reconstruction in the aftermath of storm damage will also be reduced. The discussion below addresses the potential for the Preferred Alternative to result in cumulative effects on natural resources in the impact zone. It focuses on impacts related to dredging and sand placement, the primary activities characteristic of the programs discussed above.

4.399 A cumulative impact assessment requires consideration of impacts beyond the site-specific direct and indirect impacts and consideration of effects that expand beyond the geographical extent of the proposed project. Relative to the categorization provided within Council on Environmental Quality guidance, the cumulative impacts of the federal projects on the south shore of Long Island can be characterized as additive (nourishment every 3 to 5 years, i.e., it is not a one-time event) in that programs are (or will be) scheduled on an as-needed basis for nourishment and inlet dredging and sand bypassing. The impacts are also interactive in that the stabilization of barrier beaches and mainland shoreline may alter/prevent early successional communities such as maritime beach from evolving in overwash areas (further discussed in the Indirect Impact Section). However, the context for the proposed project is one of interim, reversible actions, whose influence would not extend far outside the program's 6-year time frame.

4.400 The barrier beach environment exists in a continually changing state of "dynamic equilibrium" that depends on the size of the waves, changes in sea level relative to the land, the shape of the beach, and the beach sand supply. When any one of these factors changes, the others adjust accordingly. Generally, beach nourishment and inlet maintenance projects have short-term, minor environmental effects. The two activities associated with federal projects that have the potential to affect the human environment are the dredging of borrow areas and inlets, and the placement of sand along the shoreline. As directed in the Council on Environmental Quality's "Considering Cumulative Effects Under the National Environmental Policy Act," Table 4-4 depicts the potential direct (D) and indirect (I) cumulative impacts of federal nourishment projects on the communities present within the impact zone.

Table 4-4		
Impact Activities		
Community	**Dredging**	**Sand Placement**
Marine System		
Deepwater	D	
Intertidal Gravel/Sand Beach		D, I
Rocky Intertidal		D
Artificial Structure/Reef		D
Riprap/Artificial Shore		D
Terrestrial System		
Maritime Beach		D
Maritime Dunes		I
Maritime Shrubland		I
Maritime Heathland		I
Maritime Grassland		I

Notes:
D = Direct Cumulative Impact.
I = Indirect Cumulative Impact.

Dredging Impacts

4.401 The dredging of the borrow areas could potentially and directly impact the Marine Deepwater and Artificial Structure/Reef communities present in open water areas. Although deepwater communities would be disturbed, such disturbance would be of a temporary nature and would occur in dynamic/high energy environments where species have adapted to these conditions. Preconstruction surveys, such as those proposed for the West of Shinnecock Inlet project, ensure that impacts to highly diverse areas containing substantial surf clam populations are avoided or minimized.

4.402 The portion of borrow areas actively dredged for all the federal projects located along the south shore represent together 2 percent of the total available habitat between -18 foot MLW and -60 foot MLW in the impact zone (see Table 4-5). These areas also are spatially distributed so that dredging impacts are not concentrated in any one portion of the impact zone. In addition, the borrow areas are sloped in a manner to prevent anoxic conditions. Finally, the substrate in the borrow areas is similar in composition to pre- and post-construction conditions, allowing for the recolonization of these areas, which, studies have indicated, should occur within 12 to 18 months following dredging operations. Thus, the cumulative effect of dredging on the ecology of the impact zone would not be significant.

Table 4-5 Active Borrow Area Size by Federal Project		
Project	**Status**	**Acres**
Coney Island	Constructed	530
East Rockaway	Constructed	520
Long Beach	Proposed	1200
Westhampton Interim	Constructed	750
West of Shinnecock Interim	Proposed	230
Fire Island Interim*	Proposed Project	500
Used and Proposed Active Borrow Area Total		3,730
Available Borrow Area Habitat off Long Island South Shore		183,655
Note: * Initial construction = 390 acres; renourishment = 110 acres. **Source:** USACOE 1999.		

4.403 Cumulative impacts of dredging on artificial structure/reef communities will not be significant, since surveys will locate the majority of artificial reefs or shipwrecks, which will be avoided to allow for efficient dredging operations.

Direct Sand Placement Impacts

4.404 Sand placement activities have the potential to directly affect several shoreline communities, including the Marine Intertidal Gravel/Sand Beach; Marine Rocky Intertidal; Marine Riprap/Artificial Shore; and Terrestrial Maritime Beach. As in the borrow areas, these communities are located in dynamic, high energy areas where substrates are continuously shifting, eroding and accreting along the south shore of Long Island. Beach and surf zone organisms are well adapted to their rigorous environments. Although a temporary loss of shallow nearshore/intertidal habitat would occur, studies cited within this document indicate that a new sandy bottom should begin to recolonize shortly after construction ceases. Loss of riprap/artificial shore habitat will occur due to the sand burial of groins and other artificial structures. Varying nourishment schedules and other project variables (contractor availability, funding, local conditions, etc.) may cause staggering of construction activities so that extensive stretches of the shoreline are not nourished at the same time. In addition, for each individual project, only 500-1,000 feet of beach is nourished at one time. This practice allows motile species to avoid areas where beach fill placement will occur.

4.405 Federally listed threatened and endangered species exist in these shoreline communities and include the federally threatened piping plover, federally endangered roseate tern and the federally threatened seabeach amaranth. NYD coordinates and consults with USFWS in accordance with the ESA when projects along the south shore of Long Island have the potential of impacting affecting federally listed species. Section 7 (of the ESA) consultation usually requires that construction occur outside of the breeding/growing season of these species and/or monitoring of these species during construction with the implementation of buffer areas to minimize project-specific and cumulative impacts to these species.

Indirect Sand Placement Impacts

4.406 Sand placement activities also have the potential to indirectly impact Marine Intertidal Gravel/Sand Beach; Terrestrial Maritime Dunes; Maritime Shrubland; Maritime Heathland; and Maritime Grassland. The primary indirect impact of federal nourishment projects to the Intertidal Gravel/Sand Beach is the infusion of additional material into the predominantly east to west littoral drift. The positive cumulative effect of this condition is the additional accretion of materials along the south shore of Long Island, which will provide additional storm damage protection and the creation of additional intertidal and maritime beach habitat. The addition of materials into the littoral drift would also increase the amount of materials that will accrete in the ebb/flood shoals and inlets along the south shore. Additional maintenance of the inlets would be required. Due to the low benthic value of these inlets, no additional impacts other than those associated with maintenance dredging are expected.

4.407 The primary indirect impact that federal nourishment projects along the south shore of Long Island would have on the Terrestrial Maritime Dunes; shrubland; heathland; and grassland is the stabilization of these communities and the limiting of early successional communities associated with overwashing. The nourishment projects will increase the stability of the shoreline habitat, thereby promoting the succession of open sand, dunes and grassland to more stable shrublands. This change in dominant communities could indirectly impact shorebirds that require sparsely vegetated sand/beach cobble areas for nesting (such as the piping plover). However, these projects will not entirely prevent overwashing from occurring. This coastal process will still occur, although most likely with less frequency. Because of the continued occurrence of overwashing, and sand placement along the shoreline communities which could mimic overwash conditions, the impact to these communities and nesting shorebirds is not considered substantial. The FIMP project will include an HIS model of the piping plover which should quantify the cumulative impacts of the storm protection project on this species. The results of this study will be incorporated in future cumulative impact assessments.

Noise and Air Impacts

4.408 Noise and air emissions would be restricted to the construction site and would occur only during the construction period. The projects would not cause noise or emissions during their operational periods. The dredging is offshore, away from sensitive noise receptors, and would not have an impact. The main cause of noise during the placement is the operation of the bulldozers and trucks carrying sand from stockpiles. This source is short-term and would occur during the daylight hours. Therefore, no long-term noise impacts are expected.

4.409 According to NYSDEC, Suffolk County is severe non-attainment for ozone. New York City and Westchester and Nassau Counties are also non-attainment for this pollutant. Emissions during construction activities will be produced by the dredge, crew boat, work boats, bulldozers, trucks, and small construction vehicles. These impacts are expected to be localized, temporary, and insignificant, and within NQ and ozone limits for this non-attainment area. The FIIP is expected to be in conformity with the Clean Air Act. A draft Clean Air Conformity Act Statement is provided in Appendix F.

CUMULATIVE EFFECTS OF THE MODIFIED AUTHORIZED ALTERNATIVE

4.410 This Alternative would entail more extensive beach nourishment activities, but the nature of the actions would be the same as the Preferred Alternative, and the time frame of influence would not extend substantially beyond the project's 6-year life. The assessment above of cumulative impacts related to dredging, sand placement, noise and air quality is similarly applicable to this alternative. And, like the Preferred Alternative, the effects of the Modified Authorized Alternative would not be significantly altered or compounded by the other relevant impact zone projects.

E. PROJECT IMPACT MINIMIZATION MEASURES

4.411 The No Action Alternative as a baseline would not generate impacts and would not require mitigation. Both "build" alternatives, the Preferred Alternative/Interim Plan and the Modified Authorized Plan Alternative would have the potential to result in similar impacts on natural resources. Minimization measures have been developed for the Interim Plan, as described below.

4.412 The proposed Interim Plan has been designed to include efforts to minimize impacts on barrier island vegetation and the sandy habitat of the piping plover (an endangered species) and the seabeach amaranth, which has been listed as a threatened plant species. For general habitat protection, existing vehicle routes on the barrier island will be used whenever possible, to reduce impacts on barrier island habitat. Impacts of vehicular traffic may cause disaggregation of drift lines, as well as destruction of annual and perennial plant seedlings (Leatherman 1988). By limiting vehicular traffic to the previously established access routes, impacts to saltmarsh, freshwater wetland, or other habitats may be avoided or substantially minimized (USACOE 1995). Special measures are proposed for the piping plover and seabeach amaranth. As described in paragraph 4.296, above, no sand will be placed on identified plover nesting sites. Nonetheless, precautions have been included in the FIIP build alternatives as discussed below.

GENERAL

4.413 Implementation of the FIIP could potentially affect piping plover habitat and existing seabeach amaranth. The following minimization measures are therefore being proposed (USACOE, July 16, 1998).

a. During construction, a survey/monitoring effort will be undertaken by NYD to ensure adequate protection of these two rare species. Monitoring will be flexible. All findings will be reported to the USFWS for potential consultation to modify any procedures to reflect actual observed impacts and associated responses.

b. Excavated sediments shall be placed directly into the disposal site. No side casting (double handling) or temporary storage of dredge material at the placement site is authorized.

c. The storage of equipment and materials shall be confined to within the construction site and/or upland areas greater than 75 feet from the tidal wetland boundary (intertidal zone).

d. If present, there shall be no disturbance to vegetated tidal wetlands outside the boundaries of the placement area as a result of the construction activity.

e. The USFWS shall be notified of the start and the completion date of the proposed project.

f. Nest exclosures will be installed (under supervision of Corps biologists or designated representatives) on selected piping plover nests within 660 feet of the construction area.

g. The contractor and employees shall be adequately informed of Endangered Species Act concerns, and contractor specifications written accordingly. These shall be highlighted prior to construction actions, when possible.

h. The District biologist will be on site during laying of the pipeline to ensure it is aligned in a practicable manner conducive to minimal adverse impact to plovers and amaranths, as determined by NYD after consultation with the local, state, and federal agencies involved with project review. During sand placement operations, NYD will conduct on-site monitoring to ensure that the activity is not impacting nesting and brooding behavior, and will fence habitats of concern for specific nests or plants.

i. All fill shall consist of "clean" sand material, to maintain suitable piping plover and seabeach amaranth habitat.

PIPING PLOVERS

4.414 In addition, various minimization measures will be incorporated into the Plans and Specifications to minimize the potential adverse impacts to piping plovers. Many of these are based on measures employed during the Westhampton beach nourishment project with satisfying success. These include the following:

a. No contractor shall be allowed into piping plover nesting areas without being accompanied by a qualified biologist.

b. Dredging will take place continuously from the time the pipe is laid until placement activities are completed. If practicable, NYD will limit the operation by restricting dredging during the more sensitive, early nesting period in areas of historic piping plover usage (April-July). The noise from sand moving through the pipeline to the placement area would be negligible as a cause of disturbance, since the birds are themselves adapted to louder natural surf sounds. All other sources of loud noise (i.e., earth-moving equipment) will be muffled to minimize disturbances.

c. The hydraulic pipeline will be placed in the offshore and nearshore zones as much as possible to allow the piping plover chicks unobstructed access to the shoreline to feed. Pipeline burial or elevation on the beach will be undertaken, wherever practicable and feasible.

d. An NYD biologist or designated representative will be present during pipeline construction to ensure the approved alignment is adhered to. If a nest is present prior to pipeline construction, activities will be delayed to allow the plover chicks to fledge.

e. Because of the continuous activity, it is doubtful that any plover pair would attempt to nest along the actual placement site. However, should a pair attempt to nest in close proximity to the pipe, actions would be taken to shield the nest from construction activity in its immediate vicinity until the chicks are fledged. Work would be redirected away from the nest via enclosure erection and fencing, which would also keep any chicks away from the placement area being filled.

SEABEACH AMARANTH

4.415 Potential minimization measures would include the following:

a. An NYD or contract biologist/botanist or designated representative will survey the area immediately prior to any construction activity within the seabeach amaranth growing season

(May 1 to November 1). Approximately twice a month from June 15 to October 15, the construction area will be surveyed. Records shall include plant locations, numbers of plants, and size of plants. If there is any seabeach amaranth present, NYD shall record seabeach amaranth locations. If construction personnel or vehicles are at the site or might transit the site, symbolic fencing will be placed in a 10-foot-diameter ring.

b. All construction activities shall avoid all delineated locations of seabeach amaranth where feasible. The NYD will undertake all practicable measures to avoid an incidental take. In the unlikely event that the species appears at the placement area, and there is a very good possibility that the surrounding placed sand will encroach upon and smother the plant, NYD proposes to transplant the individual plant to a similar habitat near or within the project area to lessen the impact of placement. Transportation will include removal of a sufficiently large enough and intact volume of sand to include the full extent of the roots. This action, when necessary, will occur as soon as possible after the plant is identified, and every attempt will be made to include the entire (undamaged) root system.

c. If present, seeds of all plants transferred will be harvested and stored to be replanted at a later date. A portion of this seed shall be sent to a qualified nursery to attempt germination. If successful, germinated plants will be replanted in suitable habitats in the project area, including sites already nourished. These plants will be monitored to determine their ability to re-establish themselves under various conditions for future mitigation efforts under FIMP or other projects.

d. It is understood that this action, when feasible, will be undertaken for individual plants whose destruction could not be avoided. Seed collection or transplants will be attempted as a means of mitigating potential loss; this should not be construed as a long-term commitment or research endeavor on the part of NYD by replanting beyond the second year.

e. Placement areas shall be finished to a natural grade with compatible material.

f. A System of Notification similar to the one described above for the piping plover will also be utilized for seabeach amaranth.

4.416 Given the measures summarized above and detailed in the earlier sections, and the local implementation of existing USFWS protection measures, impacts to either piping plovers or sea-beach amaranth associated with the proposed projects will be minimized. The precautions taken will allow dredging or upland source placement of fill and continuous operation, thereby providing the most cost-effective and expeditious operation, while minimizing long-term plover and sea-beach amaranth impacts. These conditions are consistent with the findings during previous beach nourishment and breach filling activities between 1994 and 1997 (USACOE, July 16, 1988).

4.417 It is noted that quality piping plover habitat is extremely limited on Long Island. It should be maximized in areas that promised to be, or are maintained as low disturbance areas. For Long Island, recent plover seasons showed that the physical existence of an open connection to the ocean is not the feature that promotes habitation by piping plovers. Rather, it is those features that result from the major storm event (severe overwashing, breaching) that attracts plovers. Potential habitats such as this could be created and/or maintained in many areas along the project area. Non-destructive modifications and enhancements such as the removal of phragmites and dense invasive scrub (which can provide cover for predators), and the creation of overwash fans, spits, and ephemeral pools may be feasible measures to increase potentially usable habitats. These features are being studies via specific habitat research funded by NYD, along the very productive Westhampton portion of the barrier island system. Pending finding and recommendations of the studies, such features could be created and included as part of an enlarged impact minimization plan for construction activities or as separate restoration measures to address past impacts along the southshore estuarine ecosystem. What can be achieved is a balance that offers mitigation of beach nourishment activities as a method of propagating and maintaining piping plover habitat, while simultaneously creating a solution to the storm induced erosion problem and its associated safety and economic problems.

PIPING PLOVER MONITORING PROGRAM

4.418 In addition to the aforementioned mitigation measures for minimizing impacts to piping plovers within the nesting season, NYD would institute a monitoring program designed to assure the protection of the piping plovers during construction. In addition, the program would also be designed to collect data that will add to our understanding of how to implement future actions to further reduce the potential for impacting plovers, and to improve habitat and productivity. If construction activities occur between April 1 and September 1, NYD would initiate the following monitoring program:

a. A qualified Corps biologist or designated contract biologist will commence a site survey beginning April 1, which will be repeated three times a week through July 1. If piping plovers are found to nest in the proposed construction area during that time, surveys will be increased to daily coverage (including the full tidal cycle) until the last bird is fledged. The monitor shall maintain field notes, which shall be provided to the USFWS and NYSDEC as agreed upon. The Service in consultation with the District may modify survey and monitoring specifications based on site-specific considerations to avoid any adverse effects. NYD shall ensure coordination between its designated contract biologist and the project engineer responsible for the oversight of construction activities.

b. Fencing and/or exclosures will be utilized to protect the nests in the disturbance area until hatching. No placement activities shall be allowed within 660 feet of a nest. However, other construction-related activities of lesser extent (i.e., surveying, framing, equipment set-up, etc) will have 300-foot buffers. NYD understands that this is below the standard 660-foot construction activity threshold established in other Biological Opinions. However, as was demonstrated by the nests established within the Village of Westhampton Dunes, these type of impacts combined with proper protection measures are not as deleterious to the nesting plovers as actual placement activities. If the designated bird monitor finds that the above procedures are not effective, the buffer will be enlarged to 660 feet. The boundaries of the protected areas shall be adjusted based on monitors' observations of plover use, should plovers move outside the originally posted area. Areas will be expanded and contracted to accurately reflect the changes in use.

c. Courtship areas, nesting, and brood-rearing areas shall be posted immediately (supervised by the monitor), and no disturbance shall be permitted within 660 feet of the designated area. Adult (fledged) foraging areas will also be posted, but the buffer will be 300 feet. The biological monitor will pay special attention to such areas while construction is nearby. The posted areas shall extend from the ocean-side low water line to the furthest extent of the natural or man-made feature which would prohibit piping plover chicks from traversing the area (e.g., scarp or dune). Monitors shall document any reactions to disturbance from the fill activity to determine the effectiveness of the buffer. When the chicks begin to feed, the monitor will direct the contractor away from the chicks, and if necessary, will temporarily stop construction in the feeding area. A reduction or expansion in the buffer may be established, after consultation with USFWS, due to observed reactions, changes in use (abandoned nests), or natural/man-made features, which inhibit piping plovers traversing the area.

d. In addition to identifying and posting activities, the monitor shall also be looking for disturbance to plovers from project activities, including surveys, stockpiling, access routes, and transportation of new material to construction site. If such acts result in observed disturbances, the monitor will initiate immediate, if temporary, corrective actions to avoid same and will report to NYD or USFWS representatives, who will establish permanent procedures to address such disturbances. Temporary intrusions into fenced areas (i.e., surveys) shall be accompanied by a monitor and will be curtailed if there is any disturbance observed.

4.419 This trend typically indicates that the community is undergoing a period of succession or recovery from a recent environmental disturbance. Cerrato (1986) assumed that the causal disturbance was the opening and subsequent closure of the Moriches breach in 1980. Benthic communities appear to recover fairly quickly from episodic events, such as a breach or washover, provided that the disturbance is short term in nature (Cerrato, Personal Communication, April 1999).

F. USES OF RESOURCES AND THE ENVIRONMENT

4.420 In protecting against severe storm damage, the interim plan would have to make use of a variety of renewable and depletable resources. Some of this use could be irreversible or irretrievable. This section examines that potential, identifies unavoidable adverse impacts, and discusses the trade-off between short- and long-term uses of the environment and the benefit of the project.

NATURAL OR DEPLETABLE RESOURCES

4.421 For this proposed project, the sand used for construction is the critical natural resource. The sand taken from the proposed borrow site has particular characteristics, such as grain size, which make it the optimal choice for beach fill at the project area. Only a portion of the material with these optimal characteristics will be used for the initial construction and re-nourishment of the Interim Project. Large volumes of similar material are located in the immediate vicinity of the borrow area. Eventually, sand will be redistributed over the nearshore area. As the sand used in the Interim Project will remain in circulation within the sediment transport system, it will not be depleted by the proposed action. The gasoline and diesel fuel used by the dredge and other construction equipment are depletable natural resources. However, their use for this project is minimal relative to other activities that consume these fuels.

4.422 Under the No Build Alternative, salvage, repair, and reconstruction following storm damage is expected to require similar or greater amounts of sand and fuels.

4.423 Under the Modified Authorized Plan Alternative, greater amounts of sand and fuels would be required.

IRREVERSIBLE USES OF RESOURCES

4.424 An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. As discussed above (Natural or Depletable Resources) sufficient quantities of similar sand will remain in the vicinity of the borrow area to facilitate other uses. All sand used for the construction and re-nourishment of the project will remain in circulation in the sediment transport system and there will be no net loss. There will be sufficient sand remaining in the dredged area for re-colonization by benthic organisms and support of marine biota.

4.425 Under the No Build Alternative, salvage, repair, and reconstruction following storm damage is expected to require similar or greater amounts of sand and fuels.

4.426 Under the Modified Authorized Plan Alternative, greater amounts of sand and fuels would be required.

IRRETRIEVABLE USES OF RESOURCES

4.427 An irretrievable commitment of resources is one in which, due to decisions to manage a resource for another purpose, opportunities to use or enjoy the resource as it now exists are lost for a period of time. As discussed above (Natural or Depletable Resources) sufficient quantities of similar sand will remain in the vicinity of the borrow area for alternative management uses.

4.428 Under the No Build Alternative, salvage, repair, and reconstruction following storm damage is expected to require similar or greater amounts of sand and fuels.

4.429 Under the Modified Authorized Plan Alternative, greater amounts of sand and fuels would be required.

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

4.430 Species of relatively non-motile infaunal invertebrates that inhabit the borrow area will unavoidably be lost during dredging. Those species that are not able to escape the construction area are expected to recolonize after project completion. There would be an unavoidable reduction in water clarity and increased turbidity and sedimentation. This would be limited to the immediate areas of dredging and beach fill operations. This impact will be temporary and should disappear shortly after construction activities cease. Other short-term unavoidable impacts during construction include disruption of beach access, interruption of pedestrian paths along the beach, and noise from trucks and other heavy equipment.

LOCAL SHORT-TERM USES AND MAINTENANCE/ENHANCEMENT OF LONG-TERM PRODUCTIVITY

4.431 The NYD recognizes that protection of the shoreline is a continual effort. To date, no acceptable and permanent one-time solution has been identified. Using periodic renourishment is an ongoing effort. As stated above, the goal of the overall FIMP project is to provide comprehensive management of Long Island's Atlantic Coast shoreline. Renourishment efforts have a temporary and short-term impact on the biological resources on and near the shore. Removal of material from offshore borrow sites has a long-term impact on the nature of the borrow site. However, these impacts are not substantial since there are no special resources within the borrow site and some resources remain after dredging.

4.432 Coastal Barrier Resources Act/Coastal Barrier Resources Units. The proposed interim project will utilize soft measure solutions (beach nourishment and dune repair/creation) to stabilize and enhance the natural stabilization system for portions of Fire Island between Fire Island Inlet to Moriches Inlet which have been severely affected by recent coastal storms. Benefits of this project will include reduced probability of breaches and overwashes in the barrier island, affording protection of the coastal mainland and barrier island communities. In addition, the project will provide protection to the natural resources that utilize the back-bay habitats, which include both recreationally and commercially important species, and habitats for Federally and State listed species.

4.433 The CBRA and its amendments prohibit the spending of new Federal expenditures that tend to encourage development or modification of coastal barrier. The laws do not restrict activities carried out with private or other non-Federal funds and only apply to the areas that are within the defined Coastal Barrier Resource System. Based on our review, only one unit of the Coastal Barrier Resource System (CBRS) is located within the proposed project area. This is the Robert Moses State Park, CBRS map NY-59, Fire Island Unit. The District concludes that this proposed project meets the following provisions of Section 6 of the CBRA, which provides exceptions for expenditures of federal funds within CBRA units. They are:

a. Construction, operation, maintenance, and rehabilitation of Coast Guard facilities and access thereto; and
b. Nonstructural projects for shoreline stabilization that are designed to mimic, enhance, or restore a natural stabilization system.❖

5.00 PUBLIC INVOLVEMENT AND COORDINATION

PUBLIC INVOLVEMENT PROGRAM

5.01 The process of preparing the Draft Environmental Impact Statement (DEIS) and the draft main project report (and Appendices involved coordination with several federal, state and or local agencies, as well as public input. The New York District prepared and published "A Notice of Intent to prepare a DEIS." The notice appeared in the Federal Register dated November 6, 1997 (see Table 5-1). The preparation of the DEIS included the development of background information regarding fish and wildlife resources in coordination with the U.S. Fish and Wildlife Service (USFWS), as well as contact with other federal, state, and local agencies for background input.

Federal Agencies and Officials

- Advisory Council of Historic Preservation
- Environmental Protection Agency
  - Office of Federal Activities, Region II
- Department of Agriculture
  - Forest Service
  - Soil Conservation Service
- Department of Commerce
  - National Oceanic and Atmospheric Administration
    - Office of Ecology and Conservation
    - Deputy Assistant Secretary of Environmental Affairs
    - National Marine Fisheries Services
      - Habitat and Protected Resources Division
      - Milford, Connecticut Field Office
- Department of Energy
- Department of Health and Human Services
  - Office of the Secretary
  - Public Health Service Center for Disease Control
- Department of the Interior
  - Office of Environmental Affairs
  - U.S. Fish and Wildlife Service
  - Cortland, New York Field Office
  - Islip, Long Island Field office
  - National Park Service
  - Fire Island National Seashore
- Department of the Navy
  - Deputy Chief Naval Operations
- Department of Housing and Urban Development
  - Regional Environmental Office
- Department of Transportation
  - Federal Highway Administration

U.S. Coast Guard
Federal Emergency Management Administration
Senator Charles Schumer
Senator Daniel P. Moynihan
Congressman Michael Forbes
Congressman Rick A. Lazio

New York State Agencies and Officials

Governor
Lieutenant Governor
Senators
Assemblymen
New York State Department of State
Secretary of State
Coastal Zone Management
New York State Department of Environmental Conservation
Division of Coastal Resources
Bureau of Flood Protection
Division of Fish, Game and Wildlife
Division of Marine Fisheries
Bureau of Shellfisheries
Division of Regulatory Affairs
New York State Department of Parks, Recreation, and Historic Preservation
NYS Historic Preservation Officer

Suffolk County Office and Officials

Suffolk County Supervisory Robert J. Gaffney
Suffolk County Cornell Cooperative Marine Extension
Suffolk County Legislature
Suffolk County Parks
Suffolk County Planning Department

Municipal Offices and Officials

Town of Babylon
Town of Brookhaven
Town of Islip
Village of Brightwaters
Village of Lindenhurst
Village of Ocean Beach
Village of Patchogue
Village of Saltaire
Village of West Hampton Dunes

Private Organizations and Individuals

Fire Island Association
Save Our Seashores, Inc.
Sierra Club
American Littoral Society
Environmental Defense Fund
National Wildlife Federation
Natural Resources Defense Council
The Nature Conservancy, Eastern Regional Office
New York Audubon Society
Marine Sciences Research Center, SUNY at Stony Brook
Clean Ocean Action
Long Island Shorefront Defense Committee

5.02 Meetings have been held with these agencies and the preparation of the Draft Environmental Impact Statement publicly noticed as shown in Table 5-1.

Table 5-1
Coordination and Public Notice for Fire Island Interim Project

Item	Date and Location	Attendees
Scoping Paper	November 1997	Mailed to involved Agencies
Notice of Intent to Prepare an EIS	Nov. 26, 1997 Federal Register Vol. 62, No. 228	Not Applicable
Addendum to Notice of Intent to Prepare an EIS	Jan. 22, 1998 Federal Register Vol. 63. No. 14	Not Applicable
Coordination Meeting	Feb. 10, 1998	NYSDEC
Coordination Meeting	Feb. 27, 1998	NYSDEC
Coordination Meeting	June 18, 1998 USFWS Long Island Regional Office	FIIS, DOI, USFWS, NYSDEC, NYSDOS
Coordination Meeting	March 3, 1999 Patchogue Library	FIIS, DOI, USFWS, NYSDEC, NPS
Coordination Meeting	March 31, 199 FIIS Offices	FIIS
Coordination Meeting	October 1, 1999 NYD Offices	FIIS, DOI, USFWS, NYSDOS, NYSDEC, NPS

5.03 Public Law 88-587 Fire Island National Seashore Enabling Legislation provides for coordination between the Chief of Engineers, Department of the Army and the Secretary of the Interior for erosion control and beach protection measures. Any plan must be consistent with purposes of the legislation and mutually acceptable to both the Secretary of the Interior and Secretary of the Army. Coordination is ongoing with FIIS staff and members of the Department of Interior to reach a mutually acceptable approach.

5.04 In addition to public and agency coordination, compliance with environmental regulations and protection requirements have played an intrinsic role in the development of the FIIP's design plan and implementation program. The development of the FIIP's design sections, alignments and profiles has taken into consideration the human and natural environments, as well as all federal, state, and local policies that may be in effect for the FIIP study area. A number of alternatives were examined in the Draft Decision Document and DEIS but most did not meet the FIIP's purpose and need as established in Chapter 1 of the DEIS. The Preferred Alternative/Interim Project was selected based on its ability to fulfill the FIIP's goal of providing temporary storm damage protection until the completion and implementation of the Reformulation Study. Table 5-2 indicates the relationships of the proposed plan to various federal environmental protection and requirements statutes and Executive Orders, as well as state and local requirements.

Table 5-2
Compliance with Environmental Requirements and Protection Statutes

	Required Compliance
Federal Policies	
Archaeological and Historic Preservation Act, as amended	Full
Clean Air Act, as amended	Full
Clean Water Act of 1977, as amended	Full
Coastal Zone Management Act of 1972, as amended	Full
Coastal Resources Barrier Act	Full
Endangered Species Act of 1973, as amended	Full
Estuary Protection Act (PL 90-454)	Full
Federal Water Project Recreation Act, as amended	N/A
Fish and Wildlife Coordination Act, as amended	Full
Land and Water Conservation Fund Act of 1965, as amended	Full
Marine Protection, Research, and Sanctuary Act of 1969, as amended	Full
National Environmental Policy Act of 1969, as amended	Full
Organic Act of 1916	Full
Fire Island National Seashore Act (PL 88-587)	Full
Wilderness Act (PL-88-577)	Full
Fire Island Wilderness Act (PL-96-585)	Full
Rivers and Harbors Appropriation Act of 1899, as amended	N/A
Watershed Protection and Flood Prevention Act, as amended	N/A
Wild and Scenic River Act, as amended	N/A
Floodplain Management (E.O. 11988)	Full
Protection of Wetlands (E.O. 11990)	N/A
Toxic Substances Control Act (PL 94-469), as amended	N/A
Section 106 of the National Historic Preservation Act of 1966, as amended	Full
Executive Orders, Memoranda, Etc.	
Floodplain Management (E.O. 11988)	N/A
Protection of Wetlands (E.O. 11990)	N/A
Environmental Effects Abroad of Major Federal Actions (E.O. 12114)	N/A
Impacts on Prime and Unique Farmlands (CEQ Memo 8-30-76)	N/A
State and Local Policies	
The proposed project will comply with all appropriate state and local policies.	

Compliance with Environmental Requirements

5.05 As shown in Table 5-2, a number of policies are not applicable to the FIIP. For example, the Preferred Alternative would not impact prime or unique farmland or obstruct navigable waters; thus, such statues as the Impacts on Prime and Unique Farmland Protection Policy and the Rivers and Harbors Act would not be applicable to this project. The section below discusses the FIIP and whether it would be consistent with major relevant policies.

National Environmental Policy Act of 1969

5.06 As noted in Chapter 1, the FIIP approval is subject to the regulations of the National Environmental Policy Act of 1969 (NEPA). The specific requirements for the Interim Project as they relate to NEPA regulations (40 CFR 1506.1) are being met by the proposed plan. First, the proposed plan demonstrates that the Interim Project is justified independent of the outcome of the findings in the Reformulation Study. Secondly, the Interim Project is presented in both a Draft Decision Document and a Draft Environmental Impact Statement, which conforms with NEPA regulations as promulgated by the President's Council on Environmental Quality (CEQ). The DEIS evaluates the potential for adverse impacts on the quality of the human and natural environments and presents project alternatives. Thirdly, the proposed Interim Project will neither presuppose the outcome of the Reformulation Study nor limit the alternatives for the Reformulation Study.

5.07 The project must also obtain state approval and, thus, is subject to the regulations of the New York State Environmental Quality Review Act (SEQRA), which places requirements on state agencies similar to those of NEPA.

Fire Island National Seashore Act and General Management Plan

5.08 Approximately 26 miles of the 31-mile-long Fire Island portion of the project study area lies within the Fire Island National Seashore (FIIS), which was created by the Fire Island National Seashore Act in 1964 (P.L. 88-587). In addition, a portion of FIIS was established as the Otis G. Pike Wilderness Area in 1980 (P.L. 95-585) pursuant to the Wilderness Act of 1964 (P.L. 88-577). The FIIS is managed by National Parks Service (NPS) under a General Management Plan (GMP) approved in 1978 with subsequent amendments. In its role as manager of the FIIS, NPS must issue a Special Use Permit before the implementation of those components of the FIIP Preferred Alternative that are located in the FIIS.

5.09 The Department of Interior (DOI) and NPS have raised concerns about the consistency of the FIIP with the GMP. The GMP seeks to manage the FIIS by restoring, to the extent possible, natural processes on the island, and to limit development to those areas that are already set aside for that purpose. For those properties within the FIIS owned by the federal government, GMP policies recognize the difference between major land holdings, which can be managed to serve as natural recreation areas, and smaller tracts interspersed between the existing communities on Fire Island. Although the objectives of the GMP apply to all of the FIIS, the focus on restoration of natural processes and protection of natural resources is strongest on major federal land holdings and in the Otis G. Pike Wilderness Area.

5.10 The Preferred Alternative has been designed to avoid all disturbance to the wilderness area, to keep to a minimum the placement of sand on major federal lands, and to focus sand placement and dune construction in developed areas. The New York District (NYD), DOI, and NPS have been meeting and will continue to coordinate to resolve these concerns.

Endangered and Threatened Species Act

5.11 The FIIP project is in full compliance with the Endangered Species Act of 1973 (ESA). Pursuant to Section 7 of the ESA, a Biological Assessment (BA) was prepared for the piping plover and seabeach amaranth and a Formal Consultation with USFWS was initiated by the NYD on July 16, 1998 and is still ongoing. The BA was updated by way of letters dated May 20 and June 19, 1999. Relevant sections of the BA have been integrated into the DEIS impact analysis. As discussed in Section 4.E of the DEIS, the proposed Interim Project has been designed to include efforts to minimize impacts to barrier island vegetation and a program of minimization measures for the piping plover and seabeach amaranth would be included as part of the Preferred Alternative.

5.12 Additionally, pursuant to Section 7 of the ESA, the National Marine Fisheries Service (NMFS) had issued a Regional Biological Opinion (RBO) for Beach Nourishment Projects—South Shore of Long Island and Northern New Jersey Shore, Sandy Hook to Manasquan Inlet, dated December 15, 1995. This RBO determined that the project would not likely adversely affect any listed species (whales and pelagic sea turtles) under NMFS jurisdiction. It also stated that pre-construction sampling of the borrow area and monitoring of hopper dredge operations by trained NMFS observers must occur before and during project implementation; the FIIP project would comply with this sampling and monitoring requirement.

Coastal Resources Barrier Act and Coastal Barrier Improvement Act of 1990

5.13 These Coastal Barrier Act (CBRA) and its amendments prohibit the spending of new federal expenditures that tend to encourage development or modification of coastal barriers that are within the defined Coastal Barrier Resource System (CBRS). Based on the NYD review, only one unit of the CBRS is located within the proposed project area: Robert Moses State Park, CBRS map NY-59, Fire Island Unit. However, the proposed project would meet the provisions of Section 6 of the CBRA, which provides exceptions for expenditures of federal funds within CBRA units. The Preferred Alternative proposes nonstructural temporary sand placement to strengthen the natural protective features of Fire Island for storm damage protection; it does not seek to encourage encroachment of development or alterations to the coastal barriers.

Coastal Zone Management Act of 1972

5.14 A federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as Appendix A. Based on a review of the Coastal Management Program policies for New York State, 14 were found to be applicable to the formulation of the proposed interim project build alternatives. The New York State Department of State must review NYD's determination of the FIIP's consistency with the policies of the State's Coastal Management Program (Coastal Zone Management Act of 1972, P.L. 92-583 and New York State Waterfront Revitalization and Coastal Resources Act of 1982). State consistency review will be conducted during the coordination of the DEIS.

Section 106 of the National Historic Preservation Act of 1966, as Amended

5.15 Archival research, field investigations, and consultation with the New York State Historic Preservation Officer (SHPO), have been conducted in accordance with the National Historic Preservation Act, the Archeological and Historic Preservation Act of 1974, as amended, and Executive Order 11593. Section 4.B of the DEIS discusses the results of SHPO consultation. Dredging directly around possible cultural resources (PCRs) could disturb or even destroy these submerged resources. To avoid adverse impacts, buffer zones would be created within a 150-foot radius around the PCRs, and the dropping of anchors or dredging would be prohibited in the area of PCRs. With these avoidance measures, it was determined that the project would not affect historic properties included in or eligible for inclusion in the National Register of Historic Places. The project is in compliance with each of these Federal laws.

Clean Water Act of 1977

5.16 The project is in compliance with the Clean Water Act of 1977 and its subsequent amendments. Implementation of the FIIP Preferred Alternative would not result in changes in water quality. All state water quality standards would be met. A Section 404(b) evaluation is included in this report as Appendix B. An application for a Section 401 water quality certification will be submitted to the NYSDEC with the release of this DEIS. The pre-application process with representatives from NYSDEC-Region I is ongoing with discussions of the data needs and requirements that would be included in the state permit application.

Fish and Wildlife Coordination Act of 1958

5.17 This project is in full compliance with this Act. The FIIP has been coordinated with the U.S. Fish and Wildlife Service (USFWS). A Coordination Act Report (FWCAR), dated November 16, 1998, was submitted by the USFWS (see Appendix C). However, the FWCAR was prepared based on the USFWS utilizing a recommended project life of 15 years for its evaluation. Subsequent discussions between NYD and USFWS resulted in an Interagency Partnership Agreement, dated May 28 and June 1, 1999 and clarified at the October 1, 1999 Issue Resolution Conference that called for an evaluation of a 6-year project life. In a letter dated November 3, 1999, the NYD requested the FWCAR to be revised based on a 6-year project life. There have been no major changes in the project design or the source of beach fill material since submittal of the FWCAR.

Clean Air Act of 1972

5.18 The proposed project would entail the placement of sand along the Fire Island shoreline. Air quality would not be adversely affected by this project and no air quality permits would be required. This project has been coordinated with U.S. Environmental Protection Agency (EPA) and is in compliance with Section 309 of the Clean Air Act. Upon completion of the DEIS, EPA will be forwarded a copy for their review. A Draft unsigned Conformity Act Statement is included in this report as Appendix F.

New York State Coastal Erosion Hazard Areas Act

5.19 Due to the erosion-prone nature of parts of the New York coastline, the Coastal Erosion Hazard Areas Act (CEHA) (Article 34 of the Environmental Conservation Law) regulates construction in areas where buildings and structures could be damaged by erosion and flooding. NYCRR Part 505 provides procedural requirements for development, new construction, and erosion protection structures. The New York State Department of Environmental Conservation (NYSDEC) enforces the regulations if the city and county do not provide coastal hazard regulations. New York State has identified the entire Atlantic Ocean shoreline of Fire Island as a coastal erosion hazard area. The entire beach and nearshore area, as well as the primary dune to a point 25 feet landward of the landward toe of the dune, are designated as natural protective features. New construction is not permitted in these areas and pre-existing development is strictly limited to only a 25 percent increase in ground coverage area.

5.20 State law provides for the NYSDEC to revoke certification of local CEHA management programs if local administration is not consistent with statewide minimum standards, and to assert regulatory jurisdiction over these areas. Thus, continuous future enforcement of New York's CEHA law and regulations is assured for Fire Island's ocean shorelines.

5.21 All of the interim plans evaluated must incorporate a 25-foot buffer zone landward of the landward toe of the constructed or restored dune. This area must be included, together with the dune, within a permanent conservation area easement to assure that no development can occur within it. This would be consistent with Coastal Erosion Management Regulations. The interim project would be considered as the beneficial deposition of material obtained from excavation or dredging, as permitted under the Coastal Erosion Management Regulations. ❖

6.00 LIST OF PREPARERS

1.01 The following people were primarily responsible for preparing this DEIS:

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Gray Smith	Project Engineer Moffat & Nichol, Engineers	Modeling Effort
David Yang	Project Engineer Moffat & Nichol, Engineers	QA/QC

7.00 REFERENCES

Andrle, R. F. and J.R. Carroll. 1988. The Atlas of Breeding Birds in New York ~~State. Cornell~~ University Press.

Art, H.W. 1990. The Impacts of Deer on the Sunken Forest and Fire Island National Seashore, Fire Island, New York: 1967 - 1989. Draft Report, Williams College, Department of Biology, Williamstown, Massachusetts, May 1990.

Art, H.W. 1971. Atmospheric Salts in the Functioning of a Maritime Forest Ecosystem. University Microfilms, Michigan. Ph.D. Thesis, Yale University.

Atlantic Coast Piping Plover Recovery Team. May 2, 1996. Piping Plover (*Charadrium melodus*) Atlantic Coast Population Revised Recovery Plan. Report prepared for the US Fish and Wildlife Service, Hadley, Massachusetts

Barry A. Vittor and Associates, Inc. 1998. DRAFT Report on Macroinvertebrate Community Assessment. Atlantic Coast of Long Island, Fire Island to Montauk Point, New York. Reformulation Study. Fire Island and West of Shinnecock Interim Storm Damage Protection Projects. Prepared for USACE, N.Y. District.

Beltrami, E. 1996. Unusual Blooms as Excitable Systems: The Case of "Brown-Tides."

Benyus, J.M. 1989. The Field Guide to Wildlife Habitats of the Eastern United States. Simon & Schuster, Inc. New York: 336 pp.

Bent, A.C. 1963. Life Histories of North American Marsh Birds. Dover Publications, New York, New York.

Bent, A.C.1968. Life Histories of North American Cardinals, Grosbeaks, Buntings, Towhees, Finches, Sparrows and Their Allies. Smithsonian Institution Press, Washington, D.C.

Bent, A.C. 1986. Life Histories of North American Diving Birds. Dover Publications, New York, New York.

Berg, D. 1990. Wreck Valley. Vol. II. Aqua Explorers, Inc. East Rockaway, New York. ISBN 0-9616167-3-3.

Bigelow, H.B. and W.C. Schroeder. 1953. Fishes of the Gulf of Maine. Fishery Bulletin of the Fish & Wildlife Service. Volume 53.

Bilecki, M.S. 1999. Personal Communication. National Park Service, Patchogue, New York.

Blake, N.J.U., L.J. Doyle, and J.J. Culter. 1996. Impacts and direct effects of sand dredging for beach re-nourishment on the benthic organisms and geology of the West Florida Shelf, Final Report. OCS Report MMS 95-0005. U.S. Department of the Interior, Minerals Management Service, Office of International Activities and Marine Minerals, Herndon, Va.

Boggs, S. Jr. 1987. Principles of Sedimentology and Stratigraphy. Merrill Publishing Co. Ohio.

Bokuniewicz, H.J. and J.R. Schubel. 1991. The Origin and Development of the Great South Bay: A Geological Perspective. In The Great South Bay, edited by J.R Schubel, T.M. Bell, and H.H. Carter. State University of New York Press, Marine Sciences Research Center, Stony Brook, New York.

Bokuniewicz, H.J. and M.J. Zietlin. 1980. Characteristics of the Ground-Water Seepage into Great South Bay.

Bricelj, V.M., R.E. Malouf. 1980. Aspects of the Reproduction of Hard Clams in Great South Bay, N.Y. Proceedings of the National Shellfisheries Association. Vol. 70.

Briggs, P. T. 1962. The sport fisheries of Great South Bay and vicinity. N.Y. Fish and Game Journal. 9(1):1-36.

Briggs, P. T. 1963. The Sport Fishery in the Surf on the South Shore of Long Island from Jones Inlet to Shinnecock Inlet. NYSDEC publication.

Briggs, P. T. 1965. The Sport Fishery in the Surf on the South Shore of Long Island from Jones Inlet to Shinnecock Inlet. N.Y. Fish and Game Journal. 12 (1):31-47.

Briggs, P. T. 1985. Movements of American lobsters tagged off the south shore of Long Island, New York. N.Y. Fish and Game Journal 32(1) 20-25.

Briggs, P. T. and F.M. Mushacke. 1972. Characteristics of the Jonah crab and rock crab in New York Waters. N.Y. Fish and Game Journal. Vol. 29(2). July 1982.

Briggs, P.T. and F.M. Mushacke. July 1980. The American Lobster and the Pot Fishery in the Inshore Waters Off the South Shore of Long Island, New York. New York Fish and Game Journal, Vol. 27, No. 2.

Briggs, P. T. and F.M. Mushacke. 1982. Characteristics of the jonah crab and rock crab in New York Waters. N.Y. Fish and Game Journal 29(1):109-126.

Briggs, P. T. and O'Connor, J.S. 1971. Comparison of Shore-Zone Fishes Over Naturally Vegetated and Sand-Filled Bottoms in Great South Bay. New York Fish and Game Journal. Vol. 18(1): 15-41.

Briggs, P. T. and C.S. Zawacki. 1974. American lobsters at artificial reefs in New York. N.Y. Fish and Game Journal. 21(1):73-77.

Brim, M.S. and R.A. Schreiber. 1972. Fishes of Great South Bay and Vicinity. pp. 494-576 in: Final Report of the Oceanographic and Biological Study for Southwest Sewer District No. 3, Suffolk County, N.Y., Vol. 1B. Prepared for Bowe-Walsh and Associates by Marine Sciences Research Center, State Univ. of NY at Stony Brook.

Britton, N.L. and Hon. A. Brown. 1970. An Illustrated Flora of the Northern United States and Canada. Vol. I-III. Dover Publications, New York, NY.

Bull, J. 1974. Birds of New York State. (Reissued 1985 with supplement and corrections). Cornell University Press.

Bull, J. 1976 Reprint. Birds of New York State. Comstock Publishing Associates/Cornell University Press, Ithaca, NY.

Burger, J. 1987. Physical and Social Determinants of the Nest-Site Selection in Piping Plover in New Jersey. Condor 89:811-818.

Burger, J. and M. Gochfeld. July 1988. Nest Site Selection and Temporal Patterns in Habitat Use of Roseate and Common Terns. The Auk 105: 433-438.

Burger, J. and M. Gochfeld. 1990. Nest Site Selection in Least Terns (*Sterna antillarum*) in New Jersey and New York. Colonial Waterbirds 13(1):31-40.

Burke, V. J., Standora, E. A., and S. J. Morreale. 1989. Environmental Factors and Seasonal Occurrence of Sea Turtles in Long Island, New York. Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology, pp. 21-23 NOAA Tech. Memo NMFS-SEFC- 232.

Burke, V. J., Morreale, S. J., and E. A. Standora. 1991. Diet of the Kemp's Ridley Sea Turtle in Long Island, New York. Report to the National Marine Fisheries Service. Silver Spring, Maryland.

Carpenter, E.J., B.H. Brinkhuis, and D.G. Capone. 1991. Primary Production and Nitrogenous Nutrients in Great South Bay. pp. 33-42 in The Great South Bay. J.R. Schubel, T.M. Bell, and H.H. Carter. Eds. State University of New York Press, Albany.

Cashin Associates, P.C. September 1993a. The Environmental Impacts of Barrier Island Beaching with Particular Focus on the South Shore of Long Island, New York. Cashin Associates, Hauppauge, New York.

Cashin Associates, P.C. December 1993b. Preliminary Report. Environmental Study of the Barrier and Bay Island Communities, Town of Babylon, New York. Submitted to Town of Babylon.

Cashin Associates, P.C. December 1994. Preliminary Draft Dredging Master Plan and GEIS for Suffolk County, New York: Terrestrial and Aquatic Resource Components. Prepared For County of Suffolk, Department of Public Works. Cashin Associates, Hauppauge, New York.

Cashin Associates, P.C. January 1996. Peconic Estuary Program, Final Submerged Aquatic Vegetation Study. Report prepared for the Suffolk County Department of Health Services. Cashin Associates, Hauppauge, New York.

Cerrato, R.M. October 1983. Benthic Borrow area Investigations, South Shore of Long Island, New York. Marine Sciences Research Center, Special Report No. 51. State University of New York, Stony Brook, New York.

Cerrato, R.M. July 1986. A Seasonal Study of the Benthic Fauna in Moriches Bay. Special Report 72. Marine Sciences Research Center, State University of New York at Stony Brook.

Cerrato, R.M. and F.T. Scheier. 1984. The Effects of Borrow Pits on the Distribution and Abundance of Benthic Fauna in the Lower Bay of N.Y. Harbor. MSRC Special Report No. 59. Ref. No. 85-6.

Cerrato, R.M. April 1999. Telephone conversation between Robert Cerrato of Marine Sciences Research Center, SUNY at Stony Brook, New York and Matthew Billerman, EEA, Inc., Garden City, New York.

Chandler, S.K., S.P. Elias-Gerken and J.D. Fraser. November 5, 1995. Monitoring Study: Effects of the Westhampton Interim Storm Damage Protection Project on Piping Plover Habitat at Pikes Beach, Southampton, NY. Interim Report for the 1995 Breeding Season. Report to U.S. Fish & Wildlife Service, Region 5, Sudbury, MA.

Conant, R. and J.T. Collins. 1991. Reptiles and Amphibians of Eastern/Central North America. Houghton Mifflin Co., Boston.

Conley, D.C. September 1994. Impact of Little Pike's Inlet on Tides and Salinity in Moriches Bay. Final Report prepared for: Governor's Coastal Erosion Task Force.

Conner, P.F. July 1971. The Mammals of Long Island, New York. Bulletin 416, The New York State Museum and Science Service. Albany, New York.

Cornell Cooperative Extension and Wilke Architects/Engineers. August 1997. South Shore Estuary Wetlands Restoration Study. Report prepared for Southampton Town. Cornell Cooperative Extension, Suffolk County Marine Program, Riverhead, New York.

Cosper, E.M., E.J. Carpenter, & M. Cottrell. 1987. Primary Productivity and Growth Dynamics of the Brown Tide in Long Island Embayments. Springer-Verlag. Coastal and Estuarine Studies; Novel Phytoplankton Blooms, New York.

Courtenay, W.R., B.C. Hartig, and G.R. Loisel. February 1980. Ecological Evaluation of a Beach Nourishment Project at Hallandale (Broward County), Florida. Volume I. Miscellaneous Report No. 80-1(1). U.S. Army Corps of Engineers, Coastal Engineering Research Center, For Belvoir, Virginia.

Cuiffo, Phil. 1998. Personal Communication. New York State Department of Transportation, Records Access office, Hauppage, N.Y.

Culter, J.K. and S. Mahadevan. January 1982. Long-Term Effects of Beach Nourishment on the Benthic Fauna of Panama City Beach, Florida. Miscellaneous Report No. 82-2. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia.

D'Elia, C.F., J.G. Sanders, and W.R. Boynton. 1984. Impact of Point and Non-Point Nutrient Enrichment on Dynamics of Natural Phytoplankton. Maryland Water Resources Research Center, College Park. Prepared for: Geological Survey, Reston, Va. 49 pp.

Dennison, W.C., L.E. Koppleman, and R. Nuzzi.1991. Water Quality. In The Great South Bay, edited by J.R Schubel, T.M. Bell, and H.H. Carter. State University of New York Press, Marine Sciences Research Center, Stony Brook, New York.

Dennison, W.C., G.J. Marshall, and C. Wigand. 1989. Effect of Brown Tide Shading on Eelgrass (*Zostera marina L.*) Distributions. pp. 675-692 in E.M. Cosper, V.M. Bricelij and E. J. Carpenter, eds. Novel Phytoplankton Blooms: Causes and Impacts of Recurrent Brown Tides and Other Unusual Blooms. Coastal and Estuarine Studies, Vol. 35, Springer-Verlag, Berlin.

Dowhan, J.J. and R. Rozsa. 1989. Flora of Fire Island, Suffolk County, New York. Bulletin of the Torrey Botanical Club. 116 (3) pp. 265-282.

Duguay, L.E., D.M. Monteleone, &C.E. Quaglietta. 1989. Abundance and distribution of zooplankton and ichthyoplankton in Great South Bay, New York during the brown tide outbreak of 1985 and 1986. Coastal and Estuarine Studies 35: 599-623.

Durham, K. November 18, 1998. Telephone conversation between Kimberly Durham, Stranding Director, The Riverhead Foundation for Marine Research and Preservation, Riverhead, New York and Laura Schwanof, EEA, Inc., Garden City, New York.

East Hampton Town Natural Resources/Environmental Protection Department. 1998. Piping Plover and Least Tern Protection Report. Town of East Hampton, New York.

EEA, 1997. Jamaica Bay Eutrophication Study. Produced under contract with the New York City Department of Environmental Protection.

EEA, 1999. Comparative Study of Beach Invertebrates on the Westhampton Barrier Island. Report prepared for the U.S. Army Corps of Engineers, under joint venture URS Consultants, Inc./Moffatt and Nichol Engineers.

Elias-Gerken, Susan. July 1994. Piping Plover Habitat Suitability on Central Long Island, New York Barrier Islands. Master's Thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA

England, M. 1989. The Breeding Biology and Status of the Northern Harrier (*Circus cyaneus*) on Long Island, New York. Master thesis. Long Island University, C.W. Post Center, Greenvale, New York.

Fallon, D. and F. Mushacke. 1996. Tidal Wetland Trends in Shinnecock Bay, New York. 1974 to 1995. New York State Department of Environmental Conservation, Stony Brook, New York.

Fire Island Marina. 1998. Personal Communication. Marina staff, Fire Island, N.Y.

Fire Island Association. 1996. Recreation and Access Plan for the Fire Island Beach. Replenishment Program.

Foehrenback, J. 1969. Pollution and eutrophication problems of Great South Bay, Long Island, New York. Journal of the Water Pollution Control Federation. Vol. 41: 1456-66.

Franz, D.R., 1975. Distribution and abundance of inshore populations of the Surf Clam Spisula solidissima. Proceedings of the Symposium American Museum of Natural History, NYC. 3, 4, and 5 November 1975.

Franz, D.R. and W.H. Harris. 1988. Seasonal and spatial variability in macrobenthos communities in Jamaica Bay, New York. An Urban Estuary. Estuaries, Vol. Ll (1) 15-28.

Gochfeld, M. 1983. Colony Site Selection by Least Terns: Physical Attributes of Sites. Colonial Waterbirds 6:205-213.

Gosner, K.L. 1978. A Field Guide to the Atlantic Seashore. Houghton Mifflin Company, Boston, pp. 329.

Greene, G.T., A.C.F. Mirchel, W.J. Behrens, D.S. Becker. 1978. Surficial Sediment and Seagrasses of Eastern Great South Bay, N.Y. Special Report 12, Reference 77-9. Marine Sciences Research Center. State University of New York, Stony Brook, New York.

Hanlon, John R. 1983. U.S. Department of the Interior Fish and Wildlife Service Region 5, Fish and Wildlife Resource Studies for the Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project Reformulation Study, Estuarine Resource Component, May 1983.

Hill, J.M. and C.B. Knisley. 1994. Current and Historic Status of the Tiger Beetles, *Cicindela d. dorsalis* and *Cicindela d. media* in New Jersey, with Site Evaluations and Procedures for Repatriation. A report to the U.S. Fish & Wildlife Service. Pleasantville, New Jersey.

Hoff, T. 1998. Personal Communication. Mid-Atlantic Fisheries Management Council, Dover, Delaware.

Holland, F. Ross. 1989. Great American Lighthouse. Great American Places Press. The Preservation Press, Washington, D.C.

Houghton, L.M., J.D. Fraser, and S.P. Elias-Gerken. July 1997. Final Report. Monitoring Study: Effects of the Westhampton Interim Storm Damage Protection Project on Piping Plover Habitat at Pikes Beach, Village of Westhampton Dunes, NY. Interim Report for the 1996 Breeding Season. Virginia Polytechnic Institute and State University, Blacksburg, VA.

Houghton, L.M., J.D. Fraser and S.P. Elias-Gerken. February 1998. Final Report. Monitoring Study: Short Term Effects of the Westhampton Interim Storm Damage Protection Project on Piping Plover Habitat at the Village of Westhampton Dunes and Westhampton Beach, NY. Interim Report for the 1997 Breeding Season. Virginia Polytechnic Institute and State University, Blacksburg, VA.

Houghton, L.M., J.D. Fraser and S.P. Elias-Gerken. February 1999. Final Report. Effects of the Westhampton Interim Storm Damage Protection Project on Piping Plover Habitat at the village of West Hampton Dunes and Westhampton Beach, Long Island, New York. Virginia Polytechnic Institute and State University, Blackburg, VA.

Howe, M.A, et al. 1978. MESA New York Bight Program: Marine and Coastal Birds. New York Sea Grant Institute. Albany, NY.

Jack McCormick and Associates, Inc. 1975. Environmental Inventory of the Fire Island National Seashore and the William Floyd Estate, Suffolk County, New York. Submitted to the National Park Service, United States Department of the Interior, Denver Service Center, Denver, Colorado. Contract No. 2000-4-0010. January, 1975.

John Milner Associates. 1998. Cultural Resources Study, Fire Island Inlet to Montauk Point, Suffolk County, New York, Reformation Study: Phase I Archaeological Survey Volumes I and II. Prepared in association with the Greeley Polhemus Group, Inc. Prepared for the U.S. Army Corps of Engineers, New York District.

Johnson, Madeleine C. 1983. Fire Island : 1650s - 1980s. Shoreland Press, Mountainside, N.J.

Johnson, R.W. June 1981. Vegetation Study: Fire Island Inlet to Montauk Point, NY. Combined Beach Erosion Control and Hurricane Protection Project Reformulation Study. Project No. 117902-04 Prepared for the U.S. Army Corps of Engineers, New York District.

Jones, C.R. and J. R. Schubel. 1980. Distribution of Surficial Sediments and Eelgrass in Great South Bay, New York (from Smith Point, west to Wantaugh Parkway). Marine Sciences Research Center Special Report 39. State University of New York, Stony Brook, N.Y.

Jones, C.R. and J.R. Schubel. July 1978. Distribution of Surficial Sediments and Eelgrass in New York's South Shore Bays: An Assessment from the Literature. Marine Sciences Research Center, Special Report 13, Reference 78-1. State University of New York at Stony Brook, NY.

Kassner, Jeffrey. 1985. Suffolk County's Hard Clam Industry: An Overview and an Analysis of Management Alternatives.

Kassner, J. 1994. Habitat Enhancement as a Means to Increase the Abundance of the Northern Quahog Mercenaria mercenaria. Proceedings of the Third Rhode Island Shellfish Industry Conference. Rhode Island Sea Grant.

Kassner, J. 1997. Restoration of Great South Bay Hard Clam Resources. Town of Brookhaven, Division of Environmental Protection, Medford, NY.

Kassner, J. and J.A. Black. April 1983. Inlets and Barrier Beach Dynamics: A Case Study of Shinnecock Inlet, New York. Shore and Beach, Vol. 51, No. 2, pp 22-26.

Kaufman, Z., J. Lively, and E.J. Carpenter. 1984. Uptake of Nitrogenous Nutrients by Phytoplankton in a Barrier Island Estuary; Great South Bay, New York. Estuarine Coastal Shelf Sci., 17:483-493.

Kluft, J.M. 1998. Beach Macroinvertebrate Communities at Fire Island National Seashore. M.S. Thesis SUNY Stony Brook (in prep).

Knisley, C.B. and T.D. Schultz. 1997. The Biology of Tiger Beetles and a Guide to the Species of the South Atlantic States. Virginia Museum of Natural History. Special Publication No. 5.

Koetzner, K. L. 1963. An Ecological Survey of the Algae of the Great South Bay, N.Y. M.S. Thesis. University of Rhode Island, Kingston, Rhode Island.

Koppleman, L. E. 1978. Long Island Comprehensive Waste Treatment Management Plan. Nassau-Suffolk Regional Planning Board. Hauppauge, New York. Vol. I and II, July.

LaSalle, M.W. and D.G. Clarke. July 1991. A Framework for Assessing the Need for Seasonal Restrictions on Dredging and Disposal Operations. Dredging Operations Technical Support Program, Technical Report D-91-1. U.S. Department of the Army, Waterways Experiment Station, Vicksburg, Mississippi.

Leatherman, S.P. and J.R. Allen, 1985. Final Report: Geomorphic Analysis of South Shore of Long Island Barriers, New York. Report prepared for New York District Army Corps of Engineers, by National Park Service, Boston, Massachussetts.

Leatherman, S.P. 1982. Barrier Island Handbook. Second Edition. 109 pp.

Leatherman, J.S.1988. Barrier Island Handbook. Coastal Publication Series, Laboratory for Coastal Research, The University of Maryland, College Park, Maryland.

Levine, E., Editor. 1998. Bull's Birds of New York State. Federation of New York State Bird Clubs, Inc., in association with the American Museum of Natural History. Cornell University Press, Ithaca, New York.

Long Island Railroad (LIRR), Public Affairs office. 1998. Personal Communication. Jamaica, New York.

Long Island Regional Planning Board. 1982. The Long Island Segment of the National Urban Runoff Program. Hauppauge, New York. 133 pp.

Long Island Regional Planning Board. October 1984. Hurricane Damage Mitigation Plan for the South Shore of Nassau and Suffolk Counties, New York. LIRPB, Hauppauge, New York.

Long Island Regional Planning Board. December 1989. Proposed Long Island South Shore Hazard Management Program. LIRPB, Hauppauge, NY.

Lowery, M. 1998. Personal Communication. New York State Dept. Of Environmental Conservation, Division of Natural Resources, Stony Brook, New York.

MacKenzie, C. and J.R. Moring. April 1985. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (North Atlantic) - American Lobster. U.S. Fish & Wildlife Service Biol. Rep. 82 (11.33) U.S. Army Corps of Engineers, TR EL-82-4.

Marine Mammal Protection Act of 1972. As Amended Through 1988.

Marine Mammal Protection Act. Amendments of 1994. Public Law 103-238. April 30, 1994.

McCarthy, M.J., E.J. Schmelt, and G.R. Lehan. November 14-19, 1982. Construction of a Breach Closure in a Barrier Island. Reprint from the Proceedings of the Eighteenth Coastal Engineering Conference ASCE/Cape Town, South Africa.

McCluskey & Nordstrom. 1985. The Effects of Houses and Sand Fences on the Eolian Sediment Budget at Fire Island, New York, Journal of Coastal Research.

McCormick, Jack and Associates, Inc. 1975. Environmental Inventory of the Fire Island National Seashore and the William Floyd Estate, Suffolk County, New York. Report prepared for the National Park Service, Denver, Colorado under Contract No. 2000-4-0010/

McCormick, L.R., O.H. Pilkey, Jr., W.J. Neal, and O.H. Pilkey, Sr. 1984. Living with Long Island's South Shore.

McHugh, J.L. 1972. Marine Fisheries of New York State. Fishery Bulletin 70(3): 585-610.

Mid-Atlantic Fishery Management Council, Atlantic States Marine Fisheries Commission, National Marine Fisheries Service, and South Atlantic Fishery Management Council. August 1998. Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. Mid- Atlantic Fishery Management Council under NOAA Award No. NA57FC0002.

Mid-Atlantic Fishery Management Council, Atlantic States Marine Fisheries Commission, National Marine Fisheries Service, and South Atlantic Fishery Management Council. October 1998a. Atlantic Surf Clam and Ocean Quahog Fishery Management Plan. Mid- Atlantic Fishery Management Council under NOAA Award No. NA57FC0002.

Mid-Atlantic Fishery Management Council, Atlantic States Marine Fisheries Commission, National Marine Fisheries Service, and South Atlantic Fishery Management Council. October 1998b. Bluefish Fishery Management Plan Mid-Atlantic Fishery Management Council under NOAA Award No. NA57FC0002.

Mid-Atlantic Fishery Management Council, Atlantic States Marine Fisheries Commission, National Marine Fisheries Service, and South Atlantic Fishery Management Council. October 1998c. Summer Flounder, Scup and Black Sea Bass Fishery Management Plan. Mid-Atlantic Fishery Management Council under NOAA Award No. NA57FC0002.

Mitchell, R.S. 1986. A Checklist of New York State Plants. Bulletin No. 458, New York State Museum: Albany, NY.

Moffatt & Nichol, Engineers. November 1994. Impacts of Barrier Island Breaching on the Tidal Hydrodynamics, Salinity & Residence Times of Moriches Bay, New York. Report prepared for U.S. Corps of Engineers, New York District. Moffatt & Nichol, Baltimore, MD.

Monteleone, D.M. 1992. Seasonality and Abundance of Ichthyoplankton in Great South Bay, New York. Estuaries. Vol. 15, No. 2, pp 230-238.

Morreale, S.J. and V.J. Burke. Grey Literature - Undated. Conservation and Biology of Sea Turtles of the Northeastern United States. Quarterly Report to the National Marine Fisheries Service for Grant: NA26FL0406-01. Study funded by the NYSDEC Return a Gift to Wildlife Program.

Morreale, S. J. May 1992. The Status and Population Ecology of the Diamondback Terrapin, *Malaclenys Terrapin*, in New York. Okeanos Ocean Research Foundation, Inc., New Your State Department of Environmental Conservation, Return a Gift to Wildlife Program, Contract No. C002656 and The Nature Conservancy, South Fork/Shelter Island Chapter.

Morreale, S. J., Meylan, A., and B. Baumann. August 1989. Sea Turtles in Long Island Sound, New York: An Historical Perspective. Proceedings of the Ninth Annual. Workshop on Sea Turtle Conservation and Biology. pp. 121-123 NOAA Tech. Memo. NMFS-SEFC- 232.

Morreale, S. J. and V. J. Burke. Draft. Undated. Conservation and Biology of Sea Turtles in the Northeastern United States. Cornell University, Ithaca, NY.

Morreale, S. J., Meylan, A. B., Sadove, S. S., and E.A. Standora. 1992. Annual Occurrence and Winter mortality of Marine Turtles in New York Waters. Journal of Herpetology, Vol. 26, No.3, pp. 301-318.

Morreale, S. J., and E. A. Standora. 1987- 1988. Kemp's Ridley Sea Turtle Study 1987- 1988: Occurrence, and activity of the Kemp's Ridley (*Lepidochelys kempi*) and Other Sea Turtles of Long Island, New York.. Jointly Report by Okeanos Ocean Research Foundation Inc., and SUNY at Buffalo.

Morreale, S. J., and E. A. Standora. April 1988-April 1989. Occurrence, Movement and Behavior of the Kemp's Ridley and Other Sea Turtles in New York Waters. Okeanos Ocean Research Foundations Annual Report for the New York State Department of Environmental conservation, Return A Gift To Wildlife Program. Contract No. C001984.

Morreale, S. J., and E. A. Standora. April 1989-April 1990. Occurrence, Movement and Behavior of the Kemp's Ridley and Other Sea Turtles in New York Waters. Okeanos Ocean Research Foundations Annual Report for the New York State Department of Environmental conservation, Return A Gift To Wildlife Program. Contract No. C001984.

Morreale, S. J. and E.A. Standora. 1991. Habitat use and feeding activity of juvenile Kemp's Ridleys in inshore waters of the Northeastern U.S. in Proceedings of the Eleventh Annual Workshop on Sea Turtle Conservation and Biology. NOAA Tech. Mem., February 1991.

Morreale, S. J., and E. A. Standora. April 1991-April 1992. Occurrence, Movement and Behavior of the Kemp's Ridley and Other Sea Turtles in New York Waters. Okeanos Ocean Research Foundations Annual Report for the New York State Department of Environmental conservation, Return A Gift To Wildlife Program. Contract No. C001984.

Naqvi, S.M. and E.J. Pullen. December 1982. Effects of Beach Nourishment and Borrowing on Marine Organisms. Miscellaneous Report No. 82-14. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia.

Nassau-Suffolk Regional Planning Board. Circa 1974. "A Methodology to Achieve the Integration of Coastal Zone Science and Regional Planning."

National Marine Fisheries Service. 1998. Annual Landings by Species for New York as of June 16, 1998.

National Marine Fisheries Service and US Fish & Wildlife Service. 1991. Recovery Plan for U.S. Population of Loggerhead Turtle (*Caretta caretta*). National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service and U.S. Fish & Wildlife Service. 1992. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). National Marine Fisheries Service, St. Petersburg, Florida.

National Oceanic and Atmospheric Administration. 1991. Status of Fishery Resources Off the Northeastern United States for 1991. NOAA Technical Memorandum NMFS-F/NEC-86.

National Oceanic and Atmospheric Administration. 1992. Atlantic Ocean Surf Clam Population Assessment. Prepared by: Richard Fox. Bureau of Shell Fisheries.

National Oceanic and Atmospheric Administration. 1995. Amendment 5 to the Fishery Management Plan and the Final Environmental Impact Statement for the Atlantic Mackerel, Squid, and Butterfish Fishery.

National Oceanic and Atmospheric Administration. 1995. Status of the Fishery Resources Off the Northeastern United States for 1994. NOAA Technical Memorandum NMFS-NE- 108.

National Park Service. Fire Island National Seashore. February 11, 1998. Environmental Assessment for Endangered Species Habitat Management.

National Park Service. 1993a. Environmentally Preferred Plan, Piping Plover Protection. U.S. Department of the Interior, Fire Island National Seashore, Patchogue, New York.

National Park Service. 1993b. Interim Plan, Piping Plover Protection. U.S. Department of the Interior, Fire Island National Seashore, Patchogue, New York.

National Park Service. 1994a. Environmental Assessment: Management Plan for Shoreside Species Breeding Habitat. Fire Island National Seashore, National Park Service, U.S. Department of the Interior.

National Park Service. 1994b. Inventory of Historic Light Stations. National Maritime Initiative, U.S. Department of the Interior, national Park Service, History Division, New York.

National Park Service. August 1997. A Field Evaluation of Fire Island National Seashore Estuarine Resources with an Emphasis on Nekton Communities. Technical Report NPS/NESO-RNR/NRTR/97-08. US Department of the Interior, National Park Service, New England System Support Service Office, Boston, Massachusetts.

National Research Council. 1990. Decline of the Sea Turtles: Causes and Prevention. Committee on Sea Turtle Conservation, Board on Environmental Studies and Toxicology, Board on Biology, Commission of Life Sciences and National Research Council. National Academy Press, Washington, D.C.

Nelson, W.G. July 1985. Guidelines for Beach Restoration Projects. Part I. Biological Guidelines. Report No. 76. Florida Sea Grant College, Florida Institute of Technology, Melbourne, Florida.

New York City Department of Environmental Protection. 1991. New York Harbor Water Quality Survey, 1988-1990.

New York Sea Grant. 1993. Estuarine Resources of the Fire Island National Seashore and Vicinity. Prepared by N.Y. Sea Grant Institute. Prepared for National Park Service.

New York State Department of Environmental Conservation. Undated Pamphlet. Sea Turtles: New York State Reptiles. Return a Gift to Wildlife Program, New York State Department of Environmental Conservation, Albany, New York.

New York State Department of Environmental Conservation. 1985. New York State Breeding Bird Atlas Project. 1980-1985 Data.

New York State Department of Environmental Conservation. 1987. Significant Coastal Fish and Wildlife Habitats in Nassau and Suffolk Counties.

New York State Department of Environmental Conservation, 1990. New York Natural Heritage Program.

New York State Department of Environmental Conservation. September 1991. South Shore mainland Marshes Focus Area Plan (Long Island) Atlantic Coast Venture. New York State Department of Environmental Conservation, Stony Brook, New York.

New York State Department of Environmental Conservation. 1993. Endangered, Threatened, and Special Concern Fish and Wildlife Species of New York State. Wildlife Resources Center, Delmar, N.Y.

New York State Department of Environmental Conservation. February 1993. 1990-1991 Long Island Colonial Waterbird and Piping Plover Survey. Vols I and II. NYS Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Stony Brook, NY and Seatuck Foundation, Islip NY. Document prepared by T. Litwin, A. Ducey-Ortiz, R. Lent and C. Liebelt.

New York State Department of Environmental Conservation. 1994a. Atlantic Ocean Surf Clam Population Assessment Borrow Area 2 Off Rockaway Beach. Prepared by Richard Fox. Bureau of Shell Fisheries.

New York State Department of Environmental Conservation. March 1994b. Atlantic Ocean Surf Clam Population Assessment Borrow Area 2 Off Rockaway Beach. Report.

New York State Department of Environmental Conservation. December 1994c. 1992-1993 Long Island Colonial Waterbird and Piping Plover Survey. NYS Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Stony Brook, NY and Nongame and Habitat Unit, Delmar, NY. Document prepared by L. Sommers, R. Miller, K. Meskill and M. Alfier

New York State Department of Environmental Conservation. July 1995. 1994 Long Island Colonial Waterbird and Piping Plover Survey. NYS Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Stony Brook, NY and Nongame and Habitat Unit, Delmar, NY. Document prepared by K. Meskill, M. Alfieri, L. Sommers and R. Miller.

New York State Department of Environmental Conservation. 1996a. 1996 Piping Plover Productivity Survey: Site Summary. Division of Fish & Wildlife. Region 1, Stony Brook, NY.

New York State Department of Environmental Conservation. 1996b. New York State shellfish production data, 1993-1995.

New York State Department of Environmental Conservation. July 1996c. 1995 Long Island Colonial Waterbird and Piping Plover Survey. NYS Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Stony Brook, NY and Wildlife Resources Center, Delmar, NY. Document prepared by L. Sommers, M. Alfieri., K. Meskill and R. Miller.

New York State Department of Environmental Conservation. March 1997a. New York Rare Plant Status List; New York Natural Heritage Program. Albany, New York.

New York State Department of Environmental Conservation. April 1997b. 1996 Long Island Colonial Waterbird and Piping Plover Survey. NYS Department of Environmental Conservation, Division of Fish, Wildlife and Marine Resources, Stony Brook, NY and Wildlife Resources Center, Delmar, NY. Document prepared by L. Sommers and M. Alfieri.

New York State Department of Environmental Conservation. 1998a. First Draft. Database Report —NY Natural Heritage Program. Biological Information for the Fire Island Management Plan (FIMP) Interim Study DEIS.

New York State Department of Environmental Conservation. 1998b. NY Natural Heritage Program Natural Heritage Database Report on Rare Species and Ecological Communities. Site Specific Report: Fire Island Inlet to Moriches Inlet.

New York State Department of Environmental Conservation. March 1998c. Animal Status List (Active Inventory and Watch List). NY Natural Heritage Program.

New York State Department of Environmental Conservation. April 1998d. NY Natural Heritage Program, New York State Rare Plant Status List. NYSDEC Division of Lands and Forests.

New York State Department of State. 1987. Significant Coastal Fish and Wildlife Habitats in Nassau and Suffolk Counties.

New York State Department of State. 1991. Draft: Long Island's Beach-Nesting Shorebird Habitat. Prepared by NYSDOS and The Nature Conservancy.

New York State Department of State and U.S. Fish & Wildlife Service. October 24, 1997. Draft Technical Report. South Shore Estuary Reserve, Coastal Colonial Waterbirds. NYSDOS, Albany, NY.

Nuzzi, Dr. Robert. 1998. Personal Communication. Physician. Suffolk County Department of Health Services, Office of Ecology, Riverhead, New York.

Nyman, R. M.and D. O. Conover. 1988. The relation between spawning season and the recruitment of Young-of-the Year bluefish, Pomatomus Saltatrix, to New York. Fishery Bulletin. Vol. 86 (2).

O'Connell Jr., A. F. and M. Sayre. 1989. White-tailed Deer Management Study: Fire Island National Seashore.

O'Connor, J. and O.W. Terry. 1972. The Marine Wetlands of Nassau and Suffolk Counties, New York.

O'Connor, J.S. 1972. The Benthic Macrofauna of Moriches Bay, N.Y. Biol. Bull., 142:84-102.

Okeanos Ocean Research Foundation, Inc. 1993. Species Composition and Distribution of Marine Mammals and Sea Turtles in the New York Bight. Final Report to U.S. Fish and Wildlife Service, South New England - New York Bight Coastal Estuaries Project, Charlestown, Rhode Island.

Pachta, N. 1990. Statement of Deer and Vegetation Management Options for the Deer and Vegetation Management Plan, Fire Island National Seashore. US Department of the Interior, National Park Service, Fire Island National Seashore, Patchogue, New York.

Parr, T., D. Diener and S. Lacy. December 1978. Effects of Beach Replenishment on the Nearshore Sand Fauna at Imperial Beach, California. Miscellaneous Report No. 78-4. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia.

Pearce, J.B., D.J. Radoshi, J.V. Caracciolo, and F.W. Steimle, Jr. 1981. Benthic Fauna. MESA Monograph 14. N.Y. Sea Grant Institute, Albany, N.Y.

Perry, B. 1985. A Sierra Club Naturalist's Guide to the Middle Atlantic Coast. Sierra Club Books, San Francisco, CA.

Peterson, R.T.1980. A Field Guide to the Birds : Eastern Birds. Houghton Mifflin Co., New York, NY.

Petrides, G.A. 1958. A Field Guide to Trees and Shrubs of Northeastern and North-Central United States and Southeastern and South-Central Canada. Houghton-Mifflin Company. Boston, MA: 428 pp.

Ray, G. and D. Clarke, 1995. Preconstruction Monitoring for Reach 1 of the Asbury/Manasquan Section of the Atlantic Coast of New Jersey Sandy Hook to Barnegat Inlet Beach Erosion Control Project. Interim report prepared for U.S. Army Engineer District, New York by U.S. Army Corps of Engineers, Waterways Experiment Station.

Ray, G.L., D. Clarke, P. Wilber, and T.J. Fredette. July 1994. Ecological Evaluation of Mud Flat Habitats on the Coast of Maine Constructed of Dredged Material. Environmental Effects of Dredging, Vol. D-94-3.

Reed, P.B. Jr. 1988. National List of Plant Species That Occur in Wetlands: Northeast (Region 1). U.S. Fish Wildlife Service Biological Report 88(26.1): 111 pp.

Reilly, F.J., Jr. and V.J. Bellis. 1978. A Study of the Ecological Impact of Beach Nourishment with Dredged Materials on the Intertidal Zone. Prepared for U.S.A.COE Wilmington District and the Office of Marine Affairs, Dept. Of Administration, State of N.C. Institute for Coastal and Marine Resources. Technical Report No. 3.

Reilly, F.J., Jr., and V.J. Bellis. March 1983. The Ecological Impact of Beach Nourishment with Dredged Materials on the Intertidal Zone at Bogue Banks, North Carolina. Miscellaneous Report No. 83-3. US Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia.

Reiss, Warren. 1995. Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, Fire Island to Moriches Inlet Interim, Suffolk County, New York.. Prepared by Moffatt and Nichol, Engineers in affiliation with Ocean Surveys, Inc. Prepared for the U.S. Army Corps of Engineers, New York District.

Reschke, C. March 1990. Ecological Communities of New York State. New York Natural Heritage Program, New York State Department of Environmental Conservation, Latham, NY.

RMC Environmental Services. 1996. Fire Island Inlet to Montauk Point Reformulation. Borrow Sites Macroinvertebrate Community Characterization. Prepared for U.S. Army Corps of Engineers Contract No. DACW51-94-D-0035.

Robins, C.R. and G.C. Ray. 1986. A Field Guide to Atlantic Coast Fishes of North America. Houghton Mifflin Company, Boston.

Ryther, J.H. 1954. The Ecology of Phytoplankton Blooms in Moriches Bay and Great South Bay, Long Island, New York. Biological Bulletin. 106:199-209.

Ryther, J.H. 1989. Historical Perspective of Phytoplankton Blooms on Long Island and the Green Tides of the 1950's. In: "Novel Phytoplankton Blooms: Causes and Impacts of Recurrent Brown Tides and Other Unusual Blooms", Cosper, E.M., E.J. Carpenter, and V.M. Bricelj (Eds.), Lecture Notes on Coastal and Estuarine Studies, Springer-Verlag, Berlin, pp. 375-381.

Sadove, S. and P. Cardinale. 1993a. Species Composition and Distribution of Marine Mammals and Sea Turtles in the New York Bight; Final Report to United States Fish & Wildlife Service Southern New England B New York Bight Coastal Estuaries Project, Charlestown Rhode Island, Okeanos Ocean Research Foundation, Inc., Hampton Bays, New York, December 1993.

Sadove, S.S. and P. Cardinale. December 1993b. Species Composition and Distribution of Marine Mammals and Sea Turtles in the New York Bight. Okeanos Research Foundation, Inc., Hampton Bays, New York.

Safina, C. 1983. Roseate Terns: Distribution, Identification, Ecology. New York State Breeding Bird Atlas Newsletter No. 9. National Audubon Society, Islip, New York .

Safina, C. January 1984. Draft Proposal: Comparative Study of the Breeding Biology of Common Terns Nesting In Salt Marsh and Barrier Beach Colonies. National Audubon Society, Islip, New York .

Safina, C. 1985. Tern Conservation and Research. 1985 Report. National Audubon Society, Scully Sanctuary. Islip, New York .

Safina, C. and J. Burger. 1985. Common Tern Foraging: Seasonal Trends in Prey Fish Densities and Competition with Bluefish. Ecology, 66(5), pp.1457-1463.

Salisbury, E. J. 1952. Downs and Dunes, Their Plant Life and its Environment. G. Bell and Sons, London.

Saloman, C.H., S.P. Naughton, and J.L. Taylor. March 1982. Benthic Community Response to Dredging Borrow Pits, Panama City, Florida. Miscellaneous Report No. 82-3. US Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia.

Santomauro, F., P.E. July 16, 1998. Biological Assessment for the Fire Island Interim Storm Damage Protection Project Area. Correspondence from Frank Santomauro of US Army Corps of Engineers, New York District to Ms. Sherry Morgan of US Fish & Wildlife Service, Cortland, New York.

Schaefer, R.H. 1967. Species composition, size and seasonal abundance of fish in the surf waters of Long Island. N.Y. Fish and Game Journal. 14(1): 1-46.

Schmeltz, E.J., R.M. Sorensen, M.J. McCarthy, and G. Nersesian. November 14-19, 1982. Breach/Inlet Interaction at Moriches Inlet. Reprint from the Proceedings of the Eighteenth Coastal Engineering Conference, ASCE/Cape Town, South Africa.

Schubel, J.R., T.M. Bell, and H.H. Carter, eds. 1991. The Great South Bay. State University of New York Press, Marine Sciences Research Center, Stony Brook, New York .

Siddall, S.E. 1987. Climatology of Long Island Related to the Brown Tide Phytoplankton Blooms of 1985 and 1986. Grey Literature. Study conducted for the Suffolk County Department of Health Services. Marine Sciences Research Center, State University of New York at Stony Brook.

Sirkin, L.A. May - June 1972. Origin and history of maple bog in Sunken Forest, Fire Island, New York. Bulletin of the Torrey Botanical Club. Vol. 99 (3): 131-135.

Smith, J. D. 1962. Animals on the Outer Beach. Long Island Forum. August 1962.

Sorensen, R.M. and E.J. Schmeltz. October 1982. Closure of the Breach at Moriches Inlet. Shore and Beach.

Stalter, R., E.E. Lamont, and J. Northrup. July - September 1986. Vegetation of Fire Island, New York. Bulletin of the Torrey Botanical Club. Vol. 115 (3): 298-306.

Standora, E. A., Morreale, S. J., and A. Bolten. December 1992. Assessment of Sea Turtle Baseline Behavior and Trawling Efficiency in Canaveral Channel, Florida. Preliminary Report for U.S. Army Corps of Engineers Prime Grant No. DACW17-90-H-0015. Report Jointly prepared by Buffalo State College, Okeanos Ocean Research Foundation, Inc. and University of Florida.

Stone, S.L., T.A. Lowery, J.D. Field, C. D. Williams, D.M. Nelson, S.H. Jury, M.E. Monaco, and L. Andreasen. 1994. Distribution and abundance of fishes and invertebrates in Mid- Atlantic estuaries. ELMR Rep. No. 12. NOAA/NOS Strategic Environmental Assessments Division, Silver Spring, MD.

Steimle, F.W. and R.B. Stone. 1973. Abundance and Distribution of Inshore Benthic Fauna Off Southwest Long Island, New York. NOAA Tech. Rpt. NMFS SSFS-673.

Suffolk County Department of Health Services, Bureau of Marine Resources. 1996. Water quality monitoring data for Great South Bay, Moriches Bay, and Shinnecock Bay, 1977- 1995.

Tangren, S., A. 1988. A Geologic Investigation of the Salt Marsh System of Great South Bay. State University of New York at Stony Brook. p. 66. MS Thesis.

Terchunian, A.V. and C.L. Merkert. Summer 1995. Little Pikes Inlet, Westhampton, New York. Journal of Coastal Research, Vo. 11, No. 3., pp 697-703.

Thompson, J.R. January 1973. Ecological Effects of Offshore Dredging and Beach Nourishment: A Review. Miscellaneous Paper No. 1-73. U.S. Army Corps of Engineers, Coastal Engineering and Research Center, Washington, D.C.

Tubeville, D.B. and G.A. Marsh. 1982. Benthic Fauna of an Offshore Borrow Area in Broward County, Florida. Miscellaneous report 82-1. US Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia.

URS Consultants, Inc. and Moffatt and Nichol Engineers. 1999. Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York : Economics Interim Submission for the Fire Island Inlet to Moriches Inlet to Montauk Point Reformulation Study.

U.S. Army Corps of Engineers. 1972. Great South Bay (and Adjoining Lesser Bays and Inlets), Long Island, New York. Plan of Study for Water Resource Study. New York District.

U.S. Army Corps of Engineers. 1977. FEIS Fire Island Management Plan, Vol II. Beach Erosion Control and Hurricane Project. Appendix F - Biology.

U.S. Army Corps of Engineers. 1977. Final Environmental Impact Statement for Fire Island Inlet to Montauk Point, New York: Beach Erosion Control and Hurricane Protection Project. Volume I.

U.S. Army Corps of Engineers. 1983. General Design Memorandum, Moriches Inlet Project, Long Island, New York: Reformulation Study and Environmental Impact Statement.

U.S. Army Corps of Engineers. 1987. General Design Memorandum, Shinnecock Inlet Project, Long Island, New York: Reformulation Study and Environmental Impact Statement.

U.S. Army Corps of Engineers. December 1990. Alternative Dredging Equipment and Operational Methods to Minimize Sea Turtle Mortalities. Environmental Effects of Dredging Technical Notes. U.S. Army Engineers Waterways Experiment Station, Vicksburg, MS.

U.S. Army Corps of Engineers. February 1993. Montauk Point Reconnaissance Report. US Army Corps of Engineers, New York District.

U.S. Army Corps of Engineers. 1995. Fire Island Inlet to Montauk Point, New York: Moriches to Shinnecock Reach Interim Plan for Storm Damage Protection Technical Support Document with Final Environmental Assessment.

U.S. Army Corps of Engineers. Revised January 1996a. Fire Island Inlet to Montauk Point, Long Island, New York. Breach Contingency Plan. Executive Summary and Environmental Assessment. US Army Corps of Engineers, New York District.

U.S. Army Corps of Engineers. June 1996b. Fire Island Inlet to Montauk Point, Long Island, New York. Reach 1, Fire Island Inlet to Moriches Inlet: An Evaluation of an Interim Plan for Storm Damage Protection. Volume I, Main Report with Preliminary Assessment of Environmental Impacts. US Army Corps of Engineers, New York District.

U.S. Army Corps of Engineers. June 1997a. Project Study Plan (PSP): Feasibility Study, Habitat Restoration, Water Quality Improvement, and Related Environmental Features, South Shore of Long Island, New York. US Army Corps of Engineers, New York District.

U.S. Army Corps of Engineers. 1997b. "Memo for CENAN. PL : Detail Passenger Data for New York District for CY 1995, CY 1996, CY 1997". CEWRC-NDC-CQ (335).

U.S. Army Corps of Engineers. 1998. Draft Pre-Construction Baseline Studies Report: The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury to Manasquan Section, Beach Erosion Control Project, Phase I. US Army Corps of Engineers, New York District.

U.S. Army Corps of Engineers. 1999. Personal Communication.

U.S. Department of Commerce. April 1985. National Oceanic and Atmospheric Administration: Report of the Working Group on NEFC/SEFC Marine Mammal Research. Results of the Meeting Held January 8-9, 1985. NOAA Technical Memorandum NMFS-SEFC-168.

US Department of Commerce, January 1995. Status of the Fishery Resources off the Northeastern United States for 1994. NOAA Technical Memorandum NMFS-NE-108. Research Communications Unit, Northeast Fisheries Science Center, NMFS/NOAA, Woods Hole, Massachusetts.

U.S. Department of the Interior. February 1981. Fish & Wildlife Service Region 5, Environmental Inventory for the Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project Reformulation Study.

U.S. Department of the Interior. 1991. Northeast Coastal Area Study: Significant Coastal Habitats of Southern New England and Portions of Long Island. Prepared for U.S. House of Representatives and U.S. Senate, Committees on Appropriations. Southern New England Long Island Sound Coastal and Estuary Office.

U.S. Department of the Interior. December 1992. Endangered and Threatened Species Recovery Program. Report to Congress. U.S. Dept. of the Interior.

U.S. Department of the Interior. 1993. Interim Plan, Piping Plover Protection. Fire Island National Seashore, Patchogue, New York .

U.S. Department of the Interior. 1994. Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis Say*) Recovery Plan. Hadley, Massachusetts.

U.S. Department of the Interior. 1995. Migratory non-game birds of management concern in the United States: The 1995 list. Office of Migratory Bird Management. U.S. Fish & Wildlife Service, Washington D.C.

U.S. Department of the Interior. 1996. Piping Plover (*Charadrius melodus*), Atlantic Coast Population, Revised Recovery Plan, Hadley, Massachusetts.

U.S. Department of the Interior. 1997. A Field Evaluation of Fire Island National Seashore Estuarine Resources with an Emphasis on Nekton Communities. National Park Service Technical Report NPS/NESO-RNR/NRTR/97-08. Graduate School of Oceanography, University of Rhode Island, Naragansett, Rhode Island.

U.S. Department of the Interior. 1977. Final Environmental Statement, General Management Plan; Fire Island National Seashore, New York. FES 77-42. National Park Service, Denver.

U.S. Department of the Interior. 1997. Atlantic Coast of Long Island Fire Island Inlet to Montauk Point, Long Island, New York. Fire Island Inlet to Moriches Inlet and West of Shinnecock Inlet Interim Storm Damage Protection Projects. Prepared for USACE New York District. Prepared by U.S. Fish & Wildlife Service. Cortland, New York.

U.S. Department of the Interior. October 1997. South Shore Estuary Reserve: Sea Turtles, Diamondback Terrapin, Mud Turtles, and Seals Draft Technical Report.

U.S. Department of the Interior. October 31, 1997. South Shore Estuary Reserve, Sea Turtles, Diamondback Terrapin, Mud Turtles, and Seals - Draft Technical Report. U.S. Fish & Wildlife Service, Southern New England - New York Bight Coastal Ecosystems Program, Charlestown, RI.

U.S. Environmental Protection Agency. 1981. Estuarine Impact Assessment (Shellfish Resources) for the Nassau-Suffolk Streamflow Augmentation Alternatives: Draft Report on Existing Conditions.

U.S. Environmental Protection Agency. November 1982. Draft Report: Impact Assessment on Shellfish Resources of Great South Bay, South Oyster Bay and Hempstead Bay, New York. U.S. Environmental Protection Agency Region II, New York, N.Y.

U.S. Fish and Wildlife Service. 1981. Environmental Inventory for the Fire Island to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project Reformulation Study. New York Field Office, Cortland, New York.

U.S. Fish & Wildlife Service. 1988a. Draft Recovery Plan for Roseate Tern, (*Sterna douglalli*): Northeastern Population. Prepared by the Northeast Roseate Tern Recovery Team. Prepared for USFWS Region 5.

U.S. Fish & Wildlife Service. 1988b. Atlantic Coast Piping Plover Recovery Plan. U.S. Fish & Wildlife Service, Newton Corner, Massachusetts.

U.S. Fish & Wildlife Service. March 1988c. Atlantic Coast Piping Plover Recovery Plan. U.S. Fish & Wildlife Service, Region 5, Newton Corner, Massachusetts.

U.S. Fish & Wildlife Service. 1989. Recovery Plan for Roseate Tern Sterna dougallii, Northeastern Population. U.S. Fish & Wildlife Service, Region 5, Newton Corner, Massachusetts.

U.S. Fish & Wildlife Service and National Marine Fisheries Service. 1992a. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). National Marine Fisheries Service, St. Petersburg, Florida.

U.S. Fish & Wildlife Service. 1992b. Endangered and Threatened Species Recovery Program. Report to Congress. US Department of the Interior, U.S. Fish & Wildlife Service, Washington, D.C.

U.S. Fish & Wildlife Service. June 1995. Fish and Wildlife Coordination Act Report, Section 2(b): Fire Island Inlet to Montauk Point, Long Island, New York. Breach Contingency Plan. US Fish & Wildlife Service, Islip, New York.

U.S. Fish & Wildlife Service. May 1996. Piping Plover (*Charadrius Melodus*) Atlantic Coast Population. Revised Recovery Plan. USFWS, Hadley, MA.

U.S. Fish & Wildlife Service. October 31, 1997a. Draft Technical Report. South Shore Estuary Reserve, Waterfowl. USFWS, Southern New England, New York Bight Coastal Ecosystems Program, Charlestown, RI.

US Fish & Wildlife Service. November 1997b. Significant Habitats and Habitat Complexes of the New York Bight Watershed. Southern New England-New York Bight Coastal Ecosystems Program, Charlestown, Rhode Island.

US Fish & Wildlife Service, November 1998. Draft Fish and Wildlife Coordination Act Section 2(b) Report: Fire Island Inlet to Montauk Point Beach Erosion Control, and Hurricane Protection Project, Reach 2 – Moriches Inlet to Shinnecock Inlet Interim Storm Damage Protection Plan. US Fish & Wildlife Service, Islip, New York.

1991. Factors Affecting Strandings of Cold-Stunned Juvenile Kemp's Ridley and Loggerhead Sea Turtles in Long Island, New York. Copeia, (4), pp.1136-1138.

Wells, B.W. and I.V. Shunk. 1938. Salt spray, an important factor in coastal ecology. Bulletin of the Torrey Botanical Club 65:485-492.

Whipple, G. 1912. Effects of diversion of Suffolk County groundwaters upon the oyster industry in Great South Bay - Reports, resolutions, authorizations, surveys and designs showing the sources and manner of obtaining from Suffolk County, Long Island, no additional Supply of Water for the City of New York. Vol. 11, Appendix 12. Pp. 455-519.

Woodhead, P.M.J. 1992. Assessments of the Fish Community and Fishery Resources of the Lower New York Bay Area in Relation to a Program of Sand Mining Proposed by New York State. Marine Sciences Research Center, State University of New York at Stony Brook.

Woodward-Clyde Consultants, 1977. Rockaway Beach Erosion Control Project. Dredge Material Research Program Offshore Borrow Area - Final Report. Prepared for the Department of Army, New York District, Corps of Engineers.

Young, B.H., B. Ringers, T.W. Woithe, and C.T. Hamilton. July 1986. Striped Bass and the Sport Fishery During Daylight Hours From 1973 to 1975 at Montauk, New York. New York Fish and Game Journal. Vol. 33, No. 2.

Zaremba, R.E. and S.P. Leatherman. December 1984. Final Report: Overwash Processes and Foredune Ecology, Nauset Spit, MA. U.S. Army Engineers Experiment Station, Miscellaneous Paper EI-84-8. 232 pp.

WORLD WIDE WEB/INTERNET SOURCES

Terns

http://www.csc.noaa.gov

http://www.pwrc.usgs.gov

http://info.med.yale.edu/caim/terns/natural_history

http://communityservice.org/valleybirds/frames

http://www.qc.ec.gc.ca

http://eco.bio.lmu.edu/www_nat_history/birds

Plovers

http://texasbirding.simplenet.com/birds/piping.htm

http://pwl.netcom.com/~djhoff/pipllink.html

http://www.csc.noaa.gov

http://communityservice.org/valleybirds/frames

http://refuges.fws.gov/NWRSFiles/WildlifeMgmt/SpeciesAccounts/Birds/AtlPipingPlover/AtlPipingPloverIndex.html

http://www.mesc.usgs.gov/projects/piping-plover-hsi-model.html. May 1, 1998.

Raptors

http://www.raptor.cvm.umn.edu/raptor

Sea Turtles

http://www/nmfs.gov/tmcintyr/turtles

Fish

http://www.st.nmfs.gov/ows-bintest1/gc-runc_cgi.sh

http://www.noaa.gov/public-affairs/pr97/moaa97-4.html ❖

DEIS and Draft Decision Document Cross Reference

Subject	DEIS Page	DEIS Appendix	Draft Decision Document Page
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Affected Environment	Chapter 3	NA	NA
Alternatives to Interim Project	Chapter 2	NA	62, Appendix C
Appendices	End of DEIS	End of DEIS	Volume I-Appendices A,B and H Volume II Appendices C,D,E,F and G
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Authority	Chapter 1	NA	1
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NA – Not Applicable			

DEIS Appendix A—New York State Coastal Zone Management Program Consistency Determination

APPENDIX A: NEW YORK STATE COASTAL ZONE MANAGEMENT PROGRAM CONSISTENCY DETERMINATION

Project: Fire Island Interim Project

Applicant: U.S. Army Corps of Engineers, New York District (NYD)

Applicable Policies: Based on a review of the Coastal Zone Management Program policies for New York, 14 were found to be applicable to the formulation of the proposed interim project build alternatives. These policies are discussed below.

POLICY ANALYSIS

POLICY 1: Restore, revitalize and redevelop deteriorated and underutilized waterfront areas for commercial, industrial, cultural, recreational and other compatible uses.

Determination: The Fire Island Atlantic shoreline is not "deteriorated and underutilized," but it is subject to storm damage and erosion, which increases the potential for damage to structures and can disrupt access to recreational areas and downgrade opportunities for recreation on the island and mainland. As noted in DEIS Chapters 1, 2 and 3, Fire Island contains major parks and recreational areas, including Robert Moses State Park, Smith Point County Park, and the Fire Island National Seashore (FIIS). The Preferred Alternative/Interim Project would provide temporary (6-year) protection from storm damage. In doing so, these project alternatives would reduce damage and erosion and related disruption to recreational activities and access to the public shore. The project is therefore consistent with Policy 1.

POLICY 2: Facilitate the siting of water dependent uses and facilities on or adjacent to coastal waters.

Determination: The proposed project does not directly relate to this policy, in that is does not propose the siting of any use or facility. However, by reducing storm damage and erosion on Fire Island and by reducing flood damage on Long Island's bay shore, the project would improve conditions for the siting of such facilities as docks, boat launches and other water dependent uses related to commercial and recreational fishing and boating. The project is therefore consistent with Policy 2.

POLICY 7: Significant coastal fish and wildlife habitats will be protected, preserved, and where practicable, restored so as to maintain their viability as habitats.

Determination: The project study area (land and nearby waters) contains a number of significant coastal fish and wildlife habitats, including those designated by New York State Department of State, essential fish habitats designated by the National Marine Fisheries Service and the National Oceanographic and Atmospheric Administration, the federally designated Otis G. Pike Wilderness Area, important habitats such as the Sunken Forest, and other lands of the FIIS, classified in the GMP for environmental protection. The Preferred Alternative/Interim Project, which is temporary, is focused on providing storm damage protection in the developed areas/community districts on Fire Island and the south shore of Long Island. The plan has been designed to totally avoid major habitats, such as the Sunken Forest and Otis G. Pike Wilderness Area, to minimize any other intrusion into major federal lands with sensitive habitats, and to avoid disruption to important off-shore biota (see DEIS Chapter 4). As described in DEIS Chapter 4, Sections A through C, the project's alternatives would not affect most of these habitats and would have only temporary effects on others, through borrow area dredging and sand placement. An analysis of cumulative effects in Chapter 4, Section D, found no cumulative effect on these important resources. The project contains minimization measures to protect the piping plover (listed as threatened) and seabeach amaranth (endangered plant species), as described in DEIS Chapter 4, Section E. The project is therefore consistent with Policy 7.

POLICY 12: Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural protective features including beaches, dunes, barrier islands, and bluffs.

Determination: The purpose of the FIIP is to provide temporary storm damage protection to the barrier island and mainland areas along the bay shore until the findings of the Reformulation Study are available to determine whether a more permanent solution is feasible (see Chapter 1). The Preferred Alternative propose beach replenishment selectively placed to protect existing development, strengthen the barrier island, and avoid interference with sensitive habitats and protective features. The natural protective features of the barrier island would be better preserved and the bay shoreline of Long Island would be better protected from flooding. The project is therefore consistent with Policy 12.

POLICY 13: The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least 30 years, as demonstrated in design and construction standards and/or assure maintenance or replacement programs.

Determination: This policy aims to assure that "permanent" erosion protection structures are designed properly and will last in good working order for at least 30 years. There is no claim to permanent protection associated with the FIIP. The Preferred Alternative would not include assured maintenance and replacement for a period of 30 years after completion. Instead, the project would provide a guaranteed maintenance and replacement for a period of six years and a commitment to complete the Reformulation Study to select the optimum approach to long-term storm damage reduction. New York State Department of Environmental Conservation (NYCRR Part 505) Coastal Erosion Management Regulations also require that beach erosion projects must have a reasonable probability of controlling erosion for at least 30 years and that such projects must be maintained at the level of protection for a minimum period of 30 years. A variance to the Coastal Erosion Management Regulations will be sought for the interim project.

POLICY 14: Activities and development, including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development, or at other locations.

Determination: None of the project alternatives proposes erosion protection structures, e.g., groins, seawalls, etc. These were considered, but did not meet project objectives including the constraint that the proposed action be temporary and reversible. Moreover, as discussed under

Policy 12, above, the FIIP has been planned to provide storm damage protection on the barrier island and mainland bay shore, and modeling has demonstrated that it will not increase erosion or flooding in other areas (see Coastal Barrier Appendix to the Draft Decision Document). The project is therefore consistent with Policy 14.

POLICY 15: Mining, excavation or dredging in coastal waters shall not significantly interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land.

Determination: The sand for the beach nourishment would be obtained from a borrow area located well off-shore. These areas do not contribute sand to the beach, so that dredging in these areas would not lead to an increase in beach erosion. Modeling has demonstrated that the dredging would not affect the natural transport of sand on the beaches (see Coastal Barrier Appendix to Draft Decision Document). The project is therefore consistent with Policy 15.

POLICY 17: Non-structural measures to minimize damage to natural resources and property from flooding and erosion shall be used whenever possible.

Determination: The proposed use of suitable dredged sand for beach nourishment is a non-structural measure that minimizes damage to natural resources and property from flooding and erosion by strengthening Fire Island's natural protective features and providing the sediments necessary for these features to function (see also Policies 12 and 15). Other non-structural options were considered, as discussed in Chapter 2, but these did not meet the objective that the proposed action be temporary and reversible. The project is therefore consistent with Policy 17.

POLICY 18: To safeguard the vital economic, social and environmental interests of the State and of its citizens, proposed major actions in the coastal area must give full consideration to those interests, and to the safeguards which the State has established to protect valuable coastal resource areas.

Determination: The issues of vital economic, social, and environmental issues of the State and its citizens were considered, among others, and deliberated upon by the Governor's Task Force on Coastal Resources and its recommendations in 1991, and the recommendations of the Governor's Coastal Erosion Task Force in 1994. The general public, special interest groups, several local governments, and State agencies were represented on, advised, and provided other assistance to the Task Forces during their deliberations. Both Task Forces concluded that the south shore barriers, their associated protective features, and the processes that those barriers and features are dependent on should be maintained and protected for their important natural protective values. Those Task Forces and several other task forces and commissions, as well as other special government reports and studies, all indicate that the Long Island south shore barriers and their associated natural protective features should be repaired where necessary and maintained for their protective capabilities. All of those Task Forces, commissions and boards—as well as other studies, plans, and associated activities relating to flooding and erosion hazards on the south shore of Long Island—recognize the overriding need to maintain the south shore barriers for the protection they afford to the Long Island south shore mainland and the south shore bays. The DEIS demonstrates the need for the FIIP in providing temporary protection to Fire Island and the Long Island bay shore communities that the island protects (see Chapter 1), and demonstrates that by providing this protection the project would support economic, social and environmental interests in the study area (see Chapter 4, Sections B, C, and D). The project is therefore consistent with Policy 18.

POLICY 19: Protect, maintain, and increase the level and types of access to public water-related recreation resources and facilities.

Determination: As noted above and in DEIS Chapters 1 and 3, the project area contains the FIIS, which supports and maintains a number of recreational areas on Fire Island, Smith Point County Park (which lies within the FIIS boundaries), and Robert Moses State Park. These facilities support a variety of public recreational activities that attract people regionally, as discussed in DEIS Chapter 3. The increased width of the nourished public beach and the continued protection and maintenance of the beach as a public resource would ensure that these recreational resources remain available to the public. The project is therefore consistent with Policy 19.

POLICY 20: Access to the publicly owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly owned shall be provided and it shall be provided in a manner compatible with adjoining uses.

Determination: Under the Preferred Alternative/Interim Project all of the publicly owned land on Fire Island would remain in public ownership and the new land formed by beach fill would be public land for the most part. The proposed alternatives contain a Public Access Plan, as discussed in the Draft Decision Document. The project is therefore consistent with Policy 20.

POLICY 23: Protect, enhance, and restore structures, districts, areas, or sites that are of significance in the history, architecture, archaeology, or culture of the State, its communities or the Nation.

Determination: The DEIS contains a careful examination of the project's potential to affect cultural resources, including those of historical, architectural, archaeological and cultural significance (see Chapters 3 and 4). The analysis concludes that the Preferred Alternative/Interim Project would offer increased protection against storm damage or disruption to such resources. Among the resources identified are the Fire Island Lighthouse, which is on the National Register of Historic Places and potential buried archaeological resources and shipwrecks. The plan also contains a program for protection of potential shipwrecks in or near the proposed borrow area, primarily in the form of additional remote sensing and a 150-foot buffer zone (i.e., "no dredging" zone) around any such potential site in or near dredging activity. The project is therefore consistent with Policy 23.

POLICY 35: Dredging and dredge spoil disposal in coastal waters will be undertaken in a manner that meets existing State dredging permit requirements and protects significant fish and wildlife habitats, scenic resources, natural protective features, important agricultural lands, and wetlands.

Determination: Although there is dredging for this project it is for the specific purpose of obtaining suitable material for the placement of sand on certain beaches along the Atlantic coastline of Fire Island. The proposed action is subject to Water Quality Certification from the New York State Department of Environmental Conservation, as described in Appendix B. The widening of the beach and increases in dune heights would strengthen Fire Island's natural protective features and reduce storm damage and erosion. This, in turn, would maintain conditions in Great

South Bay, which is a Significant Coastal Fish and Wildlife Habitat. Impacts on other environmental resources would be relatively minor and temporary. The project also proposes impact minimization measures for the piping plover and seabeach amaranth. The project is therefore consistent with Policy 35.

POLICY 44: Preserve and protect tidal and freshwater wetlands and preserve the benefits derived from these areas.

Determination: By strengthening the protective features of Fire Island, the potential for overwash and breaches is reduced. As discussed in DEIS Chapter 4, Section A, overwash can damage wetlands by covering them with sand and killing vegetation, and breaching scour out the soils or simply wash wetlands away. The project is therefore consistent with Policy 44.

CONCLUSION

Based on the preceding policy analysis, the NYD has determined that the Preferred Alternative/ Interim Project would be consistent with and would advance the policies and purposes of the New York State Coastal Zone Management Program. ❖

DEIS Appendix B—Draft 404(b)(1) Evaluation Report

APPENDIX B

DRAFT 404(B)(1) EVALUATION REPORT
ATLANTIC COAST OF LONG ISLAND,
FIRE ISLAND INLET TO MONTAUK POINT, NEW YORK
FIRE ISLAND
INTERIM PLAN FOR STORM DAMAGE PROTECTION

I. PROJECT DESCRIPTION

(a) Location: The study area is a barrier island located off Long Island, New York between Fire Island inlet on the west and Moriches Inlet on the east. The island is about 31 miles long and generally less than 2,500 feet wide. The area lies within the authorized Federal Beach Erosion and Hurricane Protection project for Fire Island Inlet to Montauk Point, New York. The sand placement area is located approximately 50 miles by water east of the Battery, New York.

(b) General Description: The New York District has investigated public concerns within the project area related to beach erosion control and wave attack. Significant erosion has taken place in project area, and a breach of the barrier island is expected to occur if no action is taken.

The proposed project would involve fill deposition at various locations on Fire Island. The beach fill placement would be tapered into the existing shoreline profiles and area topography. The placement area would blend with the existing beach and dunes to the west. The design profile in the placement area would have a minimum 25-foot-wide dune with a maximum design crest elevation of +15 or +18 feet NGVD, and a minimum design beach berm width of 40 or 90 feet, elevation of 9.5 or 11.5 feet NGVD. The project would involve an initial fill volume of approximately 7,747,000 cubic yards (cy) of beach fill.

Beach fill would be hydraulically dredged from several possible borrow area locations, including an Atlantic Ocean offshore borrow area. The offshore borrow area would be the primary source of material for the proposed project, and a supplemental source would be material from the flood and navigation channel/deposition basin. The availability of fill material from the flood shoal is contingent on positive results from a sediment suitability analysis, cultural resources impact assessment, and monitoring of the response of the inlet system to dredging. Availability of material from the inlet navigation channel/deposition basin is dependent upon availability and the need for maintenance dredging operations.

The design and analysis of the interim plan has been evaluated for a period of six years. This interim project will be maintained for six years, including the period of initial construction, and two scheduled nourishment cycles. This time period should be sufficient to complete the Reformulation Study.

(c) Authority: The overall Fire Island Inlet to Montauk Point, Combined Beach Erosion Control and Hurricane Protection Project was authorized by the River and Harbor Act of July 14, 1960 in accordance with House Document 425, 86th Congress, 2nd Session, dated June 21, 1960, and subsequently modified in accordance with Section 103 of the River and Harbor act of October 12, 1962. The project was again modified for the cost sharing of the beach erosion portion of the project authorization was modified again by Section 31 of the Water Resources Development Act of 1964, which increased Federal participation to 70% of the first cost of the project. The authorization was further modified by Section 502 of the

Water Resources Development Act of 1986 (P.L. 99-662), which directed the Secretary of the Army to apply the cost sharing provisions of Section 31(1) of the Water Resources Development Act of 1974 (P.L. 93-251) to include periodic nourishment of the continuing construction project at Westhampton Beach, New York for a period of 20 years after the date of enactment of P.L. 99-662. The Water Resources Development Act of 1992 further modified the Federal participation in the project to extend the period of periodic nourishment for 30 years from the date of project completion for Westhampton Beach with the non-Federal share not to exceed 35 percent of the total project cost.

(d) General Description of Fill Material:

(1) General Characteristics of Material: The excavated material would consist primarily of medium-grained, glacially outwashed gray sands. Seismic data suggest that the sands are fairly homogeneous with little changes in sediment characteristics other than compaction and slight gradual changes in grain-size. The limits of the borrow area were delineated on the basis of seismic profiles and sediments samples taken from vibratory cores of the area.

(2) Quantity of Material: Approximately 7,747,000 cubic yards of material will be initially dredged from the proposed borrow area and about 2,709,000 cubic yards for the renourishment cycle (Section 2.02).

(3) Source of Materials: Borrow area as primary, and others as secondary as described in Ib of this appendix, above.

(e) Description of the Proposed Discharge Site:

(1) Location: Project area as described in 1b, above.

(2) Size: The placement area is 11.3 miles long.

(3) Type of Sites/Habitat: Hydraulic placement will be on a beach habitat. Surface water classification in the vicinity of the study area is SA as designated by the New York State Department of Environmental Conservation (NYSDEC). This classification permits fishing and secondary recreation, and shellfishing for marketing purposes (Sections 5.05-5.13).

(4) Time and Duration of Disposal: Under the plan, construction would be completed within an estimated 2 month period.

(f) Description of Disposal Methods: Use of hydraulic dredging equipment is expected upon depending construction methods selected by the contractor(s).

II. FACTUAL DETERMINATIONS

(a) Physical Substrate Determinations:

(1) Substrate Elevation and Slope: A design beach onshore slope of 1(v):15(h) to -2 NGVD would be constructed. No major impacts are expected. The modified beach slope would

return to a natural slope seaward of the new Mean High Water (MHW) line.

(2) Sediment Type: No major impacts are expected because sediments ~~similar to those~~ present in the placement areas would be utilized.

(3) Dredged/Fill Material Movement: No major impacts are expected and normal shore processes would continue.

(4) Physical Effects on Benthos: Some benthic forms may be smothered by burial. These species are expected to recolonize fairly quickly, therefore, no long-term effects are anticipated (Section 7.03-7.08).

(5) Other Effects: Not applicable.

(6) Actions Taken to Minimize Impacts: Section 7.108.

(b) Water Circulation, Fluctuation and Salinity Determinations:

(1) Water. Consider effects on:

(i) Salinity—Not applicable
(ii) Water Chemistry (pH, etc.)—No major impacts are expected.
(iii) Clarity—Temporary increases in turbidity will occur during hydraulic dredging and placement of sand on the beaches. Minor impacts are expected in view of natural turbid condition along shore zone.
(iv) Color—No major impacts are expected.
(v) Odor—No measurable odors are expected.
(vi) Taste—Not applicable
(vii) Dissolved Gas Levels—Possible short-term variations may occur due to turbulence caused by barge overflow, and dredging operations.
(viii) Nutrients—Potential short-term increase, but no longer term effects are expected.
(ix) Eutrophication—Not applicable.
(x) Others as Appropriate—Not applicable.

(2) Current Pattern and Circulation:

(i) Current Pattern and Flow—Sediment transport at the placement areas is dominated by wave driven, long shore currents which tend to move sediment, over much of the project length. This would continue.

(ii) Velocity—No major changes are expected due to discharge/fill placement operations.

(iii) Stratification—Not applicable.

(3) Normal Water Level Fluctuations: The proposed action will shift the high-water line offshore from its present location, but will not alter water level nor tidal changes.

(4) Salinity Gradients: Not applicable.

(5) Actions Taken to Minimize Impacts: Not applicable.

(c) Suspended Particulate/Turbidity Determinations:

(1) Expected Changes in Suspended Particles and Turbidity Levels in Vicinity of Disposal Site(s): Temporary increases in turbidity due to hydraulic pumping are expected. However, the existing environment at the placement area is turbid, and therefore, any increase in turbidity will not be noticeable and would be short term.

(2) Effects on Chemical and Physical Properties of the Water Column:

(i) Light Penetration—Particles will settle fairly rapidly. Minor short term impacts are anticipated.

(ii) Dissolved Oxygen—Possible short-term reduction at the borrow areas.

(iii) Toxic Metals and Organics—No toxic metals or organic compounds are anticipated to be encountered.

(iv) Pathogens—Not applicable.

(v) Aesthetics—Temporary short-term increase in turbidity are expected, but the water is naturally turbid at the primary and secondary placement areas.

(vi) Others as Appropriate—Not applicable.

(3) Effects on Biota:

(i) Primary Production, Photosynthesis—Minor short-term impacts at the borrow areas are anticipated. No significant impacts are expected.

(ii) Suspension/Filter Feeders—Minor short-term impacts are anticipated. Non-motile forms at placement site would be buried, but would recolonize shortly. At the borrow site, recolonization is also expected.

(iii) Sight Feeders—Fishes and motile invertebrates generally can avoid or leave areas of degraded water quality; therefore, there will be no significant effects.

(4) Actions taken to Minimize Impacts: Borrow area excavation is being limited to avoid deep stratified pits.

(d) Contaminant Determinations: Testing of the sediments has not been done. The material from the borrow area is predominantly sand and gravel mixtures. Silicon particles are believed to have no substantial chemical attraction to heavy metals and organics, and under ocean disposal testing guidance (EPA and USACOE, 1991), are assumed to be contaminant free.❖

DEIS Appendix C—Draft Fish and Wildlife Service Coordination Report

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

November 26, 1999

Planning Division
Environmental Assessment Branch

Mr. David Stilwell
Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13045

Dear Mr. Stilwell:

This letter serves as the U.S. Army Corps of Engineers, New York District (District) response to the November 16, 1998 letter transmitting the U.S. Fish and Wildlife Service's (Service) draft report under the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. Section 662(b)) for the proposed Fire Island to Montauk Point, Long Island, New York, Reach 1 - Fire Island Inlet to Moriches Inlet Interim Storm Damage Reduction Project. The body of this letter contains points I feel require emphasis. Enclosures 1 and 2 contain point by point responses to the FWCA report dated June 12, 1997. These points remain applicable to the current draft.

In preparing the final FWCAR we request that changes made in the plan, many of which were directly responsive to the Service's previous Coordination Act Report (CAR), be taken into account. It would also be appropriate to acknowledge the positive benefits of the beach nourishment proposed for this project. These include, but are not limited to: the creation of additional beach habitat and the opportunity to enhance/create habitat features for the Federally-listed piping plover (*Charadrius melodus*), State-listed least tern (*Sterna albifrons*) and State-listed common tern (*S. hirundo*); protection from burial of eel grass, shellfish beds and finfish nursery habitat; the protection of intertidal wetlands; and the associated socio-economic benefits. Specific socio-economic benefits include: reduced cost of breach closures; mainland storm damage reduction; and beach recreation.

The District provided the Service with a letter dated November 3,1999 requesting that the FWCA Report be modified to reflect a six year project life. The District had provided a detailed response to the June 12, 1997 draft FWCA Report by letter dated October 10, 1997, responding to both the Fire Island Interim (FIIP) and West of Shinnecock Interim Projects (Enclosure 2), in which we requested a revised FWCA Report for the FIIP in light of project changes including a change in project alignment and a reduction in length of project life. While the NYSDEC-Region I, Bureau of Natural Resources letter dated September 4, 1997 on the June 12 report was attached, and the recommendations apparently incorporated, our October 10, 1997 letter was not attached. It appears that our prior comments were not taken into account during the preparation of the November 1998 FWCA report. Therefore, our detailed responses to the original draft FWCA report are still applicable to the revision of the current report.

The latest project description is provided in the Draft Decision Document and Draft Environmental Impact Statement. The document will be delivered no later than December 10, 1999. It is requested that the USFWS provide a Final FWCA Report, within 30 days of receipt of this document, based upon all the comments provided to date.

If you have any questions or additional concerns, please contact Roselle Henn, Chief, Environmental Assessment Section.

Sincerely,

Frank Santomauro, P.E.
Chief, Planning Division

USFWS-LIFO

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

November 3, 1999

Planning Division

David Stilwell
Acting Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, New York 13045

Dear Mr. Stilwell:

Pursuant to the Fish and Wildlife Coordination, Act (48 Sta. 401, as amended; 16 U.S.C. 661 et seq.). the U.S. Fish and Wildlife Service (Service) prepared a Draft Fish and Wildlife Coordination Act Report (FWCAR) dated November 1998 for the Fire Island to Montauk Point, Long Island. New York, Reach 1 - Fire Island Inlet to Moriches Inlet Interim Storm Damage Protection Project.

The FWCAR was prepared based on the Service utilizing a recommended project life of fifteen (15) years for its evaluation. Please be aware that recommended project life as described in the Working Draft Decision Document (Volume 1 – Main Report and Draft Environmental Impact Statement [DEIS]) dated May 1999 and clarified at the October 1, 1999 Issue Resolution Conference is six (6) years. The 6-year project life was the result of discussions between our agencies concluding in the Interagency Partnership Agreement, dated May 28 and June 1, 1999. The project is defined as initial placement (with advance nourishment), and one scheduled renourishment. As such. the project's FWCAR should be for 6-years.

Based on the above, we request that the Service revise the Draft FWCAR within 30 days of receipt of this letter. If you have any questions, please contact Ms. Roselle Henn, Chief, Environmental Assessment Section at 212-264-2119.

Sincerely

Frank Santomauro, P.E.
Chief, Planning Division

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
26 FEDERAL PLAZA
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

October 10, 1997

Planning Division
Environmental Assessment Branch

Ms. Sherry Morgan
Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13045

Dear Ms. Morgan:

This letter is a detailed response to your June 12, 1997 letter transmitting the U.S. Fish and Wildlife Service's reports under the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. Section 662(b)) for the proposed interim projects for Fire Island Inlet to Moriches Inlet and West of Shinnecock Inlet.

We have provided an earlier response, dated July 10, 1997 which highlighted our concerns and plans for finalizing the FWCA Reports for these interim projects. This correspondence expands on those points in order to fully respond to your comments. Our letter addresses the Service Position as contained in the draft FWCA Reports, with a point by point discussion as an enclosure to this letter.. The specific wording quoted in our response is of that in the Fire Island Interim Project FWCA Report, but since the recommendations are identical, our response is applicable to both reports. Our single response to these two reports should not be construed as an intent to evaluate these two proposed actions in one report. As stated in our previous letter to your office dated July 10, 1997, it is our intention to proceed with an EIS for the Proposed Fire Island Interim Project, and an EA for the proposed West of Shinnecock Inlet Interim Project.

Response to USFWS Position

The first USFWS position is as follows:

"1) *It is the position of the Service that the proposed FIIP has the potential to cause serious adverse environmental impacts and is the project that was found deficient and subsequently rejected 20 years ago by CEQ. Since that time, the Corps has completed no further analysis of environmental impacts or alternatives to dune construction. In addition, the concern remains that, over a 30-year time frame, a combination of the FIIP as proposed and rising sea level will leave the barrier islands more vulnerable to breaching then they are at present. The Service has recommended the evaluation of several structural and non-structural alternatives to limit the risk of major storms to life and property.*."

There is no evidence provided in the Reports that the interim projects have a potential for serious adverse environmental impacts. The USFWS bases a large portion of their analysis on the belief that "the proposed FIIP is the project that was found deficient and subsequently rejected 20 years ago by CEQ". As discussed more thoroughly in our point by point response (enclosure 1) the use of this statement as the basis for analysis of the interim project is inaccurate. In fact, the interim projects have beach and dune fill of a smaller cross-section, with smaller alongshore extent, and provide a lower level of protection, resulting in less impacts (reference figure 1). Therefore the FWCA Reports fail to achieve one of their primary goals: the analysis of the proposed actions.

Additionally, the USFWS has concerns that "over a 30-year time frame, a combination of the FIIP as proposed and rising sea level will leave the barrier islands more vulnerable to breaching then they are at present" is unfounded. The basis of this concern are 1) an incorrect application of Leatherman and Allen's interpretation of the Geomorphic Analysis and 2) an unrealistic assumption for sea level rise over the next century. The principal adverse geological effect, specified by the USFWS is based upon the projected impacts which might result from construction of a 20 foot dune or dike system without the benefit of fronting beachfill. The interim project is comprised primarily of beachfill, with approximately 3% of the material being utilized for dune construction, and 97% for beachfill and advance fill. A more useful discussion relevant to the interim project is provided by Leatherman and Allen's comments on beach nourishment plan (which are of a larger magnitude, but closer in design to the interim project) which states:

> "beach nourishment is the most environmentally compatible means of shoreline engineering since this technique can mimic the natural process of sand addition to the barrier island. Introduction of new sand supplies, obtained from sources outside the nearshore sand-sharing system, provides the material for adjustment of the beach and shoreface according to energy conditions and sea level position".

The USFWS fails to incorporate these findings in their FWCA Reports.

The FWCA Reports' recommend evaluation of structural and non-structural measures. However, evaluations of this type were included in the information transmitted to the USFWS. Specifically, the District has conducted evaluation of 1) the continuation of the Breach Contingency Plan, 2) incorporating inlet bypassing, and 3) management measures including the requirement of NYSDEC mapping of the Coastal Erosion Hazard Management Act, prior to implementation of the Fire Island Interim Project.

The second USFWS Position is:

"2. *In the short-term, construction activities associated with the implementation of the FIIP could have direct adverse impacts on fish and wildlife resources and their supporting ecosystems. Beachfill will cover 15 miles of nearshore intertidal and subtidal marine habitats and dredging of the borrow area will temporarily disturb* *benthic resources, which could affect the amount of food available ~~to higher~~ order species. Nearby waters will also become more turbid. The reduction of water quality could temporarily interfere with nearby fish abundance and assemblages."*

Direct environmental impacts from beach nourishment activities are typically confined to the borrow and placement areas. Representative impacts in both areas include: reduced abundance of infauna, altered feeding habitats among fish, crabs, and other commercially important species (because of changes in the abundance, suitability, or accessibility of infauna) and increased turbidity. Direct impacts from dredging and filling on infaunal benthos have been examined many times within the context of beach nourishment (Nelson, 1993). Previous studies have shown that in the majority of cases, impacts to infaunal benthos are sufficiently minor (short-term reductions in standing stock biomass, which is assumed to represent secondary production). These studies were done in environments not representative of the mid-Atlantic (New York Bight) region. The District acknowledges that it has the responsibility to review these conclusions. As part of an erosion control project for the Atlantic Coast of New Jersey (similar habitat to the proposed project area), the District is conducting a biological monitoring program (BMP) in coordination with NJDEP, USFWS, NMFS to assess impacts on the biological resources potentially influenced by construction activities. The objectives of the BMP are: 1) Contrasting mean abundance and biomass between borrow areas and reference areas rather than species diversity, 2) Monitoring the food habits of fish in the vicinity of the borrow areas, 3) Infaunal monitoring of the placement area, 4) Monitoring of fish adjacent to the placement area (Spring will focus on upon larvae and fall will focus on early juveniles). Information collected within this BMP can and shall be applied to other similar projects, such as the Fire Island Interim and West of Shinnecock Inlet Interim Plans.

The USFWS Third Position is:

"3. *The FIIP could have several indirect adverse impacts on fish and wildlife habitat and the overall condition of the barrier through the prevention of natural processes which maintain the integrity and habitat diversity of the barrier islands. These processes not only keep the island above water and lead to its vertical accretion, but also maintain the balance among various habitat types, vegetation cover types, and fish and wildlife species. In particular, flood tidal deltas, overwash fans, and sand spits are commonly created by breach and overwash events. Such areas provide loafing, foraging and nesting habitat for several species of shorebirds, including the Federally listed threatened piping plover. The FIIP is designed to prevent the predicted creation of such areas in the future without addressing the potential adverse impacts of the project."*

The basis for the USFWS's position regarding the impact of the proposed interim projects on the potential for breaching and overwash is based upon the inaccurate assumption that the interim projects will prevent breaches and prevent overwashes. The interim project is largely restoring the barrier island to a condition comparable to the condition prior to the increased storm activity starting in 1990. The interim projects will reduce the probability of breaches and overwash associated with high frequency occurrences, which will ~~have an impact~~ on the transport of material to the bay environment through coastal processes, but it must be recognized that these processes are in no way being prevented by the interim project. The discussions contained within our response to comments will help to clarify the extent of impact of the interim project as compared to the existing condition and authorized project.

The USFWS's fourth position is:

"4. *The Service finds that in context of rising sea levels, eelgrass beds and tidal marshes may be lost to rising water with no offsetting creation of flood tidal deltas that would provide substrate for new habitat of these types. In addition, the FIIP is designed to prevent the overwash that maintains open sand and sparsely vegetated areas on Fire Island. As a result, bare beach and sparse grasslands will tend to be replaced by dense grasslands and thickets, with a concomminant change in animal species. As grassland/thicket species are abundant on Long Island, and seashore species populations are declining, this is likely to represent a loss of biological diversity at the community level."*

Again, the basis for the USFWS's position regarding the impact of the proposed interim project on the potential for breaching and overwash and the associated impact on the habitat creation and vegetation coverages is based upon the inaccurate assumption that the interim project will prevent breaches and prevent overwashes. The interim projects will reduce but not prevent overwashes and breaches. This has been addressed above, and in our specific response to comments. However, the USFWS must also recognize the time requirements for other factors which lead to the formation and creation of tidal marshes. The accretion of marsh sediments is a long-term geologically mediated process. Also, within the Long Island barrier bay system the supply of organic debris and seasonal input of suspended sediment has been dramatically reduced by the loss of large areas of eel grass and north shore fringing marsh and its associated surface water system. The deepening of the bay has also changed the depositional patterns, favoring the deeper areas. All of these factors contribute to even slower marsh formation.

The USFWS's fifth position is:

"5. *In addition, there remain enormous data gaps about the potential long-term effects of the FIIP and SIIP on finfish, shellfish, and the overall physical structure of the bays and barrier islands. The service finds that even basic information on erosional trends, flood elevations, and fish and wildlife baselines are lacking or deficient. These massive beach nourishment projects may precipitate enormous ecological changes, which given the present data gaps, would occur without any real awareness of the gravity of potential consequences."*

There is a large volume of information available on the barrier island and ~~bay ecosystem~~. It appears the USFWS's belief that information is not available is based upon the NY Sea Grant Study prepared in 1993 to determine research opportunities available within the Fire Island National Seashore. This report contains recommendations for research opportunities, but was not undertaken to determine the potential impacts associated with a beach nourishment project.

The USFWS's sixth position is:

"6. *The Service finds the Corp's commitment to evaluate the cumulative impacts of the FIIP, the SIIP, Westhampton Interim Project, and the Westhampton Groin Field project inadequate to the magnitude of the proposed impact and contrary to the letter and spirit of the National Environmental Policy Act of 1969. The Corps has not prepared an environmental assessment for the FIIP or the SIIP and did not enclose any such assessment with the FIIP or SIIP project description. The Corps' FIIP and SIIP proposals do not contain any natural resources discussions, do not evaluate or discuss environmental impacts, and do not consider or propose mitigation for adverse effects, and only propose to consider these questions in the future under the Fire Island Inlet to Montauk Point Reformulation Study."*

The Corps will analyze impacts under NEPA and prepare the necessary NEPA documentation, which will include discussion of the natural resources. Please note that the information provided to your office, as intended, and coordinated, was the engineering and economic evaluation to be used in generating the FWCA Report, and not environmental analysis. The Corps will incorporate mitigation measures as a component of the interim projects, if found to be necessary.

The USFWS's Seventh point is:

"7. *In preparing the FIIP and the SIIP, the Corps bypassed the early coordination stage recommended by NEPA and its own regulations. This coordination is intended to avoid inter-agency conflict late in the project development, as has occurred in this case. Early coordination with other Federal agencies would also have made it clear that the FIIP and SIIP are major Federal actions which could not be addressed with an Environmental Assessment / Finding of No Significant Impact. As a result, two years of delay have resulted and the FIMP Reformulation Study has been neglected while the Corps has focused its attention on gaining approval for the proposed interim projects."*

Corps coordination with the Federal Agencies related to the Fire Island Interim Project was initiated in November 1994. Based upon coordination with the agencies we have decided to proceed with the preparation of an EIS for the Fire Island Interim Project. However, we are still proceeding with an environmental assessment for the interim project West of Shinnecock

Inlet. The Reformulation Study has not been delayed as a result of <u>the interim</u> projects being undertaken, but is proceeding on parallel paths. Both NEPA documents will address cumulative impacts.

The USFWS Eighth point is:

"8. *The fact that the Corps has presented the interim projects as separate sub-units of the Fire Island (Inlet) to Montauk Point Beach Erosion Control and Hurricane Protection Project does not exempt these projects from National Environmental Policy Act requirements, which specifically state, under 40 CFR 1508.27(b)(7), that significance cannot be avoided by terming an action temporary or breaking it down into small component parts. The proposed interim projects combined with the deferred construction areas and the project built in Westhampton, cover 40 of the 48 barrier island miles in the 83-mile Fire Island Inlet to Montauk Point Study Area. The FIIP and the SIIP would establish a precedent for construction with deferred environmental impact analysis throughout the entire 83-mile Study Area. There is no question that this represents a major Federal action under the National Environmental Policy Act, and as such, requires the preparation of an environmental impact statement addressing their impacts on the Fire Island Inlet to Montauk Point ecosystem. The magnitude of the FIIP/SIIP and the claims made for it place it in the category of projects having a significant impact on the quality of the human environment (40 CFR 1508.27) and as such, it should not be undertaken in the absence of a Record of Decision on an EIS for the Fire Island Inlet to Montauk Point Storm Damage Reduction Reformulation Study.*"

Pertaining to the proposed Fire Island Interim Project, the New York District expects that the legal argument put forth in the eighth point goes beyond being a report or recommendation of the Secretary of the Interior on the wildlife aspects of the project, and hence goes beyond the scope of 16 U.S.C. Section 662(b). By way of further response, the District points out that the FIIP is severable from, and hence not a component of, the Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point Project authorized by Congress in 1960, now subject to reformulation. No action concerning the original project is being taken which has an adverse environmental impact or limits the choice of alternatives. The FIIP is justified independently of the original project; is to be accompanied by an adequate environmental impact statement so as to comply with NPS requirements, and will not prejudice any ultimate decision on the original project. Hence, proceeding on the FIIP is authorized by CEQ regulation and NEPA.

To further clarify, the NEPA regulation cited by the USFWS, 40 CFR 1508.7(b)(7) requires federal agencies to adequately address cumulative impacts when evaluating the intensity of impacts. Potential cumulative impacts are being evaluated in the NEPA processes underway. These analyses will facilitate determining whether there are significant impacts (EIS for FIIP) or whether there is a potential for significant impacts (EA for SIIP). However, the NEPA processes are not yet complete. The FWCARs could aid in the evaluation by providing constructive guidance for enhancing the analyzes rather than prematurely assuming a conclusion has been reached.

More pertinent requirements of the NEPA regulations are found under 40 CFR 1506.1(a) and (c). These subparts specify conditions which must be met if an agency is to undertake an action related to a proposal for which the Record of Decision has not been issued. These paragraphs are transcribed below. Together, they describe the relationship between the Reformulation Study and the two interim projects.

> a) Until an agency issues a record of decision as provided in 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:
>
> (1) Have an adverse environmental impact; or
> (2) Limit the choice of reasonable alternatives.
>
> (c) While work on the required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:
>
> (1) Is justified independently of the program;
> (2) Is itself accompanied by an adequate environmental impact statement; and
> (3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision when it tends to determine subsequent development or limit alternatives.

Both projects are being formulated pursuant to conditions set forth in 40 CFR 1506.1. As required by 40 CFR 1506.1(c)(1), the Fire Island Interim project is independently justified as to the purpose and need. Pursuant to 40 CFR 1506.1(c)(2) an EIS is being prepared for the FIIP. Additionally, the range of alternatives being considered by the Reformulation Study is not constrained by the Fire Island Interim Project as required by 40 CFR 1506.1(c)(3). The interim project is beachfill only and readily reversible, since without renourishment, the area will revert to pre-interim conditions. Additionally, the formulation and evaluation of the alternatives for the reformulation study is based upon a no action alternative, which is a pre-interim condition to ensure that the interim project not prejudice the outcome of the reformulation study.

Pertaining to the proposed West of Shinnecock Inlet Interim Project, the New York District expects that the legal argument put forth in the eighth point goes beyond being a report or recommendation of the Secretary of the Interior on the wildlife aspects of the project, and hence goes beyond the scope of 16 U.S.C. Section 662(b). By way of further response, the District points out that the SIIP is severable from, and hence not a component of, the Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point Project authorized by Congress in 1960, now subject to reformulation. No action concerning the original project is being taken which has an adverse environmental impact or limits the choice of alternatives. The SIIP is justified independently of the original project. If found to be a major federal action which may significantly affect the quality of the human environment, SIIP will be accompanied by an adequate environmental impact statement, and SIIP will not prejudice any ultimate decision on the original project. Hence, proceeding on the SIIP is authorized by CEQ regulation and NEPA.

To further clarify, an EA is being prepared for the SIIP. If the result of the EA is a FONSI, than the SIIP is in accordance with 40 CFR 1506.1(a)(1), as it will not have an adverse environmental impact. Additionally, the range of alternatives being considered by the Reformulation Study is not constrained by the West of Shinnecock Inlet Interim Project as required by 40 CFR 1506.1(a)(2). Again, the interim project is beachfill only and readily reversible, since without renourishment, the area will revert to pre-interim conditions. Additionally, the formulation and evaluation of the alternatives for the reformulation study is based upon a no action alternative, which is a pre-interim condition to ensure that the interim project not prejudice the outcome of the reformulation study. If the result is a finding that there is a potential for significant impacts, then an EIS would also be prepared, in accordance with 40 CFR 1506.1(c).

The USFWS Ninth (and final) position is:

"9. No public involvement has been conducted during the FIIP planning process to fully inform interested parties and to ascertain their views."

The District sent a notification of study initiation, at the begining of the planning process. The District has been and is presently first attempting to ascertain the viewpoints of involved government agencies. The District will seek public input, as there remains ample opportunity in the process for public input in accordance with NEPA requirements.

It is requested that the USFWS provide a revised draft FWCA Report for the ~~West~~ of Shinnecock Inlet Interim Project in 30 days, based upon the revised project description (enclosure 2). Additional plan details will be provided under separate cover, as needed. I understand that the additional draft report is not included as a component cost in the scope of work, and may result in an additional cost for preparation.

As we indicated in our July 10th letter, at the urging of the Department of Interior, we are initiating preparation of an EIS for the Fire Island Interim Project. As such, we need to reschedule finalization of the FWCA Report for the Fire Island Interim. The following is a schedule for initiation of scoping and preparation of an EIS for the Fire Island Interim. Based upon this schedule, we would like to have the USFWS provide a revised draft report in 30 days, and a finalized FWCA Report by 31 December 1997. I understand that the additional draft report is not included as a component cost in the scope of work, and may result in an additional cost for preparation.

Scoping Meetings	Nov 1997
Draft FWCAR	Dec 1997
DEIS	Feb 1998
Public Review	Feb -Mar 1998
Final FWCAR	Apr 1998
Incorporate Comments / Finalize EIS	May 1998
Final EIS	June 1998

We have taken additional time in responding to each of your concerns to aid in the preparation of the revised FWCA Reports. If there are any questions regarding this matter, please contact Peter Weppler at (212) 264-4663

Sincerely,

John Sassi, P.E.
Chief, Planning Division

Encl(s)
cf:
USFWS-LIFO

Comments on the Fire Island Interim Project Fish and Wildlife Coordination Act Report

The comments provide a point-by-point response to individual discussions contained in the FWCA Report of June 12, 1997. The summary discussion is included within the letter.
(The page numbers correspond to those provided in the Fire Island Interim Project Report)

Introduction:

P.1. para. 3:
As noted in correspondence dated April 1, 1997 and May 22, 1997 we believe that separate FWCA Reports can adequately address cumulative impacts. Separate reports are required because the interim projects are on different schedules, and are subject to different decision making processes, with potentially different outcomes.

P.2. para. 3:
The Corps has submitted biological assessments and is awaiting USFWS response and concurrence for both the West of Shinnecock Inlet Interim and Fire Island Interim Projects. Under Section 7(c) of the Endangered Species Act, the Corps initiated informal consultation for the West of Shinnecock Interim by a letter dated March 12, 1997 and requested to initiate formal consultation for the Fire Island Interim by a letter dated and May 7, 1997. The Corps also intends to receive separate Biological Opinions for each of the interim projects.

II Essential Terminology

p.2. para. 4:
Your definition is contradictory where it states that overwash tends to flatten a dune field, and also increases the barrier island elevation. It should be noted that overwash alone does not increase the elevation of the island. It is recognized that aeolian transport of material may result in an increase in the island elevation. This vertical accretion, and dune restoration is a product of aeolian transport, not overwash, and occurs over a duration of decades or longer.

p.2. para. 5:
Breach definition. To remain consistent with the definition of a breach adopted in the breach contingency plan, please revise the statement to indicate that a breach permits tidal exchange between the bay and ocean throughout the tidal range, including low tide.

P.3. para. 2:
Barrier Island Definition. Please eliminate the last sentence, or revise it to include discussion of the other factors resulting in differences in barrier island response, including sediment supply, winds, waves, and tides.

III Project Purpose

P.3. para. 4:
To clarify, the purpose of the proposed Fire Island Interim Project is to reduce potential storm damages to the mainland and barrier island by providing a limited degree of protection to the barrier island, with beach and dune fill, in order to reduce the probability of breaching and overwash associated with high-frequency storm events, until the completion of the reformulation study. Please note that emergency vehicle access is not a specific purpose of the interim project.

P.3. para. 4:
The purpose of the proposed West of Shinnecock Inlet interim project is to reduce storm damages to the mainland, barrier island, and inlet structures by providing a limited degree of protection to the barrier island, with beach and dune fill, in order to reduce the probability of breaching and overwash associated with high-frequency storm events, until the completion of the reformulation study.

IV Project History

P.3. para. 5:
To characterize the authorized project as "creating a 25 x 16 foot dune along the 83 miles of barrier beach" is incomplete and incorrect. As described in the 1977 EIS, the authorized project provides for:

a. Widening the beaches in the developed areas between Kismet and Mecox Bay to a minimum of 100 feet at an elevation of 14 feet above mean sea level;

b. Raising the dunes to an elevation of 20 feet above mean sea level from Fire Island Inlet to Hither Hills State Park, and opposite Lake Montauk Harbor;

c. Installing sand fencing and planting grass on the dunes;

d. Constructing interior drainage structures at Mecox Bay, Sagaponack Lake, and Georgica Pond;

e. Federal participation in the cost of beach nourishment for a period not to exceed 10 years from the year of completion of a useful nourishment unit;

f. Construction, as needed, of not more than 50 groins.

P.4. para. 1:
We note that the 1977 EIS was rejected because it inadequately addressed systemic environmental impacts.

P.4. para. 3:
We note, that the CEQ by letter dated January 18, 1979, expressed support of interim projects, stating that our "exchange of letters adequately adresse[d] the Council's concern that interim remedial action should be taken as quickly as possible in cooperation with interested agencies that is (1) limited to those areas for which it is essential; (2) designed and implemented in an environmentally responsible fashion; and (3) does not involve actions that are inconsistent with the reformulation project planning."

P.5. para. 1:
Statements made in sentences 1 and 2 are incorrect. The Service states that the interim project is "not a true interim project; rather, it represents a proposal for the construction of the project which was referred to the CEQ in 1977." The proposed interim projects are not the same proposed in 1977. The interim project is a beach and dune nourishment plan; however, the magnitude, configuration, and linear extent are smaller, and function to provide a lesser degree of protection than the authorized project. The lower level of protection provided results in a lesser impact on the barrier island coastal process than the authorized project.

The authorized project (House Document 425) includes a dune at elevation +20 ft, with a dune crest width of 25 ft, fronted by a beach berm at elevation +14 ft, with a width of 100 ft, fronted by a beach slope at elevation 1:20. For construction, the 1977 EIS proposed construction placement of a dune at elevation +16 ft, which would grow to an elevation of +20 ft, within two years, primarily due to the aeolian transport and capture of material. These cross-sections are shown in the enclosed figure 1.

The proposed interim project, as shown in figure 1 in comparison with the authorized project, includes a beach dune at elevation +15 to +18 feet, with a berm width ranging from 40 feet to 90 feet at an elevation of +9.5 ft. The berm is sloped seaward at 1:15.

A comparison of the proposed construction template from the 1977 EIS, with the proposed cross-section(s) for the Fire Island Interim Project shows there remains a significant difference between the cross-sections, even with a 16 foot high dune. The confusion may arise, as a comparison of the dune heights. However, it must be noted that dune height alone is not representative of the protection which will be afforded. This difference in plan cross-section results in the interim project providing a lower level of protection than the authorized project, and hence a lesser impact on the barrier island processes than the authorized project.

P.5. para. 1:
The intent of the interim projects is to provide a degree of protection until the Reformulation Study is completed. The interim projects do not presuppose the outcome of the reformulation study.

P.5. para. 1:
Please note that the project construction areas total 19 miles and not 40 miles. They include:

Element	Distance
Fire Island Interim	12.75 miles
Westhampton Interim	4.0 miles (2 mile overlap w/ Westhampton Groins)
Westhampton Groins	3.5 miles
West of Shinnecock Inlet	0.75 miles
Total Distance:	19 miles

The deferred construction discussed in the Fire Island Technical Support Document, will not be implemented as a component of the interim plan for Fire Island. Further analysis of possible actions in this area would take place only in the event that changed conditions indicate the potential need for deferred construction.

P.5. para. 1:
The State of New York requires the interim projects be developed and planned for a period of 30 years. The Corps and the NYSDEC recognize that these interim projects are subject to the outcome of, and may be superseded by the outcome of the Reformulation Study, and interim projects are not intended to set a precedent for the reformulation study.

P.5. para 2:
The Corps will undertake engineering and environmental analysis (including necessary NEPA documentation) necessary to assess the potential for impacts resulting from the proposed interim project, as was done for interim and emergency repair projects since 1978. Please eliminate this paragraph.

V. Description of the Proposed Project

P.5. para 3:
Reference comment page 5 para. 1. The interim project is a beach and dune nourishment plan; however, the magnitude, configuration, and linear extent are smaller, and function to provide a lesser degree of protection and a lesser impact than the authorized project.

P.5. para 4:
Please revise. Design section 1 is applicable to areas within Robert Moses State Park where dune elevation is sufficient to provide the required level of protection against overtopping and breaching, but the existing berm width and height is insufficient to ensure the survivability of the dune.

P.5. para 5:
The design cross-section for reach 2 is planned for areas within reach 2 which do not currently meet the design level of protection. The design in this area includes an 18 ft dune, fronted by an 11 ft berm with a width of 40 ft, to provide the required level of protection, where it currently does not exist. This is necessary for the survivability of the dune, which is generally flattened, due to the low-lying areas behind the dune. The 23 ft of material is advance fill, which serves to ensure that the design cross-section is maintained

P.6. para 5:
See response to the comment P.5. para. 1.

P.6. para 5:
The tone of this paragraph implies that the Corps designation of level of protection is opinionated, or based upon a lack of information. Please note that the basis of the design utilizes risk, and use of a return period in combination with the project life. The design return period of 44 years is based upon use of a calculated risk of 50% during the 30 year project design life. Please note that the probability of a storm with a return period of 44-years occurring at least once during the life of the project is determined by the following formula:

$$P = 1-(1-1/\text{return period})^{\text{project life}}$$

In this instance: $P = 1-(1-1/44)^{30} = 50\%$

P.6. para 5:

The level of protection (i.e. the point at which storms of a greater frequency result in no damage) of the existing condition is provided by the combination of the dune height, beach berm width and height, and foreshore slopes. In order to clarify the existing level of protection, a discussion of the functioning of a beach and dune system as a storm damage reduction feature is required.

A beach contains three specific features which function together to provide protection. These features include: (1) dune, (2) beach berm, and (3) beach slopes. Dune height alone is not representative of the protection the cross-section will afford. The function of the dune is to reduce the transmission of storm tides and waves into the land areas behind the dune through wave runup and overwash. The effectiveness of the dune to prevent landward intrusion of water is a measure of its height and width. However, the survival of the dune is based upon the protection of the dune by the fronting beach berm. The function of the beach berm is to provide protection to the dune to reduce direct exposure of the dune to wave action, to prevent the lowering and narrowing of the dune. The fronting beach slope and berm height serves to induce wave breaking to provide protection to the dune.

These three components of a beach nourishment project work together to provide a level of protection. The level of protection is defined as the condition of the post-storm eroded beach profile and the level of protection afforded to prevent storm damage impacts from inundation, wave attack, overtopping, and recession. The existing level of protection provided by the barrier varies depending upon 1) site specific locations, and 2) criteria used to establish the level of protection (inundation, wave attack, overtopping or recession).

Based upon analyzing the damage mechanisms as above, the critical element which is used to define the existing lowest level of protection of the barrier island is overtopping of the dune. A determination has been made to establish an overtopping discharge threshold (a volume of water over a period of time) which will result in triggering the damage mechanism. This threshold was established using a historical analysis of the conditions leading to the breach at Westhampton Beach in December 1992. This analysis indicated that water heights during the storm ultimately resulting in a breach, had an associated overtopping discharge of 1.7 cft/second/foot. This volume of water is equivalent to 12.7 gallons/second/foot. This overtopping resulted in sufficient dune lowering, resulting in initiation of breaching of the barrier island.

Since there is no universal approach to determining the conditions leading to breaching events, this overtopping discharge has been used to determine the storm event, which would result in overtopping sufficient to lower the dune and initiate the breaching process. This is the criteria which was used to determine the level of protection for the existing cross-section and for the interim and authorized project beachfill cross-sections.

The existing level of protection varies significantly on Fire Island, both spatially and temporally, depending upon the profile selected, seasonal variation, and local sand fill efforts. Please note that the existing protection does not take into consideration the potential for reduced level of protection in the projected future without project condition, due to long-term recession.

Project Area	**Return Interval (resulting in discharge of 1.7 cft/second/foot)**
	Existing Condition
Reach 1	200 yrs
Reach 2	15 yrs - 200 yrs
Reach 3	35 yrs - 200 yrs
Reach 4	15 yrs - 200 yrs

As described above the level of protection provided against overtopping for the existing cross-section, interim and authorized project cross-sections for Fire Island was determined by utilizing overtopping results. A project designed for for a return period of 44-years will still allow overwash to occur for storms below the 44 year return period threshold, but not of a magnitude which will result in conditions leading to the initiation of breaching. As discussed previously, a storm event with a frequency of occurrence larger than a 44-year event is expected to result in an overtopping discharge of 1.7 cft/second/foot (equivalent to 12.5 gallons/second/foot) which is anticipated to result in conditions leading to the initiation of a breach of the barrier island.

P.6. para 6:
Please note that existing surge elevations in the bay for a storm with a return period of 44-years, has been developed and provided previously to the DOI. It is also contained within the Engineering and Economic Appendices, as provided to the DOI and USFWS.

P.6. para 7:
Please note that the element of deferred construction proposed in the wilderness area would only be applicable if changes in future conditions warranted action. Currently it is not seen as highly probable that this effort would be required. For this reason we are deferring the analysis of this element and any potential for construction until a time when this action may be applicable.

P.6. para 8:
Please note that the West of Shinnecock Inlet Interim design cross-section has been revised to be beachfill only, configured as the secondary alternative proposed in our February 17, 1997 letter requesting the preparation of a FWCA Report. Detailed engineering information will be provided to the Service under separate cover.

P.7. para 1:
Please note that although the buy out plan investigated, was for a 100-year floodplain, refinement of this analysis was not undertaken because of the significantly higher cost of this alternative, and since the reversible constraints of the interim project would preclude buy out of structures within the floodplain as a readily implementable solution.

Page 7 para 3:
Please note that the West of Shinnecock Inlet Interim design cross-section has been revised to be beachfill only, configured as the secondary alternative proposed in our February 17, 1997 letter requesting the preparation of a FWCA Report. Additionally, please note that the renourishment volume of approximately 500,000 cy is anticipated every three years instead of two. More detailed information regarding the West of Shinnecock Interim Project will be provided under separate cover.

Page 7 para 4:
Please revise the paragraph to indicate that the map shows areas on Long Island where the Corps has been requested, and authorized to investigate, in combination with a local sponsor projects related to storm damage reduction, navigation, and environmental restoration.

VI Importance of The Study Area

P.7-9:
The USFWS overlooks the importance of the area for residential housing, exceeding 27,000 residential and commercial structures in addition to the roads and infrastructure contained within the floodplain along the mainland of Great South Bay.

VII Physical Structure

P.11 para 4:
This statement is inaccurate in its claim that the proposed project will "prevent natural processes" resulting in several indirect adverse impacts. It appears that the basis for this assumption is the premise that the interim project is that 1) it primarily consists of a dune, and 2) it is the same as the authorized project. This is was discussed in comment page 5 paragraph 1. A discussion on the "existing level of protection" is also included in comment page 6 paragraph 5

A comparison of the proposed construction template from the 1977 EIS, with the proposed cross-section(s) for the Fire Island Interim Project shows there remains a significant difference between the cross-sections. Because of the difference in plan cross-section, the interim project provides a much lower level of protection than the authorized project.

As described previously, (page 6 paragraph 5) the level of protection (i.e. the point at which storms of a greater frequency result in no damage) provided by a beach nourishment project (and hence its impact on the reduction of breaches and overwash) is provided by the combination of the dune height, beach width and height, and foreshore slopes. Dune height alone is not representative of the level of protection.

As discussed previously, the level of protection provided against overtopping for the interim and authorized projects for Fire Island was determined by utilizing overtopping results. A project designed for a return period of 44-years will still allow overwash to occur for storms below the 44 year return period threshold, but not of a magnitude which will result in conditions leading to the initiation of breaching. As discussed previously, a storm event with a frequency of occurrence larger than a 44-year event is anticipated to result in an overtopping discharge of 1.7 cft/second/foot (equivalent to 12.7 gallons/second/foot) which is anticipated to result in conditions leading to the initiation of a breach of the barrier island.

The change in potential for breaching (based upon conditions leading to the breach at Westhampton) for the existing condition, interim project condition, and authorized project condition are provided below.

Project Area	**Return Interval (resulting in discharge of 1.7 cft/second/foot)**		
	Existing Condition	Interim Project Condition	Authorized Project Condition
Reach 1	200 yrs	200 yrs	>200 yrs
Reach 2	15 yrs - 200 yrs	44 yrs - 200 yrs	>200 yrs
Reach 3	35 yrs - 200 yrs	44 yrs - 200 yrs	>200 yrs
Reach 4	15 yrs - 200 yrs	15 yrs - 200 yrs	>200 yrs

The USFWS apparently draws its conclusions on the impact of the interim project, from the likelihood that the authorized project would preclude overwash and breaching. It is true that the authorized project would prevent most breaches and overwashes from occurring, except for large events. Coastal analysis of the authorized project cross-section does indicate that the authorized project would likely prohibit breaching for storm events exceeding a storm with a frequency of occurrence exceeding 200 years.

It must be reiterated, however, that the proposed Fire Island Interim Project does not provide the same level of protection against breaches and overwash, as does the authorized project. The interim project was developed for a relatively low level of protection. A storm event with a frequency of occurrence larger than a 44-year event will likely result in conditions which have been shown to result in a breach of the barrier island. A storm event of with a frequency of occurrence of less than 44 years will still result in overtopping of the dune, although not to the extent shown necessary to initiate breaching.

It is recognized that according to the level of design, the proposed interim projects will prevent a some overwash, breaching and inlet formation. This will reduce the probability of the formation of certain land forms known to be advantageous to particular species of birds, and reduce the amount of coarse sediments entering into the back bay system, but the Service is extreme in its analysis of the functioning of the project.

In addition to the physical functioning of the interim projects, and their impact on the potential for breaches and overwashes, the Service must also recognize the time requirements for other factors which lead to the formation and creation of tidal marshes. The accretion of marsh sediments is a long-term geologically mediated process. Also, within the Long Island barrier bay system the supply of organic debris and seasonal input of suspended sediment has been dramatically reduced by the loss of large areas of eel grass and north shore fringing marsh and its associated surface water system. The deepening of the bay has also changed the depositional patterns, favoring the deeper areas. All of these factors contribute to even slower marsh formation.

P. 12. para. 4.

A study of tidal records at the Battery in New York City and Montauk Point, New York indicated average rates of sea level rises of 0.009 ft (2.7 mm) and 0.006 ft (1.8 mm) per year respectively. Please note that for evaluation of the interim project sea level rise was estimated at 0.01 ft (3 mm) per year or 1 ft (30 cm) per century.

There is discussion regarding the impact of global warming resulting in an increase in sea level rise. Recent sea level rise research has indicated that as a result of climate change, anthropogenic factors (compaction and subsidence of land, groundwater depletion), and natural climate variations is likely to result in global sea level rise of 17 in / 45 cm (21 in / 55 cm along the coast of NY) by 2100, with a 1 percent chance of a global sea level rise of 44 in / 112 cm (47in / 120 cm along the coast of NY) (The Probability of Sea Level Rise, James Titus, Vijay Narayanan). There is no basis for project planning to assume an extreme variability in sea level rise, and the Corps has elected to take a conservative approach to the potential for sea level rise, so as to not bias the damage potential in future with and without project conditions.

Page 12. para. 5.

We note that local interests and not the Corps of Engineers stabilized Shinnecock Inlet in 1952.

Page 13. para. 4.

We note that the Breach Contingency Plan and recent experience at Westhampton Beach indicate that a breach formed along Great South Bay likely would not close naturally, but that hydraulic forces would inhibit rapid closure of the inlet, and that human effort will likely need to be undertaken to close the breach.

Page 13. para. 5.

Please indicate the time period associated with the process of inlet migration and closure, and the time period associated with development of marsh islands and eelgrass beds..

Page 14. para. 5.
Please note that the interim project is not intended to prevent breaches, but is designed to provide protection us to a storm with a return period of 44-years.

Page 15. paragraph 3.
The quote from Leatherman and Allen (p. 271) was not attributed to the "construction of a 16-foot (NGVD) high dune with a 14-foot (NGVD) high berm" as the Service contends. This quotation is an evaluation of the impact of construction of dune/dikes at an elevation of 20 feet, without beachfill fronting the dune/dike. This is construction is not representative of either proposed interim project. The proposed interim project is primarily (97% of total) comprised of beach nourishment (design beach berm, and advance fill), with only a relatively small portion of the fill being utilized to construct dunes (9,200,000 cy vs. 300,000 cy). In addition, this alternative as constructed was assumed to preclude overwash, without providing a fronting beach. A closer representation of the interim project would be the beachfill alternative as recognized by Leatherman and Allen (p.274) "Beach nourishment is regarded as the most environmentally compatible means of shoreline engineering since this technique can mimic the natural process of sand addition to the barrier chain ... The principal effect of beach nourishment would be the delay in the advent of the natural geomorphic processes involved in landward barrier migration."

The USFWS was incorrect in applying Leatherman and Allen's description of the geological impact of dunes/dikes to the description of the interim project, and it is inaccurate to draw conclusions based upon this assumption.

Page 15. Para.5.
We note that Leatherman and Allen (1985a) is in reference to construction of dune / dike construction, to an elevation of +20 ft and that the interim project does not "prevent overwash".

Page 16. Para. 2.
The Service finds that the proposed project is "construction of a large, artificial dune", which will likely cause a steepening and narrowing of the beach." To clarify, the majority of the existing dunes along Fire Island range from +13 ft to +18 ft, and dune fill placement is a relatively minor component of the Fire Island Interim Project. The majority (97%) of the fill is configured as beachfill. The beachfill will increase the width of the barrier beach, with beach slopes matching the existing condition. Please note that the impact of "steepening and narrowing" was attributed by Leatherman and Allen to dune/dike construction.

Page 16. Para. 5.
The notion that the barrier island will be in a weaker position is based upon Leatherman and Allen's discussion regarding the impact of dune building alone, without construction of fronting beach nourishment. The interim project substantially (97%) consists of beachfill. Leatherman and Allen, indicate that the principle effect of beach nourishment would be the delay in the advent of the natural geomorphic processes. Also please note that the interim projects were planned, considering a sea level rise of 1 foot over the next century, and that the probability of sea level rise of 6.5 ft, is so unlikely it does not justify consideration for interim project planning. Please also

note that the interim projects will not result in "prevention of overwash."

Page 17. Para. 1.

Please note that the Corps utilized an updated sediment budget to determine the relative impact of the project. This is contained in the Engineering Appendix.

Page 17. Para. 2 & 3.

Please note that the following studies have either been conducted, or are underway for the interim projects.

1. Site specific coastal processes analysis (reference engineering appendix)
2. Cost estimates
3. Economic Analysis has been undertaken, environmental analysis is underway.
4. Comparison of economic benefits and costs

Page 17. Para. 5.

The USFWS recognizes that "inlet forming processes are still poorly understood", yet subsequent statements question how different analyses can have different results. The basis for our determination regarding the probability of breaching is based upon our analysis of overtopping conditions that led to the breach at Westhampton in 1992. These conditions were utilized to determine the probability of breaching in similar locations. The Corps Engineering and Economic Appendices discuss the potential for mainland flooding. The interim project will not result in greater flooding due to delay of water exiting the back-barrier lagoons. The extent of damages associated with a storm event is primarily based upon the volume of water which enters the bay, and the maximum elevation reached. The duration of the flooding is secondary to the water elevation. Although the time period may or may not be be longer with the interim project in place, the lower water elevation would offset any detriment.

Page 18. Para.1.

We note that the interim projects are designed to limit the probability of breaches and overwashes associated with high frequency events, hence a study is not necessary to see if the interim project "is capable of preventing inlet formation".

Page 18. Para.3.

Please note that cited New York Sea Grant Institute 1993 Report's purpose was to identify research opportunities within the Fire Island National Seashore. These studies were not developed to determine the relative impact of a beachfill project. In this instance, wave data collection is not necessary for a predictive model. The wave climate can be accurately determined based upon the bay configuration.

Page 18. Para. 4 & 5.

Please note that cited New York Sea Grant Institute 1993 Report's purpose was to identify research opportunities within the Fire Island National Seashore. These studies were not developed to determine the relative impact of a beachfill project. The south shore estuary is one of the most studied systems in the country. In this instance, information is readily available to make decisions regarding the relative impacts of human intervention vs. natural processes.

It should be noted that the serious problems presently afflict the barrier island system, which occur independently of the proposed interim project. The problems afflicting the barrier island include:

a. Loss of beach habitat and shallow water habitat due to development and recreational use.

b. Water quality and turbidity problems due to overwhelming developmental impacts, i.e. runoff and nutrification, loss of filtering marshes and eel grass beds, and increased depth of areas within the bays.

c. Loss and decline of economically important shellfish and finfish resources due to over fishing (and the above), as evidenced by the abundance of clams found in uncertified (unharvested waters).

d. The physical impacts to the barrier island and to the bays which degraded the ecosystem have occurred relatively rapidly. The habitats that were affected evolved over thousands of years. This is the time scale in which these processes function. Claims by the Service that barrier migration will be significantly affected with a related loss of shallows and salt marsh (due to drowning by sea level rise) during the potential 30 years of the project does not fit into this time scale.

Contrary to USFWS assertions, construction of the interim projects will not significantly exacerbate these problems, nor will the failure to construct these projects generate sufficient improvement via natural processes.

Page 19

Open Water/Non-Vegetated Bay Bottom

The Service states that valid conclusions about the ecosystem(s) of the barrier island complex cannot be drawn from examining smaller parts of the whole. In their opinion there are no separate components. In reality, Great South Bay is significantly different physically and biologically, from Moriches, and Shinnecock bays. This is the reason why only Great South Bay could support an enormous hard clam fishery in the past.

The relatively small rate of exchange within the narrow channels that connect each bay, are overwhelmed by the deep stabilized inlets which are the dominant tidal exchange mechanism. It is unlikely that the addition of ephemeral, "naturally" caused inlets in the eastern bays will have a significant influence on the water quality, temperature mediation, flushing and biota of Great South Bay. During the existence of the 1992 breach at Westhampton, reports of increased sets of hard clams together with greatly improved growth rates were attributed to the presence of the inlet in Moriches by those who wished the inlet to remain open. However, there is no subsequent evidence that the reported improvements ever occurred.

It appears that higher salinity will allow the intrusion of oceanic predators into the bay system, potentially offsetting any benefits to hard clam growth.

Re: Water Quality

The presence of more oceanic water in the vicinity of an inlet can improve water quality, but it is accompanied by a change in community to that of a more oceanic nature, including a great increase in shellfish predators, and predatory fish. After the 1980 Moriches breach, this was found to be the case. Areas where it was known that salinity would show an increase, (outside the area of immediate local tidal effects) were also monitored. Shellfish in these areas were shown to have decreased growth rates.

The projects will not induce a hydrodynamic change within the bay. Overwash, and conditions leading to a breach will still occur during storm events greater than a 44 year event.

We disagree with the Report's statements on page 32 that turbidity is unimportant to benthic organisms. Although most nearshore sessile benthic organisms are adapted to a changing sediment environment, they are not immune to the effects of siltation. So, if they were exposed to high concentrations of fine particles, they would be impacted. However, since borrow material will primarily consist of coarse sand; excessive siltation and enduring turbidity is not likely.

Mobile species (i.e. finfish) have the abililty to relocate if water quality is affected. However, if these species are exposed to lethal concentrations in a laboratory (as is customary in such tests), the option to restablish is not available. Regarding the impacts to fish eggs, few mid-Atlantic coast oceanic species have life history stages which include egg deposition and development in the intertidal and nearshore zones of ocean beaches. However, many species of benthic invertebrates spawn and develop in these areas, including the horseshoe-crab, which is a species of special concern during beach nourishment projects.

Wave action within the bay itself during storm events will resuspend bay bottom sediments, and should obscure any reduction of sediments delivered during overwash.

<u>Page 21 Inlet Channels</u>

The proposed project will not impact any existing navigation channels, except for a small increase in shoaling rates due to the greater availability of littoral material near the inlet areas.

The Service implies that inlet water ways provide rare, special habitat because fish are often present and birds and mankind can take advantage of this. Inlets provide narrow passage ways between two water bodies. The presence of fish within the inlets indicates that fish do indeed utilize the inlets. An inlet itself is a bottle neck in which fish concentrations are increased. Local fisherman know this, and therefore fish there. An inlet provides easy access to higher concentrations of fish for fishermen both on land and on boats, as compared to the open water.

Inlets also provide certain birds, including endangered and threatened species with advantageous feeding circumstances by the "bottle necking" and exposing of prey-fish via unvegetated shallows, and/or the presence of predatory fish which often drive the prey species to the surface. The fish the birds prey upon include many juveniles of commercially and recreationally important species.

However, an interesting paradox seems to have arisen. It is apparent that predatory fish are often abundant in inlets, the same inlets which also attract various species of threatened/endangered terns. Safina (1990) showed that within the inlet different species can take advantage of distinct feeding niches and avoid direct competition. What the Service did not point out was that in Safina's earlier work (1983), he showed that predatory fish (specifically blue fish) are the terns greatest competitor for prey items. Once blue fish have migrated inshore in great numbers (July), they effectively reduce the bait fish populations causing reproductive failure by way of chick starvation (inability to feed the tern chicks the required amount of food to reach fledge stage). Thus, late nesting or renesting terns attracted to an area with a constant bluefish population would be at a disadvantage.

Page 21, para. 6.

As recognized previously, inlet formation processes are difficult to predict. As discussed previously, the basis for our determination regarding the probability of breaching is based upon our analysis of overtopping conditions that led to the breach at Westhampton in 1992, which was undertaken for the interim projects and breach contingency plan. These conditions were utilized to determine the probability of breaching in similar locations. Please note that the Governor's Task Force has recommended breach closure.

Page 21, para. 7.

The storm surge model, generated for the reformulation study and interim studies, has modeled the ocean and bay interaction in various barrier island configurations, including the existing condition, and the with-project condition. The differences in flood elevations has been determined, and this information has previously been provided to the DOI.

Page 22, para. 2.

The questions raised here have been answered largely based upon analysis conducted for the breach contingency plan. This information has previously been provided to the USFWS.

Page 22, para. 3.

The engineering analysis for west of Shinnecock Inlet indicates that the existing level of protection for this area is less than 1 year, due to the historical extreme erosion rates in this area, and the potential for damages to the road. The concern for the area west of Shinnecock is not only the potential for mainland flooding, but also the concerns regarding impacts to the Federal inlet structures, and the navigability of the inlet. The Service will be provided the Engineering and Economic analysis under separate cover.

Page 22, para. 5 & 6.

This information is contained within the analyses conducted for the breach contingency plan.

Page 22 Vegetated Bay Bottom
The District concurs that there is a data gap regarding this subject. Please note that the purpose of New York Sea Grant Institute's Final Report of 1993 was to identify research opportunities within the Fire Island National Seashore. These studies were not developed to determine the relative impact of a beachfill project.

Page 24 Tidal Marsh

Page 24. Para. 4.
As discussed previously the projects as configured will not prevent barrier island process, but instead reduce the probability of breaching and overwash associated with high frequency storm events.

We disagree with the Service claim that the projects will prevent overwash processes, and halt saltmarsh succession. First, the difference between the interim project and without the project condition would impact only a few storms that would be expected to result in events that deposit sand in the back bay during the 30 years (of the project). Second, deposition of sand (the creation of shallows and intertidal area) is not the controlling factor in saltmarsh formation. Marsh creation is dependent on the supply of organic debris, suspended sediment load and the erosional/depositional regime of the area. Creation of new shallow areas will continue to occur as sea level rises.

The accretion of marsh sediments is a long-term geologically mediated process. Within the Long Island barrier bay system the supply of organic debris and seasonal input of suspended sediment has been dramatically reduced by the loss of large areas of eel grass and north shore fringing marsh and its associated surface water system. The deepening of the bay, through dredging, has also changed the depositional patterns, favoring the deeper areas. All of these factors contribute to even slower marsh formation. Diminished deposition of sand in the bay for the 30 years of the project is insignificant.

The above factors present an interesting paradox. Marsh creation even under ideal conditions is very slow. Marsh destruction, however can occur almost instantaneously. Under the present conditions that exist within the barrier island system on Long Island, overwash and related events cited to be beneficial by the Service are far more likely to bury and eliminate salt marsh than influence the creation of new marsh.

As noted in the FWCAR, the potential reduction of moist tidal flats may impact shorebird habitat, and mitigation measures may have to be taken. Mitigation may include depositing sand on the barrier bayside in conjunction with the dredging of the Intracoastal Waterway and/or altering the height/placement/shape of the constructed dune. The District, as part of the Reformulation Study, will also be looking to mitigation and restoration activities that may be necessary to compensate for project implementation. These activities may include tidal and non-tidal marsh restoration, habitat island creation, etc. Although specific mitigation sites have not been identified, it is expected that the marsh sites will be on the bayside shorelines and the islands placed where there will be the least environmental impact on the estuarine ecosystem as well as avoiding navigable areas within the bay.

Page 26 Subaerial Beach

The District recognizes that according to the level of design, the project will prevent a percentage of overwash, breaching and inlet formation. This will in turn reduce the probability of the formation of certain land forms known to be advantageous to particular species of birds, as well as reduce the amount of coarse sediments entering into the back bay system. The project will also reduce the affects of over spray and plants which are tolerant of or dependent on those conditions could be out competed.

In general, if the vegetation associated with the beach and dune system are species which are known to favor areas with relatively high coastal dynamics, then the vegetation will gradually favor species common in more stable areas. This change in vegetation could affect faunal diversity.

OCEAN SHORE - Shoreface p. 30.

The District recognizes if an area of intertidal beach is buried during the project, it will be temporarily unavailable for migrating shorebirds as foraging grounds. Once the section is completed, in less than a year, it will once again become available as suitable foraging ground.

Borrow Area

The District recognizes that project construction will eliminate benthic populations from the borrow sites. These effects will be relatively short term. Because of the vast areas available, even if all of the borrow areas are excavated at once (which is not the case), there will be little impact to the types of species that utilize benthic areas like the borrow site, other than the direct impact of being drawn into the draghead, or buried on the beach.

Recommendations

Page 33. Para.6.

As discussed previously, the proposed interim projects are far removed in scope from the project proposed in 1977. The proposed plan for west of Shinnecock Inlet does not include sheetpiling.

Page 33. Breach Contingency Plan

Please note that for the purposes of engineering and economic analysis of the future without project analysis, the Breach Contingency Plan was included as a baseline condition. The analysis of the flooding impact to the mainland of Long Island was based upon the assumption that breaches in the barrier island would be closed within three months utilizing the BCP. The results show that the economic benefits from storm damage reduction are justified with the breach contingency plan in place.

Page 34. Minimization.

Please note that sand bypassing of Moriches Inlet is currently underway, as a separate element from the proposed Fire Island Interim Project. Analysis of the interim project has taken into consideration the continued bypassing of material from Shinnecock Inlet.

The Corps did not fully investigate modification of the inlet structures as a part of the interim project for West of Shinnecock Inlet. It was determined that inlet structure modification, as a structural measure was outside the limits of an interim project. This alternative, in addition to all other alternatives will be fully explored in the reformulation study. The currently proposed interim project does include a sandbypassing component, the details of which will be provided to your office under separate cover.

Page 35. Buy out

A preliminary investigation of the buy out alternative is that purchase of mainland structures impacted by flooding up to a 44-year flood zone is too costly to implement.. In addition, it is not a readily implementable solution as an interim measure.

Page 35. Improve Institutional Management.

Please note that a prerequisite to the implementation of the Fire Island Interim Project is the State's implementation of the Coastal Erosion Hazard Act mapping, to establish zoning restrictions along Fire Island.

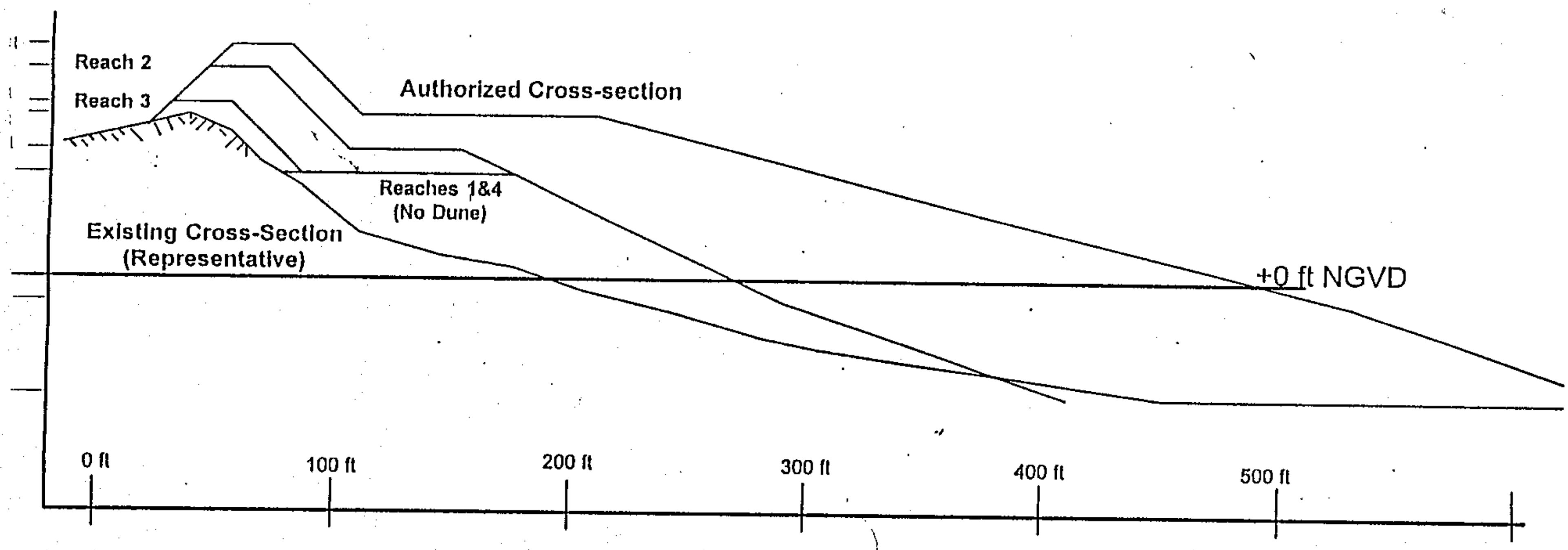
References

Nelson, W. 1993. "Beach Restoration in the Southeastern U.S.: Environmental Effects and Biological Monitoring." Ocean and Coastal Management 19:157-182

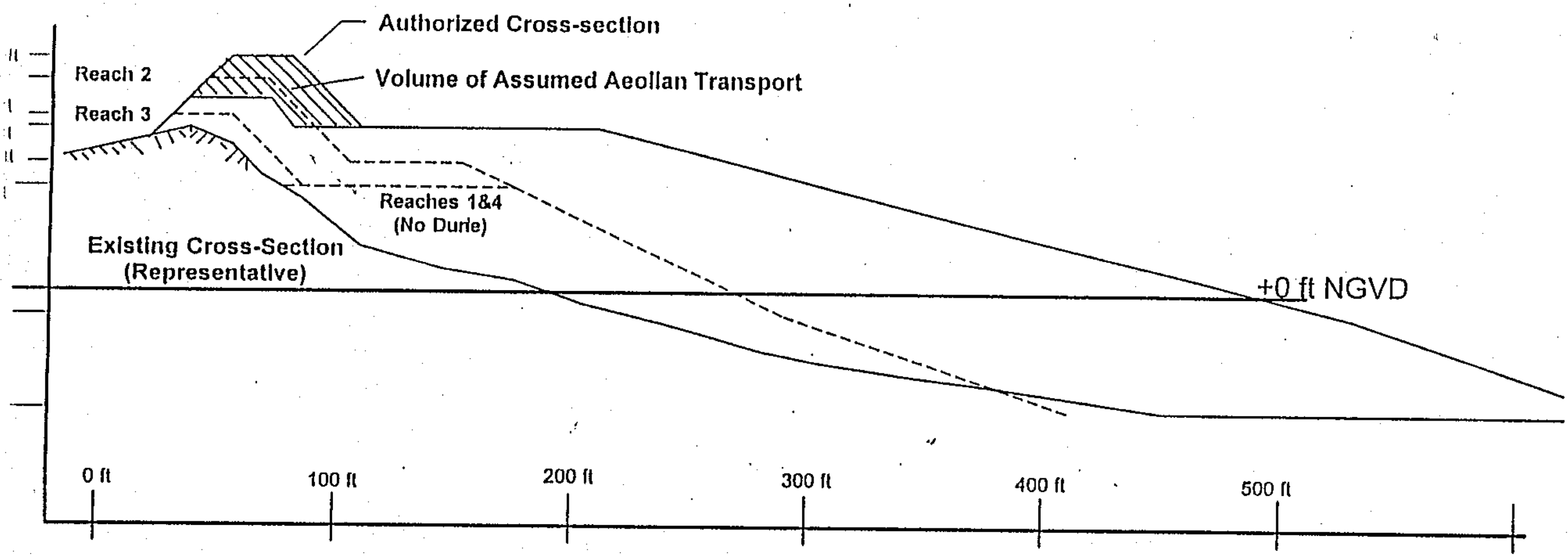
Safina, C. and J. Burger. 1983. "Effects of Human Disturbance on Reproductive Success in the Black Skimmer". Condor. 85-164-171

Safina, C. 1990. "Bluefish Mediation of Foraging Competition between Roseate and Common Terns". Ecology 71:1804-1809

COMPARATIVE CROSS-SECTIONS



COMPARATIVE CROSS-SECTIONS



West of Shinnecock Inlet Interim Project Description

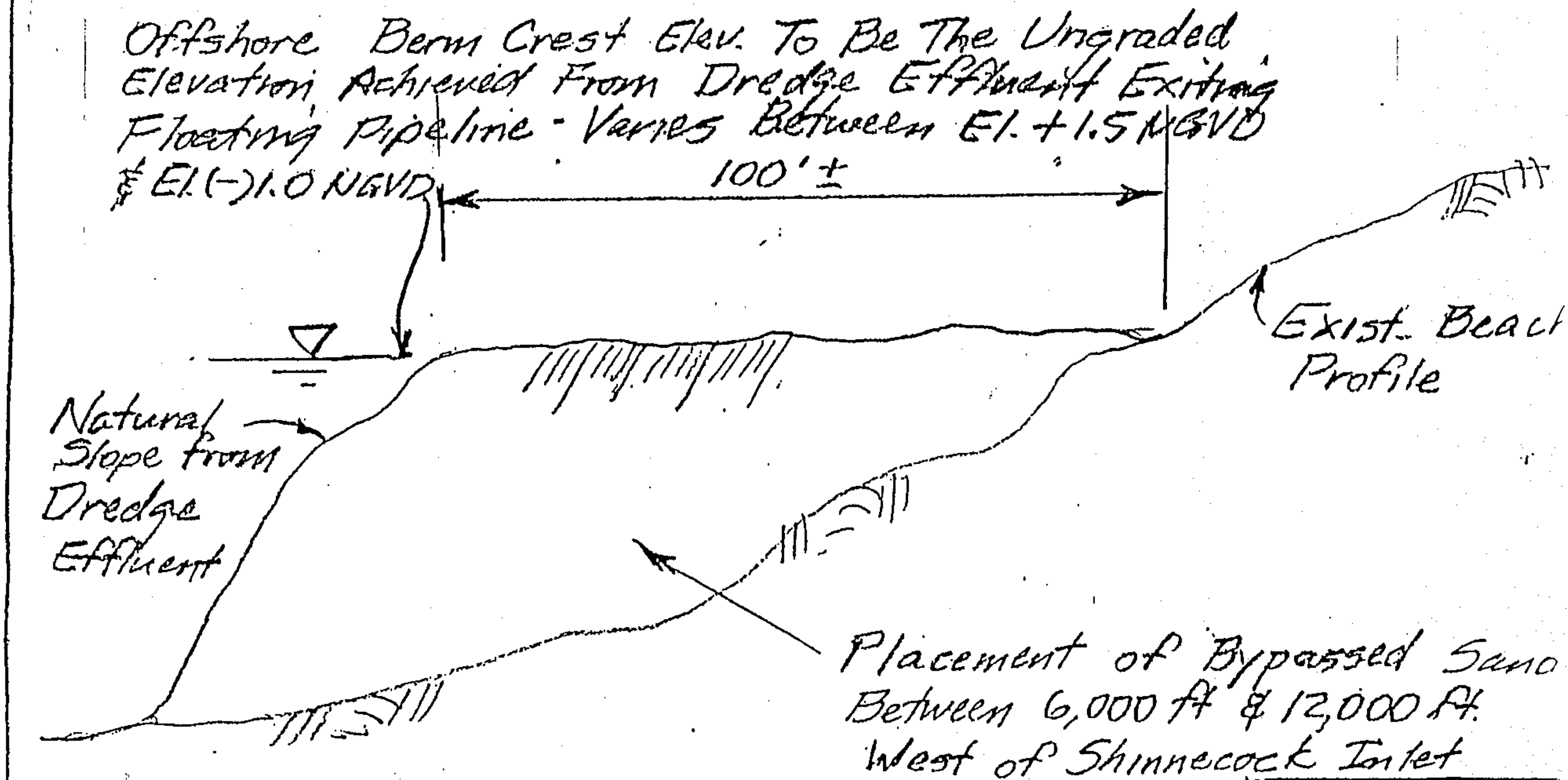
The West of Shinnecock Inlet interim project is a storm damage reduction project intended to address the critical areas immediately west of Shinnecock Inlet. The area investigated spans a distance 14,000 feet west from Shinnecock Inlet.

The recommended plan includes beach and dune fill along two sections, the first placement area is the 4,000 foot section immediately west of Shinnecock Inlet, and a second placement area approximately 6000 feet in length, westward from a distance of approximately 8,000 feet west of the West Jetty.

The plan for the 4,000 foot area west of Shinnecock Inlet includes beach and dune fill in the amount of 1,000,000 cy configured with a dune, crest width of 25 feet, a top elevation of 15 ft NGVD, fronted by a beach berm at elevation +9.5 feet, and a width of 90 feet, sloping at elevation 1:15 to elevation -6 ft NGVD, sloping (1:40) to the existing profile. The design fill is fronted by 64 feet of advance fill to account for material losses for a two year period, prior to renourishment. Every two years approximately 380,000 cy of material would need to be placed to ensure the design cross-section is not compromised.

The plan for the secondary area includes placing approximately 260,000 cy of material every two years, configured as advance fill to account for long-term erosion losses over the life of the project. The material is configured with a maximum top elevation of +1.5 feet NGVD, and a width of 100 feet, (as shown in the enclosed cross-section) extending a longshore distance of approximately 6000 feet.

The source of material for initial construction and renourishment would be an offshore borrow area. This material would be supplemented by material found to be available within the inlet navigation channel and inlet ebb shoal system. The availability of the ebb shoal and navigation channel material as a source for construction is dependent upon material compatibility analysis, cultural resource avoidance and monitoring of the inlet system response to dredging activities.



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INTERIM PROJEC

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SHINNECOCK

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

P.O. Box 608
Islip, New York 11967

November 16, 1998

Colonel William H. Pearce
District Engineer, New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Attention: Frank Santomauro

Dear Colonel Pearce:

Please find enclosed the U.S. Fish and Wildlife Service's (Service) DRAFT report prepared in partial fulfillment of Section 2(b) of the Fish and Wildlife Coordination Act (Act) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) for the U.S. Army Corps of Engineers' (Corps) project entitled, "Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project, Reach 1 - Fire Island Inlet to Moriches Inlet Interim Storm Damage Protection Plan." The enclosed report does not constitute a final report of the Secretary of the Interior as required by Section 2(b) of the Act.

As indicated above, this report is being submitted in partial fulfillment of the requirements set forth in the Act due to the deficiency of environmental information necessary to conduct an adequate impact assessment and develop substantive mitigation recommendations for the proposed 30-year dune construction/beach nourishment project.

Our report discusses the relationship between the barrier island processes and fish and wildlife resources, within the affected barrier island and back bay, and ocean nearshore ecosystem, locally encompassing Shinnecock Bay, Moriches Bay, and Great South Bay, Westhampton Island, Fire Island, and the designated borrow areas. In addition, we discuss the potential environmental impacts upon this ecosystem both with and without implementation of the Corps' recommended 30-year beach fill/dune construction plan, but recognize that our assessment is limited to the extent that other major planning efforts are underway which may impact the ecosystem in a way we are not able to predict at this time.

In addition, the report provides a discussion of the wildlife resource information which should be gathered and utilized to develop an evaluation process for this project. We provide a series of recommendations on what studies should be performed to provide a better understanding of the existing ecosystem in the project area. The recommendations include sampling in open—

water non-vegetated bay bottom, inlet channel, and ocean beach/nearshore communities

As you are aware, the Corps is in the very early stages of scoping out the types of surveys and investigations which would be necessary to assess the direct, indirect, and cumulative impacts of this project and other projects on wildlife resources through the Fire Island Inlet to Montauk Point Reformulation Study process. Many resource agencies, including the Service, participate in the Environmental Technical Management Group (TMG) which was formed to discuss the development and implementation of the environmental sampling programs. Since the surveys have not been devised, the information necessary to establish an adequate environmental baseline by which to predict or measure impacts is unavailable. We encourage the Corps to adopt a more aggressive schedule for the TMG's. It is important that the development of the sampling programs be completed in a timely manner or risk slippage of the FIMP schedule. The Service requests that the Corps contact our office to discuss the recommendations provided in the enclosed report to further develop surveys and investigations of wildlife resources.

The Fish and Wildlife Coordination Act recognizes the "...vital contribution of our wildlife resources to the Nation, the increasing public interest and significance thereof due to the expansion of our national economy and other factors, and to provide that wildlife conservation receive equal consideration and be incorporated with other features of water-resource development programs through the effectual and harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation ...." Under the Act, "...reports and recommendations of the Secretary of the Interior on the wildlife aspects of such projects...are based on surveys and investigations for the purpose of determining the possible damage to wildlife resources and for the purpose of determining means and measures that should be adopted to prevent the loss of or damage to such wildlife resources, as well as to provide concurrently for the development and improvement of such resources, shall be made an integral part of any report prepared or submitted by any agency of the Federal government responsible for engineering surveys and construction of such projects authorized to make surveys and investigations of the wildlife of the public domain...."

As is customary, a detailed discussion of the impacts of the proposed project on the Federally-listed piping plover (*Charadrius melodus*), seabeach amaranth (*Amaranthus pumilus*), and roseate tern (*Sterna dougallii dougallii*) are not contained within this report. These will be forwarded under separate cover in our Biological Opinion which is under preparation. However, we would like to reiterate comments which we provided to your office in letters dated March 23, 1995, June 15, 1995, and July 14, 1995. That is, the number, size, and scope of potential coastal stabilization projects that may affect these species are matters of serious concern. In the case of the piping plover, these projects will further erode the species' already precarious status by reducing and degrading available nesting and foraging habitats. Again, we strongly recommend that the Corps incorporate measures to reduce adverse impacts on this species into the design and implementation of these proposed projects and implement proactive measures to improve the productivity and numbers of this species on Long Island.

The Service looks forward to working with the Corps during the planning process for this and future projects. Should you have any questions, please contact Steve Mars, Supervisor of the Long Island Field Office, at (516) 581-2941.

Sincerely,

for David A. Stillwell
Acting Field Supervisor

Enclosure

cc: NYSDEC, Stony Brook, NY (C. Hamilton)
NYSDOS, Albany, NY (W. Barton)
NMFS, Milford, CT (D. Rusanowsky)
USEPA, New York, NY (G. Musumeci)
NPS, Patchogue, NY (C. Dillon)
USDOI-OEPC, Boston, MA (A. Raddant)

Fire Island Inlet to Montauk Point
Beach Erosion Control and Hurricane Protection Project
Reach 2 -
Moriches Inlet to Shinnecock Inlet Interim
Storm Damage Protection Plan

DRAFT

Fish and Wildlife Coordination Act

Section 2(b) Report

U.S. Fish and Wildlife Service

Long Island Field Office

Islip, New York

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DRAFT
Fish and Wildlife Coordination Act
Section 2(b) Report

Prepared for:

U.S. Army Corps of Engineers
New York District
New York, New York 10278

Prepared by:

U.S. Fish and Wildlife Service
Long Island Field Office
Ecological Services, Region 5
Islip, New York 11751

Preparer: Christy Johnson-Hughes
Assistant Project Leader: David Stilwell
Project Leader: Sherry Morgan

November 1998

EXECUTIVE SUMMARY

The U.S. Fish and Wildlife Service (Service) has adopted an ecosystem approach to fish and wildlife conservation as a foundation of its operational activities. It is the Service's view that a broad, holistic management strategy is an effective way to address the agency's mission to conserve, preserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people and to manage its extensive array of trust responsibilities such as migratory birds, anadromous fish, marine mammals, endangered species, wetlands, and the National Wildlife Refuge System. The goal of the Service's ecosystem approach is to effectively conserve biological diversity through perpetuation of dynamic, healthy ecosystems by means of coordinated efforts with public agencies, private organizations, landowners, and citizens.

This DRAFT report has been prepared at the request of the U.S. Army Corps of Engineers (Corps) in partial fulfillment of Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The Fire Island Inlet to Moriches Inlet Interim Storm Damage Protection Project (FIIP) is being proposed as part of the Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project (FIMP), which was authorized in 1960. The Corps is currently reformulating the authorized 1960 plan and is scheduled to publish an integrated Environmental Impact Statement (EIS) in June 2002. The programmatic EIS will determine whether there is a Federal interest in providing long-term shoreline protection, such as that proposed in the FIIP, to the 83 miles of Atlantic shoreline stretching from Fire Island Inlet to Montauk Point.

The FIIP is one of four beach fill and dune construction projects proposed as "interims" to the completion of the FIMP Reformulation Study and its associated programmatic EIS. The other three are the West of Shinnecock Inlet Interim Storm Damage Protection Project (SIIP), the Westhampton Interim Project, and the Interim Breach Contingency Plan. Overall, these encompass 48 miles of barrier beach. All of these are within an interconnected coastal bay and barrier island ecosystem. While the FIIP is proposed as an interim project, it has a 30-year project life and involves an initial expenditure of approximately 60 million dollars.

The FIIP project area encompasses 32 miles of shoreline along the ocean side of Fire Island, with beach fill and/or dune construction for over 14 miles of beach, as well as an offshore sand borrow area south of Cherry Grove, covering approximately 3 square miles. The project area is broken into four reaches: Reach 1, Robert Moses State Park; Reach 2, Kismet to Point O'Woods; Reach 3, Cherry Grove to Davis Park; and Reach 4, Wilderness Area to Moriches Inlet. The FIIP will be maintained for 15 years, with a potential maximum duration of 30 years dependent on the results of the FIMP Reformulation Study, with renourishment scheduled once every three years. The Service considers the FIIP a 30-year project for a complete assessment of impacts to natural resources. The stated purpose of the FIIP is to provide protection to the barrier island and mainland communities through the reinforcement of portions of the Fire Island barrier island, and provide protection to the communities along Great South Bay and Fire Island until the FIMP Reformulation Study could be completed. In decreasing order of importance, the economic benefits of this project are derived from reduction of damage to structures on the barrier island and mainland, reduction of emergency restoration costs, and increasing recreation values.

This DRAFT report provides Service comments on the biological and procedural issues relevant to this project. Specifically, we discuss the relationship between barrier island processes and fish and wildlife resources, describe the fish and wildlife resources within the affected barrier island and back-bay, and ocean nearshore ecosystem, which locally encompasses Shinnecock Bay, Moriches Bay, and Great South Bay, Westhampton Island, Fire Island, and the designated borrow areas. In addition, we discuss the potential environmental impacts upon this ecosystem both with and without implementation of the Corps' recommended 30-year beach fill/dune construction plan, but recognize that our assessment is limited to the extent that other major planning efforts are underway which may impact the ecosystem in a way we are not able to predict at this time. The Service notes that the Corps has separate planning efforts or permit applications underway within this ecosystem which include the SIIP, FIMP Reformulation Study/EIS, Fire Island Inlet Federal Navigation Channel maintenance, local community beach nourishment projects, and the South Shore Embayment Study. The Service disagrees with the Corps on this approach based on the grounds that all of these efforts impact a single interconnected coastal system, and that providing separate reports does not allow for an adequate analysis of potential direct, indirect, and cumulative impacts to the system.

On a procedural basis, this project is counter to the intent of the National Environmental Policy Act (NEPA) and disregards previous President's Council on Environmental Quality (CEQ) findings regarding segmentation of the authorized FIMP project. The Corps is preparing a Draft EIS. However, this may be in conflict with Section 1506.1c of NEPA of 1969 which set specific limitations on actions during the NEPA process, including interim actions which fall within a programmatic environmental impact statement. In addition, the Corps' recommended 30-year interim beach fill/dune construction plan is similar to the beach fill/dune construction measures proposed for this reach by the Corps in their 1977 FIMP EIS. Over 20 years ago, the U.S. Department of the Interior (DOI), U.S. Environmental Protection Agency, and National Marine Fisheries Service found the Corps' FIMP EIS deficient and referred it to CEQ who subsequently referred it back to the Corps in 1978. The primary concern expressed by the CEQ in 1978 was that the combination of large-scale, long-term beach construction projects and rising sea level will leave the barrier islands more vulnerable to breaching than they are at present, resulting in an on-going liability for the Federal government.

Section 2(b) of the FWCA requires that the DRAFT report of the Secretary of the Interior: 1) determine the magnitude of the impacts of the proposed projects on fish and wildlife resources, and 2) make specific recommendations as to measures that should be taken to conserve those resources. The Service has reviewed the current literature on the biological and physical processes effecting this barrier island and coastal ecosystem. Although system specific data are limited, it is clear that when the project is considered within the context of the existing and foreseeable coastal projects this project has the potential to have significant ecological impacts. Through the FIMP Reformulation Study process, Federal, State, and local resource agencies are working with the Corps to develop and implement environmental sampling programs which will provide information for the assessment of project impacts. This process is still in the early stages of development. Therefore, our report should be considered an interim report until system specific data from the above sampling programs are available for review and consideration.

In the short-term, the Corps' recommended interim plan for Fire Island will have direct and indirect adverse impacts on fish and wildlife resources and their supporting ecosystems. Initial beach fill will directly impact 14 miles of subaerial, nearshore intertidal, and subtidal marine habitats and 8 square miles of subaqueous borrow areas.

In the long-term, the 30-year beach fill/dune construction plan could also have several adverse impacts on fish and wildlife habitat and the overall condition of the barrier island through prevention of coastal processes which maintain the barrier islands as natural protective features. Coastal processes keep the barrier island above water and protect Long Island's south shore from direct influences of ocean waves and also create and maintain a natural balance among various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife species. An evaluation to identify possible adverse effects that such ecosystem manipulation may have on Long Island's barrier islands back-bay complex is needed and should be part of the final Reformulation Study. Over a 30-year time frame, these beach nourishment projects may precipitate enormous ecological changes without an understanding of the potential consequences, and would do so in the absence of an environmental baseline by which they could be measured.

The Service has recommended a number of short-term alternatives that the Corps should consider in its report evaluating the feasibility of Federal involvement in providing protection to the communities on Fire Island and along the Great South Bay. These alternatives include the implementation of the Interim Breach Contingency Plan, continuation of pre-storm sand build-up operations/issuance of emergency permits by State and local governments, incorporation of buy-out plans/land use regulations/flood proofing measures, and minimization of the project duration and scale.

This report does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA. The Service maintains that there is insufficient information regarding the existing conditions in the ocean, bay, and barrier island habitats to determine the magnitude of the impacts of the proposed projects on fish and wildlife resources over the 30-year project life. In turn, specific recommendations as to measures that should be taken to conserve those resources cannot be fully made. The Service recommends that the Corps undertake an analysis of environmental impacts that would provide data sufficient to determine the project specific and cumulative environmental impacts and provide a basis for a mitigation program prior to submitting the feasibility report for project authorization. The Service, therefore, recommends that the Corps' FIIP report not be submitted for project authorization until such analysis is complete. The Service concurs with the Corps' contention that the FIMP Reformulation Study/EIS is the proper framework for undertaking an appropriately detailed impact analysis for long-term Federal strategies to shoreline protection, and recommends that the Corps concentrate its resources on completing the FIMP Reformulation Study/EIS rather than pursuing long-term "interim" proposals.

I. INTRODUCTION

The U.S. Fish and Wildlife Service (Service) has adopted an ecosystem approach to fish and wildlife conservation as a foundation of its operational activities. It is the Service's view that a broad, holistic management strategy is an effective way to address the agency's mission to conserve, preserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people and to manage its extensive array of trust responsibilities such as migratory birds, anadromous fish, marine mammals, endangered species, wetlands, and the National Wildlife Refuge System. The goal of the Service's ecosystem approach is to effectively conserve biological diversity through perpetuation of dynamic, healthy ecosystems by means of coordinated efforts with public agencies, private organizations, landowners, and citizens.

This is the Service's DRAFT report provided in partial fulfillment of the statutory requirements of Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). This report does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FCWA. Section 2(b) of the FWCA requires that the DRAFT report of the Secretary of the Interior: 1) determine the magnitude of the impacts of the proposed projects on fish and wildlife resources, and 2) make specific recommendations as to measures that should be taken to conserve those resources. The Service has reviewed the current literature on the biological and physical processes effecting this barrier island and coastal ecosystem and has determined that there is insufficient information about the system to adequately determine the magnitude of impacts of the proposed project on fish and wildlife resources. Therefore, a final report cannot be provided until the necessary information, as detailed in this report, is available to the Service for review and consideration. As part of our commitment and responsibilities to the FWCA and to the process of identifying a project that addresses the needs of the Corps we have included a discussion of general recommendations that should be taken to conserve those resources.

This DRAFT report provides Service comments on the biological and procedural issues relevant to the U.S. Army Corps of Engineers' (Corps) Fire Island Inlet to Moriches Inlet Interim Storm Damage Protection Project (FIIP). Specifically, we discuss the relationship between barrier island processes and fish and wildlife resources, describe the fish and wildlife resources within the affected barrier island and back-bay, and ocean nearshore ecosystem, which locally encompasses Shinnecock Bay, Moriches Bay, and Great South Bay, Westhampton Island, Fire Island, and the designated borrow areas. In addition, we discuss the potential environmental impacts upon this ecosystem both with and without implementation of the Corps' recommended 30-year beach fill/dune construction plan, but recognize ~~that~~ our assessment is limited to the extent that other major planning efforts are underway which may impact the ecosystem in a way we are not able to predict at this time.

The project is located within the Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project (FIMP) which was authorized by Congress in 1960 (Figure 1). The Corps is currently reformulating the authorized 1960 plan and is scheduled to publish an integrated Environmental Impact Statement (EIS) in June 2002 (Federal Register, July 28, 1997, Vol. 62, No. 144, pages 40336-40337). The programmatic EIS will determine whether there is a Federal interest in providing long-term shoreline protection, such as that proposed in the FIIP, to the 83 miles of Atlantic shoreline stretching from Fire Island Inlet to Montauk Point. While the FIIP is designated as an "interim" project, it has a minimum 15-year project life, but there is a potential for it to be extended up to 30+ years. For the purposes of determining potential project impacts to the barrier island system, the Service will use the 30-year project life. The Corps is preparing a DRAFT EIS. The history of the FIMP, including "interim" actions proposed and undertaken by the Corps, is discussed in more detail in Chapter 3.

This DRAFT report does not constitute a biological opinion under Section 7 of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.). A detailed discussion of the impacts of the proposed project on the Federally listed-threatened piping plover (*Charadrius melodus*), Federally-endangered roseate tern (*Sterna dougallii dougallii*), and the Federally-threatened seabeach amaranth (*Amaranthus pumilus*) are not contained within this report. The Service's biological opinion will be prepared under separate cover.

During informal Section 7 consultation under the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), the Service concluded that the project is likely to adversely affect these species. Under Section 7(c), the Corps has initiated formal consultation through preparation and submission of a biological assessment detailing the Corps' analysis of the likely direct and indirect effects of the proposed projects on the listed species. In consultation with the Service, the Corps shall utilize its authority to further the purposes of the ESA in the conservation and recovery of listed species and the ecosystems on which they depend. Further, 50 Code of Federal Regulations 402.02 states that "the effects of the action" to be considered during consultation include "direct and indirect effects of an action on the species or critical habitat," together with the "effects of other activities that are interrelated or interdependent with that action...."

The Service indicated in letters sent to the Corps dated March 23, 1995, June 15, 1995, and July 14, 1995, that artificial beach stabilization projects pose a threat to the survival and recovery of the Atlantic Coast piping plover. The biological opinions for the Breach Contingency Plan (BCP), Shelter Island Erosion Control Project, and the Westhampton Interim Project provide detailed discussion of the direct, indirect, and cumulative effects of these projects on plover biology and ecology.

The FIIP is one of four beach fill and dune construction projects proposed as "interim actions" within the FIMP project area. The other three are the West of Shinnecock Inlet Interim Storm Damage Protection Project (SIIP), the Westhampton Interim Project, and the BCP (Figure 2). The SIIP consists of a 14,000 ft project area stretching from west of the western-most jetty of Shinnecock Inlet; most of the project area falls within the boundaries of Suffolk County Park property. The Corps has identified the preferred alternative as construction of a dune 15 ft National Geodetic Vertical Datum (NGVD) in elevation, fronted by a berm that is 90 ft wide and 9.5 ft NGVD. The secondary placement area is designed with a top elevation of 1.5 ft NGVD and a beach berm width of 100 ft. Like the SIIP, the Westhampton Interim Project is located within the Moriches Inlet to Shinnecock Inlet reach of the FIMP project area (Figure 1).

In addition to the beach fill/dune construction proposals, the Corps is also pursuing a feasibility study entitled "South Shore of Long Island, New York - Habitat Restoration, Water Quality Improvement and Related Environmental Features," for the purpose of identifying restoration sites within the bay-barrier island complex stretching from East Rockaway Inlet to the eastern end of Shinnecock Bay. That study area is over 50 miles in length and encompasses 155 square miles (Figure 2). The Corps is identifying sites which have been impacted by past shoreline protection, navigation, and flood control projects, and will ultimately develop a programmatic EIS evaluating the past, present and cumulative impacts to the ecosystem from such projects along with proposed restoration alternatives.

The Corps has also developed the BCP with Federal, State and local government agencies for the barrier beaches within the FIMP Reformulation Study area for the purpose of closing breaches in an expedited manner. This plan is discussed in more detail in Section III. Figure 3 provides a map of the BCP project area.

In the course of its review, the Service has determined that, in the absence of information stemming from a system-wide analyses of various shoreline and environmental protection alternatives and their individual and cumulative impacts over the entire FIMP project area, this 30-year beach fill/dune construction project could have significant ecological impacts upon the barrier islands, back-bays, and their fish and wildlife communities. In turn, these impacts may impact human activities, such as recreation and commercial fishing. The Service concurs with the Corps' contention that the FIMP Reformulation Study/EIS is the proper framework for undertaking an appropriately detailed impact analysis for long-term Federal strategies to shoreline protection, and recommends that the Corps concentrate its resources on completing the FIMP Reformulation Study/EIS rather than pursuing long-term "interim" proposals.

In spite of significant data gaps, the purpose of this report is to attempt to evaluate, using available data and current knowledge of the back-bay and barrier island ecosystems, the potential direct and indirect impacts that the FIIP may have upon fish, wildlife, terrestrial, and estuarine resources over its 30-year project life. The preparation of a final FWCA 2(b) report also requires an analysis of cumulative impacts. However, a number of factors are making this prohibitive, including the large-scale planning efforts of the overall FIMP Reformulation Study/EIS which has yet to define a preferred alternative that could be evaluated in the context of this present proposal, as well as a lack of information relative to an overall impact assessment for projects which have been constructed within the ecosystem (discussed further in Sections VIII, IX, and X).

Throughout this report the Service has identified data that must be gathered in order to determine the magnitude of the impacts of the proposed 30-year project on fish and wildlife resources and the barrier island and back-bay ecosystem and make specific recommendations as to measures that should be taken to conserve those resources. These study needs are also summarized in Section X(A).

II. ESSENTIAL TERMINOLOGY

Overwash: A process by which waves break through dunes and carry beach sediments to the interior of the barrier island by pushing beach sand across the island (Leatherman 1985). In severe circumstances, sediment is transported by waves across barrier islands to the bayside shoreline. Overwash tends to erode or flatten a barrier island dune field, may clear or bury dune and inland (backdunal) vegetation, and may also result in the creation of depositional fans extending the bayside shoreline toward the mainland. Overwash also deposits sediment into the back-barrier lagoon and on the barrier island, contributing to increases in the barrier island elevation. Overwash is one of the key processes controlling the creation of bayside barrier wetlands and barrier island persistence through vertical accretion and horizontal migration (Leatherman 1985).

Breach: A condition where severe overwash forms a channel through a barrier island which permits the exchange of ocean and bay waters throughout the tidal range or after storm elevated tidal levels have subsided. Over time, a breach may close or develop into an inlet. The likelihood that a breach may form an inlet depends on the hydrodynamics of the back-bays, as well as the hydrodynamic and morphologic characteristics of other associated and existing inlets, sediment availability, and other geological factors. The limited duration of a breach also limits the degree to which the lagoonal deposition of back barrier sediments disrupts existing habitat in the short-term and promotes habitat evolution in the long-term.

Inlet: A channel cut through a barrier island which allows for the free exchange of ocean and bay waters during all stages of the tide. Over time, inlets may grow, migrate, or close. As with a breach, the lifespan of an inlet will depend on the hydrodynamics of the back-bays, as well as the hydrodynamic and morphologic characteristics of other associated and existing inlets, sediment availability, and other geological factors. The first stage of inlet formation favors the deposition of sediments into the lagoon during the flood tide, providing a shallow substrate for barrier migration and habitat formation.

Barrier Island: An elongated, narrow offshore landform, composed of sand and other loose sediments transported by waves, currents, and wind. Barrier islands constantly change their position in response to rising sea level, changes in sediment supply, the forces of wind, waves, and tides, and the shape of the beach. How fast a given island moves depends upon the rate of sea level rise and the slope of the coastal plain over which the island moves, in addition to other factors such as offshore geological formations, sediment supply, winds, waves, and tides.

Lagoon (or Bay): A large body of open water protected from the oceanic processes by coastal barriers; freshwater input is usually limited to land surface runoff or groundwater inputs.

III. FIRE ISLAND INLET TO MONTAUK POINT (FIMP) PROJECT HISTORY

A. Authorization/Construction

The FIMP was authorized by the Rivers and Harbors Act of 1960. The authorization initially provided for:

1. Widening the beaches along developed areas between Kismet and Mecox Bay to a minimum of 100 ft at an elevation of 14 ft above mean sea level;

2. Raising the dunes to an elevation of 20 ft above mean sea level from Fire Island Inlet to Hither Hills State Park, at Montauk and opposite Lake Montauk Harbor;

3. Planting grass on the dunes;

4. Constructing interior drainage structures at Mecox Bay, Sagaponack Lake, and Georgica Pond;

5. Federal participation in the cost of beach nourishment not to exceed 10 years from the year of completion of a useful nourishment unit;

6. Construct, as needed, not more than 50 groins (Corps 1977).

A portion of the FIMP project was built between 1965 and 1970; fifteen groins plus beach fill were constructed in Westhampton Beach and two groins were constructed in the vicinity of Georgica Pond in Southampton.

B. 1977 EIS Council on Environmental Quality Referral

In 1977, the Corps prepared an EIS for the FIMP project as required by NEPA of 1969. Subsequently, the DOI, in conjunction with the U.S. Environmental Protection Agency and the National Marine Fisheries Service, referred the final EIS to the President's Council on Environmental Quality (CEQ) based on their findings that the document inadequately addressed systemic environmental impacts, including impacts to the future condition of the barrier islands, and failed to evaluate all reasonable alternatives.

The project was described by CEQ as "creating a 25 x 16 foot dune along 83 miles of barrier beach in order to slow the pace of erosion and shield developed and undeveloped areas from storm flooding. Initial construction of the overall project would involve...between 48 and 80 million cubic yards of sand taken mainly from the oceans" (see Attachment A). Due to the geographic scope of the project, the project would not be built all at once, and additional studies were planned for specific project areas before proceeding.

The CEQ informed the Corps that the course of action described in the EIS was "environmentally unacceptable and that the Corps has not demonstrated that there are no practicable alternatives available" (see Attachment A). In addition, CEQ stated, "Because the entire project area is a system, it would be disingenuous to treat these issues solely in connection with a particular segment of the shore." The CEQ concluded with the recommendation that "the Corps revise its overall project plan to create an adequate framework within which subsequent detailed planning for specific parts--or reaches--might occur." That is, reach by reach planning was to follow an overall understanding of the environmental consequences of the proposed project, not to precede them. In response to the CEQ decision, the Corps proposed a plan of study for project reformulation in 1980. The FIMP Reformulation Study/programmatic EIS is expected to be completed in 2002.

C. Long-term and Short-term Actions Within FIMP Project Area

1. 30-year Westhampton Interim Storm Damage Protection Project

Despite the CEQ directive, the Corps proposed a 30-year interim project at Westhampton Beach in September 1978. The Westhampton Interim Project specifically contradicted the CEQ recommendation that the study area be managed as a single system. However, in recognition of the substantial erosion to Westhampton Beach downdrift of the Corps' groin field to the east, involved Federal agencies came to agreement by 1980 that a beach protection project was mutually acceptable and could be undertaken at Westhampton provided that the Corps commit to seeking and attaining funding for the FIMP Reformulation Study/programmatic EIS.

Initial construction of the Westhampton Interim Project was initiated in the summer of 1996 and has been completed. The initial construction entailed beach fill/dune construction over

21,460 ft of beach and the realignment of the last two western-most groins within the groin-field. Over 4,480,000 cubic yards (cy) of sand were dredged from offshore borrow areas to complete the initial phase. Renourishment of the design profile will occur every three years, initially requiring 981,000 cy and approximately 1,179,000 cy for each renourishment thereafter (Corps 1994). The Corps has indicated that the presently identified borrow areas will not provide an adequate volume of material for 30-years of renourishment and that additional sites will be needed.

2. West of Shinnecock Inlet to Moriches Inlet Interim Storm Damage Protection Project (SIIP)

The SIIP is within the Moriches Inlet to Shinnecock Inlet reach of the FIMP project area. The project commenses at the west jetty of Shinnecock Inlet and terminates 14,000 ft to the west. The Corps has identified the preferred alternative as construction of a dune with an elevation of 15 ft NGVD, fronted by a berm 90 ft wide and 9.5 ft NGVD. The secondary placement area is designed with a top elevation of 1.5 ft NGVD and a beach berm width of 100 ft. Other alternatives identified by Federal resource agencies include buy-out plan/land use regulations/flood-proofing measures, relocate the commercial fishing fleet, continue with state and local government pre-storm sand build-up operations, and a modified authorized plan. The FIIP, like the SIIP and FIMP, would also have a 30-year project life. The Service has already forwarded a similar interim response on the SIIP to the Corps in a letter dated November 5, 1998. Our response reiterated many of the concerns listed in this report.

3. Interim Breach Contingency Plan

In addition to the larger scale, longer term interim proposals and projects, the Corps and other interested Federal, State, and local governments developed an Interim Breach Contingency Plan (BCP) for south shore barrier islands and spits (Figure 3) (Corps 1996). This plan represents a more near-term interim approach in that it addresses shoreline erosion concerns on a time frame (3 years) consistent with the FIMP Reformulation Study/programmatic EIS.

The BCP was developed in the aftermath of a breach in the barrier island at Westhampton in December 1992, whereby almost 11 months elapsed before the Corps was able to obtain the necessary authorizations to close the new inlet. The delay resulted from the necessary coordination and review of the impacts involved with closing the breach. During the 11-month period, the size of the new inlet increased, as did the costs associated with filling it. The BCP is a pre-approval approach intended to make it possible for the Corps to expeditiously fill any breach between Fire Island and Southampton within 3 months. This approach allows initial barrier island processes to occur, but limits economic risk associated with a new inlet. However, even this project requires actions which may not be an appropriate management tool over the long-term and, therefore, is also being assessed under the FIMP Reformulation Study/programmatic EIS.

4. South Shore of Long Island, New York - Habitat Restoration, Water Quality Improvement, and Related Environmental Features

In addition to the beach fill/dune construction proposals, the Corps is also pursuing a feasibility study entitled, "South Shore of Long Island, New York - Habitat Restoration, Water Quality Improvement and Related Environmental Features," for the purpose of identifying restoration sites within the bay-barrier island complex stretching from East Rockaway Inlet to the eastern end of Shinnecock Bay. That study area is over 50 miles in length and encompasses 155 square miles (see Figure 2). As part of this effort the Corps will identify sites which have been impacted by past shoreline protection, navigation, and flood control projects. A programmatic EIS evaluating the past, present, and cumulative impacts to the ecosystem from such projects along with the proposed restoration alternatives will be developed.

5. West of Shinnecock Inlet and Westhampton Interim Projects

The Corps' recommended 30-year beach fill/dune construction plan for west of Shinnecock Inlet and the Westhampton Interim Project are not true "interim" projects when both their scope and duration are considered; rather, they represent a variation of the proposal for the construction of the project which was referred to the CEQ in 1978. While the individual interim projects are described as smaller in scope and do not contain hard structures, as described in the original proposal, the overall impact of the interims on the barrier island is equivalent to the impact of the original proposal as described in the FIMP. The SIIP and Westhampton Interim Project are a construction and 30-year maintenance program that would build dunes 15 ft in elevation on the Westhampton Barrier Island including the area west of Shinnecock Inlet. These projects would establish a precedent for Corps projects to be constructed in stages along the entire 83-mile FIMP project area as proposed in the original 1977 EIS.

IV. FIIP PURPOSE

The stated purpose of the Corps' FIIP is to reduce storm damages to the barrier island and the mainland by providing a degree of protection to the barrier island, with beach and dune fill. The project will reduce the probability of breaching and overwash associated with high-frequency storm events, until implementation of any project resulting from completion of the Reformulation Study. The project will provide limited protection for a potential period of 30 years along the 32-miles of Fire Island. The Corps has prepared a DRAFT EIS for this project. However, it is still under internal review and has not gone out for public/agency comment. The FIIP is one of the many projects that the Corps is evaluating regarding the feasibility of Federal involvement in providing shoreline protection around Long Island. A map indicating the Corps' overall plan for the FIMP on Long Island is shown in Figure 4. The map does not include the Corps Operations and Maintenance Program, which also plays a role in shoreline protection through sand by-passing of the inlets.

In decreasing order of importance, the economic benefits of this project, as reported by the Corps, are derived from the reduction of damage to structures on the barrier island and mainland, reduction of emergency restoration costs, and increasing recreation values.

V. DESCRIPTION OF THE RECOMMENDED PLAN AND "NO ACTION" ALTERNATIVE

A. Recommended Plan: 30-year Beach Fill/Dune Construction

The recommended plan spans a distance of 32 miles along the ocean shore (Figure 5). The plan includes beach fill and dune construction along four reaches, totaling 14 miles of fill. Reach 1 (Robert Moses State Park) extends from the eastern jetty at Fire Island Inlet, 26,900 ft to the eastern boundary of Robert Moses State Park. Reach 2 extends from Kismet to Point O'Woods and includes 25,200 ft of Atlantic shoreline. Reach 3 includes the communities of Cherry Grove to Davis Park, covering 43,200 ft of coastline. Reach 4 includes FINS Wilderness Area and Smith Point County Park and includes a total of 67,800 ft of Atlantic coastline.

The proposed FIIP would be built and then maintained for up to 30 years using sand dredged from an offshore borrow area located south of Cherry Grove (Figure 6). In addition to the initial fill of approximately 9,021,670 cy of fill material, at least 2,285,400 cy more will be dredged and placed on the beach during maintenance cycles (Tables 1 and 2). Over the 30-year project life additional nourishment cycles are proposed involving approximately 16 million cy of dredged material from the borrow area.

The plan involves multiple dune and berm beach fills. The design profile for the beach fill/dune construction area for Reach 1 entails a 90 ft wide berm at 9.5 ft NGVD fronting the existing dune line. Reach 2 entails a 90 ft wide berm at 9.5 ft NGVD backed by a dune with a crest width of 25 ft and a height of 15 ft NGVD. In some areas of Reach 2, the berm has a height of 11 ft NGVD with a width of 40 feet for greater protection and a dune height of 18 ft NGVD. Reach 3 entails a berm width of 90 ft at 9.5 ft NGVD, and backed by a dune with a crest width of 25 ft at 15 ft NGVD. Reach 4 entails a minimum beach width of 90 feet at 9.5 ft NGVD. Existing dunes are of sufficient height to provide protection, but the fronting beach width is considered to be highly eroded. The design fill will act as a feeder beach to downdrift areas. Each of the beach profiles are designed to provide storm protection up to a 44-year storm event. The plan layout is shown in Figure 7.

The project design profile has a 50% chance of surviving the storms which are likely to occur during its 30-year project life. As stated by the Corps, this design profile provides protection for a "44-year storm," which is a statistically constructed model storm of a size that is likely to occur only once in 44 years in the Long Island area or one which has a 2.2% chance of occurring in any given year.

1. Comparison to 1977 EIS Plans Referred to CEQ

The following is an excerpt from the Corps' 1977 EIS which describes construction plans for the Fire Island Inlet to Moriches Inlet reach.

> Section 1.38. Work in this area will consist mainly of emplacing dune fill and planting grass. Beach fill will be provided from Point O'Woods westward to Kismet. The construction of up to 13 groins is authorized for this reach. Dune and beach fill will be the same dimensions as the Moriches Inlet to Shinnecock Inlet reach ... with approximately 20,000,000 cubic yards of sand gained from offshore deposits.

We recognize the design profile for the Interim plan is smaller than that proposed in the 1977 EIS plan. However, the impact of the Interim project, for all intents and purposes, will have the same effect as that identified in the CEQ referral.

B. <u>No Action Alternative</u>

The No Action alternative, or without project, provides that no Federally-funded beach fill/dune construction measures would be initiated for a duration of 30 years pending the completion of the FIMP. As structured by the Corps, the No Action alternative would include the implementation of the Interim BCP to close any breaches which may occur in the area within a period of three months, at an elevation of +9 ft NGVD. The No Action also alternative includes the continuation of existing efforts such as the interim BCP and dredging/beach nourishment by barrier island communities, within the project limits of the FIIP.

VI. IMPORTANCE OF THE STUDY AREA

The study area includes residential, recreational, and commercial developments as well as parks, a wilderness area, national wildlife refuges, State- and Federally-designated fish and wildlife habitats. Commercial fisheries, residential housing and park beaches have developed on the barrier island for investment and recreational purposes.

A. <u>Public Emphasis on the Back-Bay, Barrier Island, and Ocean Nearshore Habitats</u>

As recently as January 1997, in its announcement of the "Embayment area along the south shore of Long Island, New York: Reconnaissance study -- Environmental Initiatives," the New York District of the Corps identified the value of this area, stating:

> "The bays represent a vital link in the region's coastal ecology. Together, they provide critical nesting habitat for a variety of shorebirds, including several endangered species, as well as a primary stopover along the Atlantic Flyway, a major migratory route for east coast waterfowl. They also provide spawning and nursery habitat for shellfish and many species of commercially or recreationally valuable anadromous and estuarine

fish." (Corps 1997)

The ecological importance of the project area is recognized via public and private investments in conservation and recreation projects. For example, the Fire Island National Seashore has increased the level of habitat protection and monitoring for Federally-listed shorebird and other species which use the barrier island within the last two years. It has achieved this while maintaining recreational opportunities such as recreational fishing permits. Suffolk County Parks and Recreation Department has also increased their habitat protection efforts at Smith Point County Park. In addition, the New York State DEC and the South Shore Estuary Reserve Council are developing research initiatives to study aquatic species and identify possible restoration projects. The study area also supports habitat for numerous finfish and wildlife, including some State- and Federally-rare and endangered species. All told, the area supports a strong economic and environmental base to Long Island's east end.

1. Significant Habitat Designations

Great South Bay, Moriches Bay, and Shinnecock Bay are identified as Significant Habitat Complexes in the Service's "Significant Habitats and Habitat Complexes of the New York Bight Watershed" dated November 1996. Great South Bay (including Fire Island) and Moriches Bay are Federally-identified Significant Coastal Fish and Wildlife Habitat as published in the Service's "Northeast Coastal Areas Study: Significant Coastal Habitats of Southern New England and Portions of Long Island Sound, New York." dated August 1991.

All of the bays and several tributary and marsh systems along Long Island's south shore are also designated as a Significant Coastal Fish and Wildlife Habitat by New York State as documented in the New York State Department of State report entitled, "Significant Coastal Fish and Wildlife Habitats Program" dated July 1992. The Carmans River has been designated a "Wild, Scenic and Recreational River" by New York State.

2. Public Lands and Private Conservation Preserves

There are a large number of county, town, and private conservation holdings along the Great South Bay's north shore. They include Indian Island County Park, Gardiner County Park (abutted to the east by a New York State Conservation area and a property owned by The Nature Conservancy), Islip Town Beach (backed by an Audubon Society property to the north and adjoining Seatuck National Wildlife Refuge), Islip Meadows County Nature Preserve, and the undeveloped Smith Point County Marina North. The Nature Conservancy manages four preserves in Great South Bay including the Finlay-Wolf Preserve, Hollins Preserve, Orr Preserve, and Thorne Preserve.

3. New York State Designation as South Shore Estuary Reserve

Recognizing this area's unique importance, New York State passed the South Shore Estuary

Reserve Act of 1993, creating a council to produce a comprehensive management plan for restoration, maintenance, and protection of the bays from Hempstead Bay to Shinnecock Bay (Figure 8). Federal, State, and local governments, as well as private organizations and the public, are engaged in a cooperative effort to address natural resource management concerns within the estuary.

4. New York State Park Lands

Robert Moses State Park occupies the western end of Fire Island, with Captree State Park extending into Great South Bay on the eastern tip of Jones Beach Island. Gilgo State Park is located several miles to the west of Captree or Jones Beach Island. Heckshher State Park and Connetquot River State Park extend north from the Great South Bay's north shore. Sections of the Connetquot River have been designated as Scenic and Recreational Rivers under the New York State Wild, Scenic, and Recreational Rivers Act. New York State also maintains a number of conservation areas along the north shore of the bay, including one that adjoins Wertheim National Wildlife Refuge, and Carmans River.

5. Fire Island National Seashore and Federal Wilderness Area

Fire Island is a prime example of a barrier island, a strip of land dividing the Atlantic Ocean from Great South Bay and Moriches Bay. The Fire Island National Seashore (FIIS) (Figure 9), a national park, was established by Act of Congress (Act) in 1964. The Act requires that "The Secretary [of the Interior] shall administer and protect the FIIS with the primary aim of conserving the natural resources found there." With regard to any proposed Corps shoreline protection activities in this area, Section 8(a) of the "Act to Establish the Fire Island National Seashore" states that "erosion control and beach protection measures on lands within the FIIS shall be exercised in accordance with a plan that is mutually acceptable to the Secretary of the Interior and the Secretary of the Army and that is consistent with the purposes of this Act."

In 1980, the 7-mile long section of Fire Island from Smith Point County Park west to Watch Hill was designated a wilderness area in accordance with Section 3C of the Wilderness Act. The Fire Island National Wilderness Area is the only Federally designated wilderness area in New York State. Wilderness areas provide an opportunity to focus management attention on natural processes, not only to maintain natural conditions, but to maintain natural dynamics for their own sake.

6. National Wildlife Refuges

The Service administers two National Wildlife Refuges on the northern shore of the Great South Bay. These include the Wertheim and Seatuck National Wildlife Refuges.

7. Other

Several wetlands have been identified as protection priorities under the Federal Emergency Wetlands Resources Act of 1986 including Swan River, Beaverdam Creek, and the Carmans River. Dune Road Marsh and the Shinnecock Bay Barrier Beach are also recognized as priority wetlands for protection under the Emergency Wetland Resources Act of 1986. The Atlantic Coast Joint Venture of the North American Waterfowl Management Plan recognizes the south shore marshes as a focus area.

Part of Fire Island has been designated and mapped as an undeveloped beach unit as part of the Coastal Barrier Resources System pursuant to the Coastal Barrier Resources Act, which set limitations on Federal assistance or flood insurance within this unit. Other parts of Fire Island have been mapped as otherwise protected units under the Coastal Barrier Resources Act.

The New York State Heritage Program, in conjunction with The Nature Conservancy, recognizes the reaches from Moriches Inlet to Westhampton Beach, Tiana Beach to Southampton Beach, and sites along Fire Island as Priority Sites with biodiversity ranks of high to very high.

Below is a description of the habitat impacted by the FIIP. Note that the Service evaluates all projects on their impacts to the quality, quantity, and significance of fish and wildlife resources. The Service recognizes that residential housing, commercial structures, and roads exist within the scope of the project, but it is not within the Service's authority when preparing a FWCA to analyze the impacts of the project on those structures.

B. Ecological Significance and Uniqueness

Barrier islands contain unique and faceted ecosystems that are not found anywhere else (Herbst 1982). An illustration of a cross-section of a typical barrier island is shown in Figure 10. They provide habitats and food for hundreds of species of coastal birds, fish, shellfish, reptiles, and mammals (Clark 1977; Herbst 1982). Barrier island chains operate as a unit, passing sand, water, animals, and even plants (through seed transport) from island to island and form a common pool for resource replenishment (Clark 1977). Gregg (1982) states that in order to insure the health of this ecosystem, we must insure the health of all of the ecosystem elements, as well as the flows of energy and materials between them. If any one of the components is disturbed, the whole system reacts by becoming less well-ordered and less productive in one or more of its functions (Gregg 1982).

The waters that surround barrier islands are unusually productive, compared to other aquatic ecosystems. This may be due to their position between marine and terrestrial habitats (Beatley 1991). In temperate environments, such as the U.S. mainland, coastal ecosystems support greater biological resources than most inland habitats (Beatley 1991). Many forms of life throughout the world depend entirely or partially upon coastal shorelines (Beatley 1991).

Society derives tremendous direct benefit from coastal flora and fauna, including considerable medical, scientific, and commercial benefits (Beatley 1991).

The existence and function of Shinnecock Bay has regional importance for fish and shellfish, migrating and wintering waterfowl, colonial nesting waterbirds, migratory shorebirds, raptors, and rare plants. Great South Bay is the largest shallow saltwater bay in New York State and one of the largest in the northeastern United States. Open water merges into an extensive series of salt marshes, salt marsh islands, and intertidal sand flats along the protected northern edge of the barrier beach that separates Great South Bay from the Atlantic Ocean. These habitats were all created and are maintained by coastal processes involving the interaction between the ocean, barrier island, and the back-bay. Primary productivity, the production of plant biomass, in the Great South Bay is among the highest for any estuary in the world (Schubel 1991). Because of the very shallow depth, the contribution to the total primary production by rooted plants such as eelgrass (*Zostera marina*) is large (Schubel 1991).

The sheltered tidal wetlands of the bay are highly productive and provide regionally significant habitat for fish, migrating, wintering and nesting waterfowl, rare plants, and other species associated with open water marshes, estuarine watersheds, and the largest undeveloped barrier beach in the New York Bight watershed.

1. Species of Special Concern and Threatened/Endangered Species

There are 210 species of special emphasis in the Great South Bay complex including 43 species of fish and 101 species of birds, 105 species of emphasis in Moriches Bay, and 97 species of special emphasis in Shinnecock Bay (U.S. Fish and Wildlife Service 1996b) (Table 3). Species of special emphasis are those either protected by Federal or State law or are regionally rare, declining, or otherwise regionally important species.

The south shore estuary marshes provide foraging habitat for thousands of migrating raptors each year, including the Federally-listed peregrine falcon (*Falco peregrinus*), the State-listed osprey (*Pandion haliaetus*) and northern harrier (*Circus cyaneus*), and two State species of special concern, the short-eared owl (*Asio flammeus*) and Cooper's hawk (*Accipiter cooperii*). Other species of special emphasis include the Federally-endangered roseate tern (*Sterna dougallii*), the Federally-threatened piping plover (*Charadrius melodus*), the State-endangered least tern (*Sterna antillarum*), and the State-threatened common tern (*Sterna hirundo*). Lanes Island and the Warners Islands in Shinnecock Bay supported the two largest roseate tern colonies on the south shore of Long Island in 1995.

A large number of raptors migrate along the barrier beaches of Long Island, especially during the fall migration. The most abundant raptors counted at Fire Island during the fall migration are American kestrel *(Falco sparverius)*, merlin *(Falco columbarius)*, sharp-shinned hawk *(Accipiter striatus)*, northern harrier, osprey, peregrine falcon, and Cooper's hawk.

Within the south shore estuary, the Great South Bay complex is a focal area for State- and Federally-listed plants and animals, including the Federally-endangered peregrine falcon, roseate tern, and Kemp's ridley sea turtle (*Lepidochelys kempi*), the Federally-threatened piping plover, loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*), the State-endangered least tern (*Sterna antillarum*), and the State-threatened common tern, osprey, northern harrier, and eastern mud turtle (*Kinosternon subrubrum*), and five State species of special concern, northern diamondback terrapin (*Malaclemys t. terrapin*) and black rail (*Laterallus jamaicensis*), the short-eared owl, coastal barrens buckmoth (*Hemileuca maia maia*), and eastern bluebird (*Sialia sialis*). Although only one Federally-threatened plant is found in this area (seabeach amaranth, *Amaranthus pumilus*), the area contains seven State-endangered, 13 State-threatened, and 13 State-rare plant species.

2. Wintering Waterfowl

The Great South Bay supports the largest wintering waterfowl concentrations in New York State, including greater and lesser scaup (*Aythya marila* and *A. affinis*), American black duck (*Anas rubripes*), red-breasted merganser (*Mergus serrator*), brant (*Branta bernicla*), and common goldeneye (*Bucephala clangula*). Dabbling ducks concentrate in the shallow water and marsh areas behind Fire Island, the shoals near East and West Fire Islands, Sexton Island, and Captree Island, as well as in the Carmans and Connetquot River estuaries. Diving ducks tend to be distributed more uniformly throughout the bay. Moriches Bay is important overwintering waterfowl habitat for such species as greater and lesser scaup, American black duck, red-breasted merganser, brant, and common goldeneye. The area is also an important migratory shorebird concentration area, especially during the spring and fall migrations when large numbers of shorebirds use the flats and marshes behind the barrier beaches. Figure 11 shows wintering waterfowl concentrations and habitat use based on field surveys and waterfowl gut analyses conducted in the 1960s relative to the FIMP project. Figure 12 provides a recent assessment of waterfowl use areas based on results of a Service-sponsored workshop in May 1997.

3. Sea Turtles and Mammals

The Federally-threatened loggerhead sea turtle and green sea turtle are known to occur in Great South Bay, and several whale species can be found in the nearshore ocean waters. The barrier island is a regionally important haulout area for harbor seal (*Phoca vitulina*), gray seal (*Halichoerus grypus*), and other Arctic seals. The Corps should consult with the National Marine Fisheries Service who have jurisdiction of these species under the Marine Mammal Protection Act and Endangered Species Act.

4. Recreational and Commercial Fisheries

Great South Bay serves as both nursery and foraging habitat for winter flounder (*Pleuronectes americanus*), summer flounder (*Paralichthys dentatus*), striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), weakfish (*Cynoscion regalis*), tomcod (*Microgradus tomcod*), and blue crab (*Callinectes sapidus*). Species which spawn in the bay include winter flounder, weakfish, Atlantic silverside (*Menidia menidia*) and other forage species, as well as the commercially valuable hard clam.

Great South Bay has the largest sport catch of winter flounder on Long Island. The bay provides both nursery and spawning habitat for winter flounder and summer flounder. Winter flounder in Great South Bay support a very modest commercial fishery, on the order of 1,000 to 3,000 pounds per year. The recreational fishery for winter flounder in Great South Bay is several orders of magnitude larger (New York Sea Grant Institute 1993). Summer flounder or fluke is the main focus of the recreational fishery in Great South Bay during the summer. Bluefish has been among the top five species landed by recreational fishermen each year since 1979 (New York Sea Grant Institute 1993). The bay also provides an especially significant nursery habitat for young-of-the-year and juvenile Hudson River striped bass (*Morone saxatilis*) and juvenile bluefish, while Atlantic sturgeon (*Acipenser oxyrhynchus*) and American shad use the area during migration (U.S. Fish and Wildlife Service 1991). Inlets and adjacent areas are generally recognized as having relatively high fish abundance and provide for high recreational fishing opportunities (Cashin Associates 1993).

Hard clams account for 60% of average annual seafood (shellfish and finfish) landings in Great South Bay (NMFS landings data 1985-1994). The hard clam shellfishery of Great South Bay is the largest in the state in terms of total value and percentage of harvest. In 1992, the total value of the State's harvest was just over $2 million (NYSDOS in review). The area also supports a commercial and recreational shellfishery for soft shell clam (*Mya arenaria*), blue mussel (*Mytilus edulis*), hard-shell clam (*Mercenaria mercenaria*), bay scallop (*Argopecten irradians*), and blue crab. Oyster populations have declined drastically in the subtidal areas of Great South Bay. Hard clam landings peaked in the mid-1970's and declined substantially over a 10-year period from 1975 to 1985.

The proposed offshore borrow area has been identified as Essential Fish Habitat for summer flounder, bluefish, scup, and sea bass (Serranidae). These species have been designated as overfished by the Department of Commerce.

VII. PHYSICAL PROCESSES AND HABITAT FORMATION

The Service recognizes that the project area contains land development, and hence the proposal for the project (see Chapter X, Section B). However, the review of the project includes an analysis of the barrier island system as a whole, therefore discussions include descriptions of the processes which occur over the entire system.

A constantly evolving and changing habitat complex, unusual in other landforms, is typical of barrier islands. Changes in the islands' shape and position occur from season to season, and even day to day. The sandy ocean beachfront constantly adjusts to the balance between two factors: (1) the erosive forces of storm winds and waves, and (2) the restorative powers of prevailing geological, oceanic, and meteorological actions. In response to the interplay of these forces, the whole system of beaches, barrier islands, and dunes shift more or less continuously (Clark 1977).

Over a longer time span, the mass/energy interaction has resulted in a relatively continuous, though intermittent, landward migration (Panageotou et al. 1985) of Long Island's barrier island system. The force driving the islands landward is rising sea level. The relative sea level rise in the New York area has averaged about 0.1 in (2 mm) per year during the past 50+ years (Leatherman et al. 1985). However, higher rates of sea level rise have been predicted for the next century (Beatley 1991). Globally, sea level may rise between 10 in and 6.5 ft (between 25 and 200 cm) in the next century (Bokuniewicz and Schubel 1991; Beatley 1991), suggesting a 3 in to 2 ft (7.5 to 60 cm) rise during the 30-year project life.

The phenomenon of migration is often termed erosion by some but this is not accurately descriptive for barrier beaches. What happens to the whole barrier landform is not erosion in the sense that the barrier is being chopped away and is gradually disappearing; barriers retreat or migrate and they do so as entire ecological units. In marked contrast to the sea cliffs which erode from fixed positions, coastal barriers move themselves backwards onto marsh and lagoonal deposits as they climb the slope of the continental shelf (Department of the Interior 1983).

As the barrier landform retreats, its transported sand buries parts of its system, such as salt marshes, but new marshes develop further landward on the leading edge of the new sediment. Although a barrier's movement is in response to the steadily rising sea level, the pace of its migration is not steady. Its migration depends in large part upon crucial events which occur during storms: inlet formation and overwash. These are the primary mechanisms by which sand is transported landward from the oceanfront, along with a third process which occurs on some coastal barriers: wind blow dune migration (Department of the Interior 1983).

All three processes can be affected by stabilized dune systems. Formation and stabilization of well developed dunes can significantly moderate a barrier's dynamic of change. Inlets contribute to barrier island retreat. Enormous quantities of sand can be swept through a new inlet. New marshes form on the flood tidal delta. The net result of these dynamics is the further retreat of the barrier system with all ecological units retained (Department of the Interior 1983).

A. Overwash

Barrier beaches in active retreat actually roll over themselves into the lagoon or back-bay. The most common mechanism for accomplishing this is overwash, the breaching of dunes by a severe storm surge which carries beach and dune sand onto the backdune region (Figures 13 and 14). Depending on the storm's magnitude and the island's width, the overwash area of newly transported sand may go no further than the dunes, or it may spread onto the marshes or into the lagoon. In general, major overwashes only occur during exceptionally severe storms (Department of the Interior 1983).

Overwash processes can provide a source of sediments to the barrier island and contribute to elevational changes. In locations where the dunes are not breached during a major storm, washover deposits are negligible, and the dominant sediment transport direction is seaward. In locations where the dune is absent or breached, overwash processes are uni-directional, delivering sand to the island surface, but not removing sand from the littoral system as an inlet would (Leatherman 1985). These rare but potentially large overwashes generally result in localized accretion on the bay side (New York Sea Grant Institute 1993).

B. <u>Inlet Dynamics</u>

Barrier ecosystems seem to rely mainly upon inlet dynamics for landward displacement. Migrating and temporary inlets provide flood tidal deltas upon which the barrier island environments are established. A flood tidal delta exhibits a deltaic pattern upon full development, and when an inlet closes or migrates it becomes prime substrate for salt marsh development. These actually become the substrates for marsh growth and thereby extend the bay shoreline landward. Wind-carried and overwash sediments are deposited on top of this accretionary base. These two types of sediment movement (via wind and overwash) are what makes it possible for a barrier to grow vertically (Department of the Interior 1983). While inlet formation is an infrequent process in this barrier island system, it is within the range of natural variability of that system. It is gradually becoming apparent that major disturbance events, such as avalanches, fires, and floods, are integral to the effective function of dynamic systems that are prone to such disturbance (Sousa 1984; Holling and Meffe 1996; Murray 1996).

Significant storm conditions are required in order to induce the formation of an inlet. This fact is emphasized by the number of washovers that occur during large storms. Few of these washovers cross the island completely, much less produce new inlets. Of the four inlets that opened into Shinnecock Bay in 1938, only Shinnecock Inlet persisted, eventually being stabilized by the Corps in 1954. The hurricane of 1938 washed over the entire beach between Democrat Point and Ocean Beach and many other places as well (Bokuniewicz and Schubel 1991). After that, 63 washovers occurred after a hurricane in 1944. Thirteen washovers were found after a storm in 1949. A storm in 1953 caused seven or more, while nine washovers were reported after a storm in 1960. Fifty more occurred after another storm in 1962. A storm in 1963 produced four washovers on eastern Fire Island. None of these washovers resulted in a permanent inlet. For inlet formation to occur, certain geophysical and meteorological conditions must be met. Leatherman (1982) states that overwash is a relatively common event, happening during most major storms, but that inlets are relatively rare, occurring only once in fifty to seventy-five years along some shorelines. This implies that the opportunity for inlet-based habitat formation is an equally rare occurrence.

Inlets have been reported in Great South Bay since the colonial times. However, survey maps from the period stretching from 1890 to 1937 show no existence of inlets. As a result of the 1938 hurricane, Shinnecock Inlet was formed. From that time on, local interests as well as the Corps have worked to stabilize and maintain the inlet jetty structures and channel.

Inlets of varying size and number have developed at various times in Fire Island's history, particularly in eastern Fire Island. By examining the barrier island chain from Fire Island to Montauk Point, it can be demonstrated that 59% of the system has been subject to inlet activity (Leatherman et al. 1985). Other parts of Fire Island, particularly the central portion, have been stable for hundreds of years. For example, Fire Island's Sunken Forest, a true maritime forest, could only have developed under conditions of prolonged limitation of environmental stresses, particularly salt spray and salt water flooding (Leatherman et al. 1985). The development of the Sunken Forest is due to the fact that it is protected behind a high secondary dune. In this location, washovers do not penetrate the secondary dune, which is also effective at screening back-barrier vegetation from salt spray.

The western part of Fire Island has not migrated landward but has narrowed while following the migration of Fire Island Inlet to the west. No inlets have formed in this area during its evolution. During the past four decades, no new permanent inlets have opened on Fire Island, but several ephemeral breaches have occurred on eastern Fire Island during major storm events (Kana and Krishnamohan 1994).

C. Habitat Formation

Coastal processes lead to the creation and maintenance of valuable terrestrial, intertidal, and subtidal habitat, including the barrier island. For instance, a new inlet represents a new habitat area. Numerous fish and bird species take advantage of this inlet and associated shoal habitat, some examples are bluefish, common terns, and roseate terns.

Along the south shore of Long Island, the normal evolution for an inlet results in sediments and geomorphic features moving both northward (landward) and westward (downdrift) (Leatherman 1985). This inlet migration in two directions over time gives rise to complex sedimentary patterns involving a variety of different inlet-related environments: bay bottom, deep to shallow inlet channel, active and relict flood and ebb tidal deltas, spit platform, and spit (Figure 15) (Leatherman 1985). Each of these sedimentary forms has specific niche functions in the ecology of Great South Bay (New York Sea Grant Institute 1993), Moriches Bay, and Shinnecock Bay. The outstanding biological diversity and abundance of Long Island's south shore estuary is, in part, a consequence of the variety of habitat types within the system.

Through time an unstabilized inlet achieves a net downdrift migration and eventually becomes choked with sand and closes. Marsh islands develop in the bay if the flood tidal delta achieves sufficient elevation and the bay hydrodynamic environment supports its development. Eelgrass beds may develop below the mean low water line of the flood tidal delta at a depth controlled by turbidity and bay wave turbulence. The presence of salt marsh islands and the wide bayside marshy plains on the northern shore of Long Island's barrier islands can be an impediment to inlet development because of the resistance of the marshy substrate to erosion. Inlet migration and closure depend upon the longshore current and the tidal jet flushing capacity (Leatherman 1985). The subsequent formation of flood tidal deltas varies in time depending on the forces at the inlet.

Comparison of wetland areas and historical inlet locations illustrate that barrier islands have widened and strengthened at historical inlet sites. Creation of these wetland areas has also led to habitat formation. Inlet processes are mainly responsible for providing sediment to the barrier bayshore, causing a widening of the island at inlet locations and, therefore, promoting landward migration (Leatherman et al. 1985). When the inlet closes, this large sedimentary deposit becomes an excellent substrate for potential salt marsh colonization (Gregg 1982; Leatherman 1982; National Park Service 1995). The marsh islands in the bay and most, if not all, of the bayshore marshes formed atop flood-tidal delta sediments (Leatherman et al. 1985; New York Sea Grant Institute 1993) in locations where bay wave energies are sufficiently small.

As discussed in more detail in Section VI, salt marsh is essential habitat for waterfowl, shorebirds, forage fish, and such predators as the northern harrier and the short-eared owl. Washovers and the formation of new inlets can substantially alter the distribution of habitats by converting shallow shoals to intertidal marshland, marshland to subaerial beach, or deeper-water habitat to shoal areas (New York Sea Grant Institute 1993). Breaches and inlet formation also promote spit growth along the margins of their channels.

Overwash contributes in several important ways to maintaining barrier islands and their ecosystem functions, especially as habitat for many plant and animal species. In the process of the barrier island's growth through overwash, several important unique landforms are produced, including overwash channels, overwash fans, vegetated and non-vegetated subtidal flats, and backdunal swales. Overwash that crosses the entire barrier island leaves behind distinct corridors known as washovers (Kana and Krishnamohan 1994). These areas are important biological corridors, linking ocean and bay habitat. Several species, especially the piping plover, are known to take advantage of the increased access to bayside forage areas afforded by overwash corridors. Overwash areas produced the highest densities of piping plover nesting in New York State during the 1995 and 1996 breeding seasons.

Overwash maintains unvegetated intertidal sand flats by providing a vital clearing function, similar to naturally occurring forest fires and river bank floods. Bayside sand spits are especially productive for shorebirds and wading birds. A new spit and shoal complex formed following the 1992 breach at Westhampton has become a highly productive nesting and forage area for shorebirds, including black skimmer (*Rhynchops niger*), American oystercatcher (*Haematopus palliatus*), willet (*Catoptrophorus semipalmatus*), least tern, common tern, and piping plover. This area produced one of the highest nesting densities of piping plover in New York State from 1995 to 1996.

Both overwash fans and flood tidal deltas are prime spawning grounds for the horseshoe crab (*Limulus polyphemus*) (New York Sea Grant Institute 1993). Intertidal beaches are used by several fish species as a spawning site. The Atlantic silverside deposits its eggs in filamentous algae (*Enteromorpha* spp.) or other vegetative material in the upper intertidal zone of salt marshes and open beaches (Conover and Kynard 1984). The mummichog also deposits eggs in the upper intertidal zone either on stems of *Spartina*, within empty mussel shells, or amongst filamentous algae (Able and Castagna 1975; Taylor et al. 1977). The unvegetated stretch of sand between mean high water and the upper tidal limit is also prime feeding habitat for numerous species of shorebirds, especially during spring and fall migrations, and prime nesting habitat for several beach nesting birds, including piping plover, common and least terns, black skimmer, and American oystercatcher (Bull and Farrand 1977).

VIII. OTHER FEDERAL AND LOCAL ACTIONS

The following is a partial listing of existing or proposed Federal, State, and local proposals or actions between Shinnecock Inlet and Fire Island Inlet over the last 50 years:

A. <u>Federal Authorizations/Activities</u>

1) Fire Island Inlet Federal Navigation Project authorized in 1948 and Shore Westerly Project (Corps; Active);

2) Moriches Inlet Federal Navigation Channel, Jetty Rehabilitation Project, authorized in 1959. Reformulated in 1983 (Corps; Active);

3) Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project authorized in 1960. Currently undergoing Reformulation with a programmatic EIS scheduled for completion on 2002;

4) Shinnecock Inlet Federal Navigation Channel and Jetty Rehabilitation Project, authorized in 1960. Reformulated in 1987 (Corps; Active);

5) Establishment of Fire Island National Seashore in 1964 (Department of the Interior);

6) Construction of Westhampton Groin Field and beach fill from 1965-1970 under FIMP authorization;

7) Breach Fill at Cupsogue County Park in 1980;

8) Breach Fill at Village of Westhampton Dunes in 1993;

9) Westhampton 30-year Interim Storm Damage Protection Project - May 1994 (Corps; Active);

10) South Shore Embayment Restoration Reconnaissance Study adopted May 1996 (Corps' proposal; EIS will be prepared);

11) West of Shinnecock Inlet 30-year Interim Storm Damage Protection Project (1998) (Corps' proposal; EA being prepared);

12) Sand Stockpile Creation at Democrat Point (1994) and Cupsogue County Park (1996);

13) 1996 Interim Breach Contingency Plan (Corps; Active); and

14) Issuance of Corps' permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act - Exact number currently undetermined (Active);

B. State and Local Activities

1) Establishment of Suffolk County Parks at Smith Point and Shinnecock East; Maintenance of beach in front of facilities;

2) Establishment of Robert Moses State Park;

3) Construction of Robert Moses Causeway Bridge; Construction and major rehabilitation of Ponquogue Bridge in 1989;

4) Shinnecock Inlet dune and beach fortification (Active; usually implemented by NYSDEC during major storm/wave events);

5) Suffolk County Department of Public Works Channel Maintenance Dredging (Active); and

6) Development and Construction of Cooperative Fishing Station at Shinnecock Inlet (mid-1980s).

C. Corps' Conducted or Sponsored Environmental Studies

1) Benthic Sampling conducted in Westhampton Interim Project Area Borrow Area in spring/fall of 1996 and 1997;

2) Piping Plover Monitoring Study at Village of Westhampton Dunes (1995-present); and

3) Formulation of Habitat Suitability Index for the Piping Plover at Selected Locations (in progress).

IX. IMPACTS OF THE CORPS' RECOMMENDED 30-YEAR BEACH FILL/DUNE CONSTRUCTION PLAN ON FISH AND WILDLIFE RESOURCES

As a preface to the discussion below, Berg (1977) and Hobbs et al. (1981) noted that the Fire Island Inlet to Montauk Point Reformulation Study, as initiated in 1980, was intended to address the entire barrier system as a unit, because action under a comprehensive plan that considers the erosion processes over the full length of the receding shore segment is both more effective and more economical, and because, as the CEQ noted, actions in one part of the system tend to affect other parts of the system.

A. NEPA and Agency Planning/Environmental Analysis

NEPA requires consideration of all reasonable alternatives (including a comparison of their environmental impacts) in addition to the No Action and Preferred Alternatives. The Corps' Policy and Planning: Planning Guidance (ER 1105-2-100, December 1990), Appendix F, paragraph 16, describes the level of review necessary for the Corps to fulfill NEPA requirements for environmental consequences. In regard to potential impacts of alternatives, it states, "Impacts should be quantified and clearly described as beneficial or adverse. The discussion shall identify direct, indirect, and cumulative impacts as defined in 40 CFR 1508.8, etc., and the mitigation measures...incorporated into the alternatives to avoid, minimize, rectify, reduce or compensate for those impacts." The discussion should include:

> "(1) Impacts of all alternatives including the proposed action;
> (2) Unavoidable adverse environmental impacts which can not be avoided should the proposal be implemented;
> (3) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and
> (4) Any irreversible or irretrievable commitments of resources which would be involved in the alternative should it be implemented."

As described in the Service's Mitigation Policy, the Service must consider project impacts as part of its review, including: (1) the total long-term biological impact of the project, including any secondary or indirect impacts regardless of location; and (2) any cumulative effects when viewed in the context of existing or anticipated projects. Direct impacts occur in the same place and location. Indirect impacts can occur later in time or farther removed in distance, but are still reasonably foreseeable. CEQ defined cumulative impact (40 CFR 1508.7) as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions..." Also, "...cumulative impacts can result from individually minor, but collectively significant actions taken place over a period of time."

In most circumstances, the Service is able to address the impacts surrounding a project proposal. However, in this case, the Service is unable to fully address these impacts due to a lack of information specific not only to this proposal but also in regard to other proposals within the FIMP project area which are being considered concurrently. As mentioned earlier, the major Corps' planning efforts include the SIIP/EA, FIMP Reformulation Study/EIS, and the South Shore of Long Island Habitat Restoration, Water Quality Improvement and Related Environmental Features - EIS. The implications of these concurrent efforts on the impact assessment are discussed in subsection C. In addition to the above, there is also the effort by the New York State Department of State chaired South Shore Estuary Reserve Council to develop a Comprehensive Management Plan for the South Shore Estuary.

The number of other projects which have either been authorized, funded, or carried out by Federal, State and local governments in the project area is numerous (partial listing provided in Section VIII). Without an understanding of the total combined impacts of these projects, which would require in part an indication of the preferred alternatives for the Corps' proposals mentioned above, an accurate assessment of the impacts of this 30-year beach fill/dune construction plan can not be made.

B. <u>Adequacy of Current Data</u>

It is not possible to adequately assess the environmental impacts of the Corps' recommended 30-year beach fill/dune construction plan on barrier island, back-bay and offshore resources or to suggest possible mitigation strategies of this project with the information presently available. In Section X, the Service identifies a number of studies it believes are necessary for assessing environmental impacts of the 30-year recommended plan. At the time of this report preparation, the only environmental information supplied by the Corps, or special environmental studies conducted relative to this proposal, has been data collected from two benthic invertebrate spring-summer surveys of the offshore borrow area. The data gathered from these two studies are woefully inadequate in assessing impacts of the issues raised in this report.

The planning effort underway for the overall FIMP Reformulation Study/programmatic EIS has preliminarily identified a number of data gaps and research needs within the barrier island and back-bay systems including Great South Bay. The Corps has indicated that studies will be developed to examine the potential environmental impacts of longer term beach fill/dune construction proposals such as that proposed in the FIIP. However, the results of these studies will not be available until the conclusion of the FIMP Reformulation Study/programmatic EIS, scheduled for April 2002.

Ultimately, any decision reached by the Corps on this project should be based on data from appropriate environmental field studies and investigations which have been concluded prior to construction of any long-term beach fill/dune construction alternative and not before. In addition, the Corps should closely evaluate the applicability of using results of field investigations from other areas (e.g. New Jersey shores) to describe the impacts to this system.

C. Direct and Indirect Impacts

Direct and indirect adverse impacts on fish and wildlife habitat and the overall condition of the barrier island due to the reduced likelihood of natural processes, and dredging and disposal of sand material will result from the Corps' 30-year beach fill/dune construction plan. As discussed in Section VII, coastal processes are very important in maintaining the barrier island and back-bay communities. For instance, overwash can contribute to vertical sand accretion and the horizontal migration in some locations on the barrier island. This along with aeolian reworking keeps the barrier island above water during periods of rising sea level, therefore protecting Long Island's south shore from the direct influence of ocean waves. Coastal processes also create and maintain a natural balance among various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife species. In particular, flood tidal deltas, overwash fans, sandspits, and tidal marshes are commonly created and maintained by breach and overwash events. Long Island's waterfowl, shorebird, and wading bird species require the loafing, foraging, and nesting habitat that such areas provide. The recommended plan is designed to reduce the probability of the occurrence of coastal processes that maintain and create such habitats and that support fish and wildlife species.

The recommended 30-year beach fill/dune construction plan will also further reduce habitat diversity on the barrier beach and result in the loss or degradation of natural communities. The species composition in this and other barrier beach ecological communities is dependent, in part, on natural coastal processes such as overwash.

Long-term Federal efforts to prevent breaches will be a detrimental alteration to this environment. According to Leatherman and Allen (1985a), available evidence suggests that the dominant mechanism for maintaining the barrier's integrity while migrating is flood tidal sediment deposition through inlets which provides for basal sediments and salt marsh development. Large, infrequent storms may be the most important sources of sediment to the back-bay (Schubel and Hirschberg 1978). Inlets facilitate the influx of great quantities of sediment into the bay, which then serve as a substrate for new marsh growth, while washover deposits determine marsh colonization and burial cycles (Crowell and Leatherman 1985). Rising sea levels are expected to drown existing marshes, eelgrass beds and shallows.

Preventing breaches will also prevent the creation of new habitats to take the place of those lost to rising sea level.

Overwash prevention could cause serious damage to the barrier island. Leatherman and Allen (1985a) state:

> "Without sand deposition on the backbarrier area, the island interior will become progressively lower relative to [a rise in] mean sea level. Since inlets are now stabilized, overwash is the only means of promoting landward barrier transgression so that this option would set the stage for *in situ* drowning, the exact timing depending upon the rate of sea level rise and the concomitant (ocean and bay) shore recession in the absence of landward barrier migration."

The option referred to by Leatherman and Allen (1985a) was the construction of a +16 ft NGVD high dune and a +14 ft NGVD high berm, with optional groin placement later if necessary to prevent excessive sand loss. The option described above is different from the recommended plan in terms of the berm height and width but the recommended plan includes dune construction and beach nourishment. If overwash is prevented from occurring, or the probability of overwash is reduced significantly, then the same environmental effects will occur. That is, the island interior will become lower and landward barrier transgression will not occur.

1. Open Water/Non-Vegetated Bay Bottom

Barrier island and coastal processes may positively affect water quality in the back-bays by reducing the number of water-borne pathogens, reducing turbidity, and moderating bay temperatures. All of these could prove favorable to the production of shellfish, especially the hard clam. However, the Corps' recommended plan is designed to prevent such processes up to a 44-year storm event, and the BCP provides the plan to close any breaches that may occur. Due to the hydrodynamics of the Great South Bay, which currently has only two inlets, a new breach would have the potential to improve water quality.

The Corps (1995) has expressed concern that a breach may cause changes in bay salinity that would be damaging to shellfish. While we agree that a breach between Moriches and Fire Island Inlets will raise salinity levels in the Great South Bay, we don't believe it will adversely effect the survival rates of the hard clam and the hard clam industry. Increased salinity allows for an accelerated rate of shellfish growth and improved larval development (Cashin Associates 1993). Higher salinity rates also appear to be more favorable to hard clam growth at non-optimal temperatures ($\geq$30 or $\leq$20°C) (Malouf 1991). The seasonal temperatures in Great South Bay range from 0 to 30°C (Lively et al. 1983), well within the range identified by the Malouf report. Rising sea level over the next thirty years will create more deep water habitat and non-vegetated bay bottom in the back-bays regardless of the FIIP.

Increased tidal flushing in the bay resulting from an overwash or breach could reduce the number of water-borne pathogens in shellfish growing areas through the action of improved flushing of the bay. This could lead to a possible reduction in the number of areas now closed to commercial and recreational clamming (Cashin Associates 1993). Cashin Associates (1993) also notes that increased flushing reduces turbidity, which may have positive effects on both shellfish populations and eelgrass.

As light penetration is a major limiting factor affecting the primary productivity of submerged aquatic vegetation in the bays (U.S. Fish and Wildlife Service 1996), reduced turbidity could increase light penetration and with it, primary productivity and the habitat structure that submerged aquatic vegetation provides. Turbidity also affects the feeding efficiency of filter feeders such as the hard clam (Schubel 1991). Many bivalves, including hard clams, have the ability to sort the food particles (phytoplankton) from the nonfood particles (silt) that they filter out of suspension (Kiorbe et al. 1980; Newell and Jordan 1983; Bricelj 1984; Bricelj and Malouf 1984), but hard clams tend to respond to increasing silt loads by reducing their filtration rates (Bricelj 1984; Bricelj and Malouf 1984). Therefore, it appears that hard clams are less well adapted for survival in a turbid environment than many other bivalve species (Bricelj 1984).

The introduction of additional ocean water through a breach might also moderate bay temperature (Cashin Associates 1993), as the annual temperature range for ocean water is from 4 to 21°C (U.S. Fish and Wildlife Service 1981), narrower than the bay water temperature range of 0 to 30°C. Hard clam growth is disrupted outside of the optimal temperature range, approximately 20 to 23°C (Malouf 1991). Moderation of bay temperature would tend to reduce these disruptions (Cashin Associates 1993).

Finfish would be largely unaffected by a breach, although a new channel resulting from a breach may provide attractive habitat for certain species. Unvegetated bay bottom is the preferred habitat of several benthic fishes. Sogard (1992) found that juvenile winter flounder were more abundant in unvegetated habitats than in eelgrass habitats; there was also some suggestion that winter flounder may grow faster in unvegetated habitats with coarse sediments. However, flounder populations are not limited by any shortage of non-vegetated bottom habitat (New York Sea Grant Institute 1993), and the flounder population would not be increased by the creation of more non-vegetated bottom area. Also, recreational fishing would almost certainly increase in the area of a new breach, adding unknown benefits to the communities most affected by the breach.

2. Inlet Channel

Inlet channels, and their attendant physical features, appear to be preferred habitat for bluefish and may provide essential foraging habitat for black skimmers, common terns, and roseate terns. The roseate tern is a Federally-listed endangered species. Safina (1990 a,b) found that common terns were able to take advantage of prey that had been driven to the surface by

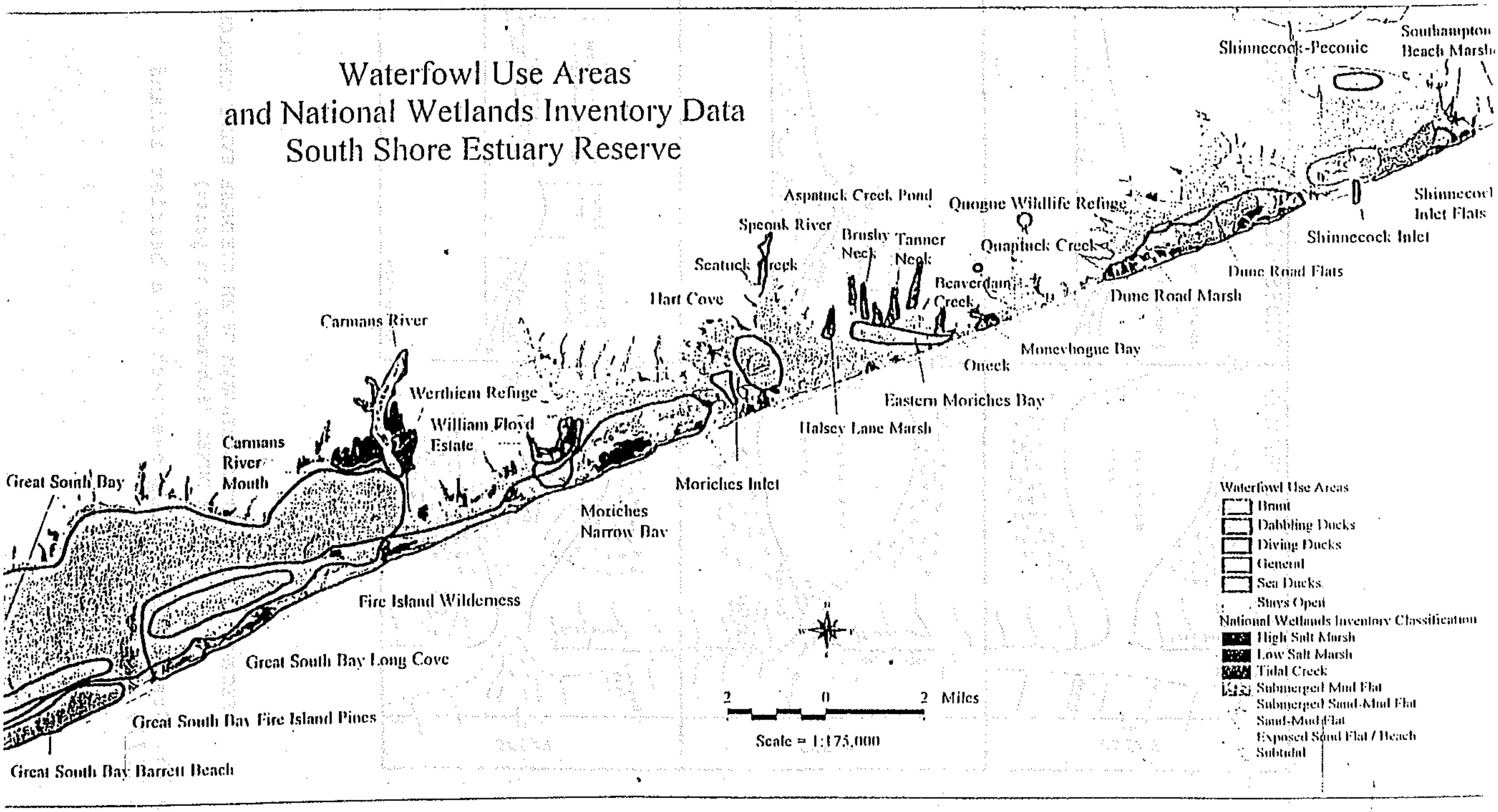

Figure 12. continued.

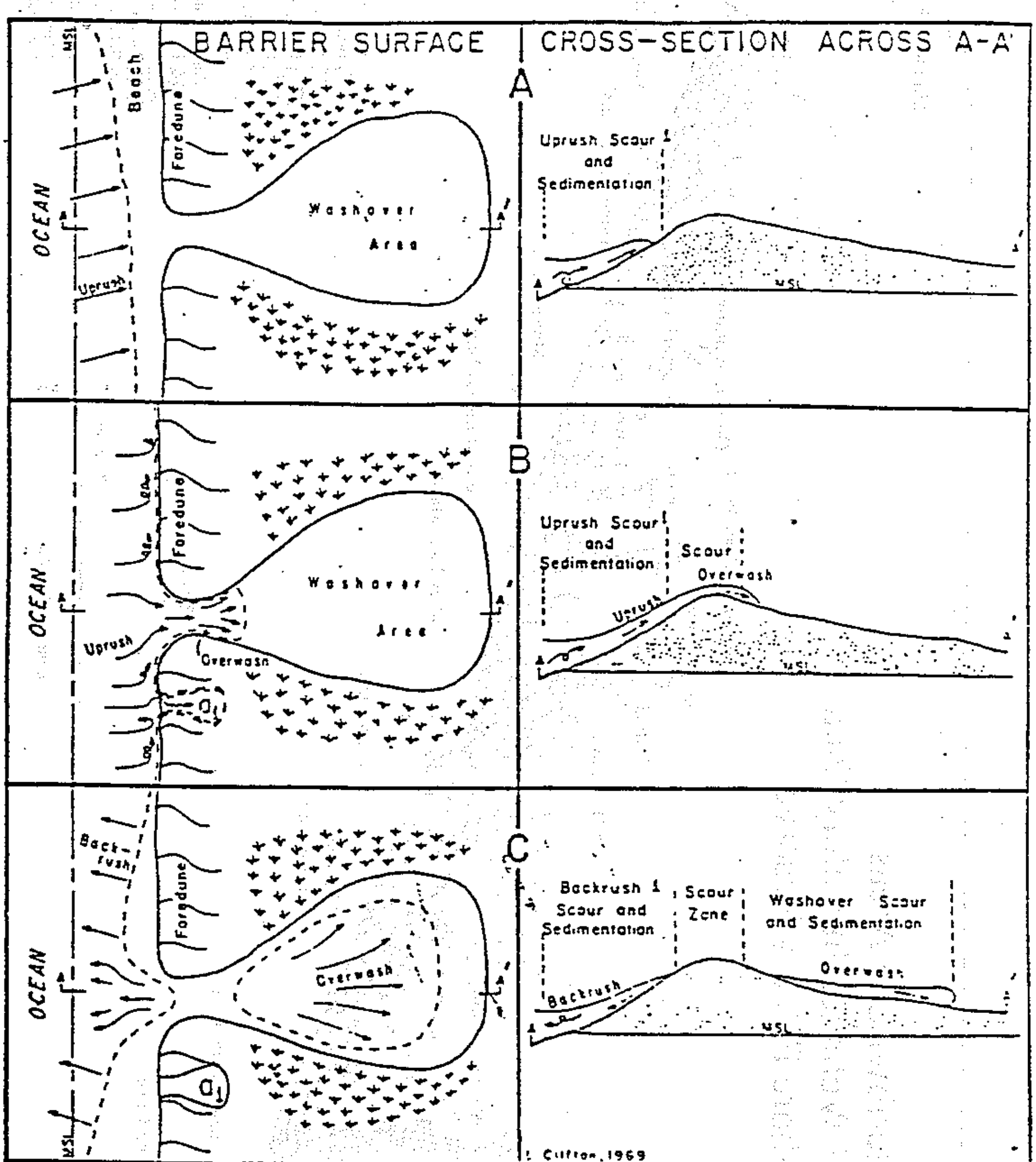

FIGURE B-8: SEQUENTIAL DIAGRAM OF AN OVERWASH EVENT THROUGH GAP IN THE DUNES (Schwartz, in press)

Figure 13. Graphic depicting overwash on a barrier island (Corps 1977).

bluefish, which tend to congregate near inlets, while roseate terns relied on physical features associated with inlet channels, such as shoals, which cause prey to move up into their diving range.

The FIIP does not reduce the amount of presently available channel habitat, but is intended to reduce the likelihood of formation of any new inlet channel habitat. Although the interim BCP is intended to close any new inlet quickly, short-term impacts of a breach may be ecologically important, including the habitat provided by the temporary existence of the new channel itself and the changes in bottom topography due to delivery of new sediment to the bays.

Among possible ecological benefits due to inlet formation are potentially increased recruitment of juvenile and larval fish to the bay. Inlets and adjacent areas are generally recognized as having relatively high fish abundance and provide for high recreational fishing opportunities (Cashin Associates 1993). This suggests that a new inlet channel might have ecological and economic value that would be specifically prevented by the Corps' recommended plan. Inlet channels appear to be preferred habitat for bluefish, which has been among the top five species landed by recreational fishermen each year since 1979 (New York Sea Grant Institute 1993). Young-of-the-year bluefish, American eel and the summer flounder use inlet channels only during the summer to migrate into back-bays from continental shelf waters.

3. Vegetated Bay Bottom

Eelgrass beds are important habitat for life stages of bay scallops, tautog, winter flounder, and waterfowl. A reduction in this habitat would reduce the productivity of these species, which would translate directly into an economic loss as well. However, the net impacts of the FIIP on vegetated bottom habitat, specifically eelgrass beds, are difficult to determine at this time since there is a lack of recent data on the distribution and biomass of eelgrass meadows in the back-bays.

Over the long-term, sea level rise represents a potential negative impact upon eelgrass in the back-bays. Much of the eelgrass and salt marsh habitat in the bays has developed on top of relict flood tidal deltas; the formation of these deltas is discussed in the preceding section on physical habitat. Due to anticipated sea level rise of 2 in (5 cm) to more than 6.5 ft (2 m) over the next 20 to 100 years, some of these deltas will be submerged too deeply to support their present plant community. Eelgrass is primarily found in areas less than 6.5 ft (2 m) deep, and rarely found in areas deeper than 13 ft (4 m).

Sediment passing through a new inlet would create sand flats elevated above the bay bottom, potentially compensating for some of the eelgrass area that will be lost to increased water depth. In this manner, a new inlet could be beneficial to the eelgrass population of the bays by providing new substrate for growth. For example, the densest eelgrass beds in Great South Bay are near the existing inlets (Cashin Associates 1993). This has been attributed to the clearer water and sediment input available in these locations which is suitable for eelgrass development. It is possible that a new inlet could more than compensate for short-term physical damage with a long-term improvement in conditions, however, an assessment of the existing conditions at the existing inlet would provide a better understanding of what those benefits would be after the opening of a new inlet. The FIIP could prevent ~~these potential~~ significant benefits.

Seagrass beds represent a critical habitat for at least one species, the bay scallop (*Argopecten irradians*) (New York Sea Grant Institute 1993). The rock crab (*Cancer irroratus*) was found to be restricted to thick eelgrass areas (WAPORA 1982). The blue mussel and hard clam are species found in moderate to dense vegetation (O'Connor 1972). Seagrass beds provide hard clams with protection from whelks (*Buscyon* spp.) and possibly other predators as well (Peterson 1982). *Gemma gemma* is an extremely abundant, suspension feeding bivalve found in especially high abundance in eelgrass regions (WAPORA 1982). It is an important forage species for shorebirds.

Seagrass beds are also noted for high densities of fish, in part because of the abundant food supply (Heck et al. 1989). The importance of eelgrass (*Zostera marina*) as a habitat for the juvenile and adult stages of numerous marine fishes has been frequently documented (New York Sea Grant Institute 1993). Many studies have shown that eelgrass beds support significantly higher faunal densities than other habitats (Orth et al. 1984).

New York Sea Grant Institute (1993) reported that juvenile tautog (*Tautoga onitis*) and cunner (*Tautogolabrus adspersus*) depend strongly on eelgrass habitat as a shelter and/or nursery. Winter flounder also appears to use eelgrass beds as nursery areas (Heck et al. 1989). Again, forage fish species critical to the bay food web, particularly stickleback species (*Apeltes quadracus* and *Gasterosteus aculeatus*), also depend upon this habitat.

Eelgrass is an important foraging resource for avian species, especially brant. The distribution of major waterfowl feeding and nesting areas in Great South Bay closely corresponds to the distribution of eelgrass meadows (Marine Sciences Research Center 1973; Beck et al. 1978; New York Sea Grant Institute 1993).

4. Tidal Marsh

The Corps' recommended 30-year beach fill/dune construction plan has the potential to alter the balance between marsh creation and marsh burial. The degree of impact depends upon the extent to which the plan achieves the stated goal of reducing overwash and inlet formation. To the extent that the project is effective, loss of salt marsh without offsetting effects is likely. Loss of plant detritus producing regions of the estuary such as *Spartina* marshes will greatly lower the productivity of the estuary and directly limit its potential to produce commercially important species of fish and crustaceans (Odum 1970).

Cashin Associates (1993) points out that tidal marsh areas near active, migrating inlets will stay in the early stages of vegetative succession, maintaining their highest rate of organic production and export to the estuary. In comparison, long-term stability will result in decreased productivity. The dredging of flood tidal deltas at existing inlets reduces the potential for the creation of new wetlands (Cashin Associates 1993), as will the Corps' recommended plan if it is effective in substantially preventing barrier island processes. Without inlet formation to compensate for wetland loss, tidal wetlands will eventually decline.

If the FIIP prevents inlet formation without preventing overwash, overwash will bury existing marshes. Where this occurs, vegetation changes from marsh to barrier-flat vegetation. The ground elevation rises above the tidal range and barrier-flat grasses and shrubs colonize the washover surface (Leatherman et al. 1985). As discussed in more detail in the following section on subaerial beach habitat, if the recommended plan reduces the probability of an overwash to such a degree as to effectively prevent overwash, there is likely to be a major change in both the plant and animal communities. If both overwash and inlet formation processes are impacted, marsh will still be lost to rising sea level and bayside erosion, again without compensating marsh formation.

In many locations, the transitional area between the Fire Island barrier island and Great South Bay is occupied by salt marsh. Salt marshes are of brackish or tidal origin, and are found along estuaries and behind barrier beaches. Tidal marshes generally consists of dense stands of herbaceous wetland vegetation dominated by *Spartina alterniflora* and *S. patens* and subject to variation in water depth during each tidal cycle (McCormick and Associates 1975). Salt marshes are among the most productive communities known. Most of the tremendous production of salt marshes is used in the form of organic detritus (Odum 1961). This organic detritus, mostly *Spartina* wrack (New York Sea Grant Institute 1993), is then distributed throughout the system (Odum 1961). Coastal marshes are also important in stabilizing shorelines and as wildlife habitat (New York Sea Grant Institute 1993).

Key invertebrate species in salt marshes include the mud snail (*Ilyanassa obsoleta*), the salt-marsh snail (*Melampus bidentatus*), the ribbed mussel (*Geukensia demissa*), the marsh crab (*Sesarma reticulatum*), and the fiddler crabs (*Uca pugilator* and *U. pugnax*) (New York Sea Grant Institute 1993). These species are an important forage resource for mammals and birds. Salt marshes are nurseries for a variety of forage fishes as well (Weinstein 1979, Rountree and Able 1992). The primary finfish found in tidal mid-Atlantic salt marshes are Atlantic silverside and mummichog (*Fundulus heteroclitus*) (Rountree and Able 1992). New York Sea Grant Institute (1993) speculates that the relatively low abundance of mummichogs in Great South Bay is probably a reflection of the shortage of salt marsh habitat. Sheepshead minnow (*Cyprinodon variegatus*) and bay anchovy (*Anchoa mitchillii*) are also abundant, but less so than the above species (New York Sea Grant Institute 1993).

Great South Bay is the largest wintering waterfowl area in the state. Consequently, creation and continued productivity of back-barrier wetlands would tend to be of long-term benefit to these avian species (Cashin Associates 1993), such as greater and lesser scaup, American black duck, red-breasted merganser, brant, and common goldeneye. Dabbling ducks, especially mallard (*Anas platyrhynchos*), American black duck, and gadwall (*Anas strepera*), concentrate in the shallow water and marsh areas behind the Wilderness Area and on small islands such as Captree Islands.

Migratory shorebirds rely on these back-barrier salt marshes for roosting and feeding areas. This is especially important during high tides when intertidal flats are underwater. During the spring migration (April to June), the back-barrier marshes of Great South Bay have some of the highest concentrations of migratory shorebirds on the south shore of Long Island.

5. Subaerial Beach

The Corps' recommended 30-year beach fill/dune construction plan could have a significant impact on barrier island vegetation. The regular deposition of material on the shoreline could mean not only the loss of the present beach strand community, but the loss of the seashore habitat itself, particularly sparsely vegetated overwash areas and inter-dunal swales. The simplified shoreline would not provide the range of habitat features critical to species diversity on the barrier islands. Environmental conditions would become more similar to those prevailing on the mainland of Long Island. Inevitably, the vegetation would also come to resemble the more mature vegetational stages, with more grassland, thicket, and forest at the expense of bare or sparsely vegetated habitat.

This would represent a loss of biodiversity at the community level, if not at the species level. Denser grassy vegetation, combined with encroaching habitat for mammals, could make Fire Island unsuitable for shorebirds. In addition, several species of reptiles that use the seashore, especially the Eastern mud turtle, the spotted turtle and the diamondback terrapin, could be adversely affected by this predicted habitat change.

a. Seashore Community

The seashore habitat includes open sandy beaches, sand flats, mudflats, and dunes, the latter covered with beach grass (Bull and Farrand 1977). Nesting shorebird populations have declined severely and several shorebird species are either in danger of or threatened with extinction. A number of birds that are known to use this habitat are either Federally-listed (roseate tern and piping plover) or State-listed (least tern and common tern). Other breeding birds, such as the American oystercatcher (Melvin et al. 1991), and black skimmer (Safina and Burger 1983), are also affected by human activity on Atlantic Coast beaches. Though not State- or Federally-listed, their reliance on this habitat puts them at risk for population decline.

Species are classified as "endangered" when they are in danger of becoming extinct throughout all or a significant portion of their ranges. Species are listed as "threatened" when they are likely to become endangered throughout all or a significant portion of their ranges. When a species gets to the point of being listed, tremendous effort, and often sacrifice, are required to recover the population to self-sustaining numbers. For example, the modeled scenarios that most closely approximate the current status of the Atlantic Coast piping plover population--a population of 1,200 or 1,500 pairs with average productivity of 1.25 chicks per pair per year--showed, respectively, extinction probabilities of 35% or 31% over the next 100 years, and 95% and 92% for extinction should the population drop below 500 pairs during the next 100 years. The precarious state of the piping plover on Long Island has resulted in sections of beach being fenced to restrict public use of the beach, and limits being placed on beach users. Every summer since 1986, thousands of hours of paid and volunteer time have been invested to protect these birds, including Service, NYSDEC, and The Nature Conservancy biologists, Service law enforcement special agents, NYSDEC environmental conservation officers, New York State Park Police, Department of the Interior solicitors and U.S. Department of Justice attorneys. On Long Island, two lawsuits involving the birds have been settled out of court, and a third one resulted in conviction. If present trends continue, similar efforts may be required to save other shorebird species from extinction.

Loss of habitat is a major contributor to the decline of populations and fledging success for State- and Federally-listed birds found in the project area. Piping plovers, for example, are threatened by cumulative impacts of habitat loss and alteration, human disturbance, and predation. Breeding and wintering habitat for piping plovers along the Atlantic coast can be attributed to a variety of coastal development and coastline stabilization activities (U.S. Fish and Wildlife Service 1996). Coastal stabilization activities, such as installation of snow fencing and placement of Christmas trees, can severely degrade plover nesting habitat by altering or impeding natural processes (U.S. Fish and Wildlife Service 1996). Beaches and dunes have been altered to the point of being unacceptable to plovers through construction of recreational and residential dwellings, commercial buildings, boardwalks, piers, roads, and parking lots (Melvin et al. 1991).

The FIIP shoreline design profile does not actually resemble a natural dune line composed of a series of parabolic sand mounds, but is an uninterrupted, unconsolidated trapezoidal levee running the length of the project area. This means that the interdunal habitat, with its diversity of microhabitats and microclimates, that would normally be found in the sheltered low areas between dune crests, will not exist on the constructed beach. The loss of niche habitats represented by the replacement of the existing beach surface with a more uniform system represents a significant change in habitat quality and diversity.

Several studies have shown that piping plovers favor a complex beach habitat that includes ephemeral pools (Elias-Gerken and Fraser 1994), overwash corridors that provide access to bayside forage areas (Loegering and Fraser 1995), and dune blowout areas (Strauss 1990). Strauss (1990) specifically noted that piping plovers did not nest seaward of steep foredunes. The Piping Plover Atlantic Coast Population Recovery Plan (U.S. Fish and Wildlife Service 1996a) specifically identifies the maintenance of natural coastal formation processes that perpetuate high quality breeding habitat as, "an action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the future."

The amount and type of vegetation on the surface of the barrier islands is largely controlled by the amount of sea spray and overwash. The amount of salt-water exposure defines the type of vegetation that can survive in a given location, contributing to habitat patchiness and diversity. Several shorebirds, including the piping plover, the least tern, and the black skimmer, and reptiles such as the northern diamondback terrapin, must nest in areas where overwash regularly thins or clears away the vegetation. By preventing overwash, the FIIP would also eliminate this ecologically critical beach clearing function.

The project area contains a Federally-listed threatened plant, seabeach amaranth *(Amaranthus pumilus)*, which colonizes areas disturbed by overwash and breaching. The Recovery Plan for this species (U.S. Fish and Wildlife Service 1995a) states that "any stabilization of shoreline is detrimental for a pioneer, upper beach annual whose niche or 'life strategy' is the colonization of unstable, unvegetated, or new land, and which is unable to compete with perennial grasses." On North Carolina's barrier islands, the zone where seabeach amaranth is absent corresponds almost exactly with the presence of an artificial barrier dune built and maintained by various Federal agencies from the 1930's to 1950's. Because seabeach amaranth survives by colonizing new patches of suitable habitat, these new patches must be extensive enough and close enough to each other for the plant to occupy suitable habitat as it becomes available. Fortifying a lengthy portion of the barrier island shoreline could be enough to preclude the survival of seabeach amaranth and similar plants, such as seabeach knotweed *(Polygonum glaucum)* throughout the barrier island system.

b. Vegetated Beach Community

For Fire Island, the most likely change in vegetation patterns would be from sparsely vegetated beach to vegetated beach and grassland. This would alter the competition among species for this area, favoring bird species which have adapted to more heavily vegetated beach areas elsewhere, particularly black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), and ring-billed gull (*Larus delawarensis*). Common species able to tolerate denser stands of beach grass would tend to displace and prey upon rarer species requiring bare or sparsely vegetated sand, which represents a potential loss of species diversity for the barrier beach/back-bay community.

c. Thicket/Woodland Community

Increasing thicket vegetation at the expense of sparsely vegetated beach would change the species that could survive on the barrier islands. The net result would favor mammals, which have already adapted relatively well to the human presence on the barrier islands, and the sorts of birds and reptiles found on the Long Island mainland, over the remaining examples of seaside species. The suburbs of Long Island resemble a thicket habitat in many locations as thickets naturally follow the land clearing associated with suburban development (Bull and Farrand 1977). The recommended plan does not include land clearing, but the end result of the reduced probability of overwash and inlet formation is the increase in density of vegetation, leading to thicket formation.

Birds observed in the barrier island thickets resemble those routinely found in the suburban yards of Long Island. They include: American robin (*Turdus migratorius*), song sparrow (*Melospiza melodia*), mourning dove (*Zenaida macroura*), and gray catbird (*Dumetella caroliniensis*). Development of thickets on wetland edges may also be advantageous for several tree-nesting species associated with marshes, including green-backed heron (*Butorides striatus*). During the winter, the barn owl (*Tyto alba*) and the loggerhead shrike (*Lanius ludovicianus*) make use of this habitat.

McCormick & Associates (1975) identified the following reptiles as using thickets on Fire Island as probable breeding habitat: box turtle (*Terrapene carolina*), Eastern hognose snake (*Heterodon platyrhinos*), and black racer (*Coluber constrictor*). They tend to favor moist, shaded environments. The black racer is the most indiscriminate predator, eating rodents, small birds, lizards, snakes, frogs and insects (Conant and Collins 1991). The eastern hognose snake is a State species of special concern.

The mammals of the barrier islands would be afforded a great increase in nesting and forage habitat by any increase in dense, woody vegetation. The following mammals have been identified as breeding in thicket or woodland habitat (McCormick & Associates 1975): Opossum (*Didelphis marsupialis*), short tailed shrew (*Blarina brevicauda*), Norway rats (*Rattus norvegicus*), red fox (*Vulpes fulva*), long tailed weasel (*Mustela frenata*). Several of these animals are omnivorous, and all will eat birds if they can catch them (Godin 1977). Unfledged birds are particularly vulnerable to this predation. Herbivorous mammals in the area include Eastern cottontail (*Sylvilagus floridanus*), grey squirrel (*Sciurus carolinensis*), and white-tailed deer (*Odocoileus virginianus*). Populations of these species are already large enough to cause complaint in the Fire Island and Westhampton communities, and a deer contraception program was established on Fire Island in 1995 in an effort to control the size of the herd. Small mammals are often consumed by migrating birds of prey during the spring and fall.

6. Ocean Shore/Borrow Areas

a. Shoreface

Renourishment of the FIIP is expected to take place every three years; this suggests that in 10 years out of 30, migratory birds and birds that winter in the nearshore area may be confronted with a reduced food supply. Changes in foraging and nesting patterns may also result, but there are no existing data which would allow for an accurate impact assessment. Both the biomass and species composition of the shoreline community are critical for supplying the nutritional needs of migrating shorebirds and wintering seabirds, but data defining the biomass and species composition of the Long Island barrier shoreline community are lacking. Studies examining the effects of beach nourishment on migratory shorebirds are lacking in the scientific literature. The Service is concerned that birds migrating or wintering along newly created beaches would be at risk of not meeting their nutritional needs, which are particularly high during these periods. It is not known how long it will take infaunal communities to recover after the proposed placement of dredged sand material. Impacts would occur to birds if they encounter too much sterile (recently buried) area or if their preferred prey have failed to recover from beach fill/dune construction activities.

Even the magnitude and duration of direct impacts of the Corps' 30-year beach fill/dune construction plan on intertidal organisms are uncertain. While some may migrate through the fill material, a project of this size, involving 9 million cy during initial construction, is likely to displace or bury most intertidal organisms. Decimation of food-chain organisms by heavy deposition of sediment could be equally devastating to birds, fish and some invertebrate populations, but this impact has not been studied. Although marine bottom communities survive periodic change related to the natural erosion and accretion, nearshore communities are in a more stable environment and are less adaptable to such perturbations (Naqvi and Pullen 1982). Some infaunal bivalves and crustaceans can migrate vertically through sediments, but their survival depends not only on sediment depth, but also on length of burial time, season, particle size distribution, and other habitat requirements of the animal.

While adult fish are unlikely to be affected by project construction, planktonic life stages will be unable to avoid the increased turbidity near shore. It is not possible to estimate the impact of the activity on larval fish populations. Any species that may undergo a dormant phase in the nearshore area would be unable to escape burial.

The FIIP entails the initial deposition of 9,021,670 cy of dredged sand in the beach fill/dune construction area, burying the existing profile to an average depth of approximately 5.5 ft (1.65 m). Only Reilly and Bellis (1978) examined a project of comparable burial depth, which was carried out on Bogue Banks, North Carolina; other studies of beach nourishment impacts involved burial depths of generally less than 30 cm (1 ft). This is also the only study that identified significant impacts associated with beach nourishment, including the complete elimination of intertidal organisms for 15-30 days following beach nourishment. As the study only lasted two months, it is not possible to be certain of the magnitude of these effects over a full season.

Recovery of macrobenthic animals varies and differs from one site to another. Reilly and Bellis (1978) and Parr et al. (1978) noted that when nourishment ceases, the recovery of the macrofauna is rapid and complete recovery might occur within one or two seasons. Recovery will depend on the season of the year of the nourishment operation and the recruitment of larval fauna. Meiofauna recover very slowly from a major disturbance, perhaps due to their slow reproduction, limited ability to migrate, and their highly specialized adaptations to a restricted environment (Naqvi and Pullen 1982).

Most studies, which generally involve the placement of less sand per mile than the FIIP, have shown that moderate to complete recovery of motile animals will occur within a year. Studies have shown that motile animals generally leave an area of perturbance temporarily, but return when the disturbance ceases. The motile animals which have a stringent requirement for biological activities, i.e., habitat requirements or food source, are most likely to be affected. It appears that motile fauna are generally not affected adversely by dredging at ~~the borrow~~ area or sand placement along the shore unless a major food source or habitat is removed or the quality of the area is severely degraded.

Turbidity, while comparatively unimportant to benthic organisms, may be relatively more important to fish and the fish community structure. Suspended solids in water can affect the fish population by delaying hatching time of fish eggs (Schubel and Wang, 1973), killing the fish by coating their gills, and by anoxia (O'Connor et al. 1976). Sherk et al. (1974) found that demersal fish are more tolerant to suspended solids and filter-feeding fish are least tolerant, giving an advantage to demersal fish and a disadvantage to filter feeders. This is an advantage to populations of forage fish and a disadvantage to predatory fish.

b. Nearshore Community

The sand borrow area for the FIIP is located within the nearshore community and lies a minimum of 0.5 miles offshore of Cherry Grove. No description has been provided for the Corps' work plan for this area, however, 800 acres of ocean bottom will be dredged to supply the 9 million cubic yards of material.

Of these issues, the two that have received the greatest attention from the Service (1993, 1995b) are the medium and long-term impacts of the loss of benthic infauna and the potential for reduced dissolved oxygen concentrations.

Initial recolonization is expected to consist primarily of pioneer, early successional species, which may not be the preferred forage of local fish populations. There is no baseline data on the borrow area benthic community which could be used to compare with post-construction monitoring results. A change in available forage species over an area of approximately 5000 acres or more of intertidal, subtidal, and beach habitat could have substantial negative environmental impacts. In addition, the Corps has provided limited information on the status of commercially valuable species of proposed borrow area. The New York State DEC has indicated that the borrow area is a significant foraging and breeding area for squid and other fish species. Without adequate baseline data, impacts to the borrow area are unknown.

D. Cumulative Impacts

The cumulative impacts of the Corps' recommended 30-year beach fill/dune construction project, in conjunction with the partial listing of projects provided in Section VIII have not, to date, been qualitatively assessed or quantified on an ecosystem level by the Corps. On a local level, the long-term beneficial or adverse environmental effects of projects completed on the

Westhampton Barrier Island have not been addressed scientifically. The protocol by which the cumulative impact evaluation would be accomplished has not been developed by the interested and involved agencies and organizations.

In terms of Corps' related activities in the FIMP project area, the Service notes the concurrent development of the "South Shore of Long Island, New York - Habitat Restoration, Water Quality Improvement, and Related Environmental Features - EIS," the FIMP Reformulation Study/programmatic EIS, and the SIIP-EA. The purpose of the Corps' "South Shore of Long Island, New York - Habitat Restoration, Water Quality Improvement, and Related Environmental Features," for which an EIS will be prepared, is to identify impacts to the bay ecosystem and related environmental features, e.g., barrier islands, due to past Federal navigation, shoreline protection, and flood control projects.

As part of the South Shore of Long Island EIS effort, the Corps has identified a number of environmental study tasks including baseline investigations of existing vegetative cover, on-site surveys of vertebrate and invertebrate species of both aquatic and wetland habitats, and numerical modelling of salinity and other physical-chemical features of the embayments (Corps, 1997). In addition, the Corps has programmed into their preliminary budget for this effort a habitat analysis consisting of appropriate techniques such as a Habitat Evaluation Procedures (HEP) study. The Corps has identified over 90 restoration sites within the south shore bays. Of these, the Corps has only estimated restoration acreages for 24 sites, totalling 3,116 acres. The Corps is uncertain at this time how many additional acres are in need of restoration for the remaining 70 or so sites.

In regard to the FIMP, the Corps has identified a number of major environmental study areas including estuarine impact surveys, water quality modelling, eelgrass and eelgrass fauna inventories, juvenile fish surveys, plankton, phytoplankton and larval fish surveys, benthic surveys of the offshore dredging areas, barrier island terrestrial inventories, shorebird inventories, HEP for threatened and endangered species, vegetative mapping, waterfowl use surveys, and hard clam surveys during its initial identification of study needs for the project area including the Corps' recommended 30-year beach fill/dune construction *on Fire Island*. With the exception of two studies, all the others have not yet been started/completed for incorporation into this report.

The Corps has scoped out the issues relative to the FIIP-EIS and is preparing a DRAFT EIS. In terms of environmental studies, the Corps has indicated that it would not undertake any studies for the "interim" project. The Corps indicated in its Notice of Intent to prepare an EIS (Federal Register Notice, November 26, 1997, Volume 62, No. 228, pages 63134-63135 and Federal Register Notice, January 22, 1998, Volume 63, No. 14, pages 3312-3313) that it anticipated release of its Draft EIS in June 1998, which is still pending. The Corps and the New York State DEC have discussed necessary environmental field surveys and investigations.

In this case, as will likely be the case for the SIIP, potentially long-term beach fill/dune construction projects are being planned without the benefit of appropriately designed environmental studies. If the FIIP, the SIIP beach fill/dune construction alternatives, the Westhampton Interim, and the Westhampton groin field are collectivley examined, including areas which may be designated for "deferred construction" under the FIIP, the Corps' interim projects would encompass nearly 40 miles of the original 83-mile study area.

As noted previously, the South Shore Estuary Reserve Council lead by the New York State Department of State is developing a Comprehensive Management Plan for the south shore estuary stretching from Hempstead Bay to Shinnecock Bay. The purpose of the Comprehensive Management Plan (CMP) is to provide information on species found inside the south shore estuary and provide preliminary recommendations to guide management decisions in regard to the subject species. The Plan will include shorebirds, waterfowl, diadromous fish, and shellfish. The Corps proposal should ensure that it does not conflict with the recommendations being developed by the SSER.

Research topics, through the FIMP process, are currently being planned which would aid in the development of the impact assessments, however, they will not be finalized until after the planning for the Corps' interim projects are completed. As stated throughout this report, the lack of comprehensive, quality research presents difficulties in conducting adequate impact assessments.

X. RECOMMENDATIONS

A. Study Needs

In order to gauge the potential environmental impacts of the recommended 30-year beach fill/dune construction plan, a number of information and data needs should be completed so that impact assessments can be effectively conducted. While several studies have been conducted in the south shore estuary, more studies are needed for a comprehensive impact assessment, such as those listed below.

Among the data Buckley (1982) saw as necessary are:

> "(1) site-specific geomorphic analyses of barrier island dynamics;
> (2) authentic cost estimates of the various alternatives identified as feasible following the geomorphic analyses;
> (3) sensible analysis of the actual impacts (environmental and economic) of the feasible alternatives;
> (4) realistic comparison of the economic and environmental benefits and costs over both the short-term (one to twenty years) and the long-term (twenty to one hundred years). The reason for the long-term/short-term distinction is the inexorable rise of sea level . . . one hundred years is not beyond the design lifetime of many structures."

Our review of numerous reports relative to fish and wildlife resources and back-bay/barrier island environments identified the need for the following assessments: 1) baseline data is required concerning plankton and water quality on the bay side of Fire Island which will require a comprehensive bay-wide water quality sampling program; 2) a survey of benthic organisms, including commercial shellfish, and their habitat is necessary; 3) inlet formation potential and habitat-related evaluations should be done (Kana and Krishnamohan 1994); 4) adult fish use of inlets should be assessed (e.g., Cashin Associates 1993); 5) productivity and spawning habitat use of seagrass meadows in Great South Bay; 6) seasonal productivity of invertebrates and predator-prey relationships; and 7) animal communities (benthic and otherwise) along the shore face and in the borrow area should be surveyed before, during, and after dredging and throughout nourishment years (Naqvi and Pullen 1982). In addition, studies should address the basic ecology of eelgrass meadows within Great South Bay, Moriches Bay, and Shinnecock Bay, especially the identification of which species and life stages makes use of this habitat. Many of the same studies were also identified in our interim 2(b) report on the SIIP.

The following provides some of the relevant environmental questions surrounding the beneficial or adverse effects of reducing the probability of overwash and breaching or allowing breaches and overwashes on the fish and wildlife resources of the barrier islands.

In light of the fact that there is little quantitative data available that would permit an accurate assessment of the relative impact of most human activities compared to the effect of natural processes on water quality and local habitats of the Fire Island National Seashore (New York Sea Grant Institute 1993), what is our understanding of the coastal processes affecting Great South Bay?

1. Open Water/Non-Vegetated Bay Bottom

   a) What are the flushing rates with and without breaches and overwashes, and the potential effects on water quality including pathogen loads? How will the presence or absence of breaches and overwashes affect important shellfish resources such as the hard clam or species which may impact this resource such as brown tide?

   b) What are the existing primary and secondary productivity levels in the back-bay and ocean nearshore areas and what are the anticipated effects of preventing or allowing breaches and overwashes?

   c) How will the presence or absence of breaches and overwashes affect the suitability of the back-bays as habitat for juvenile fish, benthic and mobile invertebrate intertidal and subtidal species, shorebird species, wading birds, and waterfowl, including threatened and endangered species?

d) What is the existing distribution and abundance of the species mentioned above within the back-bay system (and ocean nearshore system)?

e) How does the presence or absence of breaches and overwashes affect the distribution and abundance of shellfish predators within the back-bays?

2. Inlet Channel

a) What are the anticipated effects of leaving inlets open, artificially closing them, or creating new ones on the back-bay habitats and mainland habitats?

b) What is the anticipated probability, size, and location of a new inlet opening on Fire Island and how long will it likely remain open?

c) How many inlets might form with or without the proposed 30-year beach fill/dune construction plan?

d) How much new habitat would form or be lost by preventing or allowing breaches and overwashes?

e) How much habitat on Fire Island has been either beneficially or adversely affected by the intercoastal waterway Federal Navigation Projects, including the jetty work, on Fire Island?

3. Vegetated Bay Bottom

a) What is the distribution and biomass of eelgrass habitat in the back-bays? What is the role of eelgrass beds and other vegetated and non-vegetated bottom habitats in supporting the recruitment of fish to the back-bays (e.g., New York Sea Grant Institute 1993) and providing winter habitat for fish?

b) What are the anticipated impacts of preventing or allowing breaches and overwashes on eelgrass distribution and biomass, and the fauna which utilize this habitat?

4. Tidal Marsh

a) What is the importance of overwash sand, breaching and inlet formation to the development of back-bay salt marsh and how will the prevention of breaches and overwashes affect the rate of marshland formation on the bay side of the barrier islands?

b) What are the projected outcomes of bayside flooding and storm erosion, including the role of marshes, eelgrass beds, and channels in the process of inlet formation (New York Sea Grant Institute, 1993)?

c) In order to have a baseline by which the impacts of a shoreline stabilization project could be measured, what is the baseline distribution and abundance of salt marsh fauna?

d) What are the populations of benthic resources, including shellfish, in each of the major habitats including salt marshes and intertidal beaches (e.g., New York Sea Grant Institute 1993)?

e) What will be the source of sediments to the back-bays with and without breaches and overwashes? How will wetland, intertidal and subtidal habitats be formed and maintained if these processes are interrupted?

5. Subaerial Beach

a) What is the distribution and abundance of beach invertebrates? How will these change relative to allowing or preventing breaches and overwashes?

b) What are the effects of preventing or allowing breaches and overwashes on salt-spray and overwash maintained dune-swale plants/communities?

c) What are the predicted proportional changes in habitats and species with or without breaches and overwashes?

d) What are the anticipated impacts related to changes of moisture on vegetation and infauna due to increases or decreases in beach elevations?

e) What are the ecological and/or geological impacts of creating a uniform dune line?

f) What is the present distribution and abundance of bay-side intertidal macrofauna and forage fish species and how will these fluctuate with or without breaches and overwashes?

g) What are the short- and long-term impacts of overwash and breach prevention/allowance on rare species and their habitat on the barrier beach?

6. Ocean Beach/Nearshore Communities

a) What is the effect of beach construction on the feeding habitat of migratory birds?

b) What are the effects of dredging the borrow area, including benthic and otherwise, and burial of the nearshore area on the supply of forage organisms for local fish populations?

c) What are the biological impacts, either beneficial or adverse, of beach fill/dune construction on nesting shorebird habitat areas? What are the potential shorebird nesting areas with and without breaches and overwashes?

B. Alternative Management Strategies

The purpose of this section is to provide planning input to the Corps regarding the consideration of additional reasonable alternatives to the FIIP. As noted in the Introduction section, the Corps' proposed FIIP is very nearly the same project rejected by CEQ: a 16-foot high dune built in stages along Long Island's south shore from Fire Island Inlet to Montauk Point. The Service is concerned that this would continue the process started in Westhampton of constructing long-term (30-year) interim projects without fully considering available alternatives and fully understanding the cumulative impacts.

In its June 6, 1978, letter (see Attachment A), the CEQ concluded:

> ". . . we believe that the proposed course of action, as described in the environmental impact statement, is environmentally unacceptable and that the Corps has not demonstrated that there are no practicable alternatives available. Rather, a number of reasonable alternatives and combinations of alternatives, which we believe warrant serious consideration by the Corps, have been given short shrift or been omitted from the programmatic statement."

With the above in mind, the Service recommends the following alternative management strategies which should be considered by the Corps in its comparison of environmental impacts. The recommendations are ordered based on preference.

1. Implement the Existing Interim Breach Contingency Plan Until Completion of the Reformulation Study

The BCP (described in Section III -FIMP Project History) is currently included under the No Action alternative, but since it is also an interim plan it should not be included as an activity which will continue into the future without a rigorous assessment of its impacts and feasibility. Although the BCP may be the best short-term alternative available at present, the National Park Service is studying the question of whether systematically closing all breaches is scientifically justified. As noted earlier, the prompt closure of new inlets prevents the landward movement of the island's base, accelerating the relative loss of elevation of the island's interior, preventing the island's natural response to rising sea level and risking the island's integrity over the long-term. In addition, breaches are valuable habitat areas to a number of species, and the BCP precludes their existence over time periods greater than three months.

It seems reasonable to believe that the BCP, designed to "expedite breach closure, minimize breach closure costs, and minimize storm damages to barrier island and back-bay shoreline areas" (U.S. Army Corps of Engineers 1995) is a suitable interim measure until the Fire Island Inlet to Montauk Point Reformulation Study area is completed (2002). This is especially prudent considering that the additional flooding risk associated with breaches and overwash has not yet been quantified.

A breach or inlet in the barrier island does not increase damages due to the storm causing the breach, but rather due to storms which follow (Kana and Krishnamohan 1994). The probability of a 50-year storm (a storm with an annual probability of 2%) being followed by a 5-year storm (a storm with a probability of 20%) in any one year conservatively calculates to 0.2%, a once in 500-year probability. The probability of these two storms occurring in the three months whereby the BCP would likely be implemented, which would further reduce our conservative figure.

2. State and Local Governments Continue with Pre-Storm Sand Build-up Operations/Issuance of Emergency Permits

In addition to the BCP, many of the local communities affected by the FIIP have performed their own beach nourishment projects. This pre-storm material placement provides short-term levels of protection to specific, critical locations, on an as-needed basis. The Corps should evaluate the feasibility of this plan, possibly in combination with the BCP or other alternatives, in providing an adequate level of short-term protection until the FIMP Reformulation Study/EIS is completed in 2002.

In addition to constructing temporary dunes, the NYSDEC and the Corps Regulatory Branch have issued numerous beach emergency permits to property owners which allows emergency protection measures to be implemented.

3. Minimization

a) Project of Shorter Duration and Scale.

The Corps should evaluate, in the context of the time line for completion of the FIMP Reformulation Study/programmatic EIS, a project of lesser duration and scale. The objectives of this plan should be to promote habitat diversity and protection along with the protecting the communities. For example, the Corps has determined that these objectives could be met in the development of the Assateague Island Restoration Project which sought to alleviate and mitigate downdrift erosion attendant to the Corps' Ocean City Inlet Federal Navigation Channel. Also, as stated in the DOI letter dated, April 23, 1996, and in the SIIP FWCA report, dated November 5, 1998, a one time placement of material in select locations could serve as an interim measure until completion of the FIMP Reformulation Study.

b) Sand By-passing.

A short-term alternative to shoreline protection which should be considered along with the other alternatives may be sand by-passing. This approach which was endorsed by the Long Island Regional Planning Board (1989) and would attempt to restore the downdrift flow of sand that would otherwise be trapped in flood and ebb tidal deltas at the stabilized inlets. In comparison to the recommended 30-year beach fill/dune construction plan, it would likely have less environmental impacts than introducing large volumes of sand in the form of a constructed dune. Also, the Corps' Operations and Maintenance dredging cycles provide additional shoreline protection through the placement of dredged material on the beach adjacent to the fishing cooperative area. These efforts may be sufficient until completion of the FIMP.

4. Improve Institutional Management

The Long Island Regional Planning Board developed a detailed program of institutional control in 1989. The institutional management alternative relies on a collection of (primarily financial) incentives and disincentives to reduce public liability for structures in the flood zone and permit as little intervention in barrier island processes as possible. This approach is supported by legislation. The Coastal Zone Management Act requires that approved State Coastal Management Plans improve management of development in coastal areas in order to avoid or mitigate losses of life and property (Glazer 1982). In addition, the Coastal Barrier Resources Act recommends that the Federal government eliminate Federal expenditures and financial assistance for development of privately owned properties that are not otherwise protected, but yet within the boundaries of governmental conservation areas (Kunz and Verbarg 1985).

a) Incentives and Disincentives

Incentives and disincentives for managing erosion-prone shorelines could include various combinations of grants, cost-sharing, and preferential tax, loan, and insurance policies closely tied to the desired regulatory and advisory approaches (Hobbs et al. 1981). Holling and Meffe (1996) specifically recommend establishing disincentives to discourage further floodplain development. Carlton (1986) suggests that species preservation could be enhanced by restructuring tax and subsidy programs to eliminate conservation disincentives for private landowners and to distribute conservation costs and benefits equitably.

b) Monitoring and Reporting of Activities

Local government and privately funded beach nourishment, dune building, and beach scraping project initiatives on the south shore barriers should be monitored for the effectiveness of such activities. There are multiple private homeowner, town, county, and state government erosion and flooding protection projects and beach stabilization projects undertaken every year within the FIMP Reformulation Study/EIS project area, and many more such efforts are planned for the future. Hundreds of private applicants along the south shore and barrier island receive permits from the Corps to build or reconstruct bulkheading to protect their properties from flooding every year. Hundreds of acres of wetlands along the south shore of Long Island have been restored over the last five years, thereby absorbing flood waters and minimizing flood damages. Twelve of Fire Island's 17 communities, affecting 13 linear miles of Fire Island, undertake beach scraping activities to rehabilitate dunes and dune scarps. Nine Fire Island communities received dune and beach building permits in 1994. Federally sponsored sand by-passing downdrift of Moriches Inlet was undertaken in 1996 and 1998, and the New York State Department of State is assessing long-term sand bypassing at Shinnecock Inlet in 1998. There are multiple projects undertaken every year to protect properties from erosion and flooding and their individual and cumulative effects must be considered.

c) Limitation of Activities

Outside activities that tend to undermine a local program of institutional management of coastal issues should be limited. Kunz and Verbarg (1985) specifically identify "The implementation of large scale dune building and beach maintenance projects along Fire Island" as just such an outside activity, and suggest limiting "public expenditures for artificial shoreline maintenance east of Robert Moses State Park and west of Smith Point County Park, except where it may be necessary to close or prevent the opening of a new inlet." This approach is embodied in the BCP.

XI. MITIGATION RECOMMENDATIONS

The views and recommendations of the Service on this project are guided by its Mitigation Policy (U.S. Fish and Wildlife Service 1981). This policy seeks to mitigate losses of fish, wildlife, and their habitats, and uses thereof, from land and water developments. The Service's mitigation policy does not apply to the Endangered Species Act, and three listed species (piping plover, roseate tern, and seabeach amaranth) will be affected by the project. The term "mitigation" is defined as: (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating impacts over time; and (e) compensating for impacts by replacing or providing substitute resources or habitats.

As discussed in Section IX (D), the Corps is developing EIS's for several projects within the back-bay/barrier island ecosystem, including the FIIP-EIS, FIMP Reformulation Study/programmatic EIS and the South Shore of Long Island, New York - EIS. A number of environmental tasks, which would require significant field effort and analysis, have been identified for the FIMP Reformulation Study/EIS and South Shore of Long Island Study. When gathered, this information would assist in the development of a mitigation program for the back-bay/barrier island ecosystem. The Corps has recently begun developing workgroups comprised of Federal, State, and local environmental resource managers as well as academia and natural resource organizations to define study and research needs for the back-bay systems as part of the FIMP Reformulation Study/programmatic EIS effort. In addition, other efforts such as those of the South Shore Estuary Reserve Council have identified numerous information and data gaps, as part of its process of developing a Comprehensive Management Plan for the back-bay system, which would assist in the development of a mitigation program.

Before initiating these projects, it is prudent and necessary to understand the status and distribution of fish and wildlife species, and the fundamental processes which shape and maintain their communities. This level of knowledge is necessary in order to establish the level of potential compensation of these resources. Because the thorough program of research proposed for the FIMP Reformulation Study/programmatic EIS has not been completed, it is not possible at this time for the Service to recommend a mitigation program that would account for all of the potential changes that the FIIP might induce in this ecosystem over a 30-year period. Studies, which have been preliminarily identified by the Service, that could form the basis of such an understanding are presented in Section X.

Other mitigation issues are more directly concerned with living organisms than their habitat. New York Sea Grant Institute (1993) stated that there was not enough information to accurately characterize the carrying capacity of Long Island's south shore bay and barrier island resources and habitats. For this reason, an analysis of energy inputs and outputs with and without the FIIP would be advisable; such a study would provide a simplified guideline estimate of the total impact of the FIIP on this ecosystem, as measured in energy units.

Another approach would be to develop an Index of Biological Integrity (IBI) for Long Island's barrier island/back-bay ecosystem. The IBI is an approach for incorporating information from multiple biological indicators into a single numerical index, where conditions observed in the system being assessed are compared to region specific expectations for an undegraded system (Angermeier and Karr 1994). The major difficulty in adapting IBI, which was designed for riverine systems, to a coastal ecosystem would be in finding an undegraded reference site. However, even if an IBI were developed, further study would be needed to determine how to restore the system to something more nearly resembling the undegraded condition.

XII. SERVICE POSITION

The Service has adopted an ecosystem approach to fish and wildlife conservation as a foundation of its operational activities. It is the Service's view that a broad, holistic management strategy is an effective way to address the agency's mission to conserve, preserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people and to manage its extensive array of trust responsibilities such as migratory birds, anadromous fish, marine mammals, endangered species, wetlands, and the National Wildlife Refuge System. The goal of the Service's ecosystem approach is to effectively conserve biological diversity through perpetuation of dynamic, healthy ecosystems by means of coordinated efforts with public agencies, private organizations, landowners and citizens.

This DRAFT report provides the Service's comments on the biological and procedural issues relevant to this project. The Service notes that the Corps has separate planning efforts underway within this ecosystem which include the SIIP-EA, FIMP Reformulation Study/EIS, and the South Shore Embayment Study-EIS. The Service disagrees with the Corps on this approach based on the grounds that all of these efforts impact a single interconnected coastal system, and that providing separate reports does not allow for an adequate analysis of potential direct, indirect, and cumulative impacts to the system.

On a procedural basis, this project is counter to the intent of the NEPA and disregards previous President's Council on Environmental Quality (CEQ) findings regarding segmentation of the authorized FIMP project. The Corps has prepared a Draft Environmental Assessment for this project, which is still undergoing internal review within the Corps. However, this may be in conflict with Section 1506.1(c) of the National Environmental Policy Act (NEPA) of 1969 which set specific limitations on actions during the NEPA process, including interim actions which fall within a programmatic environmental impact statement. In addition, the Corps' recommended 30-year interim beach fill/dune construction plan is similar to the beach fill/dune construction measures proposed for this reach by the Corps in their 1977 FIMP-EIS. Over 20 years ago, the DOI, U.S. Environmental Protection Agency, and National Marine Fisheries Service found the Corps' FIMP-EIS deficient and referred it to CEQ which subsequently rejected the Corps' EIS in 1978. The primary concern expressed by the CEQ in 1978 remains, namely, that the combination of large-scale, long-term beach construction projects and rising sea level will leave the barrier islands more vulnerable to breaching than they are at present, resulting in an ongoing liability for the Federal government.

Section 2(b) of the FWCA requires that the DRAFT report of the Secretary of the Interior: 1) determine the magnitude of the impacts of the proposed projects on fish and wildlife resources and 2) make specific recommendations as to measures that should be taken to conserve those resources. The Service has reviewed the current literature on the biological and physical processes effecting the barrier island and coastal ecosystems. Although system specific data are limited, it is clear that when the project is considered within the context of the existing and foreseeable coastal projects this project has the potential to have significant ecological impacts.

In the short-term, the Corps' recommended plan will have direct and indirect adverse impacts on fish and wildlife resources and their supporting ecosystems. Initial beach fill will directly impact 14 miles of subaerial, nearshore intertidal, and subtidal marine habitats (approximately 500 acres) and 5 square miles of subaqueous borrow areas.

In the long-term, the 30-year beach fill/dune construction plan could also have adverse impacts on fish and wildlife habitat and the overall condition of the barrier island through prevention of coastal processes which maintain the barrier islands as natural protective features. Coastal processes keep the barrier island above water and protect Long Island's south ~~shore from~~ direct influences of ocean waves and also create and maintain a natural balance among various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife species. An evaluation to identify possible adverse effects that such ecosystem manipulation may have on Long Island's barrier islands back-bay complex is needed. Over a 30-year time frame, these beach nourishment projects may precipitate enormous ecological changes without an understanding of the potential consequences, and would do so in the absence of a baseline by which they could be measured.

The Service has recommended a number of short-term alternatives that the Corps should consider in its report evaluating the feasibility of Federal involvement in providing protection to the barrier island and south shore communities. These alternatives include the implementation of the Interim Breach Contingency Plan until completion of the Reformulation Study, continuation of pre-storm sand build-up operations/issuance of emergency permits by State and local governments, institutional management, and minimization of the project duration and scale.

This DRAFT report does not constitute the final report of the Secretary of Interior as required by Section 2(b) of the FWCA, because the Service cannot fulfill the basic requirements of determining the magnitude of the impacts of the proposed projects on fish and wildlife resources and making specific recommendations as to measures that should be taken to conserve those resources until further information is provided.

The Service recommends that the Corps undertake an analysis of environmental impacts that would provide data sufficient to determine the cumulative environmental impacts and provide a basis for a mitigation program prior to submitting the feasibility report for project authorization. The Service, therefore, recommends that the Corps' FIIP report not be submitted for project authorization until such analysis is complete. The Service concurs with the Corps' contention that the FIMP Reformulation Study/EIS is the proper framework for undertaking an appropriately detailed impact analysis for long-term Federal strategies to shoreline protection, and recommends that the Corps refocus its efforts on completing the FIMP Reformulation Study/EIS rather than pursue long-term interim proposals.

CITATIONS

Able, K.W. and M. Castagna 1975. Aspects of an undescribed reproductive behavior in *Fundulus heteroclitus* (Pisces:Cyprinodontidae) from Virginia. *Chesapeake Science* 16:282-284.

Angermeier, P.L. and J.R. Karr. 1994. Biological integrity versus biological diversity as policy directives. *Bioscience* 44:690-697.

Bascom, W. 1964. Waves and Beaches. Doubleday & Co. Garden City, NY. 267 pp.

Beatley, T. 1991. Protecting biodiversity in coastal environments: Introduction and overview. *Coastal Management* 19:1-19.

Beck, R., P. Schettig, D. Geismar, and S. Feter. 1978. Nassau/Suffolk Bi-County Region Water Quality Management Planning: South Shore Bays. Energy Resources Co., Inc., Cambridge, MA and Washington, DC.

Berg, D.W. 1977. Beachfront protection - I. *in* Clark, J.R., ed., Coastal Ecosystem Management: A technical manual for the conservation of coastal zone resources. John Wiley & Sons, NY. 928 pp.

Bokuniewicz, H.J., and J.R. Schubel. 1991. The origin and development of the Great South Bay: A geological perspective. *in* Schubel, J.R., T.M. Bell, and H.H. Carter, eds. The Great South Bay. State University of New York Press, Albany, NY. 107 pp.

Bricelj, V.M. 1984. Effects of suspended sediments on the feeding physiology and growth of the hard clam, *Mercenaria mercenaria* L. Ph.D. Thesis, Marine Sciences Research Center, SUNY, Stony Brook, NY. 157 pp.

Bricelj, V.M. and R.E. Malouf. 1984. The influence of suspended sediments on the feeding physiology and growth of the hard clam, *Mercenaria mercenaria* L. *Marine Biology* 84:155-165.

Buckley, P.A. 1982. Reconciling structural and non-structural solutions to coastal erosion problems. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service. 207 pp.

Bull, J., and J. Farrand Jr. 1977. The Audubon Society Field Guide to North American Birds. Alfred A. Knopf, New York. 778 pp.

Carlton, R.L. 1986. Property rights and incentives in the preservation of species. *in* B.G. Norton, ed., The Preservation of Species. Princeton University Press, Princeton, NJ.

Cashin Associates, P.C. 1993. The environmental impacts of barrier island breaching with particular focus on the south shore of Long Island, New York. Unpublished report prepared for State of New York, Department of State, Albany, NY. 44 pp.

Clark, J.R. 1977. Coastal Ecosystem Management: A Technical Manual for the Conservation of Coastal Zone Resources. John Wiley & Sons, NY. 928 pp.

Conant, R., and J.T. Collins. 1991. The Peterson Field Guide Series: Reptiles and Amphibians of North America (Eastern/Central North America). Houghton Mifflin Company, Boston, New York. 450 pp.

Conover, D.O., and B.E. Kynard. 1984. Field and laboratory observations of spawning periodicity and behavior of a northern population of the Atlantic silverside, *Menidia menidia* (Pisces: Atherinidae). *Environmental Biology of Fishes* 11:161-171.

Crowell, M, and S.P. Leatherman. 1985. Quantitative shoreline and environmental change. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic Analysis of South Shore of Long Island Barriers, New York. National Park Service, Boston, MA.

Department of the Interior. 1983. Undeveloped Coastal Barriers, Final Environmental Statement. DOI, Coastal Barriers Task Force, Washington, D.C.

Elias-Gerken, S.P. and J.D. Fraser. 1994. Piping plover foraging ecology on Pike's Beach, Southampton, New York. Final report submitted to U.S. Fish and Wildlife Service, Sudbury, MA. 61 pp.

Glazer, M. 1982. Coastal zone management: Opportunity for action. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop. Provincetown, Mass. May 1980. Boston, U.S. National Park Service, 207 pp.

Godin, A.J. 1977. Wild Mammals of New England. The Johns Hopkins University Press, Baltimore, MD. 304 pp.

Gregg, W.P. 1982. Development alternatives: New directions. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service, 207 pp.

Heck, K.L., Jr., K.W. Able, M.P. Fahay, and C.T. Roman. 1989. Fishes and decapod crustaceans of Cape Cod eelgrass meadows: Species composition, seasonal abundance patterns and comparison with unvegetated substrates. *Estuaries* 12:59-65.

Herbst, R. 1982. The year of the coast. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service, 207 pp.

Hobbs, C.H., III. R.J. Byrne, W.R. Kerns. N.J. Barber. 1981. Shoreline erosion: A problem in environmental management. *Coastal Zone Management Journal* 9: 89-105.

Holling, C.S., and G.K. Meffe. 1996. Command and control and the pathology of natural resource management. *Conservation Biology* 10: 328-337.

Kana. T.W., and R. Krishnamohan. 1994. Assessment of the vulnerability of the Great South Bay shoreline to tidal flooding. Unpublished report prepared by Coastal Science and Engineering, Inc., Columbia, SC, for New York Coastal Partnership, Babylon, NY. 127 pp.

Kiorbe, T., F. Mohlenberg, and O. Nohr. 1980. Feeding, particle selection, and carbon absorption in *Mytilus edulis* in different mixtures of algae and resuspended bottom material. *Ophelia* 19:193-205.

Kunz, A., and R. Verbarg. 1985. Strategies and recommendations by coastal reach and detailed study area. *in* Conference Proceedings: The Great South Bay: An Outlook for the Future. Oakdale, NY, April 15, 1985.

Leatherman, S.P. 1982. Non-structural approach to coastal problems. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service, 207 pp.

Leatherman, S.P. 1985. Stratigraphic correlations. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Leatherman, S.P., C.E. Johnson, and D.C. Joneja. 1985. Morphological analysis. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Leatherman, S.P. and J.R. Allen. 1985a. Discussion and Synthesis. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Leatherman, S.P. and J.R. Allen, eds. 1985b. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Lively, J.S., Z. Kaufman, and E.J. Carpenter. 1983. Phytoplankton of a barrier island estuary: Great South Bay, New York. *Estuarine, Coastal and Shelf Science* 16:51-68.

Loegering, J.P. and J.D. Fraser. 1995. Factors affecting piping plover chick survival in different brood-rearing habitats. *Journal of Wildlife Management* 59:646-655.

Long Island Regional Planning Board (LIRPB). 1989. Proposed Long Island South Shore Hazard Management Program. New York State Department of State, Albany, NY.

Malouf, R.E. 1991. The Hard Clam: Its biology and the natural processes that affect its success. *in* Schubel, J.R., T.M. Bell, and H.H. Carter, eds. The Great South Bay. State University of New York Press, Albany, NY. 107 pp.

Marine Sciences Research Center. 1973. Final Report of the oceanographic and biological study for southwest sewer district #3, Suffolk County, New York. Prepared for Bowe, Walsh and Associates, Huntington Station, NY, by Marine Sciences Research Center, SUNY, Stony Brook, NY. 269 pp.

McCormick & Associates 1975. Environmental inventory of the Fire Island National Seashore and the William Floyd Estate. Contract No. 2000-4-0010. Submitted to National Park Service, Denver, CO.

Melvin, S.M., C.R. Griffin, and L.H. MacIvor. 1991. Recovery strategies for piping plovers in managed coastal landscapes. *Coastal Management* 19:21-34.

Moffatt and Nichol, Engineers. 1995. Breach Contingency Plan, Fire Island Inlet to Montauk Point, Long Island, New York, Reformulation Study. Unpublished study prepared for U.S. Army Corps of Engineers, New York District.

Murray, M.P. 1996. Natural processes: Wilderness management unrealized. *Natural Areas Journal* 16:55-61.

Naqvi, S.M. and E.J. Pullen. 1982. Effect of beach nourishment and borrowing on marine organisms. Miscellaneous Report No. 82-14. U.S. Army Corps of Engineers Coastal Engineering Research Center. 43 pp.

National Park Service. 1995. Fire Island official map and guide. Government Printing Office:387-038/00166 Reprint. Multi-fold pamphlet.

New York Sea Grant Institute. 1993. Estuarine resources of the Fire Island National Seashore and vicinity. Report No. NYSGI-T-93-001. New York Sea Grant. Stony Brook, NY.

New York State Department of State. 1992. Significant Coastal Fish and Wildlife Habitats Program. New York State Department of State, Albany, New York.

New York State Department of State. in review. Wetlands technical report for South Shore Estuary Reserve. New York State Department of State, Albany, New York.

Newell, R.I.E. and S.J. Jordan. 1983. Preferential ingestion of organic material by the American oyster *Crassostrea virginica*. *Marine Ecological Progress Series* 13:47-53.

Nordstrom, K.F., and J.M. McCluskey. 1985. The effect of houses and sand fences on the eolian sand budget at Fire Island, NY. *Journal of Coastal Research* 1:39-46.

O'Connor, J.S. 1972. The benthic macrofauna of Moriches Bay, NY. *Biological Bulletin* 142:84-102.

O'Connor, J.M., D.A. Neumann, and J.A. Sherk, Jr. 1976. Lethal effects of suspended sediments on estuarine fish. TP 76-20, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.

Odum, E.P. 1961. The role of tidal marshes in estuarine production. Contribution Number 29 from the University of Georgia Marine Institute. Information leaflet. New York State Conservation Department. 4 pp.

Odum, W.E. 1970. Insidious alteration of the estuarine environment. *Transactions of the American Fisheries Society* 90: 836-847.

Orth, R.J., K.L. Heck Jr., and J. van Montfrans. 1984. Faunal communities in seagrass beds: A review of the influence of plant structure and prey characteristics on predator-prey relationships. *Estuaries* 7:339-350.

Panageotou, W., S.P Leatherman, and C. Dill. 1985. Geophysical interpretation. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Parr, T., D. Diener, and S. Lacy. 1978. Effects of beach replenishment on the nearshore sand fauna at Imperial Beach, California. Miscellaneous Report No. 78-4. Prepared for U.S. Army Corps of Engineers Coastal Engineering Research Center, Fort Belvoir, Virginia. 125 pp.

Peterson, C.H. 1982. Clam predation by whelks (*Busycon* spp.): experimental tests of the importance of prey size, prey density, and seagrass cover. *Marine Biology* 66: 159-170.

U.S. Fish and Wildlife Service. 1993. Fish and Wildlife Coordination Act Report, Section 2(b): Atlantic Coast of New Jersey--Sea Bright to Ocean Township Beach Erosion Control study. Sandy Hook to Barnegat Inlet: Section II--Asbury Park to Manasquan Inlet. Analysis of the Corps of Engineers selected plan. Pleasantville, NJ. 30 pp.

U.S. Fish and Wildlife Service. 1995a. Seabeach Amaranth Technical/Agency Draft Recovery Plan. Atlanta, GA. 75 pp.

U.S. Fish and Wildlife Service. 1995b. Fish and Wildlife Coordination Act Report, Section 2(b): Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet. Long Beach Island, New York. Storm Damage Reduction Project. Islip, NY. 31 pp.

U.S. Fish and Wildlife Service. 1996a. Piping Plover *(Charadrius melodus)*, Atlantic Coast Population, Revised Recovery Plan. Hadley, MA. 258 pp.

U.S. Fish and Wildlife Service. 1996b. Significant Habitats and Habitat Complexes of the New York Bight Watershed. U.S. Fish and Wildlife Service, Charlestown. RI.

WAPORA, Inc. 1982. Impact assessment on shellfish resources of Great South Bay, South Oyster Bay, and Hempstead Bay, NY. Draft report submitted to U.S. Environmental Protection Agency, Region II, New York, NY, by WAPORA, Inc. 115 pp.

Weinstein, M.P. 1979. Shallow marsh habitats as primary nurseries for fishes and shellfish, Cape Fear River, North Carolina. *Fisheries Bulletin* 77:339-357.

Zimmer, R.L. 1991. Sand supply to coastal dunes Long Island, New York. M.S. Thesis. State University of New York, Stony Brook, NY. 86 pp.

TABLES

LIST OF TABLES

TABLE C20

DESIGN DUNE AND BEACH FILL VOLUME REQUIREMENTS FOR INTERIM PROJECT

Design Reach 1	Dune Elevation (Ft, NGVD)	Berm Width (Feet)	Berm Elevation (Ft, NGVD)	Fill Volume (Cubic Yards)	Fill Distance (Feet)
F5	NA	90	9.5	31,670	1,296
F6	NA	90	9.5	23,387	2,591
F7	NA	NA	NA	0	6,363
F8	NA	NA	NA	0	6,373
F9	NA	NA	NA	0	1,886
F10	NA	NA	NA	0	1,264
F11	NA	NA	NA	0	1,313
Reach 1 Total				55,057	21,086
Design Reach 2	**Dune Elevation (Ft, NGVD)**	**Berm Width (Feet)**	**Berm Elevation (Ft, NGVD)**	**Fill Volume (Cubic Yards)**	**Fill Distance (Feet)**
F12	18	40	11.5	223,230	1,886
F13	18	40	11.5	227,418	1,264
F14	15	90	9.5	164,556	1,313
F15	15	90	9.5	117,291	1,348
F16	15	90	9.5	108,651	1,338
F17	15	90	9.5	57,100	1,240
F18	15	90	9.5	83,027	1,137
F19	15	90	9.5	22,032	1,244
F20	18	40	11.5	167,448	1,200
F21	18	40	11.5	180,871	968
F22	18	40	11.5	216,643	1,081
F23	15	90	9.5	301,470	1,332
F24	15	90	9.5	155,243	1,436
F25	15	90	9.5	121,706	1,310
F26	18	40	11.5	164,530	1,202
F27	15	90	9.5	205,836	1,279
F28	15	90	9.5	212,721	1,101
F29	18	40	11.5	258,873	1,315
F30	15	90	9.5	134,778	1,665
Reach 2 Total				3,143,424	24,659

BASED ON SPRING 1998 SURVEY

Table 1. Estimates of dredged material for the Corps' recommended beach fill/dune construction plan. (Corps 1998).

TABLE C20- CONTINUED

DESIGN DUNE AND BEACH FILL VOLUME REQUIREMENTS FOR INTERIM PROJECT

Design Reach 3	Dune Elevation (Ft, NGVD)	Berm Width (Feet)	Berm Elevation (Ft, NGVD)	Fill Volume (Cubic Yards)	Fill Distance (Feet)
F31	NA	90	9.5	29,934	1,296
F32	15	90	9.5	49,740	2,034
F33	NA	90	9.5	30,429	2,579
F34	NA	NA	NA	0	2,150
F35	NA	NA	NA	0	2,007
F36	NA	90	9.5	35,848	1,610
F37	NA	90	9.5	42,841	1,215
F38	NA	90	9.5	93,839	1,327
F39	15	90	9.5	159,467	1,340
F40	NA	90	9.5	134,851	1,309
F41	NA	90	9.5	97,687	1,350
F42	NA	90	9.5	81,472	1,315
F43	NA	90	9.5	32,503	1,118
F44	NA	90	9.5	14,029	1,195
F45	NA	90	9.5	56,403	1,541
F46	NA	90	9.5	53,036	1,339
F47	NA	90	9.5	39,863	1,375
F48	NA	NA	NA	0	1,622
F49	NA	NA	NA	0	1,191
F50	NA	90	9.5	8,003	1,128
F51	NA	90	9.5	45,018	1,253
F52	NA	90	9.5	34,496	954
F53	NA	90	9.5	13,284	990
F54	NA	90	9.5	10,279	1,470
F55	NA	90	9.5	145,105	1,648
F56	15	90	9.5	92,115	1,279
F57	NA	90	9.5	39,016	1,119
F58	NA	90	9.5	18,118	2,309
F59	NA	90	9.5	166,082	3,470
Reach 3 Total				1,523,458	44,565
Design Reach 4	Dune Elevation (Ft, NGVD)	Berm Width (Feet)	Berm Elevation (Ft, NGVD)	Fill Volume (Cubic Yards)	Fill Distance (Feet)
F60	NA	NA	NA	0	3,487
F61	NA	NA	NA	0	3,503
F62	NA	NA	NA	0	3,342
F63	NA	NA	NA	0	3,179
F64	NA	NA	NA	0	2,886
F65	NA	NA	NA	0	2,598
F66	NA	NA	NA	0	2,439
F67	NA	NA	NA	0	2,276
F68	NA	NA	NA	0	2,175
F69	NA	NA	NA	0	2,077
F70	NA	NA	NA	0	4,579
F71	NA	90	9.5	209,393	3,110
F72	NA	90	9.5	281,422	3,133
F73	NA	NA	NA	0	836
Reach 4 Total				490,815	39,620

BASED ON SPRING 1998 SURVEY

Table 1. continued.

TABLE C22
TOTAL INITIAL FILL VOLUME ESTIMATE
FIRE ISLAND INTERIM PROJECT

FILL DISTANCE (FT.)	DESIGN FILL VOLUME (C.Y.)	ADVANCE FILL VOLUME (C.Y.)	15% TOLLERANCE VOLUME (C.Y.)	SUB-TOTAL (C.Y.)	OVERFILL FACTOR	TOTAL FILL VOLUMES (C.Y.)
DESIGN REACH 1						
3,887	55,057	0	8,259	63,316	1.00	63,316
DESIGN REACH 2						
24,659	3,143,424	1,080,457	633,582	4,857,464	1.00	4,857,464
DESIGN REACH 3						
37,595	1,523,458	1,339,882	429,501	3,292,841	1.00	3,292,841
DESIGN REACH 4						
6,243	582,652	120,000	105,398	808,050	1.00	808,050
TOTAL						
72,384	5,304,591	2,540,339	1,176,740	9,021,670		9,021,670

NOTES:
DESIGN FILL VOLUME INCLUDES BERM AND DUNE (DESIGN REACHES 2 AND 3)
ADVANCE FILL BASED ON 3 YR. CYCLE (23 FT. (WIDTH) x 1.35 C.Y./FT.) = 31.05 C.Y. / FT.
ADVANCE FILL VOLUMES INCLUDE ADDITIONAL 0.2 C.Y./FT/YR FILL FOR SEA LEVEL RISE
ADVANCE FILL IN DESIGN REACHES 2 AND 3 INCLUDE STOCKPILE VOLUMES
ADVANCE FILL VOLUME IN REACH 4 IS STOCKPILE VOLUME
TOLERANCE APPLIED TO ENTIRE INITIAL PLACEMENT VOLUME
VOLUMES BASED ON SPRING 1998 SURVEY

Table 2. Total initial fill volume estimate for the proposed plan. (Corps 1998).

Shinnecock Bay
List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW / Rank	Shinn. Bay
ANIMALS									
INVERTEBRATES									+
MOLLUSCA									+
Argopecten irradians	bay scallop							BW4	+
Crassostrea virginica	eastern oyster							BW4	+
Mercenaria mercenaria	northern quahog							BW5	+
Mya arenaria	softshell clam							BW4	+
CRUSTACEA									+
Callinectes sapidus	blue crab							BW5	+
Homarus americanus	American lobster							BW4	+
MEROSTOMATA									-
Limulus polyphemus	horseshoe crab							BW5	-
VERTEBRATES									+
FISH									+
Raja eglanteria	clearnose skate (A)							BW5	+
Raja erinacea	little skate (A)							BW5	+
Raja ocellata	winter skate (A)							BW5	+
Acipenser oxyrinchus	Atlantic sturgeon (A-F/AN)	G3		S1	P	S3		BW1	+
Ammodytes americanus	American sandlance (A)	G?		SN	U			BW4	+
Anguilla rostrata	American eel (A-F/CA)	G5		S5	U	S5		BW4	+
Menidia beryllina	inland silverside (A-F)	G5		S2S3	U	S4S5		BW4	+
Menidia menidia	Atlantic silverside (A)	G5		S2S3	U			BW4	+
Opsanus tau	oyster toadfish (A)							BW4	+
Paralichthys dentatus	summer flounder (A)	G?		SN	P			BW4	+
Scophthalmus aquosus	windowpane (A)	G?		SN	U			BW5	-
Alosa aestivalis	blueback herring (A-F/AN)	G5		S3	U	S5		BW4	+
Alosa pseudoharengus	alewife (A-F/AN)	G5		S5	U	S5		BW4	+
Alosa sapidissima	American shad (A-F/AN)	G5		S4	U	S3S4	W	BW4	+
Brevoortia tyrannus	Atlantic menhaden (A)	G?		SN	U			BW5	+
Clupea harengus	Atlantic herring (A)	G?		SN	U			BW4	+
Fundulus heteroclitus	mummichog (A-F)	G5		S3	U	S5		BW4	+
Fundulus luciae	spotfin killifish (A-F)	G3G4		S1	U	S3		BW3	+
Anchoa mitchilli	bay anchovy (A-F)	G5		S3	U			BW3	+
Microgadus tomcod	Atlantic tomcod (A)	G5		S3	U	S3		BW3	+
Urophycis chuss	red hake (A)	G?		SN	U			BW4	+
Gobiosoma bosci	naked goby (A-F)	G5		S2S3	U			BW3?	+
Gobiosoma ginsburgi	seaboard goby (A)	G?		S2S3	U			BW3?	+
Tautoga onitis	tautog (A)	G?		SN	P			BW4	+
Tautogolabrus adspersus	cunner (A)	G?		SN	U			BW3	+
Mugil cephalus	striped mullet (A-F)	G5		SN	U			BW4	+
Osmerus mordax	rainbow smelt (A-F/AN)	G5		S5	U	SU		BW4	+
Morone americana	white perch (A-F)	G5		S4	U	S5		BW4	+
Morone saxatilis	striped bass (A-F/AN)	G5		S4	P	S4	W	BW4	+
Pleuronectes americanus	winter flounder (A)	G5?		S3?	P			BW4	-
Pomatomus saltatrix	bluefish (A)	G?		SN	P			BW5	+
Salmo trutta	brown trout (A-F-I/AN)	G5		SE	P	SE		BW4	?
Cynoscion regalis	weakfish (A)	G?		SN	P			BW4	-
Leiostomus xanthurus	spot (A)	G5		SN	U			BW4	+
Menticirrhus saxatilis	northern kingfish (A)	G?		SA	U			BW4?	+
Scomber scombrus	Atlantic mackerel (A)	G?		SN	P			BW5	+
Centropristis striata	black sea bass (A)	G?		SN	P			BW5	+
Trinectes maculatus	hogchoker (A-F)	G5		S3	U			BW3	+
Stenotomus chrysops	scup (A)	G?		SN	U			BW4	+
Peprilus triacanthus	butterfish (A)	G?		SN	U			BW5	+
Syngnathus fuscus	northern pipefish (A)	G?		S3	U			BW4	+
Prionotus carolinus	northern searobin (A)	G?		SN	U			BW3	+
REPTILES									+
Caretta caretta	loggerhead sea turtle	G3	T	SZN	T	SN	E	BW2	+
Chelonia mydas	green sea turtle	G3	T	SZN	T	SN	T	BW2	+
Malaclemys t. terrapin	northern diamondback terrapin	G5T5	C2	S4	U/SC	SU		BW3	+
BIRDS									+
Casmerodius albus	great egret	G5		S2	P	S3	S/S	BW3	B
Egretta caerulea	little blue heron	G5		S2	P	S3	T/S	BW2	B
Egretta thula	snowy egret	G5		S2S3	P	S3	S/S	BW3	B
Egretta tricolor	tricolored heron	G5		S2	P	S3	INC/S	BW3	B?

Table 3. Species of Special Emphasis within south shore bay complex stretching from Great South Bay to Shinnecock Inlet (USFWS 1996)

Shinnecock Bay
List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW # Rank	Shinn. B
Nycticorax nycticorax	black-crowned night-heron	G5		S3	P	S3	D/S	BW3	B
Plegadis falcinellus	glossy ibis	G5		S2	P	S3	D/S	BW3	B
Branta canadensis	Canada goose	G5		S5	G	S5		BW5	B/M/W
Branta bernicla	brant	G5		SN	G	SN		BW5	M/W
Anas platyrhynchos	mallard	G5		S5	G	S5		BW4	M/W
Anas rubripes	American black duck	G4		S4	G	S4		BW5	B/M/W
Aythya valisineria	canvasback	G5		SN	G	SN		BW3	M/W
Aythya marila	greater scaup	G5		SN	G	SN		BW4	M/W
Aythya affinis	lesser scaup	G5		SA	G	SN		BW4	M/W
Bucephala clangula	common goldeneye	G5		S2	G	SN		BW3	M/W
Bucephala albeola	bufflehead	G5		SN	G	SN		BW4	M/W
Clangula hyemalis	oldsquaw	G5		SN	G	SN		BW3	M/W
Mergus merganser	common merganser	G5		S5	G	S4		BW4	W?
Mergus serrator	red-breasted merganser	G5		S1S2	G	SN		BW4	M/W
Accipiter cooperii	Cooper's hawk	G4		S4	P/SC	S2	E	BW2	M
Accipiter striatus	sharp-shinned hawk	G5		S4	P (SC)	S1	U/U	BW2	M
Circus cyaneus	northern harrier	G5		S3	T (SC)	S2	E/U	BW1	M/W
Falco columbarius	merlin	G4		SN	P	SN	S	BW2	M
Falco peregrinus	peregrine falcon	G3	E,E (SA)	S2	E	S1	E	BW2	M
Pandion haliaetus	osprey	G5		S4	T (SC)	S3	T/T	BW2	B/M
Rallus longirostris	clapper rail	G5		S3	P	S5		BW4	B
Charadrius melodus	piping plover	G3	T	S2B	E	S1	E	BW2	B/M
Haematopus palliatus	American oystercatcher	G5		S3	P	S4	INC/S	BW3	B/M
Catoptrophorus semipalmatus	willet	G5		S3	P	S4	INC/S	BW3	B?
Rynchops niger	black skimmer	G5		S2	P (SC)	S2	E	BW3	B/M
Sterna antillarum	least tern	G4		S3B	E (T)	S2	E	BW1	B/M
Sterna dougallii	roseate tern	G5	E	S1B	E	S1	E	BW1	B/M
Sterna hirundo	common tern	G5		S3B	T	S3	D/S	BW3	B/M
Asio flammeus	short-eared owl	G5		S2	P/SC (E)	S1	E/U	BW2	W
Eremophila alpestris	horned lark	G5		S5	P (SC)	S3	D/S	BW3BW4	B?
Cistothorus palustris	marsh wren	G5		S5	P	S4	D/S	BW4	B/M
Ammodramus caudacutus	sharp-tailed sparrow	G5		S3	P	S4	S/S	BW3	B
Ammodramus maritimus	seaside sparrow	G4		S2S3	P (SC)	S4	S/S	BW3	B
MAMMALS									+
Balaenoptera acutorostrata	Minke whale	G5		SN	U	SA	U	BW3BW4	+
Balaenoptera physalus	finback whale	G2	E	S1	E	SN	E	BW1	+
Eubalaena glacialis	northern right whale	G2	E	SZN	E	SA	E	BW1	+
Tursiops truncatus	bottle-nosed dolphin	G5		S3	U	SN	S	BW4	+
Halichoerus grypus	gray seal	G4		SZ	U	SR	P	BW3?	+
Phoca vitulina	harbor seal	G5		S3	P	SN	S	BW4	+
VASCULAR PLANTS									+
Amaranthus pumilus	seabeach amaranth	G2	T	S1	U	SH	E	BW1	+
Polygonum glaucum	seabeach knotweed	G3		S3	U	S1	E	BW3	+
COMMUNITIES and ECOSYSTEMS									+
Brackish Subtidal Aquatic Bed		G4		S2S3	U	SU		BW3	+
Low Salt Marsh		G5		S3S4		S5		BW5	+
High Salt Marsh		G5		S4S4		S5		BW5	+
Salt Panne		G5		S3		S5		BW4	+
Maritime Interdunal Swales		G3G4		S2	U			BW2	+
Maritime Dunes		G4		S3	U			BW3	+
Coastal Dune Shrubland		G4				S2?		BW2	+
ANIMAL CONCENTRATION AREAS									+
Coastal Heron Rookery		GU				S3		BW3	+
Migratory Shorebird Concentration Site		G?				S?		BW2	+
Waterbird Nesting Colony				S?				BW4	+
Raptor Concentration Area				S?	U			BW2	+
Waterfowl Concentration Area				S3S4				BW4	+

See Appendix I for definition of federal, global, state, and bight watershed (BW) ranks and status

Shinn. Bay column contains codes indicating the status of a species population within the Shinnecock Bay habitat complex:

+ = known to occur in the area; seasonal use not specified; B = breeds in the area; S = regular non-breeding use in the summer

M = migrates through the area and has identifiable migratory stopover or staging areas within the area; W = overwinters in the area

P = primarily pelagic; ? = unconfirmed or questionable occurrence or seasonal use; H = occurred historically in the area

Table 3. continued

Complex #

Moriches Bay
List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW # Rank	Mor. Bay
ANIMALS									
INVERTEBRATES									-
MOLLUSCA									+
Argopecten irradians	bay scallop							BW4	+
Crassostrea virginica	eastern oyster							BW4	-
Mercenaria mercenaria	northern quahog							BW5	+
Mya arenaria	softshell clam							BW4	+
CRUSTACEA									+
Callinectes sapidus	blue crab							BW5	+
Homarus americanus	American lobster							BW4	-
MEROSTOMATA									+
Limulus polyphemus	horseshoe crab							BW5	+
VERTEBRATES									+
FISH									+
Raja eglanteria	clearnose skate (A)							BW5	+
Raja erinacea	little skate (A)							BW5	+
Raja ocellata	winter skate (A)							BW5	-
Acipenser oxyrinchus	Atlantic sturgeon (A-F/AN)	G3		S1	P	S3		BW1	+
Ammodytes americanus	American sandlance (A)	G?		SN	U			BW4	-
Anguilla rostrata	American eel (A-F/CA)	G5		S5	U	S5		BW4	+
Menidia beryllina	inland silverside (A-F)	G5		S2S3	U	S4S5		BW4	-
Menidia menidia	Atlantic silverside (A)	G5		S2S3	U			BW4	-
Opsanus tau	oyster toadfish (A)							BW4	-
Paralichthys dentatus	summer flounder (A)	G?		SN	P			BW4	+
Scophthalmus aquosus	windowpane (A)	G?		SN	U			BW5	+
Alosa aestivalis	blueback herring (A-F/AN)	G5		S3	U	S5		BW4	+
Alosa pseudoharengus	alewife (A-F/AN)	G5		S5	U	S5		BW4	+
Alosa sapidissima	American shad (A-F/AN)	G5		S4	U	S3S4	W	BW4	+
Brevoortia tyrannus	Atlantic menhaden (A)	G?		SN	U			BW5	+
Clupea harengus	Atlantic herring (A)	G?		SN	U			BW4	+
Fundulus heteroclitus	mummichog (A-F)	G5		S3	U	S5		BW4	+
Fundulus luciae	spotfin killifish (A-F)	G3G4		S1	U	S3		BW3	+
Anchoa mitchilli	bay anchovy (A-F)	G5		S3	U			BW3	+
Microgadus tomcod	Atlantic tomcod (A)	G5		S3	U	S3		BW3	+
Urophycis chuss	red hake (A)	G?		SN	U			BW4	+
Gobiosoma bosci	naked goby (A-F)	G5		S2S3	U			BW3?	+
Gobiosoma ginsburgi	seaboard goby (A)	G?		S2S3	U			BW3?	+
Tautoga onitis	tautog (A)	G?		SN	P			BW4	+
Tautogolabrus adspersus	cunner (A)	G?		SN	U			BW3	+
Mugil cephalus	striped mullet (A-F)	G5		SN	U			BW4	+
Osmerus mordax	rainbow smelt (A-F/AN)	G5		S5	U	SU		BW4	+
Morone americana	white perch (A-F)	G5		S4	U	S5		BW4	-
Morone saxatilis	striped bass (A-F/AN)	G5		S4	P	S4	W	BW4	+
Pleuronectes americanus	winter flounder (A)	G5?		S3?	P			BW4	+
Pomatomus saltatrix	bluefish (A)	G?		SN	P			BW5	-
Salmo trutta	brown trout (A-F-I/AN)	G5		SE	P	SE		BW4	?
Cynoscion regalis	weakfish (A)	G?		SN	P			BW4	+
Leiostomus xanthurus	spot (A)	G5		SN	U			BW4	+
Menticirrhus saxatilis	northern kingfish (A)	G?		SA	U			BW4?	-
Scomber scombrus	Atlantic mackerel (A)	G?		SN	P			BW5	+
Centropristis striata	black sea bass (A)	G?		SN	P			BW5	+
Trinectes maculatus	hogchoker (A-F)	G5		S3	U			BW3	+
Stenotomus chrysops	scup (A)	G?		SN	U			BW4	+
Peprilus triacanthus	butterfish (A)	G?		SN	U			BW5	-
Syngnathus fuscus	northern pipefish (A)	G?		S3	U			BW4	+
Prionotus carolinus	northern searobin (A)	G?		SN	U			BW3	+
REPTILES									+
Caretta caretta	loggerhead sea turtle	G3	T	S2N	T	SN	E	BW2	+
Malaclemys t. terrapin	northern diamondback terrapin	G5T5	C2	S4	U/SC	SU		BW3	+
BIRDS									+
Phalacrocorax auritus	double-crested cormorant	G5		S3	P	SN	INC	BW3	B/M
Botaurus lentiginosus	American bittern	G4		S4	P (SC)	S3	T/S	BW1	B
Casmerodius albus	great egret	G5		S2	P	S3	S/S	BW3	B
Egretta caerulea	little blue heron	G5		S2	P	S3	T/S	BW2	B
Egretta thula	snowy egret	G5		S2S3	P	S3	S/S	BW3	B
Plegadis falcinellus	glossy ibis	G5		S2	P	S3	D/S	BW3	B
Branta canadensis	Canada goose	G5		S5	G	S5		BW5	B M W
Branta bernicla	brant	G5		SN	G	SN		BW4	M,W
Anas platyrhynchos	mallard	G5		S5	G	S5		BW5	B,M,W

Table 3 continued

Great South Bay
List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW # Rank	Gr. So. Bay
Malaclemys t. terrapin	northern diamondback terrapin	G5T5	C2	S4	U/SC	SU		BW3	–
Terrapene c. carolina	eastern box turtle	G5		S4	G (SC)	S5	S	BW4	–
BIRDS									–
Podilymbus podiceps	pied-billed grebe	G5		S3	P (T)	S1	E/S	BW2	W
Phalacrocorax auritus	double-crested cormorant	G5		S3	P	SN	INC	BW3	S/M
Ardea herodias	great blue heron	G5		S5	P	S2	T/S	BW2BW3	S.M/W
Botaurus lentiginosus	American bittern	G4		S4	P (SC)	S3	T/S	BW1	B
Bubulcus ibis	cattle egret	G5		S2	P	S3	INC.INC	BW3	?
Casmerodius albus	great egret	G5		S2	P	S3	S/S	BW3	B/M
Egretta caerulea	little blue heron	G5		S2	P	S3	T/S	BW2	B
Egretta thula	snowy egret	G5		S2S3	P	S3	S/S	BW3	B/M
Egretta tricolor	tricolored heron	G5		S2	P	S3	INC/S	BW3	B
Nycticorax violaceus	yellow-crowned night-heron	G5		S2	*P	S2	T/T	BW2	B
Nycticorax nycticorax	black-crowned night-heron	G5		S3	P	S3	D/S	BW3	B
Plegadis falcinellus	glossy ibis	G5		S2	P	S3	D/S	BW3	B
Branta canadensis	Canada goose	G5		S5	G	S5		BW5	B.M/W
Branta bernicla	brant	G5		SN	G	SN		BW4	W
Aix sponsa	wood duck	G5		S5	G	S5		BW5	B/M
Anas acuta	northern pintail	G5		S2	G	SN		BW2	W
Anas americana	American wigeon	G5		S3	G	SN		BW3	B.M
Anas clypeata	northern shoveler	G5		S2	G	SN		BW2	M.W
Anas crecca	green-winged teal	G5		S3	G	SN		BW2BW3	B.M/W
Anas discors	blue-winged teal	G5		S5	G	S5		BW4	M.W
Anas platyrhynchos	mallard	G5		S5	G	S5		BW5	B M/W
Anas rubripes	American black duck	G4		S4	G	S4		BW4	B M/W
Anas strepera	gadwall	G5		S3	G	S5		BW3	B M/W
Aythya valisineria	canvasback	G5		SN	G	SN		BW3	M/W
Aythya americana	redhead	G5		SE	G	SN		BW1?	M/W
Aythya marila	greater scaup	G5		SN	G	SN		BW4	M.W
Aythya affinis	lesser scaup	G5		SA	G	SN		BW4	M/W
Bucephala clangula	common goldeneye	G5		S2	G	SN		BW3	M/W
Bucephala albeola	bufflehead	G5		SN	G	SN		BW4	S.M/W
Clangula hyemalis	oldsquaw	G5		SN	G	SN		BW3	M/W
Lophodytes cucullatus	hooded merganser	G5		S4	G	SN		BW2	W
Mergus merganser	common merganser	G5		S5	G	S4		BW4	W
Mergus serrator	red-breasted merganser	G5		S1S2	G	SN		BW4	M.W
Oxyura jamaicensis	ruddy duck	G5		S1	G	SN		BW2	B?
Accipiter striatus	sharp-shinned hawk	G5		S4	P (SC)	S1	U/U	BW2	M
Circus cyaneus	northern harrier	G5		S3	T (SC)	S2	E/U	BW1	B.M/W
Falco columbarius	merlin	G4		SN	P	SN	S	BW2	M
Falco peregrinus	peregrine falcon	G3	E (SA)	S2	E	S1	E	BW2	M
Pandion haliaetus	osprey	G5		S4	T (SC)	S3	T/T	BW2	B.M
Fulica americana	American coot	G5		S3	G	S1	D	BW2	B/M/W
Laterallus jamaicensis	black rail	G4?	C2	S1	P/SC (E)	S3	T	BW1	B
Porzana carolina	sora	G5		S4	G	S4		BW3	B
Rallus limicola	Virginia rail	G5		S4	G	S4		BW3	B.M/W
Rallus longirostris	clapper rail	G5		S3	P	S5		BW4	B/M
Charadrius melodus	piping plover	G3	T	S2B	E	S1	E	BW2	B.M
Charadrius semipalmatus	semipalmated plover	G5		SN	P	S?	S	BW3BW4	M
Pluvialis squatarola	black-bellied plover	G5		SN	P	SN	S/S	BW3BW4	M
Haematopus palliatus	American oystercatcher	G5		S3	P	S4	INC.S	BW3	B.M
Calidris alba	sanderling	G5		SN	P	SN	D	BW3?	M
Calidris minutilla	least sandpiper	G5		SN	P	SN	S	BW3?	M
Catoptrophorus semipalmatus	willet	G5		S3	P	S4	INC/S	BW3	B.M
Limnodromus griseus	short-billed dowitcher	G5		SN	P	SN	S	BW3	M
Numenius phaeopus	whimbrel	G5		SN	P	SN	S	BW3?	M
Tringa flavipes	lesser yellowlegs	G5		SN	P	SN	S	BW3	M
Tringa melanoleuca	greater yellowlegs	G5		SN	P	SN	S	BW3	M
Rynchops niger	black skimmer	G5		S2	P (SC)	S2	E	BW3	B.M
Sterna antillarum	least tern	G4		S3B	E (T)	S2	E	BW1	B/M
Sterna dougallii	roseate tern	G5	E	S1B	E	S1	E	BW1	B/M
Sterna hirundo	common tern	G5		S3B	T	S3	D/S	BW3	B/M
Sterna nilotica	gull-billed tern	G5		S1	P	S3	S	BW2	B?
Coccyzus americanus	yellow-billed cuckoo	G5		S5	P	S4	S/S	BW4	B
Coccyzus erythropthalmus	black-billed cuckoo	G5		S5	P	S4	S.S	BW3	B

Table 3. continued.

Complex #1

Moriches Bay

List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW # Rank	Mor. Bay
Anas rubripes	American black duck	G4		S4	G	S4		BW4	B/M/W
Anas strepera	gadwall	G5		S3	G	S5		BW3	B?
Aythya valisineria	canvasback	G5		SN	G	SN		BW3	M/W
Aythya marila	greater scaup	G5		SN	G	SN		BW4	M/W
Aythya affinis	lesser scaup	G5		SA	G	SN		BW4	M/W
Bucephala clangula	common goldeneye	G5		S2	G	SN		BW3	M/W
Bucephala albeola	bufflehead	G5		SN	G	SN		BW4	M/W
Mergus merganser	common merganser	G5		S5	G	S4		BW4	W?
Mergus serrator	red-breasted merganser	G5		S1S2	G	SN		BW4	M/W
Accipiter cooperii	Cooper's hawk	G4		S4	P/SC	S2	E	BW2	M
Accipiter striatus	sharp-shinned hawk	G5		S4	P (SC)	S1	U/U	BW2	M
Circus cyaneus	northern harrier	G5		S3	T (SC)	S2	E/U	BW1	M/W
Falco columbarius	merlin	G4		SN	P	SN	S	BW2	M
Falco peregrinus	peregrine falcon	G3	E (SA)	S2	E	S1	E	BW2	M/W?
Pandion haliaetus	osprey	G5		S4	T (SC)	S3	T/T	BW2	B/M
Rallus limicola	Virginia rail	G5		S4	G	S4		BW3	B?
Rallus longirostris	clapper rail	G5		S3	P	S5		BW4	B
Charadrius melodus	piping plover	G3	T	S2B	E	S1	E	BW2	B/M
Haematopus palliatus	American oystercatcher	G5		S3	P	S4	INC/S	BW3	B/M
Calidris alba	sanderling	G5		SN	P	SN	D	BW3?	M/W
Catoptrophorus semipalmatus	willet	G5		S3	P	S4	INC/S	BW3	B?
Limnodromus griseus	short-billed dowitcher	G5		SN	P	SN	S	BW3	M
Numenius phaeopus	whimbrel	G5		SN	P	SN	S	BW3?	M
Rynchops niger	black skimmer	G5		S2	P (SC)	S2	E	BW3	B/M
Sterna antillarum	least tern	G4		S3B	E (T)	S2	E	BW1	B/M
Sterna dougallii	roseate tern	G5	E	S1B	E	S1	E	BW1	B/M
Sterna hirundo	common tern	G5		S3B	T	S3	D/S	BW3	B/M
Asio flammeus	short-eared owl	G5		S2	P/SC (E)	S1	E/U	BW2	W
Eremophila alpestris	horned lark	G5		S5	P (SC)	S3	D/S	BW3BW4	B
Cistothorus palustris	marsh wren	G5		S5	P	S4	D/S	BW4	B/M
Ammodramus caudacutus	sharp-tailed sparrow	G5		S3	P	S4	S/S	BW3	B
Ammodramus maritimus	seaside sparrow	G4		S2S3	P (SC)	S4	S/S	BW3	B
MAMMALS								-	+
Balaenoptera acutorostrata	Minke whale	G5		SN	U	SA	U	BW3BW4	+
Tursiops truncatus	bottle-nosed dolphin	G5		S3	U	SN	S	BW4	+
Halichoerus grypus	gray seal	G4		SZ	U	SR	P	BW3?	+
Phoca vitulina	harbor seal	G5		S3	P	SN	S	BW4	-
VASCULAR PLANTS									+
Carex bullata	button sedge	G5		S1	T	S5		BW3BW4	+
Carex venusta var. minor	small graceful sedge	G4T3T4		S1	R	S4		BW3	+
Scleria reticularis var. reticularis	reticulated nutrush	3G4T3T4		S3	R	S4		BW3BW4	-
Amaranthus pumilus	seabeach amaranth	G2	T	S1	U	SH	E	BW1	-
Aster nemoralis	bog aster	G5		S3	R	C		BW3?	+
Lobelia nuttallii	Nuttall's lobelia	G4G5		S3	R	S5		BW4	+
Minuartia (=Arenaria) caroliniana	pine-barren sandwort	G5		S3	R	S5		BW4	+
Desmodium ciliare	tick-trefoil	G5		S2S3	T	S5		BW4	-
Polygonum glaucum	seabeach knotweed	G3		S3	U	S1	E	BW3	+
COMMUNITIES and ECOSYSTEMS									+
Brackish Subtidal Aquatic Bed		G4		S2S3	U	SU		BW3	-
Low Salt Marsh		G5		S3S4		S5		BW5	+
High Salt Marsh		G5		S4S4		S5		BW5	+
Salt Panne		G5		S3		S5		BW4	-
Maritime Interdunal Swales		G3G4		S2	U			BW2	-
Maritime Dunes		G4		S3	U			BW3	-
Coastal Dune Shrubland		G4				S2?		BW2	+
ANIMAL CONCENTRATION AREAS									+
Coastal Heron Rookery		GU				S3		BW3	-
Migratory Shorebird Concentration Site		G?				S?		BW2	+
Waterbird Nesting Colony				S?				BW4	+
Raptor Concentration Area				S?	U			BW2	+
Waterfowl Concentration Area				S3S4				BW4	+

See Appendix I for definition of federal, global, state, and bight watershed (BW) ranks and status

Mor. Bay column contains codes indicating the status of a species population within the Moriches Bay habitat complex:

+ = known to occur in the area; seasonal use not specified; B = breeds in the area; S = regular non-breeding use in the summer

M = migrates through the area and has identifiable migratory stopover or staging areas within the area; W = overwinters in the area

P = primarily pelagic; ? = unconfirmed or questionable occurrence or seasonal use; H = occurred historically in the area

Table 3. continued.

Complex *

Great South Bay
List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW # Rank	Gr. So. B.
Spiranthes vernalis	grassleaf ladies'-tresses	G5		S1	R	S4		BW3BW4	+
Diplachne maritima	saltpond grass	G5T3		S1	U	S2		BW1?	+
Sphenopholis pensylvanica	swamp oats	G4		S1	U	S3		BW2	+
Amaranthus pumilus	seabeach amaranth	G2	T	S1	U	SH	E	BW1	+
Asclepias purpurascens	purple milkweed	G4G5		S3	T	S4		BW3BW4	+
Gnaphalium purpureum	purple everlasting	G5		S1	R	S4		BW3BW4	+
Helianthus angustifolius	swamp sunflower	G5		S2	T	S5		BW4	+
Solidago elliottii	coastal goldenrod	G5		S2	U	S3		BW2BW3	+
Cardamine longii	Long's bittercress	G3G4Q	3C	S2	U	SH	E	BW1	+
Lobelia nuttallii	Nuttall's lobelia	G4G5		S3	R	S5		BW4	+
Chenopodium rubrum	red goosefoot	G5		S1	U	S1	E	BW1	+
Lechea pulchella var. moniliformis	pinweed	G5T4		S1	T	SU		BW1?	+
Lechea racemulosa	pinweed	G5		S3	R	S5		BW3BW4	-
Lechea tenuifolia	slender pinweed	G5		S2	R	S1	E	BW2	-
Hypericum hypericoides ssp. multicaule	St. Andrew's cross	G5T4		S1	E	NA?		BW1?	+
Hypericum prolificum	shrubby St. John's-wort	G5		S2	T	S1	E	BW1	-
Crassula aquatica (=Tillaea aquatica)	pygmyweed	G5		S1	E	NA		BW1	+
Pyxidanthera barbulata	pixies, flowering moss	G4		S1	E	S4		BW3BW4	+
Sabatia campanulata	slender marsh-pink	G5		S1	E	S3		BW3	-
Proserpinaca pectinata	comb-leaved mermaid-weed	G5		S2	R	S4		BW4	-
Utricularia fibrosa	fibrous bladderwort	G4G5		S2	R	S5		BW4	-
Utricularia radiata	small floating bladderwort	G4		S2	R	SU		BW2?	-
Linum intercursum	sandplain flax	G4G5		S2	T	S1	E	BW1	-
Linum medium var. texanum	southern yellow flax	G5T5		S2	T	S4		BW3	-
Polygala lutea	yellow milkwort	G5		S1	E	C		BW3	-
Polygonum glaucum	seabeach knotweed	G3		S3	U	S1	E	BW3	-
Rumex maritimus var. fueginus	golden dock	G5T5		S1	T	NA?		BW1?	-
Viola brittoniana var. brittoniana	coast violet	G4G4T?		S1	E	S3		BW1BW2	-
COMMUNITIES and ECOSYSTEMS									+
Marine Subtidal Aquatic Bed		G5		S3		SU		BW3	+
Marine Intertidal Gravel/Sand Beach		G5		S5	U	SU		BW5	+
Brackish Subtidal Aquatic Bed		G4		S2S3	U	SU		BW3	+
Tidal River		G4		S3	U			BW3	-
Low Salt Marsh		G5		S3S4		S5		BW5	-
High Salt Marsh		G5		S4S4		S5		BW5	-
Salt Panne		G5		S3		S5		BW4	-
Brackish Tidal Marsh		G4		S2S3	U	S2?		BW3	?
Coastal Plain Pond (lacustrine)		G3G4		S2	U			BW2	-
Maritime Interdunal Swales		G3G4		S2	U			BW2	-
Maritime Dunes		G4		S3	U			BW3	-
Coastal Dune Shrubland		G4				S2?		BW2	-
Coastal Dune Woodland		G2G3		S1	U	S1		BW1	-
Maritime Oak-Holly Forest		G2G3		S1	U			BW1	-
ANIMAL CONCENTRATION AREAS									-
Coastal Heron Rookery		GU				S3		BW3	-
Migratory Shorebird Concentration Site		G?				S?		BW2	-
Waterbird Nesting Colony				S?				BW4	-
Raptor Concentration Area				S?	U			BW2	-
Waterfowl Concentration Area				S3S4				BW4	-

See Appendix I for definition of federal, global, state, and bight watershed (BW) ranks and status

Gr. So. Bay column contains codes indicating the status of a species population within the Great South Bay habitat complex:

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P = primarily pelagic; ? = unconfirmed or questionable occurrence or seasonal use; H = occurred historically in the area

Table 3 . continued.

Great South Bay
List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW # Rank	Gr. Su. B.
ANIMALS									-
INVERTEBRATES									+
MOLLUSCA									+
Argopecten irradians	bay scallop							BW4	-
Crassostrea virginica	eastern oyster							BW4	+
Mercenaria mercenaria	northern quahog							BW5	-
Mya arenaria	softshell clam							BW4	+
Hemileuca maia maia	coastal barrens buckmoth	G4T2T3		S2	U/SC			BW2	-
CRUSTACEA									+
Callinectes sapidus	blue crab							BW5	+
Homarus americanus	American lobster							BW4	+
MEROSTOMATA									+
Limulus polyphemus	horseshoe crab							BW5	+
VERTEBRATES									+
FISH									-
Raja eglanteria	clearnose skate (A)							BW5	+
Raja erinacea	little skate (A)							BW5	-
Raja ocellata	winter skate (A)							BW5	+
Acipenser oxyrinchus	Atlantic sturgeon (A-F/AN)	G3		S1	P	S3		BW1	+
Ammodytes americanus	American sandlance (A)	G?		SN	U			BW4	-
Anguilla rostrata	American eel (A-F/CA)	G5		S5	U	S5		BW4	-
Aphredoderus sayanus	pirate perch (F)	G5		S1	U (SC)	S4		BW3	+
Menidia beryllina	inland silverside (A-F)	G5		S2S3	U	*S4S5		BW4	-
Menidia menidia	Atlantic silverside (A)	G5		S2S3	U			BW4	+
Opsanus tau	oyster toadfish (A)							BW4	-
Paralichthys dentatus	summer flounder (A)	G?		SN	P			BW4	-
Scophthalmus aquosus	windowpane (A)	G?		SN	U			BW5	+
Alosa aestivalis	blueback herring (A-F/AN)	G5		S3	U	S5		BW4	+
Alosa pseudoharengus	alewife (A-F/AN)	G5		S5	U	S5		BW4	+
Alosa sapidissima	American shad (A-F/AN)	G5		S4	U	S3S4	W	BW4	+
Brevoortia tyrannus	Atlantic menhaden (A)	G?		SN	U			BW5	+
Clupea harengus	Atlantic herring (A)	G?		SN	U			BW4	+
Fundulus heteroclitus	mummichog (A-F)	G5		S3	U	S5		BW4	+
Fundulus luciae	spotfin killifish (A-F)	G3G4		S1	U	S3		BW3	+
Anchoa mitchilli	bay anchovy (A-F)	G5		S3	U			BW3	+
Microgadus tomcod	Atlantic tomcod (A)	G5		S3	U	S3		BW3	+
Urophycis chuss	red hake (A)	G?		SN	U			BW4	+
Gobiosoma bosci	naked goby (A-F)	G5		S2S3	U			BW3?	-
Gobiosoma ginsburgi	seaboard goby (A)	G?		S2S3	U			BW3?	-
Tautoga onitis	tautog (A)	G?		SN	P			BW4	+
Tautogolabrus adspersus	cunner (A)	G?		SN	U			BW3	+
Mugil cephalus	striped mullet (A-F)	G5		SN	U			BW4	-
Osmerus mordax	rainbow smelt (A-F/AN)	G5		S5	U	SU		BW4	-
Morone americana	white perch (A-F)	G5		S4	U	S5		BW4	-
Morone saxatilis	striped bass (A-F/AN)	G5		S4	P	S4	W	BW4	-
Pleuronectes americanus	winter flounder (A)	G5?		S3?	P			BW4	+
Pomatomus saltatrix	bluefish (A)	G?		SN	P			BW5	+
Salmo trutta	brown trout (A-F-I/AN)	G5		SE	P	SE		BW4	-
Cynoscion regalis	weakfish (A)	G?		SN	P			BW4	-
Leiostomus xanthurus	spot (A)	G5		SN	U			BW4	+
Menticirrhus saxatilis	northern kingfish (A)	G?		SA	U			BW4?	-
Scomber scombrus	Atlantic mackerel (A)	G?		SN	P			BW5	-
Centropristis striata	black sea bass (A)	G?		SN	P			BW5	-
Trinectes maculatus	hogchoker (A-F)	G5		S3	U			BW3	-
Stenotomus chrysops	scup (A)	G?		SN	U			BW4	-
Peprilus triacanthus	butterfish (A)	G?		SN	U			BW5	-
Syngnathus fuscus	northern pipefish (A)	G?		S3	U			BW4	-
Prionotus carolinus	northern searobin (A)	G?		SN	U			BW3	-
AMPHIBIANS									-
Hemidactylium scutatum	four-toed salamander	G5		S5	U	S3	D	BW3BW4	-
REPTILES									-
Caretta caretta	loggerhead sea turtle	G3	T	SZN	T	SN	E	BW2	-
Kinosternon subrubrum	eastern mud turtle	G5		S1	T (E)	S?	U	BW1	-
Lepidochelys kempii	Atlantic (=Kemp's) ridley sea turtle	G1	E	S1N	E	SN	E	BW1	?

Table 3. continued.

Great South Bay
List of Species of Special Emphasis

Scientific Name	Common Name(s)	Global	Federal	NY Rank	NY Stat.	NJ Rank	NJ Stat.	BW # Rank	Gr. So. Bay
Asio flammeus	short-eared owl	G5		S2	P/SC (E)	S1	E/U	BW2	B/W
Tyto alba	common barn-owl	G5		S3	P/SC (P)	S4	S/S	BW3	B?
Caprimulgus vociferus	whip-poor-will	G5		S4	P (SC)	S4	D/S	BW3	B/M
Chaetura pelagica	chimney swift	G5		S5	P	S5	S/S	BW4BW5	B
Contopus virens	eastern wood-pewee	G5		S5	P	S4	S/S	BW4	B/M
Empidonax traillii	willow flycatcher	G5		S5	P	S4	INC/S	BW4	B
Myiarchus crinitus	great crested flycatcher	G5		S5	P	S4	S/S	BW4BW5	B/M
Tyrannus tyrannus	eastern kingbird	G5		S5	P	S5	D/D	BW4BW5	B
Eremophila alpestris	horned lark	G5		S5	P (SC)	S3	D/S	BW3BW4	B/M
Progne subis	purple martin	G5		S5	P	S4	D/S	BW4	B/M
Riparia riparia	bank swallow	G5		S5	P	S4	S/S	BW3BW4	B
Stelgidopteryx serripennis	northern rough-winged swallow	G5		S5	P	S4	S/S	BW4	B
Certhia americana	brown creeper	G5		S5	P	S4	S/S	BW3BW4	B/M/W
Cistothorus palustris	marsh wren	G5		S5	P	S4	D/S	BW4	B/M
Catharus fuscescens	veery	G5		S5	P	S4	S/S	BW4	B
Catharus guttatus	hermit thrush	G5		S5	P	S4	S/S	BW3	B
Hylocichla mustelina	wood thrush	G5		S5	P	S5	S/S	BW4	B/M
Polioptila caerulea	blue-gray gnatcatcher	G5		S5	P	S4	INC/S	BW4	B
Sialia sialis	eastern bluebird	G5		S5	P/SC (P)	S4	S	BW4	B
Dumetella carolinensis	gray catbird	G5		S5	P	S5	S/S	BW5	B
Vireo griseus	white-eyed vireo	G5		S4	P	S4	D/S	BW4	B
Dendroica coronata	yellow-rumped warbler	G5		S5	P	S4	S/S	BW2BW3	M
Dendroica discolor	prairie warbler	G5		S5	P	S5	S/S	BW4BW5	B
Dendroica pinus	pine warbler	G5		S5	P	S4	S/S	BW4	B
Mniotilta varia	black-and-white warbler	G5		S5	P	S4	S/S	BW4	B/M
Parula americana	northern parula	G5		S3S4	P	S3	P/S	BW1	M
Protonotaria citrea	prothonotary warbler	G5		S2	P	S3	INC/S	BW2	B
Seiurus aurocapillus	ovenbird	G5		S5	P	S5	S/S	BW4	B/M
Setophaga ruticilla	American redstart	G5		S5	P	S5	S/S	BW4BW5	B/M
Vermivora pinus	blue-winged warbler	G5		S5	P	S4	INC/S	BW4	B/M
Ammodramus caudacutus	sharp-tailed sparrow	G5		S3	P	S4	S/S	BW3	B/M
Ammodramus maritimus	seaside sparrow	G4		S2S3	P (SC)	S4	S/S	BW3	B
Junco hyemalis	dark-eyed junco	G5		S5	P	S4	S/S	BW3BW4	M/W
Melospiza georgiana	swamp sparrow	G5		S5	P	S4	S/S	BW3BW4	B
Pipilo erythrophthalmus	rufous-sided towhee	G5		S5	P	S5	S/S	BW4	B/M
Zonotrichia albicollis	white-throated sparrow	G5		S5	P	SN	S/S	BW2	M
Icterus spurius	northern oriole	G5		S5	P	S5	S/S	BW4BW5	B
Sturnella magna	eastern meadowlark	G5		S5	P	S4	D/S	BW3BW4	B
Carpodacus purpureus	purple finch	G5		S5	P	S4	S/S	BW3	B
MAMMALS									+
Balaenoptera acutorostrata	Minke whale	G5		SN	U	SA	U	BW3BW4	+
Delphinapterus leucas	beluga	G4		SN	U	SA	P	BW1	+
Tursiops truncatus	bottle-nosed dolphin	G5		S3	U	SN	S	BW4	+
Lutra canadensis	river otter	G5		S5	G	S4		BW4	+
Halichoerus grypus	gray seal	G4		SZ	U	SR	P	BW3?	+
Phoca vitulina	harbor seal	G5		S3	P	SN	S	BW4	+
VASCULAR PLANTS									+
Carex argyrantha	hay sedge	G5		S2	U	S4		BW3	+
Carex barrattii	Barratt's sedge	G4	3C	S1	E	S4	LP	BW2BW3	+
Carex bullata	button sedge	G5		S1	T	S5		BW3BW4	+
Carex collinsii	Collins' sedge	G4		S1S2	R	S4		BW3	+
Carex hormathodes	necklace sedge	G4G5		S2S3	R	S5		BW4	+
Carex styloflexa	bent sedge	G4G5		S1	U	S4		BW3BW4	+
Cyperus erythrorhizos	red-rooted flatsedge	G5		S3	R	S4		BW3BW4	+
Eleocharis elliptica var. pseudoptera	slender spikerush	G5T?		S1	U	S4		BW3	+
Eleocharis quadrangulata	angled spikerush	G4		S1	T	S2		BW2	+
Eleocharis tuberculosa	long-tubercled spikerush	G5		S2	T	S5		BW4	+
Scirpus maritimus	saltmarsh bulrush	G5		S1	U	SH	E	BW1	+
Scleria minor	slender nutrush	G4		S1	E	S4	LP	BW3	+
Scleria pauciflora var. caroliniana	few-flowered nutrush	G5T4T5		S1	T	S2		BW2	+
Scleria triglomerata	whip nutrush	G5		S2	R	S5		BW4	+
Juncus debilis	weak rush	G5		S1	T	S5		BW4	+
Aletris farinosa	stargrass	G5		S2	U	S4		BW3BW4	+
Listera australis	southern twayblade	G4		S1S2	R	S2	LP	BW2	+
Platanthera cristata	crested yellow orchid	G5		S1	T	S3	LP	BW2	+

Table 3. continued.

Table 3. continued

FIGURES

LIST OF FIGURES

Figure 16. Graphic depicting sequential changes in barrier island resulting from overwashing and inlet formation/closure.

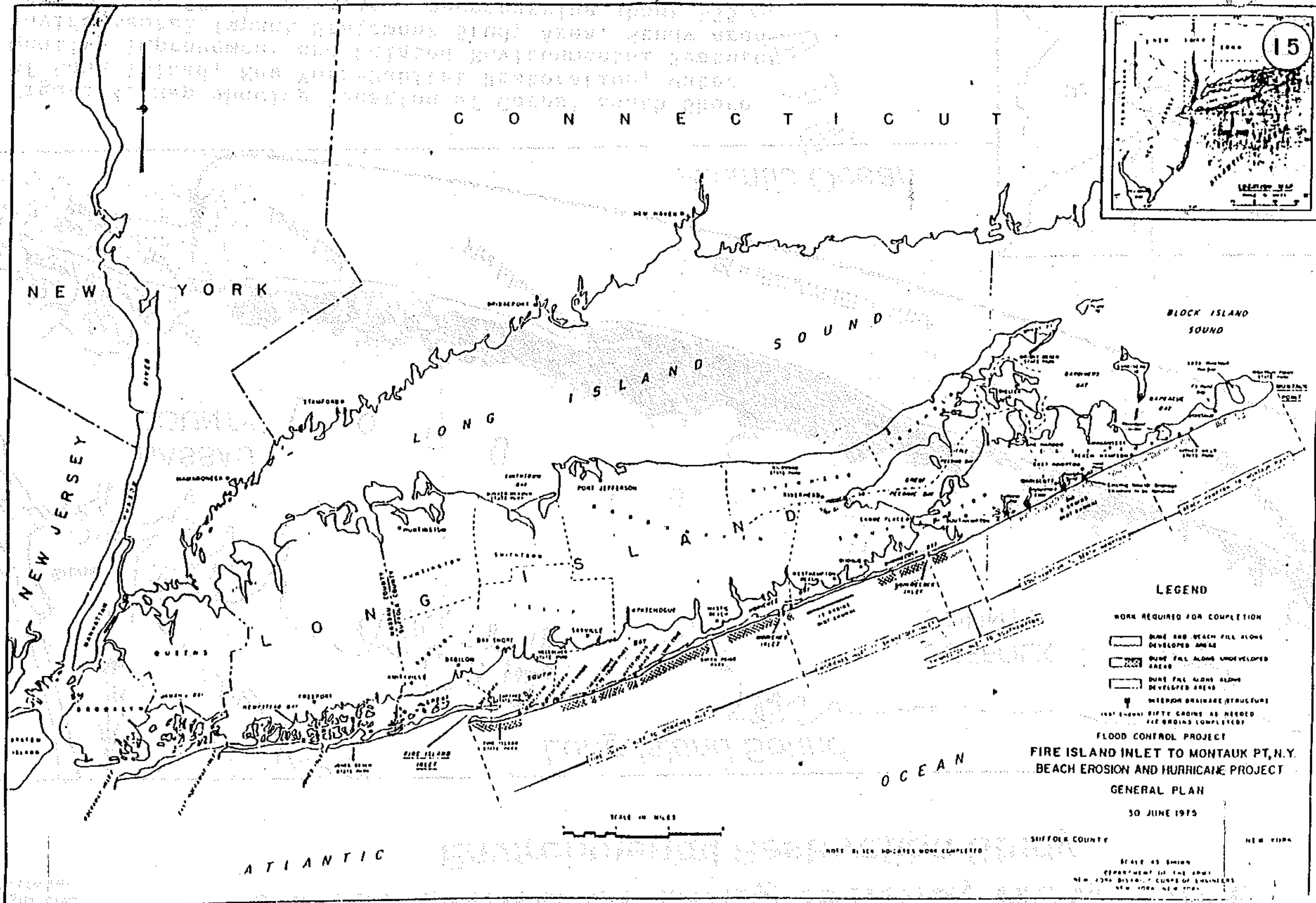
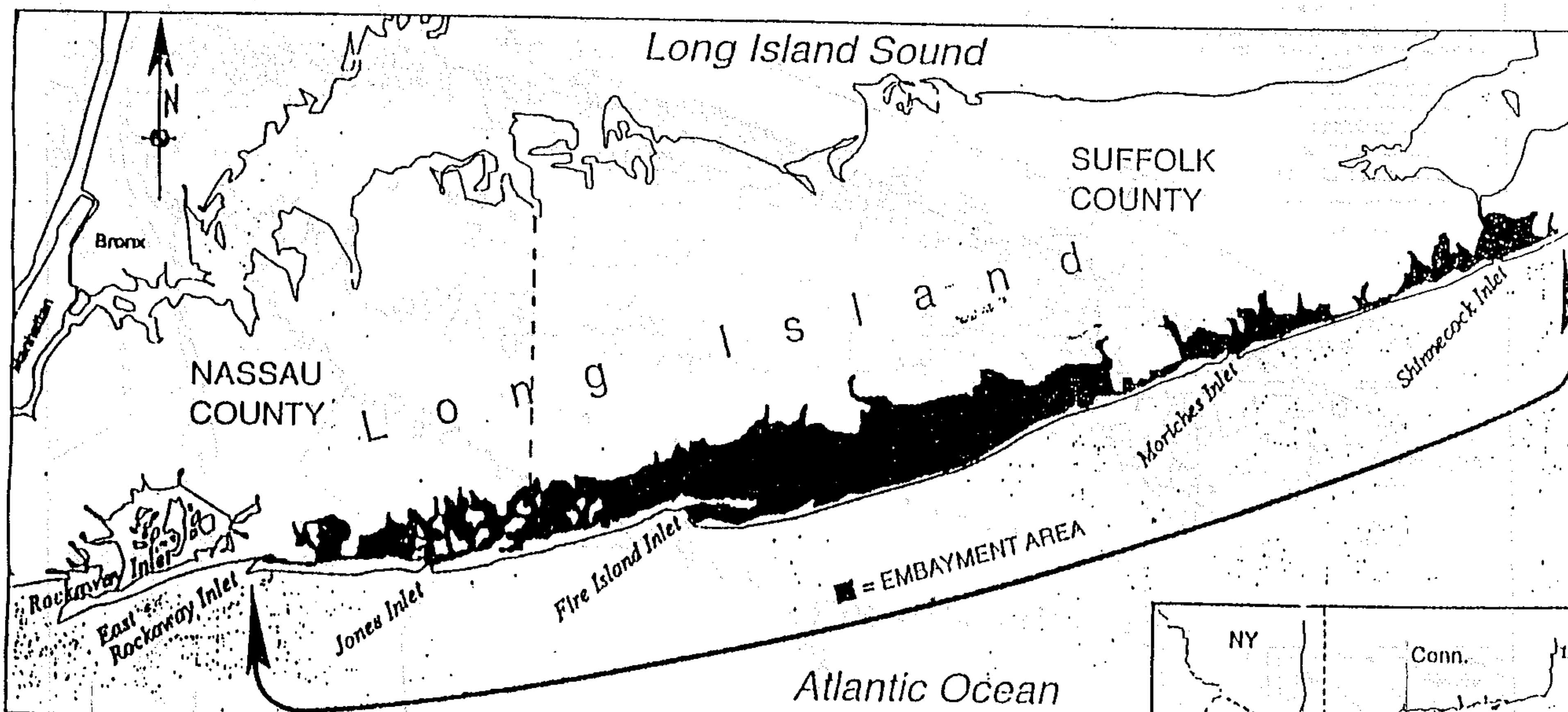


Figure 1. Map showing location of Corps' proposed Fire Island Inlet Interim Storm Damage Protection Project within the Fire Island Inlet to Moriches Inlet of the Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project study area. Included also are the Westhampton Interim Project and the West of Shinnecock Inlet Interim Project. (Corps 1975).

US Army Corps of Engineers
New York District

South Shore of Long Island, New York
Environmental Restoration Study



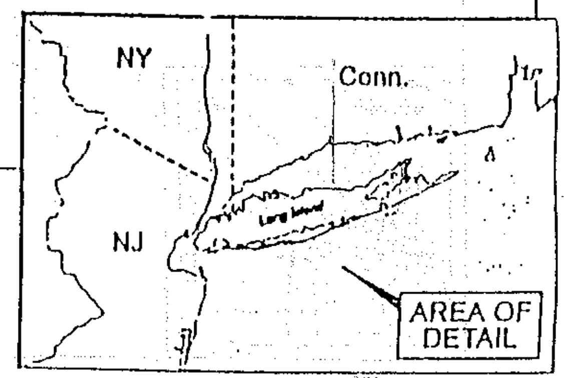


Figure 2. Map showing location of Corps' South Shore of Long Island, New York-Habitat Restoration, Water Quality Improvement and Related Environmental Features Environmental Impact Statement Study Area. Study area covers over 50 linear miles, encompassing about 155 square miles of south shore habitats. (Corps 1997)

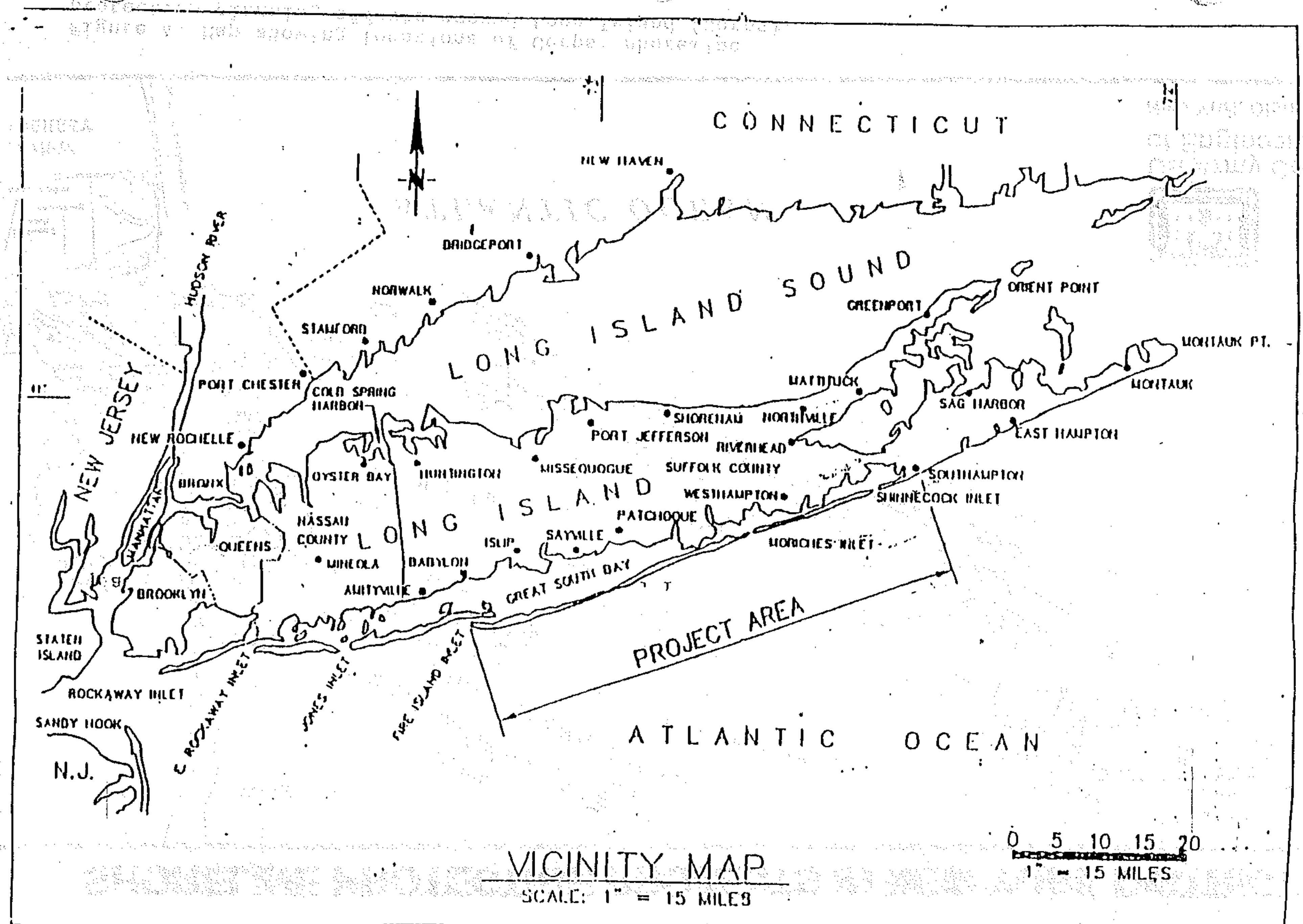


Figure 3. Map showing barriers covered under Corps' Breach Contingency Plan (Corps 1996).

SHORELINE PROTECTION PROJECTS IN NEW YORK DISTRICT

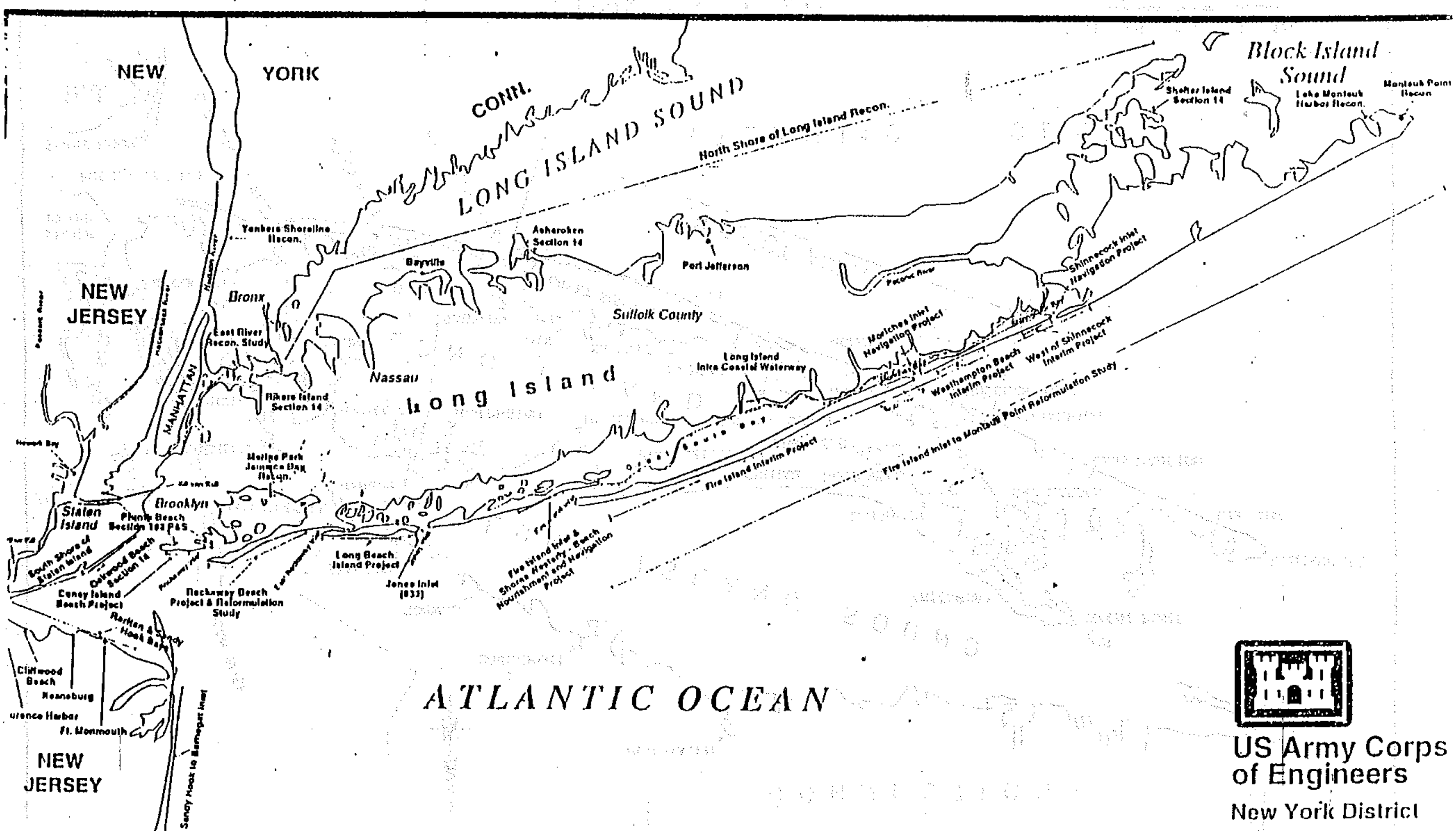
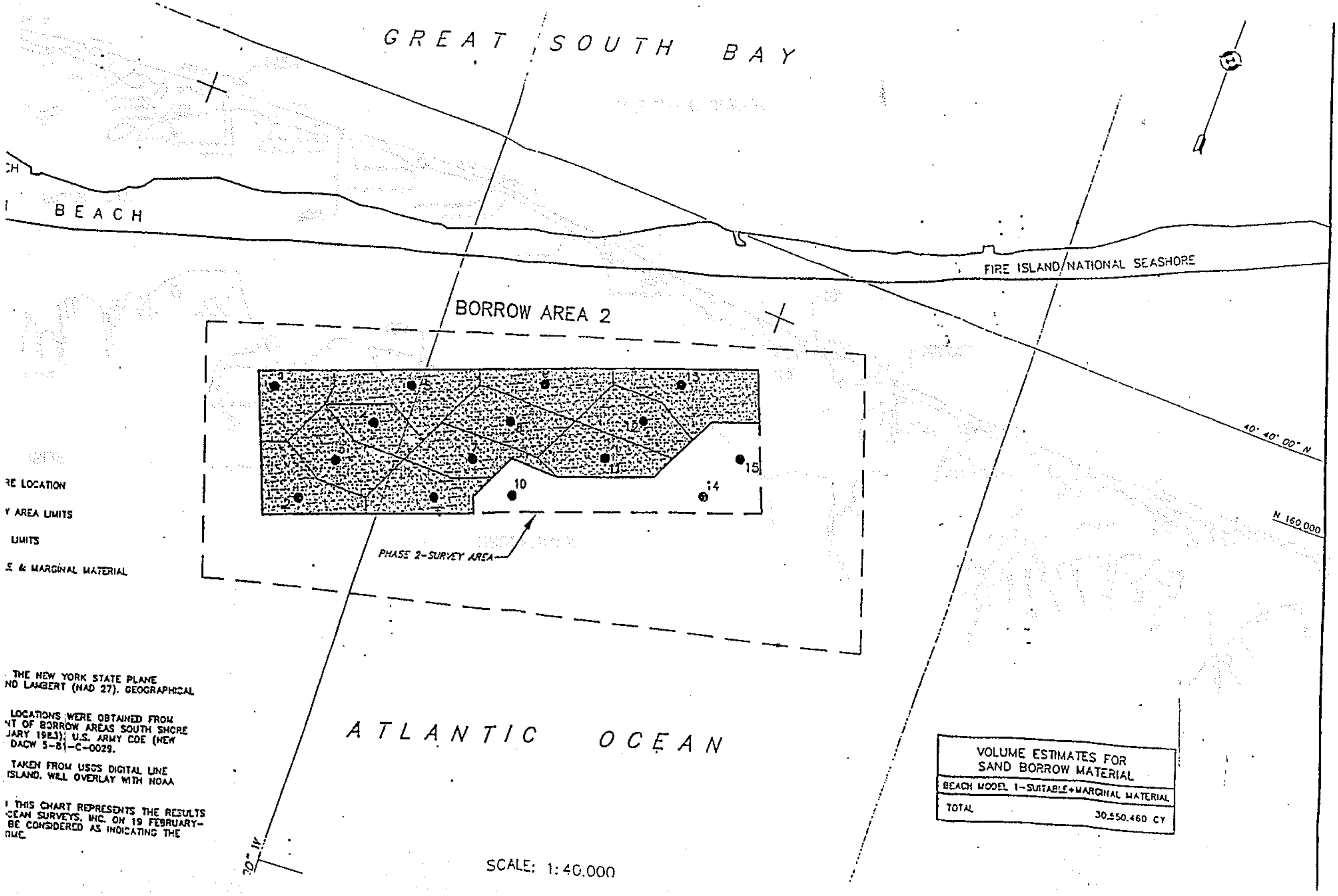


Figure 4. Map showing locations of Corps' shoreline protection planning efforts around Long Island (Corps).



ɌE LOCATION

Y AREA LIMITS

LIMITS

Ɛ & MARGINAL MATERIAL

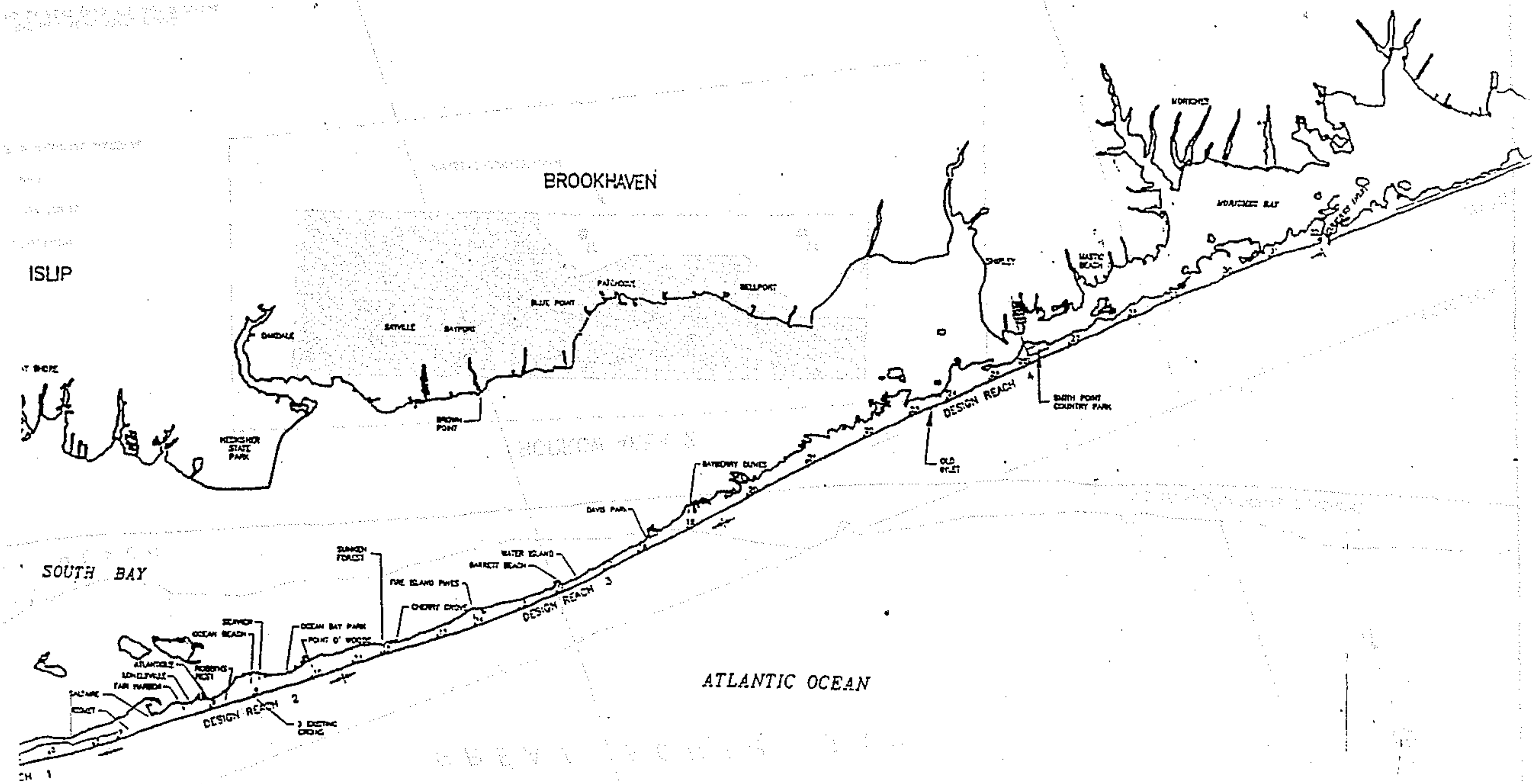
. THE NEW YORK STATE PLANE
ND LAMBERT (NAD 27). GEOGRAPHICAL

LOCATIONS WERE OBTAINED FROM
NT OF BORROW AREAS SOUTH SHORE
JARY 1983); U.S. ARMY COE (NEW
DACW 5-81-C-0029.

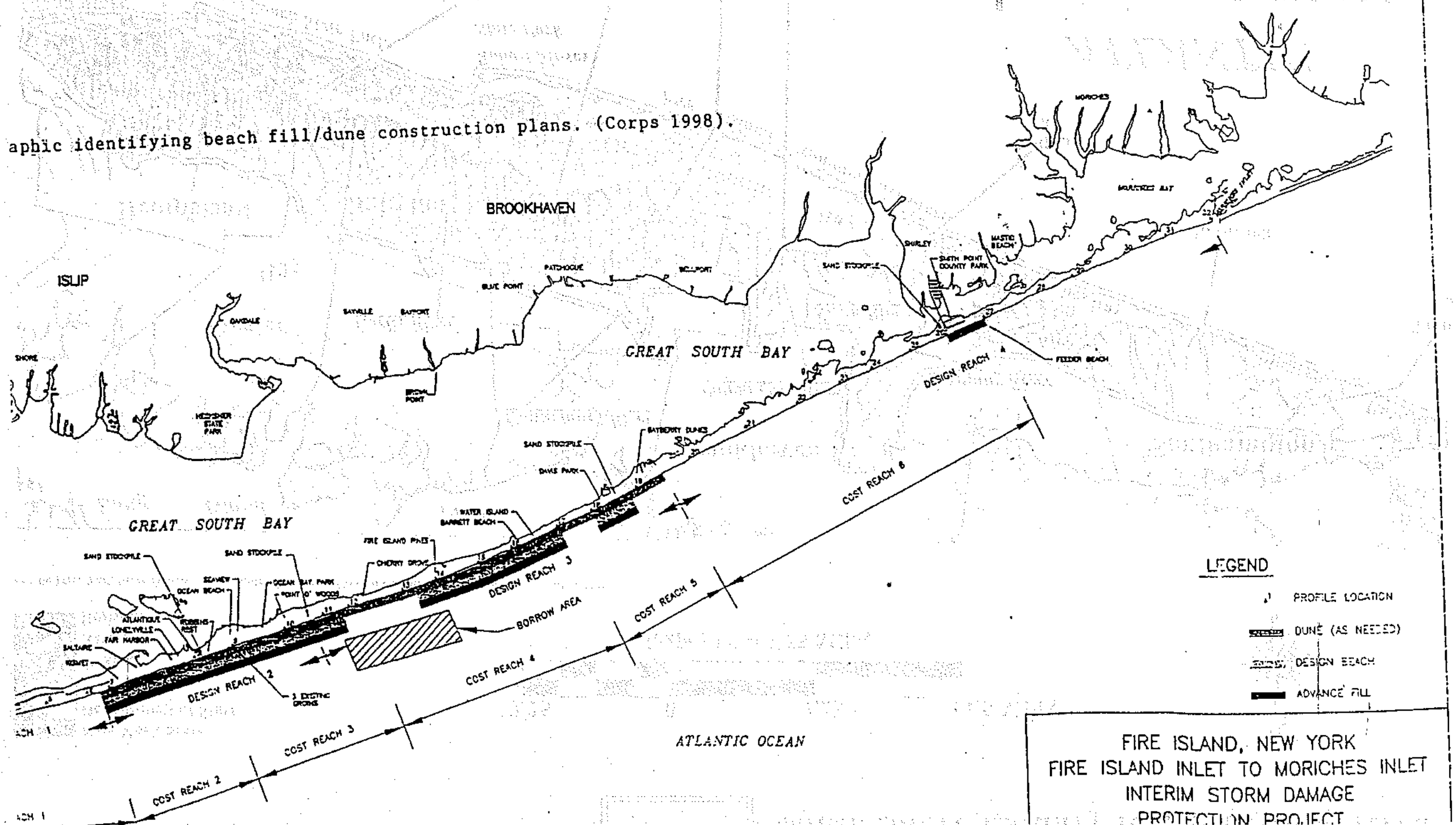
TAKEN FROM USGS DIGITAL LINE
ISLAND. WILL OVERLAY WITH NOAA

I THIS CHART REPRESENTS THE RESULTS
CEAN SURVEYS, INC. ON 19 FEBRUARY-
BE CONSIDERED AS INDICATING THE
IME.

VOLUME ESTIMATES FOR SAND BORROW MATERIAL	
BEACH MODEL 1-SUITABLE+MARGINAL MATERIAL	
TOTAL	30,550,460 CY



BROOKHAVEN
ISLIP
SOUTH BAY
ATLANTIC OCEAN
MORICHES
MORICHES BAY
MASTIC BEACH
SHIRLEY
BELLPORT
PATCHOGUE
BLUE POINT
BAYPORT
SAYVILLE
OAKDALE
BROWN POINT
HECKSCHER STATE PARK
SMITH POINT COUNTY PARK
DESIGN REACH 4
OLD INLET
BAYBERRY DUNES
DAVIS PARK
WATER ISLAND
BARRETT BEACH
DESIGN REACH 3
FIRE ISLAND PINES
CHERRY GROVE
SUNKEN FOREST
OCEAN BAY PARK
POINT O' WOODS
SEAVIEW
OCEAN BEACH
ROBBINS REST
ATLANTIQUE
FAIR HARBOR
SALTAIRE
KISMET
DESIGN REACH 2
3 EXISTING GROINS


aphic identifying beach fill/dune construction plans. (Corps 1998).
BROOKHAVEN
ISLIP
GREAT SOUTH BAY
GREAT SOUTH BAY
ATLANTIC OCEAN
MORICHES
MORICHES BAY
SHIRLEY
MASTIC BEACH
SMITH POINT COUNTY PARK
SAND STOCKPILE
FEEDER BEACH
PATCHOGUE
BELLPORT
BLUE POINT
SAYVILLE
BAYPORT
BROWN POINT
OAKDALE
HECKSCHER STATE PARK
SHORE
BAYBERRY DUNES
SAND STOCKPILE
DAVIS PARK
WATER ISLAND
BARRETT BEACH
FIRE ISLAND PINES
CHERRY GROVE
SAND STOCKPILE
SAND STOCKPILE
SEAVIEW
OCEAN BEACH
OCEAN BAY PARK
POINT O' WOODS
ROBBINS REST
ATLANTIQUE
LONELYVILLE
FAIR HARBOR
SALTAIRE
KISMET
3 EXISTING GROINS
DESIGN REACH
DESIGN REACH 3
DESIGN REACH 2
BORROW AREA
COST REACH 6
COST REACH 5
COST REACH 4
COST REACH 3
COST REACH 2
LEGEND
PROFILE LOCATION
DUNE (AS NEEDED)
DESIGN BEACH
ADVANCE FILL
FIRE ISLAND, NEW YORK
FIRE ISLAND INLET TO MORICHES INLET
INTERIM STORM DAMAGE
PROTECTION PROJECT

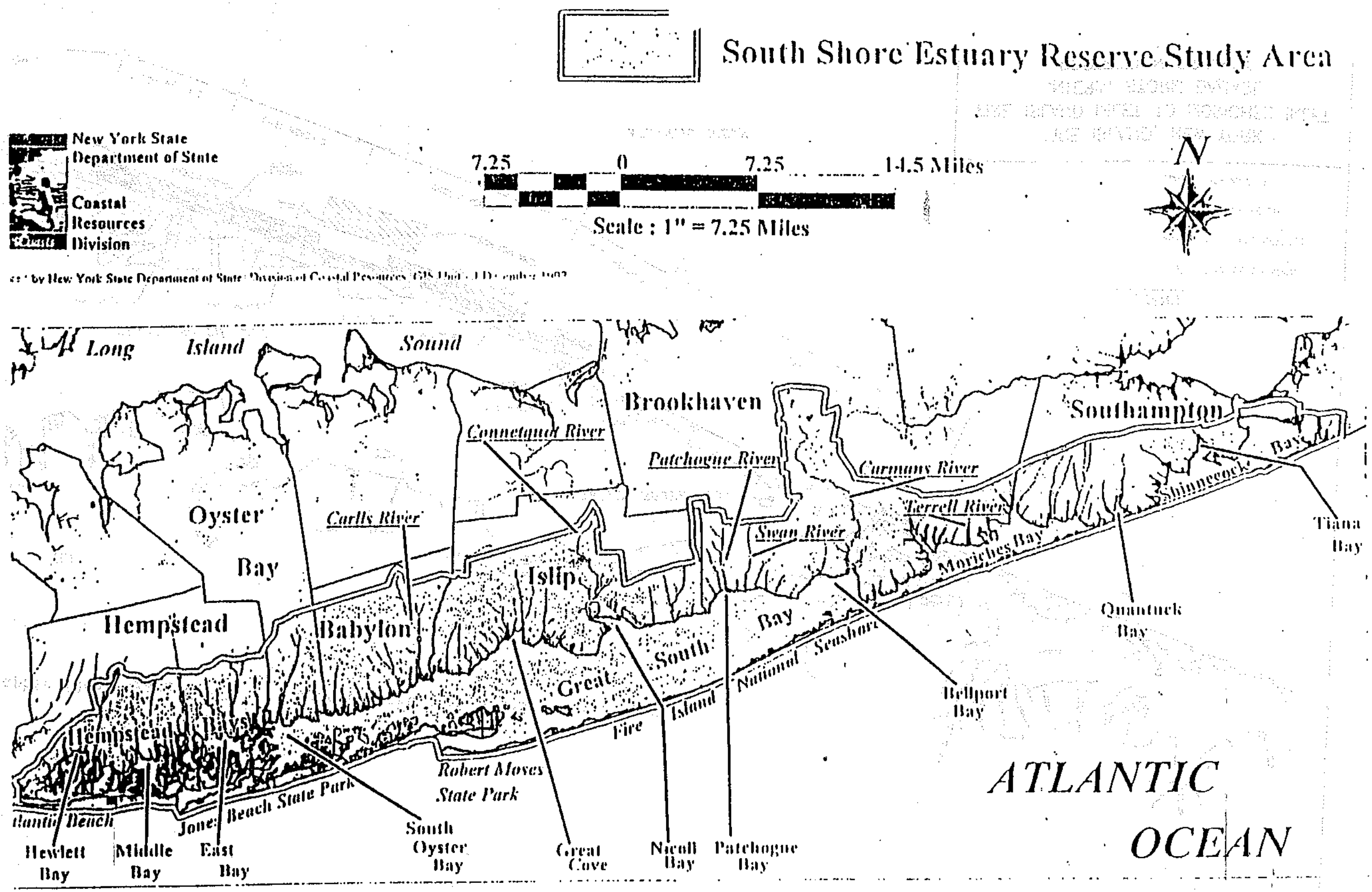


Figure 8. Map showing boundaries of the South Shore Estuary Reserve created by the State of New York under the South Shore Estuary Reserve Act of 1993 (NYS DOS 1997).

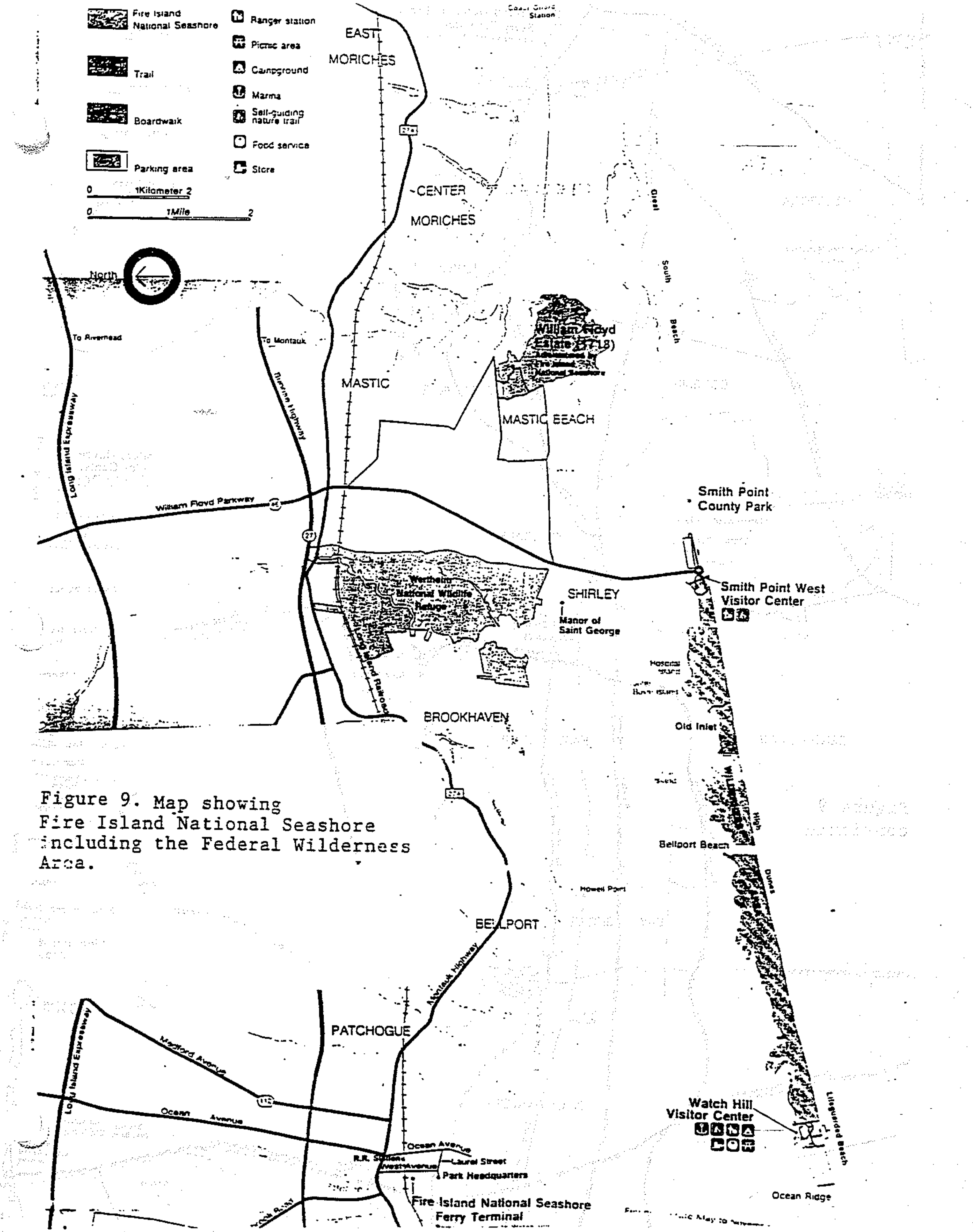


Figure 9. Map showing Fire Island National Seashore including the Federal Wilderness Area.

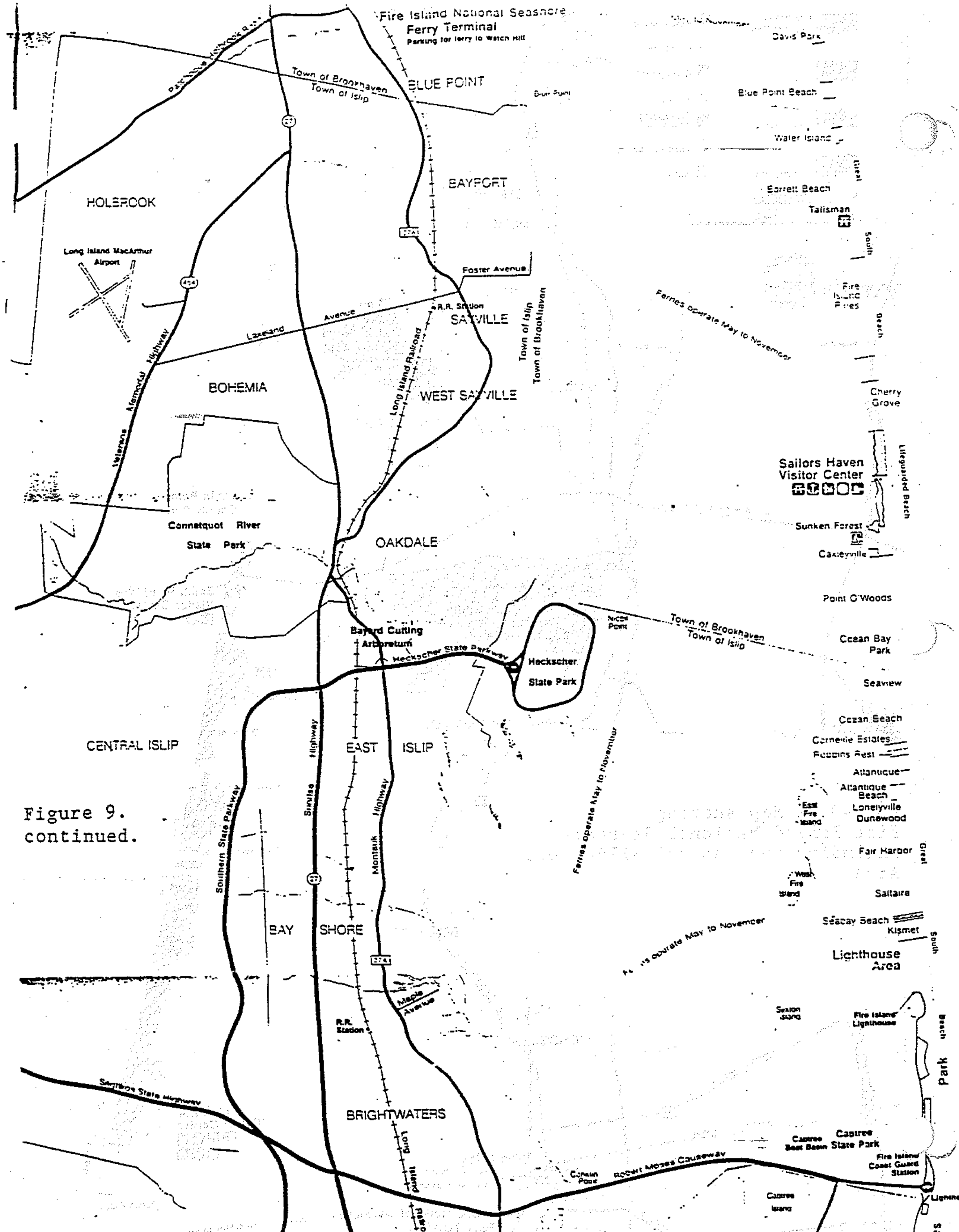


Figure 9.
continued.

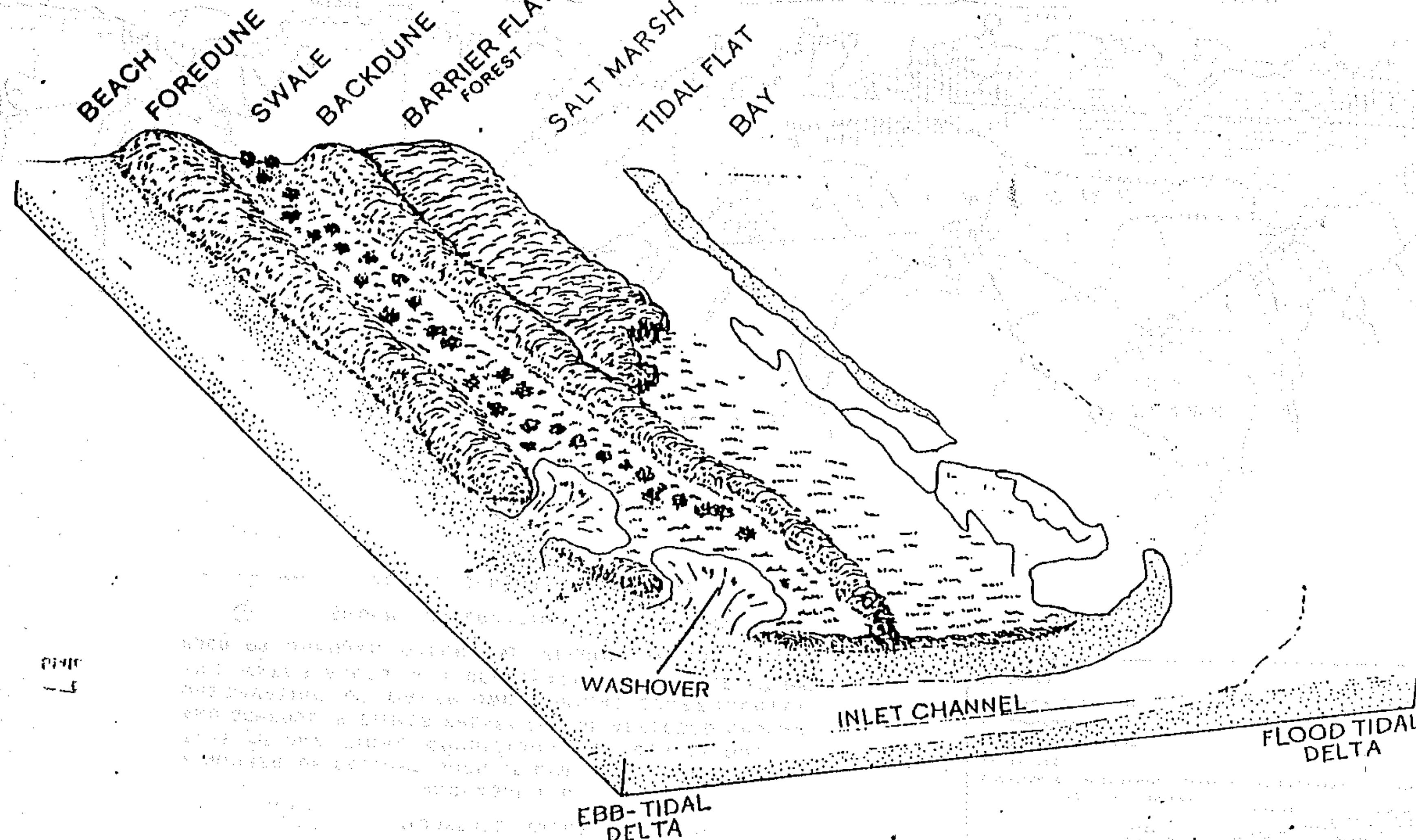


Figure 10. Graphic showing typical cross-section of undeveloped barrier island (Leatherman 1988).

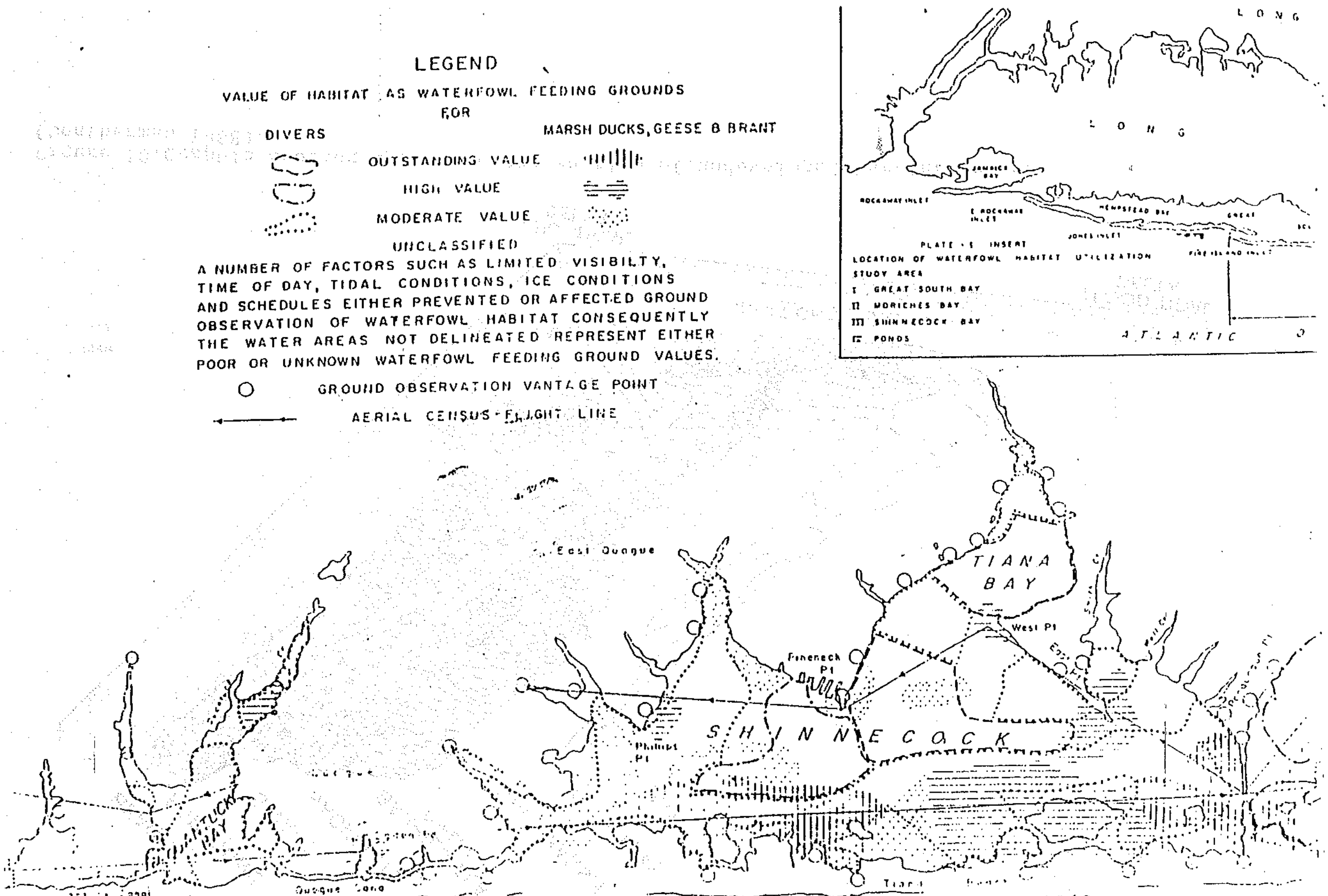


Fig 11. Map showing Waterfowl Use Areas based on surveys conducted in the 1960s relative to the Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project (USFWS 1965).

PLATE – I

MORICHES BAY – SHINNECOCK BAY

LONG ISLAND, NEW YORK

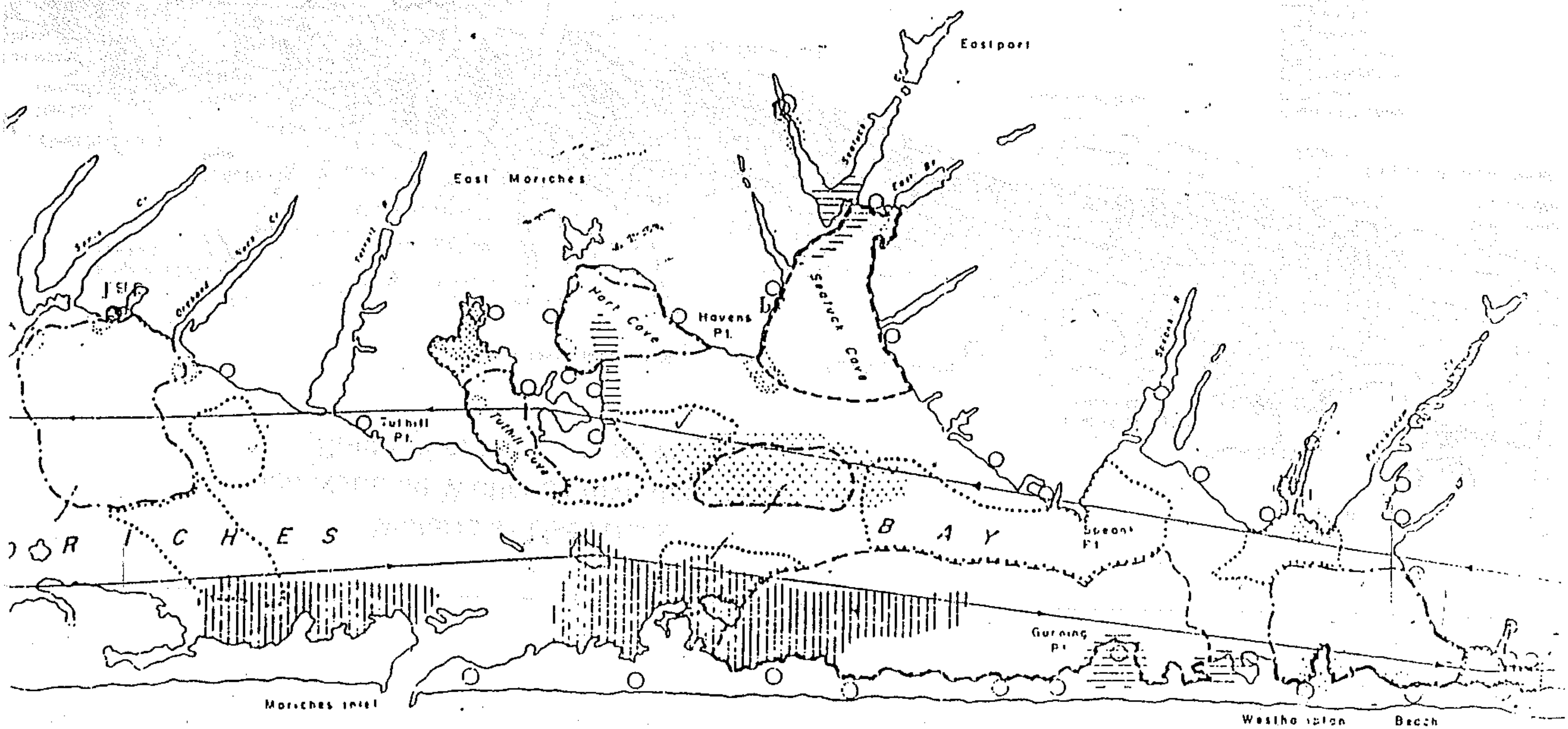


Figure 11. continued.

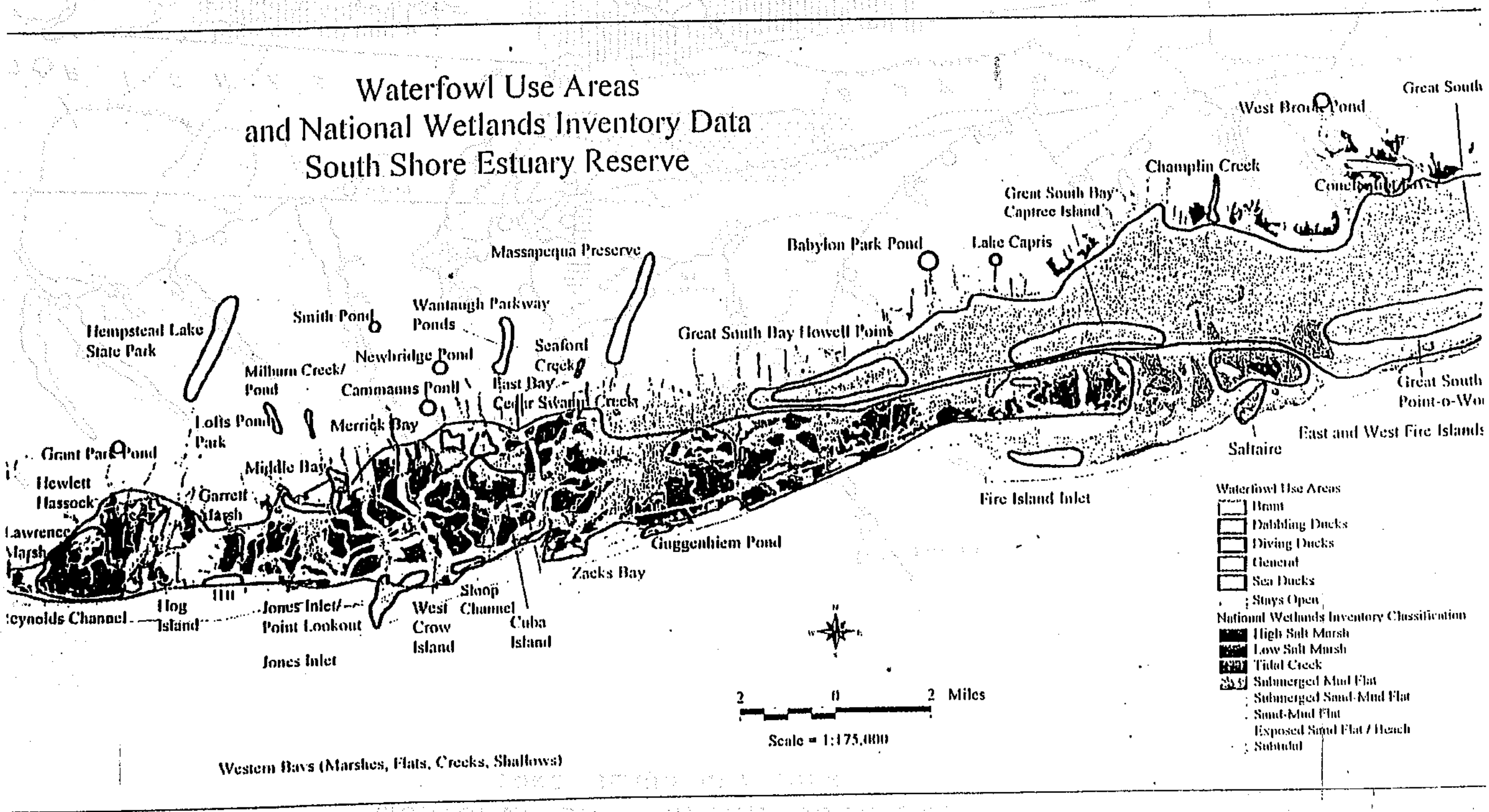


Figure 12. Map showing Waterfowl Use Areas based on information obtained at a Service sponsored workshop in May 1997 (USFWS 1997).

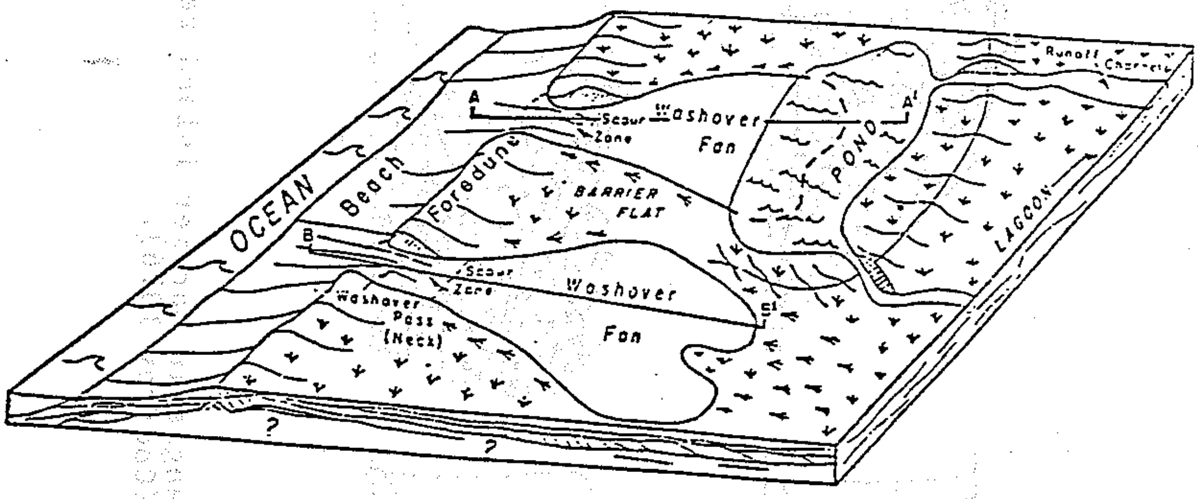


FIGURE E-9: BLOCK DIAGRAM OF SMALL SCALE WASHOVER FANS
(Schwartz, in press)

Figure 14. Graphic depicting overwash on a barrier island (Corps 1977).

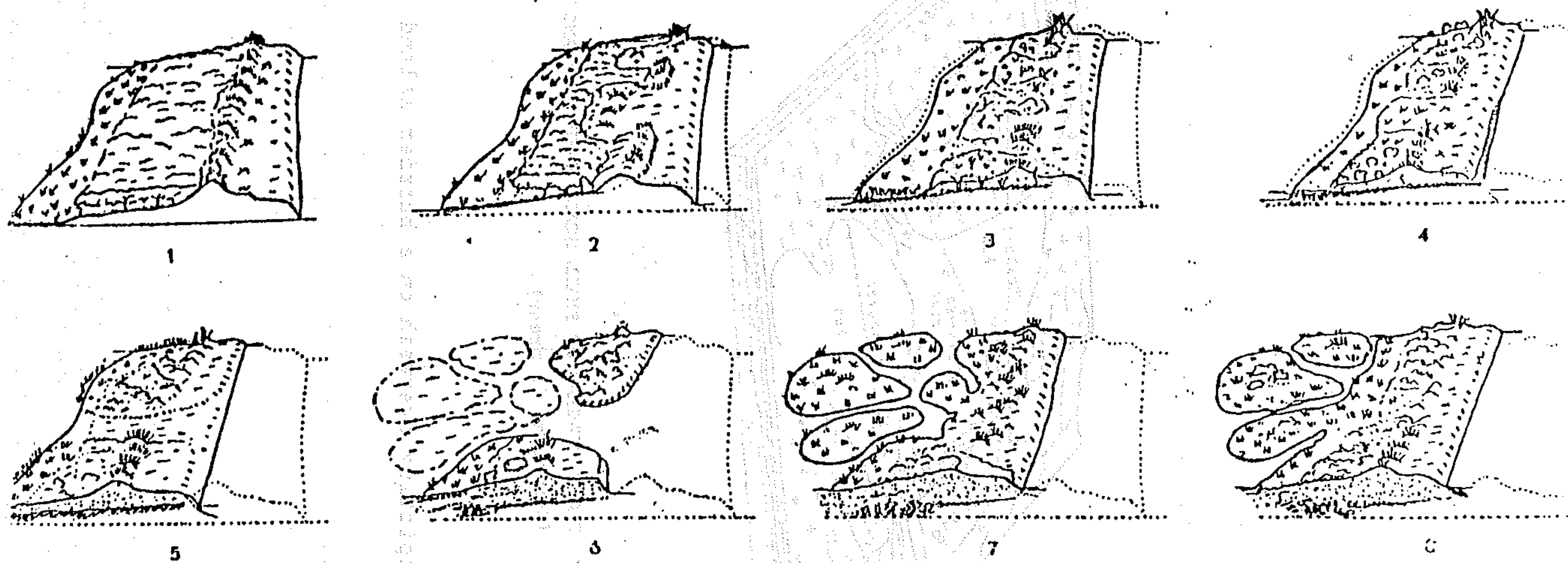


Figure 16. Graphic depicting sequential changes in barrier island resulting from overwashing and inlet formation/closure. (Godfrey 1976).

ATTACHMENT A

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
722 JACKSON PLACE, N. W.
WASHINGTON, D. C. 20006

JUN 6 1978

Lt. Gen. John W. Morris
Chief of Engineers
U.S. Army Corps of Engineers
Washington, D.C. 20314

Dear General Morris:

The Council has reviewed the U.S. Army Corps of Engineers' proposal for a beach erosion control and hurricane protection project from Fire Island to Montauk Point, N.Y., in response to the referral from the Secretary of the Department of the Interior. The Commerce Department and the Environmental Protection Agency also expressed major concerns about your proposed course of action.

The Council agrees with the objectives of the proposal, which are to preserve the natural shoreline and barrier beaches of Long Island and to reduce the risk of human and other losses as a result of flooding. As you know, the Council has maintained a long-standing interest and involvement in these two aspects of the human environment.

We have carefully reviewed the final environmental impact statement; we also appreciate the briefings your staff has provided on the proposal. As we understand the proposal, the Corps of Engineers would rebuild the southern edge of Long Island by creating a 25 x 16 foot dune along 83 miles of barrier beach in order to slow the pace of erosion and shield developed and undeveloped areas from storm flooding. Initial construction of the overall project would involve more than $100 million of federal funds, between 48 and 80 million cubic yards of sand taken mainly from the ocean, and the potential for dredging operations at existing inlets and for substantial construction of groins and other works. These estimates do not include the resources required for frequent maintenance of the system for an unspecified period of time after initial construction. We realize the Corps does not intend to construct the entire proposal immediately, but would study each part in detail before proceeding.

This is a proposal for a radical, artificial facelift for Long Island's southern shoreline. The major policy questions are whether the proposal presented and analyzed in the environmental impact statement will resolve the problems it seeks to address and whether it is the best available alternative.

By way of background, we fully agree with your statement on the first page of the final environmental impact statement that the whole project area "must be considered as a system." We also agree, therefore, that the evaluation of alternative courses of action and their environmental impacts and acceptability is required for the entire system and must be presented in a single statement, prior to proceeding with any part of the proposal.

The dynamics of barrier beaches and islands underscores this point, as does your own analysis. The impact statement repeatedly reveals the system-wide effects that actions on one part of the Long Island shore have had on other parts. Indeed, Long Island has had a history of subsequently confronting and constantly compensating for human manipulations of the barrier island system for several decades since the inlets at Moriches and Shinnecock Bays were first artificially kept open. The impact statement illustrates the westward erosion that can result from the construction of groins. The actions taken on one part of Long Island's barrier beach and ocean shore have repeatedly been shown to affect other parts that are often many miles away.

The Fire Island National Seashore, for example, which comprises nearly a third of the project area and is located on the western end of the system, is likely to be affected by any major shoreline changes to its east. This relationship gives us special cause for concern in light of the intention of the Congress and the National Park Service to allow the National Seashore to revert to as natural a state as possible. In addition, the Congress wisely instructed the Corps to exercise its authority within the Fire Island National Seashore in accordance with a plan which is acceptable to the Secretary of the Interior (16 U.S.C. 459e-7).

Although the Corps recognizes the impact on the National Seashore of actions taken to its east, the Corps would proceed first with the reach immediately to the east of the Seashore without any plan to which the Secretaries of the Army and the Interior have agreed. This lack of coordination at the planning stage can only cause subsequent delays and referrals to the Council which should be avoided.

We believe that the proposed course of action has not been planned with adequate attention to the significant, potentially adverse impacts of the project. We have appended an indication of several specific concerns and have noted areas requiring your attention.

In conclusion, we believe that the proposed course of action, as described in the environmental impact statement, is environmentally unacceptable and that the Corps has not demonstrated that there are no practicable alternatives available. Rather, a number of reasonable alternatives and combinations of alternatives, which we believe warrant serious consideration by the Corps, have been given short shrift or been omitted from the programmatic statement. Because the entire project area is a system, it would be disingenuous to treat these issues solely in connection with a particular segment of the shore.

We would have strong objections to the Corps proceeding with the project as planned and would seek full Executive branch resolution prior to any Administration request for appropriations of funds for the project. However, we recognize that the project, initially conceived about two decades ago, and its impact statement, begun more than a year ago, may not accurately reflect the Corps' currently stated intention to include other alternative approaches in its plans before proceeding with any actual construction. We also recognize the vast improvement in the knowledge of barrier beach dynamics that has occurred since the project was authorized in 1960.

Because each facet of the proposal is likely to affect other parts, as well as the whole highly dynamic barrier beach system, we recommend that the Corps revise its overall project plan to create an adequate framework within which subsequent detailed planning for specific parts--or reaches--might occur. We would expect, of course, that your existing final EIS would be revised accordingly (by draft and final supplement if you believe that to be most appropriate). We would also expect your revised analysis to explain the rationale and criteria for dividing the overall project into its constituent parts for detailed review and future actions.

We appreciate the Corps' current plan to prepare "fully coordinated EIS supplements in draft and final format for each reach" which would discuss the full range of alternatives, as General Wilson noted in his April 28, 1978 letter to the Council. We believe that this approach would, however, cause unnecessary duplication and delay. We agree with your view that further site-specific analysis for actions on a particular reach (and their impacts on neighboring reaches) is appropriate at the design stage, prior to funding and construction. But the Corps' intention to prepare detailed analyses of all reasonable alternatives and their environmental impacts for each individual reach--including broad alternatives and impacts which apply to the entire system--would result in repetitive analysis of questionable scope conducted at different times in the absence of an overall framework. This approach is likely to delay planning and decisionmaking processes unnecessarily, and would undercut the Corps' laudable effort to produce an adequate overview or "umbrella" statement for the proposal that fully recognizes the dynamic and fragile character of the entire shoreline.

In addition to treating the deficiencies mentioned above, we recommend that you work more closely with the Interior and Commerce Departments and the Environmental Protection Agency in revising your programmatic proposals and analysis of their impacts.

Sincerely,

Gus Speth

Gus Speth
Member

Attachment

Appendix

We believe that the proposed course of action has not been planned with adequate attention to the significant, potentially adverse impacts of the project and recommend that you pay particular attention to the following in any subsequent work:

1. The physical capability of the proposed construction techniques may not achieve the project's stated purposes over the long run, particularly in light of the anticipate storms. (The impact statement indicates a minimum 10-year federal commitment; the costs and benefits were computed on a 50-year basis.) Recent scientific evidence has shown that the radical modification of barrier beach floodplains, such as is proposed here, can accelerate--not reduce--erosion. This, in turn, increases the need for and commitment of persistent federal efforts to rebuild these environments, accompanied by new and usually more disruptive environmental effects. This approach would be contrary to sections 101 and 102 of the National Environmental Policy Act, which require careful attention to long term environmental consequences in order to fulfill the Federal Government's responsibility to each generation as trustee of the environment for succeeding generations.

2. By their very nature, barrier beaches are constantly changing and reforming, but the proposal neither incorporates actions to eliminate the existing structures which impede natural processes, nor employs wider use of natural processes to achieve the purposes of the proposal, such as greater reliance on sand bypasses or a combination of alternative approaches. More serious consideration of the system-wide impact of groins on beach erosion and of the advisability of removing existing groins is warranted, as well as the definition of circumstances or limitations for using long term, heavy structural devices.

3. The impact statement recognizes that the project will spur development of the barrier beach and mainland coast, much of which is adjacent to the National Seashore, but it does not identify or analyze non-structural alternatives to the project. Corps officials should know whether, or to what extent, or under what circumstances the Corps could or would condition its assistance on local efforts to control floodplain development, including the use of appropriate enforcement tools. We would call your attention to Executive Order 11988 on floodplain management, which requires the Corps to avoid conducting or supporting floodplain development unless there is no practicable alternative, and, equally important, to provide leadership and take action to restore and preserve the natural and beneficial values served by floodplains.

4. We have several other concerns about the proposal, which do not require detailed discussion in this letter. Among these are the impacts of the planned pond drainage structures on wetlands and the contradictory assumptions regarding the impacts of the proposal and its alternatives on the bay wetlands, bay ecology, and shellfish population.

DEIS Appendix D—List of Common and Scientific Names

Appendix D
Index to Scientific Names Used in this Report

Scientific Name	Common Name	Scientific Name	Common Name
Macrobenthic Invertebrates		**Macrobenthic Invertebrates (Continued)**	
Acanthohaustorius millsi	Digger amphipods	*Tharyx acutus*	Fringed worm
Ampelisca abdita	Four-eyed amphipod	*Unicola irrorata*	Amphipod
Arabella iricolor	Opal worm	**Shellfish**	
Asabellides oculata	Ampharetid worm	*Aequipecten irradians*	Bay scallop
Astarte castanea	Chestnut astarte	*Artica islandica*	Black clam or Ocean quahog
Capitalla capitata	Capitellid thread worm	*Bittium alternatum*	Alternate bittium
Chiridotea tuftsi	Isopod	*Gemma gemma*	Gem shell
Clymenella torquata	Bamboo worm	*Guekensia demissus*	Ribbed mussels
Diastylis polita	Sharp-tailed cumacean	*Littorina littorea*	Common periwinkle
Gammarus annulatus	Scud amphipod	*Mercenaria mercenaria*	Hard clam
Gemma gemma	Gem shell	*Mitrella lunata*	Crescent mitrella
Glycera americana	Blood worm	*Mulinia lateralis*	Little surf clam
Haustorius canadensis	Digger amphipods	*Mytilus edulis*	Blue mussel
Heteromastis filiformis	Polychaete worm	*Nassarius obsoletus*	Mud dog whelk
Idotea baltica	Isopod	*Solemya velum*	Veiled clam
Leptocheirus pinguis	Amphipod	*Spisula solidissima*	Surf clam
Lumbrineris tenuis	Lumbrinerid thread worm	*Tellina agilis*	Dward tellin
Magelona papillicornis	Polychaete worm	*Urosalpinx cenerea*	Oyster drill
Mnemiopsis leidyi	Plankton comb jelly	**Squid**	
Nephthys incias	Polychaete	*Ilex illecebrosus*	Short-finned squid
Nephtys picta	Red-lined worm	*Loligo pealei*	Long-finned squid
Nereis arenaceodonta	Polychaete worm	*Lolliguncula brevis*	Brief squid
Nereis succinea	Clam worm	**Echinoidea**	
Nucula proxima	Near nut shell	*Asterias forbesi*	Forbes asteria
Pherusa affinis	Polychaete worm	*Echinarachnius parma*	Sand dollar
Platynereis dummerilli	Dumeril's clam worm	**Crustaceans**	
Polydora ligna	Mudworm	*Ampelisca abdita*	Four-eyed amphipod
Polygordius sp.	Archiannelid worm	*Callinectes sapidus*	Blue-claw crab
Protohaustorius sp.	Digger amphipods	*Cancer borealis*	Jonah crab
Protohaustorius wigleyi	Digger amphipods	*Cancer irroratus*	Rock crab
Psammonyx nobilis	Amphipod	*Crangon septemspinosa*	Sand shrimp
Pseudoleptocuma minor	Crustacean	*Dyspanopeus sayi*	Mud crab
Pseudounciola obliquua	Amphipod	*Emerita talpoida*	Mole crab
Sabellaria vulgaris	Sand-builder worm	*Hippolyte pleurocantha*	Grass shrimp
Scolelepis squamata	Polychaete worm	*Homarus americanus*	American lobster
Spiophanes bombyx	Mudworm	*Libinia sp.*	Spider crab
Spisula solidissima	Surf clam	*Limulus polyphemus*	Horseshoe crab
Talorchestia longicornis	Beach flea amphipod	*Palaemonetes pugio*	Shore shrimp

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Scientific Name	Common Name	Scientific Name	Common Name
Custaceans (Continued)		***Fin Fish (Continued)***	
Palaemonetes vulgaris	Common shore shrimp	*Sphaeroides maculatus*	Northern puffer
Tellina agilis	Dwarf tellin	*Stenotomus chrysops*	Scup or porgy
Pagurus longicarpus	Long-clawed hermit crab	*Syngnathus fuscus*	Northern pipefish
Ovalipes ocellatus	Lady crab	*Tautogalabrus adspersus*	Cunner
Finfish		*Tautoga onitis*	Tautog or black fish
Alosa aestivalis	Blueback herring	*Urophycis chuss*	Red hake
Alosa mediocris	Hickory shad	*Raja erinacea*	Little skate
Alosa pseudoharengus	Alewife	*Scomber scombrus*	Atlantic mackerel
Alose sapidissima	American shad	**Mammals**	
Ammodytes sp.	Sand lance	*Balaena glacialis*	Northern right whale
Anchoa hepsetus	Striped anchovy	*Balaenoptera acutorostrata*	Minke whale
Anchoa michilli	Bay anchovy	*Balaenoptera borealis*	Sei whale
Anguilla rostrata	American eel	*Balaenoptera physalus*	Fin whale
Apeltes quadracus	Four-spined stickleback	*Delphinapterus leucas*	Beluga whale
Brevoortia tyrannus	Atlantic menhaden	*Megaptera novaeangliae*	Humpback whale
Centropristis striata	Black seabass	*Microtus sp.*	Voles
Clupea harengus	Atlantic herring	*Mustela vison*	Mink
Conger oceanica	Conger eels	*Odocoileus virginianus*	Whitetail deer
Cynoscian regalis	Weakfish	*Ondatra zibethica*	Muskrat
Cyprinodon variegatus	Sheepshead minnow	*Peromyscus leucopus*	White-footed mouse
Enchelyopus cimbrius	Four-beard rocking	*Phoca vitulina*	Harbor seal
Fundulus heteroclitus	Mummichog or common killifish	*Phocoena phocoena*	Harbor porpoise
Fundulus majalis	Striped killifish	*Procyon lotor*	Raccoon
Gadus morhua	Atlantic codfish	*Rattus norvegicus*	Norway rat
Gasterosteus aculeatus	Three-spined stickleback	*Scalopus aquaticus*	Short-tailed shrew
Gobiosoma ginsbureghi	Seaboard goby	*Sorex cinereus*	Masked shrew
Leiostomus xanthurus	Spot	*Sylvilagus floridanus*	Eastern cottontail
Membras martinica	Rough silversides	*Tursiops truncatus*	Bottlenosed dolphin
Menidia menidia	Atlantic silverside	*Vulpes fulva*	Red fox
Menticirrhus saxatilis	Northern kingfish	**Birds**	
Merluccius bilenearis	Silver hake	*Alca torda*	Razorbill
Morone saxatilis	Striped bass	*Alle alle*	Dovekie
Opsanus tau	Oyster toadfish	*Accipiter cooperii*	Cooper's hawk
Paralichthys dentatus	Summer flounder	*Accipiter gentilis*	Goshawk
Peprilus triancanthus	Butterfish	*Accipiter striatus*	Sharp-skinned hawk
Pleuronectes americanus	Winter flounder	*Aegolius acadicus*	Saw-whet owl
Pomatomus saltatrix	Bluefish	*Scophthalmus aquosus*	Windowpane

Appendix D (Continued)

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Scientific Name	Common Name	Scientific Name	Common Name
Birds (Continued)		**Birds (Continued)**	
Anas platyrhynchos	Mallard	*Lazarus atricilla*	Laughing gull
Anas rubripes	American black duck	*Lazarus marinus*	Great black-backed gull
Ardea herodias	Great blue heron	*Limnodromus griseus*	Short-billed dowitcher
Asio flammeus	Short-eared owl	*Lophodytes cucullatus*	Hooded mergansers
Prionotus carolinus	Northern sea robin	*Mergus serrator*	Red-breasted merganser
Prionotus evolans	Striped sea robin	*Morus bassanus*	Northern gannet
Asio otus	Long-eared owl	*Nyctanassa violacea*	Yellow-crowned night heron
Aythya marila	Greater scoup	*Nyctea scandiaca*	Snowy owl
Branta bernicla	Brant	*Nycitcorax nycticorax*	Black-crowned night heron
Branta canadensis	Canada goose	*Oxyura jamaicensis*	Ruddy duck
Bubulcus ibis	Cattle egret	*Pandion haliaetus*	Osprey
Bucephala albeola	Bufflehead	*Oceanites oceanicus*	Wilson's storm petrel
Bucephala clanguila	Common goldeneye	*Otus asio*	Screech owl
Buteo jamaicensus	Red-tailed hawk	*Phalacrocorax auritus*	Double-crested cormorant
Buteo lagopus	Rough-legged hawk	*Pluvialis squatarola*	Black-bellied plover
Buteo lineatus	Red-shouldered hawk	*Puffinus diomeda*	Cory's Shearwater
Buteo platypterus	Borad-winged hawk	*Puffinus gravis*	Greater shearwater
Calidris alba	Sanderlings	*Puffinus griseus*	Sooty Shearwater
Calidris alpina	Dunlin	*Rynchops nigra*	Black shimmer
Calidris maritima	Purple sandpiper	*Sterna antillarum*	Least tern
Calidris mauri	Western sandpiper	*Sterna dougalli*	Roseate tern
Calidris minutilla	Least sandpipers	*Sterna hirundo*	Common tern
Calidris pusilla	Semipalmated sandpiper	*Tringa melanoleuca*	Greater yellowlegs
Cathartes aura	Turkey vulture	*Tyto alba*	Barn owl
Catoptrophorus semipalmatus	Willet	*Uria aalge*	Thick-billed murre
Charadrius melodus	Piping plover	**Plants**	
Charadrius semipalmatus	Semipalmated plovers	*Amelanchier canadensis*	Serviceberry
Circus cyaneus	Northern harrier	*Ammophila breviligulata*	Beachgrass
Falco columbarius	Merlin	*Andropogon glomeratus*	Bushy beardgrass
Falco peregrinus	Peregrine falcon	*Andropogon scoparius*	Little bluestem
Falco rusticolus	Gyrfalcon	*Andropogon virginicus*	Broomsedge
Falco sparverius	American kestrel	*Aralia nudicaulis*	Wild sarsaparilla
Gavia immer	Common loon	*Arctostaphylos uva-ursi*	Bearberry
Gavia stellata	Red-throated loon	*Artemisia campestris*	Wormwood
Haematopus palliatus	American oystercatcher	*Artemisia stelleriana*	Dusty miller
Haliaeetus leucocephalus	Bald eagle	*Baccharis halimifolia*	Groundsel-tree
Ixobrychus exilis	Least bittern	*Cakile edentula*	Sea rocket
Lazarus argentatus	Herring gulls	*Digitaria sp.*	Crabgrasses

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Scientific Name	Common Name	Scientific Name	Common Name
Plants (Continued)		**Plants (Continued)**	
Distichlis spicata	Spike grass	*Sambucus cnadensis*	Elderberry
Dryopteris thelypteris	Marsh shield-fern	*Sassafras albidum*	Sassafras
Euphorbia polygonfolia	Seaside spurge	*Smilacina stellata*	Starry false-solomon's seal
Gaylussacia baccata	Black huckleberry	*Smilax glauca*	Sawbrier
Hudsonia tomentosa	Beach-heather	*Smilax rotundifolia*	Bullbrier
Hypericum virginicum	Marsh St. John's-wort	*Solidago sempervirens*	Seaside goldenrod
Ilex glabra	Inkberry	*Solidago tenuifolia*	Slender-leaved goldenrod
Ilex opaca	American holly	*Spartina alterniflora*	Salt marsh cordgrass
Iva frutescens	Marsh-elder	*Spartina patens*	Saltmeadow
Juncus gerardi	Blackgrass	*Spergularia sp.*	Sand spurreys
Juniperus virginiana	Eastern redcedar	*Trientalis borealis*	Starflower
Lathyrus japonicus	Beach pea	*Vaccinium corymbosum*	Highbush blueberry
Limonium carolinianum	Sea lavender	*Vaccinium macrocarpon*	Large cranberry
Maianthemum canadense	Canada Mayflower	*Viola lanceolata*	Lance-leaved violet
Myrica pennsylvanica	Bayberry	*Vitis sp.*	Grape
Nyssa sylvatica	Sour gum or tupelo	*Xyris sp.*	Yellow-eyed grasses
Osmunda cinnamomea	Cinnamon fern	**HERPETILES**	
Panicum sp.	Panic grasses	*Bufo woodhousei fowleri*	Fowler's toad
Parthenocissus quinquefolia	Virginia creeper	*Caretta caretta*	Loggerhead sea turtle
Phragmites australis	Common reed	*Clemmys guttato*	Spotted turtle
Pinus rigida	Pitch pine	*Chelonia mydas*	Green sea turtle
Pinus thunbergii	Japanese black pine	*Chelydra serpentina*	Snapping turtle
Prunus maritima	Beach plum	*Coluber constrictor*	Northern black racer
Prunus serotina	Black cherry	*Dermochelys coriacea*	Leatherback sea turtle
Pyrus arbutifolia	Red chokeberry	*Eretomochelys imbricata imbricata*	Hawksbill sea turtle
Quercus stellata	Post oak	*Heterodon platyrhinos*	Eastern hognose snake
Quercus velutina	Black oak	*Kinosternon subrubrum*	Eastern mud turtle
Rhododendron viscosum	Swamp honeysuckle	*Lepidochelys kempi*	Kemp's Ridley sea turtle
Rhus copallina	Winged sumac	*Malaclemys terrapin terrapin*	Northern diamondback terrapin
Rhus radicans	Poison ivy	*Terrepene carolina*	Eastern box turtle
Rhynchospora capitellata	—	**INSECTS**	
Rosa rugosa	Rugosa rose	*Acrididae*	Grasshoppers
Rubus hispidus	Swamp dewberry	*Aedes cantator*	Brown salt marsh mosquito
Rumex sp.	Docks	*Aedes sollicitans*	Salt-marsh mosquito
Sabatia stellaris	Sea pink	*Asilidae*	Robger flies
Salicornia sp.	Glasswort	*Carabidae*	Ground beetles
Salsola kali	Common saltwort	*Ceratopogonidae*	Biting midges

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Scientific Name	Common Name	Scientific Name	Common Name
INSECTS (Continued)		**SUBMERGED AQUATIC VEGETATION (Con't)**	
Cicindela dorsalis dorsalis	Northeastern beach tiger beetle	*Chaetomorpha sp.*	—
Coelopidae	Kelp flies	*Champia parvula*	Barrel weed
Chironomidae	Non-biting midges	*Chondrus crispus*	Irish moss
Coccinellidae	Ladybug beetles	*Cladophora sp.*	—
Dytiscidae	Predaceous diving beetles	*Codium fragile*	Green fleece
Formicidae	Ants	*Crytomonas sp.*	Phytoplankton
Gryllidae	Crickets	*Cycotella sp.*	Phytoplankton
Lycosidae	Wolf spiders	*Cylindrotheca closterium*	Phytoplankton
Miridae	Plant bugs	*Enteromorpha sp.*	Hollow green weed
Mutilidae	Velvet ants	*Eutreptia viridis*	Phytoplankton
Muscidae	Stable flies	*Fucus vesiculosis*	Rockweed
Odonata	Dragonflies	*Gracilaria foliifera*	Graceful red weed
Poduridae	Springtails	*Gracilaria verrucoasa*	False Agardhiella
Ptilidae	Feather-winged beetles	*Minutocellus polymorphus*	Phytoplankton
Reduviidae	Assassin bugs	*Nannochloris sp.*	Phytoplankton
Sphecidae	Sand wasps	*Punctaria latifolia*	Delicate ribbon weed
Staphilinidae	Rove beetles	*Ruppia maritima*	Widgeon grass
Tabanidae	Deer and greenhead flies	*Skeletonema costatum*	Phytoplankton
Tenebrionidae	Darkling Beetles	*Sphacelaria cirrosa*	—
SUBMERGED AQUATIC VEGETATION		*Strichlococcus sp.*	Phytoplankton
Agardhiella tenera	Agardh's red weed	*Thalassionima gravida*	Phytoplankton
Aureococcus anphagefferens	"Brown Tide" chrysophyte	*Ulva lactuca*	Sea lettuce
Ceramium sp.	Banded weeds	*Zostera marina*	Eelgrass

DEIS Appendix E
New York District Biological Assessment
Sea Beach Amaranth and Piping Plover

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

October 7, 1999

Planning Division

David Stilwell
Acting Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, New York 13045

Dear Mr. Stilwell:

This letter is a follow-up to our letter dated August 23, 1999 regarding the potential impacts of the proposed Fire Island Interim Project on the Federally-listed piping plover (*Charadrius melodus*), seabeach amaranth (*Amaranthus pumilus*), and roseate tern (*Sterna dougallii dougallii*).

The aforementioned letter discussed two points: 1) six-year project life and 2) the development and incorporation of conservation measures and enhancement features into the project description. To better facilitate the development of these enhancement features with your Long Island Field Office staff, we request that the consultation period be extended to January 31, 2000. This extension will allow the Service and the District to ensure that all actions will be beneficial to the current ecological, commercial and recreational uses associated with the project area.

We look forward to continued cooperative effort during the consultation process. If you have any questions, our point of contact regarding this matter is Peter Weppler, Project Biologist, telephone number 212-264-0195.

Sincerely

Frank Santomauro, P.E.
Chief, Planning Division

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

August 23, 1999

Planning Division

David Stilwell
Acting Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, New York 13045

Dear Mr. Stilwell:

This letter is in response to the U.S. Fish and Wildlife Service's (Service) letter dated July 14, 1999 regarding the impacts of the proposed Fire Island Interim Project on the Federally-listed piping plover (*Charadrius melodus*), seabeach amaranth (*Amaranthus pumilus*), and roseate tern (*Sterna dougallii dougallii*).

The letter states that for the preparation of the Biological Opinion for the above-mentioned species, the Service will use a recommended project life of fifteen (15) years for its evaluation. Please be aware that recommended project life as described in the June 9, 1999 Biological Assessment and the Draft Decision Document (Volume 1 – Main Report and Draft Environmental Impact Statement) dated May 1999 is six (6) years. The 6-year project life was the result of discussions between our agencies concluding in the Interagency Partnership Agreement, dated May 28 and June 1, 1999. The project is defined as initial placement (with advance nourishment), and one scheduled renourishment. As such, the project's Biological Opinion should be for 6-years.

As a follow-up to discussions started with the Service and Fire Island National Seashore (FIIS) regarding the development and incorporation of conservation measures and enhancement features, we are reviewing the Smith Point County Park Master Plan, date January 1997 to see if our potential recommendations are compatible with the Suffolk County's vision. We would like to make this a cooperative effort to ensure that all actions will be beneficial to the current ecological, commercial and recreational uses associated with the project area.

We look forward to continued exchange of project information during the consultation process. If you have any questions, our point of contact regarding this matter is Peter Weppler, Project Biologist, telephone number 212-264-0195.

Sincerely

Peter R Blum 8/20

for Frank Santomauro, P.E.
Chief, Planning Division

Copy Furnished: Mars-LIFO

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

July 16, 1998

REPLY TO
ATTENTION OF

Environmental Analysis Branch
Environmental Assessment Section

Ms. Sherry Morgan
Field Supervisor
U.S. Fish and Wildlife Service
New York Field Office
3817 Luker Road
Cortland, NY 13045

Dear Ms. Morgan:

This letter serves to notify the U.S. Fish and Wildlife Service that the New York District has prepared a Biological Assessment on the Federally listed plant species, seabeach amaranth (*Amaranthus pumilus*) and shorebird, the piping plover *(Charadrius melodus)* which occur within the Fire Island Interim Storm Damage Protection Project area.

With the forwarding of the completed Biological Assessment, the District requests to initiate formal consultation with the Service as specified in 50 CFR Part 402.14(c) under Section 7 of the Endangered Species Act. If the information provided does not fulfill the Service's requirement for initiating formal consultation, we request that you contact Mr. Peter Weppler to arrange a meeting with our respective staffs to resolve any outstanding concerns promptly.

If you have any questions please contact Mr. Weppler at (212) 264-4663.

Sincerely,

Frank Santomauro, P.E.
Chief, Planning Division

Enc.
CF: Papa, USFWS-LIFO

Biological Assessment

Potential Impacts of the Fire Island Inlet to Moriches Inlet Interim Storm Damage Protection Project (FIIP) on the Federally listed plant species seabeach amaranth (*Amaranthus pumilus*) and shorebird species, the piping plover *(Charadrius melodus)*

1.0 Introduction

The U.S. Army Corps of Engineers, New York District (District), is conducting a study to evaluate Federal participation in providing interim storm damage protection measures for the Fire Island Inlet to Moriches Inlet Reach of the Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project (FIMP).

Portions of the barrier beach within FIIP project area is suffering from severe erosion which threatens the mainland of southern Long Island communities with increased exposure to storm damages. Recent coastal storm damage to the mainland and barrier islands resulting from a series of severe northeasters (i.e. Oct. 1992, December 1992, March 1993) has exacerbated this condition. The New York State Department of Environmental Conservation along with various congressional representatives and affected municipal officials, requested that the District study the feasibility of providing short-term protection until the results of the reformulation study are determined.

The Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 1531 et seq.) mandates the protection from extinction of uncommon or threatened wildlife and plant species. Section 7(a) of the ESA requires Federal agencies to evaluate their actions with respect to any listed or proposed species or listed/proposed critical habitat. Section 7(a)(2) of the Act requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or results in the destruction or adverse modification of its critical habitat. The responsible Federal agency must enter into formal consultation with the U.S. Fish and Wildlife Service or National Marine fisheries Service if it determines that its action may affect a listed species, or its critical habitat.

Any actions within the Fire Island National Seashore (FINS) shall be exercised in accordance with a plan that is mutually acceptable to the Secretary of Interior and the Secretary of the Army and that is consistent with Public Law 88-587, the enabling legislation creating FINS.

The Atlantic Coast population of piping plover *(Charadrius melodus)* was designated as Federally threatened on January 10, 1986 (Federal Register; December 11, 1985). Seabeach amaranth *(Amaranthus pumilus)* was designated as Federally threatened on May 7, 1993 (Federal Register; April 22, 1993). Both species occur in and around the project area (USACOE, 1996).

This Biological Assessment (BA) shall address potential project impacts on the piping plover and seabeach amaranth and measures to avoid or minimize such impacts.

2.0 Project Description

Study Area. The FIIP study area is located entirely in Suffolk County, Long Island, New York, along the Atlantic shore and is within the larger area under study as part of the Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point (FIMP), Beach Erosion Control and Hurricane Protection Project. This area of coastline is vulnerable to storm damage and severe overwashing that may lead barrier island breaching. Great South Bay and Moriches Bay are connected to the Atlantic Ocean through Fire Island Inlet and Moriches Inlet, which are maintained as Federal navigation channels. The project area encompasses the barrier island from Fire Island Inlet to Moriches Inlet, including the bay shorelines, adjacent back-bay areas, and mainland. The study area on the mainland extends from Strong Point in Lindenhurst to Smith Point. The barrier island of the project area is approximately 32 miles in length and includes populated communities as well as Fire Island National Seashore, Robert Moses State Park, and Smith Point County Park.

The basic design of the interim plan consists of beach nourishment. The plan for the project area includes a protective minimum beach berm width of 90 feet (ft) at elevation +9.5 ft NGVD berm and a minimum 25-ft wide dune crest at elevation +15 ft NGVD fronted by advance fill. For a complete description of the proposed project alternative, please see Attachment 1.

The anticipated date of construction has been scheduled for the spring of 2001 for a duration of approximately 18 months. In addition to USFWS' Section 7 formal consultation concerns, FINS has implemented an Endangered Species Habitat Management Plan that will restrict activities March 1 – September 1 in the year 2000 (NPS, 1998). It shall be assumed that 2001 and beyond shall have the same restrictions. Due to the safety concerns and higher costs associated with work performed in the late fall and winter months, construction most likely will occur sometime during the piping plover breeding and seabeach amaranth growing season. It may be possible to schedule the work to initiate in July, after plover nesting areas have been established. This assessment will also be coordinated with FINS to address their concerns as well.

Expected staging areas for construction vehicles and personnel are expected throughout the placement area during various stages of the project. Specific areas are to be determined during the Plans and Specifications stage of the project.

3.0 Pipinq Plover *(Charadrius melodus)*

3.1 Background

The piping plover is a small, sand-colored shorebird approximately 7 inches long with a wingspan of about 15 inches. Breeding birds have white underparts, light-beige back and crown, white rump and black upper-tail with a white edge. Breeding plumage characteristics are a single black breastband, often incomplete, and a black bar across the forehead. The black breastband, is generally more pronounced in breeding males than in females (Wilcox, 1939). Eggs are an average 1.2 x 1.0 inches in diameter. They are laid daily, with four being the usual clutch size; rarely as few as two eggs are found, with eight the highest reported (Hussel and Woodford, 1985). Incubation is shared equally by both sexes, with hatching usually in 27-28 days (occasionally as long as 31 days). Young birds can leave the nest within a few hours, and can fly at 30-35 days of age (Wilcox, 1959).

One brood a season is the average, but if the eggs or nest are destroyed during their initial attempt, the same pair will often rebuild another during the same season usually within 100-200 feet from the first. Wilcox found most pairs did not remain mated together beyond the first year; but that those that did had a much greater tendency to return closer to the previous years nest (average distance of 204 feet between the two years nest, with a maximum of 1,150 feet) than those birds that chose a new partner (average distance of 788 feet between the two years, with a maximum of 8,600 for males, and a much greater separation of up to 82,363 feet for females). Downer and Leibelt (1990) reports an average annual turnover rate of 23-30% among the known nesting sites on Long Island, indicating that plovers regularly shift within the breeding areas. In Wilcox's study of three breeding areas on Long Island, young birds, returning the year after their hatching, were more likely to nest in a different area from which they were hatched. Adults were much less likely to leave their original nesting area, though they frequently change nest sites within the area. It should be pointed out that only one-quarter of Wilcox's banded birds were recaptured. It is likely, that at least some of the banded birds returned to nesting areas other than the three Wilcox concentrated on, while unbanded birds from other areas may have moved into his study area as well.

Piping plovers breed on the northern Great Plains, around the Great Lakes, and along the Atlantic Coast. The Great Lakes population is listed as endangered; the others are listed as threatened (USFWS, 1985). Breeding grounds are occupied from late March to August. Wintering occurs along the Atlantic (North Carolina to Florida) and Gulf of Mexico Coasts, as well the Bahamas and West Indies (USFWS, 1985).

The coastal populations choose breeding habitat that is dry and sandy, open water beaches well above high tide. Grassless areas are traditionally utilized, though openings in grassy dunes as small as 200-300 feet wide may be used (Wilcox, 1959). District biologists have spotted plover nests along the southern shore of Long Island, in grassy areas at the edges of dunes and even behind dunes in blowouts. The 1989 Long Island Colonial Waterbird and Piping Plover Survey reports that Long Island nests are located primarily on peninsulas (30%) and barrier islands (39%). Other breeding areas include shoreline/ocean/estuary (24%) and saltwater non-barrier island (5%). Sand and/or gravel beaches (87%) were the most frequently used nesting areas with dune (7%) being used less often. Sand was the predominant nest substrate (90%), although gravel (11%) was also used. Nests are shallow, scraped depressions, sometimes lined with small pebbles, shells, or other debris (USFWS, 1985). The shell lining is apparently common among the Long Island population (Wilcox, 1959). Densities as great as 20 pairs along a 2-mile stretch of beach just west of Moriches Inlet have been reported by Wilcox (1959) and as much as 31 pairs (between Moriches and Shinnecock Inlet) in 1997.

Adults and chicks feed on small crustaceans, mollusks, marine worms, insects, insect larvae, and other invertebrates. They forage in the intertidal zone of bays and inlets and on oceanfront sand beaches, mud flats, and tidal wrack deposits. Most feeding occurs at low or falling tides during the daytime.

3.2 Piping Plover Status on Long Island

On Long Island, piping plovers begin arriving at the nesting area during the last week of March (Wilcox, 1959). Earliest egg laying is late April. Earliest hatching is late May, with most hatching complete by mid to late June. Brooding is completed within 20 days and all young are gone from the nest by late July. Wilcox (1959) reports that chicks leave the nest soon after hatching, but usually stay within 400-500 feet of the nest until time of flight (30-35 days after hatching). Even very young birds are very agile, Wilcox having timed chicks as young as 2 days old running 81 feet in twelve seconds. Based on data collected in 1996, 256 pairs of piping plovers nested on Long Island, up from 249 pairs in 1995 and 209 pairs in 1994 (Sommers and Alfieri, 1997). Recent increases in plover monitoring efforts acknowledge these as accurate counts. The population of piping plovers in New York over the last 10 breeding seasons is believed to have remained relatively constant .

Because of their smaller size, subpopulations of piping plovers such as those found on Long Island face increased risks of extirpation. This is especially true when productivity is substantially below that which is recognized as the coast-wide average and needed to maintain a resilient population. Unfortunately, this is the present situation on Long Island (except for an area within Westhampton Beach.). These poor rates of reproductive success have been recently documented in what has been described prime plover habitat with very little human disturbance present (Elias-Gerken, 1994).

Plover productivity within the Westhampton area in 1997 was higher than the 0.8 to 1.24 chicks/pair needed to maintain a stationary population (Houghton, et.al., 1997). It is likely that the large increase in piping plover productivity was due to good predator management associated with the recently constructed Corps beach nourishment project at Westhampton. Symbolic fencing and active on-site monitoring of the nesting and foraging areas decreased human disturbance within those areas. Disturbance issues likely will increase as the area becomes more populated and since the project is not presently active, fencing and daily monitoring by the Corps will not occur.

3.3 Piping Plover Status within Proposed Project Area

Piping plovers utilize the habitat found at the study site. However, nesting has not occurred successfully in the last three years and productivity can be assumed low. To create more favorable conditions within the Seashore, the FINS has implemented the Endangered Species

Habitat Management Plan that restricts beach driving from April 1 – July 15 this year, and extending them from March 1- July 15, and March 1 – September 1, in 1999 and 2000 respectively (NPS, 1998). As of this writing, one nest consisting of four eggs has been identified near the Old Inlet area.

3.4 Non Activity Factors Affecting Plovers

According to the U.S. Fish and Wildlife Service (1985), there is enough available information to indicate a substantial decline in the species and its habitat, shrinkage of its breeding range, and continued threats to the species, its habitat, and range. As late as the 1920's the piping plover was still considered common along the Atlantic Coast. Since 1972, the National Audubon Society has continued to include the plover on its Blue List of breeding birds in potential trouble. On Long Island alone, the birds have declined from an estimated population of over 500 breeding pairs (Wilcox, 1959) to the present estimate of 249 pairs (Somers, et. al., 1996). Increased beach development and recreational use are considered the major reasons for the decline, with the latter primarily responsible for curtailed breeding success (USFWS, 1985). The 1989 Long Island Colonial Waterbird and Piping Plover Survey reported that on Long Island, human recreation and vehicle use accounted for the greatest disturbances to nesting birds (54% and 41% respectively), with pets (27%), habitation (21%), predation (25%), and flooding (15%) being other current forms of disturbance. One-third of all nesting sites are on private property, and therefore under the potential threat of future development. While habitat on public lands protected by restrictions on development are not free from disturbances, the remaining nesting sites use public recreational beaches. Heightened local and public concern for the plight of shorebirds such as the plover has led to active protective measures and possibly stabilized population estimates in recent years. However, because of the non-colonial nature of piping plovers, their breeding areas aren't as conducive to protection as the colonial species (such as terns). Approximately 25% of the plover nesting areas examined by the aforementioned plover survey had no recorded protection, and just about all nesting areas were in close proximity to human use. Such exposure however, does tend to acclimate birds to human activities, thereby reducing their tendency to permanently abandon nests when startled. Such a phenomenon has been observed by District biologists on a number of occasions when birds disturbed repeatedly by human activity continually returned to their nests and successfully hatched full broods.

3.5 Potential Direct Effects of Proposed Action

It is anticipated that dredging would have no adverse impact on piping plovers, as the material to be removed is taken from the offshore, an area which does not represent a special, unique, or limited habitat for this species. No loss of breeding habitat would occur as a result of the proposed dredging therefore, no threat to the species, continued existence, or decline in its current population is anticipated. Stabilizing the eroding beaches within the proposed project area may have a positive effect on maintaining or increasing suitable shoreline nesting or feeding habitat in the long-term.

Potential adverse impacts to piping plover habitat could result from the proposed filling activities. The sand would be moved through hydraulic pipeline that would extend from the dredging site across the inlet and nearshore. Due to the placement activities, there may be a temporary decrease in the habitat quality of piping plover's food source (macro invertebrates), resulting in a decrease in the value of the foraging habitat until the newly placed beach is stabilized and its faunal community restored. Potential newly hatched and older plover chicks feeding along the shoreline in the vicinity of the placement area (if nesting occurs) could be impacted. If construction begins during the breeding season, activity associated with the laying of the pipeline could disrupt breeding and nesting of plovers, whereas the pipe itself could serve to block access of young chicks to the shoreline. If the pipe is laid along the surface of the beach for its entire route (as normally occurs) this could affect all multiple nesting sites. In a similar situation, all mobile equipment poses direct threats to nests (crushing), chicks (crushing, trapped in tire ruts), as well as direct disturbance to chicks and adults from the presence of equipment and humans.

Beach slope is also a critical factor for piping plover habitat selection and use. It is important not to design a slope greater than the piping plover can utilize. In order to maintain existing habitat conditions, the slope of the placement material shall be consistent with adjacent existing beaches that contain successful brooding areas.

3.6 Potential Indirect Effects of Proposed Action

The increasing of barrier island height and width may be either beneficial or detrimental to piping plovers. However, a stabilized beach should result in longer-term protection of habitat currently being lost to storm-induced erosion. Adversely, early successional habitats formed by way of overwash activities will be decreased due to the reduction of overwashes from occurring.

Impacts associated with the No Action alternative are:

a. An increase in suitable nesting and foraging habitats associated with overwash activities after breach closure.

b. Stability in the number breeding pairs and productivity in non-erosional areas.

c. Increase in the loss of eggs or chicks if breach occurs in nesting season.

d. Reduction in habitat formation associated with inlet creation.

e. Continued loss of beach habitat in erosional areas.

In the severely eroded areas, there is a potential that the number of breeding pairs may increase due to the increase in berm width which will decrease the probability of piping plover habitat loss through major hurricane or major storm activities. Concurrently, there is also the potential that the increased berm width may provide habitat for predatory species and an increase in vegetation establishment.

3.7 Proposed Mitigation/Conservation Measures

Various measures are being proposed to be incorporated into the Plans and Specifications that will minimize potential direct adverse impacts to piping plovers. Many of these are based on measures employed during the Westhampton beach nourishment project with satisfying success. The hydraulic pipeline will be placed offshore as much as possible to allow the plover chicks to forage unobstructed. The pipe will placed in the nearshore zone as much as possible to lessen contact with the beach. A District biologist or designated representative will be present during pipeline construction to ensure the approved alignment is adhered to. If a nest is present prior to pipeline construction activities will be delayed to allow the plover chicks to fledge.

Because of continuous construction activity, it is doubtful that any plover pair would be able to successfully nest along the actual placement site, unless construction is delayed to summer. However, plovers often change nesting sites within a given area and should be able to establish nests in the undisturbed beach areas outside the nourishment site as occurred after filling the Westhampton breach, and the construction of the Westhampton Interim Project. It is still conceivable that a pair could attempt to nest behind the pipe, in a widened area that was formed earlier in the project. This is not likely given the unsettled nature of the recently deposited sand, and the presence of continued construction activity further up the beach. Regardless, should a nest be built in proximity to the pipe, actions would be taken to shield the nest from construction activity in its immediate vicinity until the checks are fledged. Work would be redirected away from the nest via exclosure erection and fencing, which would also keep any chicks away from the placement area being filled.

Dredging will take place continuously, from the time the pipe is laid until completion. If practicable, the District will limit the operation by restricting dredging during the more sensitive, early nesting period (April-July). The noise from sand moving through a pipeline to the placement area would be negligible as a cause of disturbance, as the birds are themselves adapted to louder natural surf sounds.

To ensure that impacts to the piping plover are minimized the following mitigation measures shall occur during each placement cycle:

All fill shall consist of "clean" sand fill material and shall conform with the existing beach substrate and consist of material that is capable of maintaining suitable piping plover and seabeach amaranth habitat. Grain size shall be compatible with existing beach material.

Excavated sediments shall be placed directly into the disposal site. No side casting (double handling) or temporary storage of dredge material at the placement site is authorized.

The storage of equipment and materials shall be confined to within the project work site and or upland areas greater than 75' from the tidal wetland boundary (intertidal zone) .

If present, there shall be no disturbance to vegetated tidal wetlands outside the boundaries of the placement area as a result of the construction activity.

The Service shall be notified of the start and the completion date of the proposed project.

If construction activities are initiated outside the piping plover nesting season, all feasible attempts shall be made to complete the proposed fill activity prior to the start of the nesting season (April 1).

Nest exclosures will be installed (under supervision of Corps biologists or designated representatives) on selected piping plover nests within 660' of the project area.

The contractor and employees shall be adequately informed of Endangered Species Act concerns, and contractor specifications written accordingly. These shall be highlighted prior to construction actions, when possible.

3.8 Monitoring Program

In addition to the above mitigation measures for minimizing impacts within the nesting season, the District will institute a monitoring program designed to assure the protection of the piping plovers during construction. In addition, the program will also be designed to collect data that will add to our understanding of how to implement future actions to further reduce potential for impacting plovers and improve habitat and productivity. The program will consist of the following:

1. If construction activities occur between April 1 and September 1, the District will initiate the following monitoring program:

a. A qualified Corps biologist or designated contract biologist will commence a site survey April 1, three times a week through July 1. If piping plovers are found to nest in the proposed construction area during that time, surveys will be increased to daily coverage (including the full tidal cycle) until the last bird is fledged. The monitor shall maintain field notes, which shall be provided to the U.S Fish and Wildlife Service and New York Department of Environmental Conservation (NYSDEC) as agreed upon. The Service in consultation with the District may modify survey and monitoring specifications based on site specific considerations to avoid any adverse effects. The District shall ensure coordination between its designated contract biologist and the project engineer responsible for the oversight of construction activities.

b. Fencing and/or exclosures will be utilized to protect the nests in the disturbance area until hatching. No placement activities shall be allowed within 660 feet of such fenced area. However, other construction-related activities of lesser extent (i.e. surveying, framing, equipment set-up, etc) will have 300 foot buffers. The District understands that this is below the standard 660 foot construction activity threshold established in other Biological Opinions. However, as demonstrated with the nests within the Village of Westhampton Dunes, these type of impacts combined with proper protection measures is not as profound on the nesting plovers as actual placement activities. If the designated bird monitor finds that the above procedures are not effective, the buffer will enlarged back to 660 feet. The boundaries of the protected areas shall be adjusted based on monitors observations of plover use should plovers move outside the originally posted area. Areas will be expanded and contracted to accurately reflect the changes in use.

c. Courtship areas, nesting, and brood rearing areas shall be posted immediately (supervised by the monitor) and no disturbance shall be permitted within 660 feet of the designated area. Adult (fledged) foraging areas will also be posted, but the buffer will be 300 feet. The biological monitor will pay special attention to such areas while construction is nearby. The posted areas shall extend from the ocean side low water line to the furthest extent of the natural or man made feature which would prohibit piping plover chicks from traversing the area (e.g. scarp or dune). Monitors shall document any reactions to disturbance from the fill activity to determine the effectiveness of the buffer. When the chicks begin to feed, the monitor will direct the contractor away from the chicks, and if necessary, temporarily stop construction in the feeding area. A reduction or expansion in the buffer may be established, after consultation with USFWS due to observed reactions, changes in use (abandoned nests), or natural/man-made features, which inhibit piping plovers traversing the area.

d. In addition to identifying and posting activities, the monitor shall also be observing for disturbance to plovers from project activities, including survey, stockpiling, access routes, and transportation of new material to construction site. If such an act results in observed disturbances, then the monitor will initiate immediate, if temporary corrective actions to avoid same and report to Corps or Service representatives to establish permanent procedures to address such disturbances. Temporary intrusions into fenced areas (i.e. surveys) shall be accompanied by a monitor and will be curtailed if there is any disturbance observed.

e. A system of notification shall be established. If disturbance of Piping plovers cannot be avoided with the ongoing construction activities, the District shall contact the Service by the end of that working day for further consultation. The monitor shall also notify the Corps' project engineer and biologist, on-site contractors, and the NYSDEC. The on-site contractors shall be notified immediately and activities adjusted or halted by the monitor to avoid or minimize any immediate threat to the birds. In the event that an adult or chick is injured or killed during the construction activities two sets of actions will be undertaken by the monitor: (1) notification of all appropriate personnel (the Corps, the

Service, NYSDEC, contractor, managers etc.) and (2) collection of evidence, information and production of a written record. The information will include; the incident, the time and location, maps, photographs (if possible), a written description and names and telephone numbers of witnesses to the incident or the discovery.

f. The Service, the New York State Department of Environmental Conservation, or their designated representatives should be given access to the action area, subject to site safety plans, for the purpose of surveying, monitoring, posting, and/or symbolically fencing piping plover courtship, nesting and brood rearing areas, and, erecting predator exclosures for nests during the plover breeding season (April 1 to September 1). Access shall be given during daylight hours on any day(s) of any given year at the required frequency to accomplish the purposes stated above. Symbolic fencing may be placed in a 50 meter radius around nest sites where pedestrians, joggers, picnickers, fisherman, boaters, or other recreational users are present in numbers that could harm or disturb incubating plovers, their eggs or chicks.

All protection measures will follow and be consistent with the Service's Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitats on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the ESA.

4.0 Seabeach Amaranth (Amaranthus Pumilus)

4.1 Background

Seabeach amaranth is indigenous to Atlantic Coastal Plain beaches, with 13 known populations in New York State. The species occurs on barrier island beaches, where its primary habitat consists of overwash flats at accreting ends of islands and lower foredunes and upper strands of non- eroding dunes. It sometimes establishes small temporary populations in other areas, including bay-side beaches, blow- outs in foredunes, and beach nourishment material. According to Weakley and Bucher (1991), "Seabeach amaranth appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. This allows it (seabeach amaranth) to move around in the landscape, as a fugitive species, to occupy suitable habitat as it becomes available."

Seabeach amaranth is an annual plant that germinates from April to July. Upon germinating, the plant becomes a small unbranched sprig, but quickly branches into a clump consisting of 5-20 branches. The stems are fleshy and pink-red with small rounded leaves approximately 2.0 cm in diameter. The leaves are at the tip of the stem and usually a spinach-green color with a small notch at the rounded tip. Flowering begins as early as June, but more typically starting in July and continuing until death in September.

4.2 Non-Activity Factors Affecting Seabeach Amaranth

Seabeach amaranth has been and continues to be threatened by destruction or adverse alteration of its habitat. Although storms and related erosion of beaches threaten the species, non-coordinated efforts to stabilize beaches can be more destructive to the species in the long term. However, beach renourishment projects can have positive impacts on the species.

Unrestricted recreational use of beaches is known to threaten populations of seabeach amaranth. Pedestrian activity occurs during the growing season, but does not usually occur where the species is present because most people will walk around any plant when observed. Off-road vehicle (ORV) use during the growing season has adverse effects if the vehicles are not routed around the plants. The stems of the plant are brittle and are easily broken, therefore killing the plant and reducing seed production. If ORV use takes place in the dormant season, then the impacts are not as significant, unless it degrades or alters the physical aspects of the habitat.

4.3 Potential Direct Effects of Proposed Action

Dredging of the borrow area would have no adverse impact on seabeach amaranth, as the material to be removed does not represent a special, unique, or limited habitat for this species. No loss of habitat would occur as a result of the proposed dredging therefore, no threat to the species, continued existence, nor cause a decline in its current population.

Potential impacts would occur via the beach nourishment part of the proposed action. Direct sand placement onto the plant species, will result in mortality with no chance of seed production. This could significantly impact the local population.

Beach slope is also a critical factor for seabeach amaranth habitat selection and use. It is important not to engineer a slope greater than what is exhibited at seabeach amaranth locations, if present. In order to maintain existing habitat, the slope of the placement material must be consistent as compared to the current habitat.

Overwash areas have been identified as being primary habitat for the seabeach amaranth. Being a temporary species, seabeach amaranth occupies suitable habitat when it becomes available, i.e. washovers, therefore stabilizing these areas before they breach could decrease such overwashes.

Trampling by workers or construction equipment could also destroy the plants directly.

4.4 Proposed Management Practices

A District or contract biologist/botanist or designated representative will survey the area immediately prior to any project activity within the seabeach amaranth growing season (May 1 - November 1). Approximately twice a month, June 15 to October 15 the project area will be surveyed. Records shall include plant locations, numbers of plants and size of plants . If there is any seabeach amaranth present, the District shall record seabeach amaranth locations. If construction personnel or vehicles are at the site or might transit the site, symbolic fencing will be placed in a 10 foot diameter ring.

All construction activities shall avoid all delineated locations of seabeach amaranth where feasible. The District will undertake all practicable measures to avoid an incidental take. In the unlikely event that the species appears at the placement area, and there is a very good possibility that the surrounding placed sand will encroach upon and smother the plant, the District proposes to transplant the individual plant to a similar habitat near or within the project area to lessen the impact of placement. Transplantation will include removal of a sufficiently large enough and intact volume of sand to include the full extent of the roots. This action, when necessary, will occur as soon as possible after the plant is identified and every attempt will be made to include the entire (undamaged) root system.

If present, seeds of all plants transferred will be harvested and stored to be replanted at a later date. A portion of this seed shall be sent to a qualified nursery to attempt germination. If successful, germinated plants will be replanted in suitable habitats in the project area, including sited already nourished. These plants will be monitored to determine its ability to re-establish itself under various conditions for future mitigation efforts under FIMP or other interim projects.

It is understood that this action, when feasible will be undertaken for individual plants whose destruction could not be avoided. The action will be attempted as a means of mitigating such loss but will not be construed as a long-term commitment or research on the part of the District by replanting beyond the second year.

Placement areas shall be finished to a natural grade with compatible material.

A System of Notification similar to the one described above for the piping plover will also be utilized for seabeach amaranth.

5.0 Other Species of Concern

The habitats utilized by piping plovers are dynamic, storm-maintained environments. Other flora and faunal considered threatened or endangered by New York State utilize the same environments. These species include the state-endangered least tern *(Sterna antillarum)*, and state-endangered plant species, seaside knotweed *(Polygonum glaucom)*.

6.0 Summary of Overall Impacts and Proposed Mitigation

Impacts due to project implementation to nesting piping plovers and existing seabeach amaranth are possible. No contractor shall be allowed into nesting areas without being accompanied by a qualified biologist. Dredging will occur continuously, 24 hr/day until placement activities are completed. Sources of loud noise (above that of movement through the pipe, i.e. earth-moving equipment) will be muffled to minimize disturbances.

Additional impacts to the feeding activity of the piping plovers may occur. Piping plover chicks feed on their own almost immediately after hatching, and must have access ~~to a~~ beach or other shoreline until they are able to fly. A pipeline lying across the beach would block access to its food source. Practicable measures (i.e. pipeline burial or elevation) will be undertaken to allow the piping plover chicks to feed undisturbed.

A survey/monitoring effort will be undertaken. District biologists will be on site during laying of the pipeline to ensure it is aligned in the agreed to manner (as designated by the local, State, and Federal agencies involved with project review). During placement operations, the District will conduct on-site monitoring and fence habitat of concern for specific nests or plants, to ensure the activity is not impacting nesting and brooding behavior. Monitoring will be flexible, and include full reporting of finding to the Service and potential consultation to modify any procedures to reflect actual observed impact associated responses.

There is a potential that the number of breeding pairs may increase due to the increase in berm width as that there will be a decrease in the probability of piping plover habitat loss through major hurricane or major storm activities. Concurrently, there is also the potential that the increased berm width may provide habitat for predatory species and an increase in vegetation establishment.

7.0 Conclusions

Given the control measures summarized above and detailed in the earlier sections and the local implementation of existing USFWS protection measures, impacts to either piping plovers or seabeach amaranth associated with the proposed projects will be minimized. The precautions taken will allow dredging or upland source placement of fill and continuous operation, thereby providing the most cost-effective expeditious operation minimizing long-term plover and seabeach amaranth impacts. These conditions are consistent with the findings during previous beach nourishment and breach filling activities between 1994 and 1997.

It is noted that quality piping plover habitat is extremely limited on Long Island. It should be maximized in areas that promise, or are maintained as, low disturbance areas. For Long Island, recent plover seasons showed that the physical existence of an open connection to the ocean is not the feature that promotes habitation by piping plovers. Rather, it is those features that result from the major storm events (severe overwashing, breaching) that attracts plovers. Potential habitats such as this could be created and/or maintained in many areas along the project area. Non-destructive modifications such as the removal of phragmites and dense invasive scrub (which can provide cover for predators), and the creation of overwash fans, spits, and ephemeral pools may be feasible enhancement measures to increase potentially useable habitats. These features are being studied via specific habitat research funded by the District, along the very productive Westhampton portion of the barrier island system. Pending findings and recommendations of the studies, such features could be created and included as part of an enlarged mitigation for construction activities or as separate restoration measures to address past impacts along the southshore estuarine ecosystem. What can be achieved is balance that offers mitigation of beach nourishment activities as a method of propagating and maintaining piping plover habitat while simultaneously creating a solution to the storm induced erosion problem and it's associated safety and economic problems.

REFERENCES:

Downer, R. and C. Leibelt. 1990. 1989 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

Elias-Gerken, Susan.P. 1994. "Piping plover habitat suitability on Central Long Island, New York Barrier Island." M.S. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Hussel, D.J.T., and J.K. Woodford. 1985. "Piping Plover's Nest Containing Eight Eggs". Wilson Bulletin. 77:29A

Leatherman, S.P., and J.R. Allen, eds. 1985. Final Report: Fire Island Inlet to Montauk Point, Long Island, New York - Reformulation Study. National Park Service - North Atlantic Region, Boston, MA. Report to USACOE, NY District.

National Park Service. Fire Island National Seashore. 1998. Environmental Assessment for Endangered Species Habitat Management. 11, February.

New York State. Department of Environmental Conservation. 1997. 1997 Long Island Colonial Waterbird and Piping Plover Survey. Preliminary Tables l.

Somers, et. al. 1996. 1995 Long Island Colonial Waterbird and Piping Plover Survey. The New York State Department of Environmental Conservation, Stony Brook and Delmar, New York.

Somers, L.A. and M.L. Alfieri 1997. 1996 Long Island Colonial Waterbird and Piping Plover Survey. The New York State Department of Environmental Conservation. Stony Brook and Delmar, New York April.

Suffolk County Parks. 1997. Unpublished Maps and Piping Plover Data Sheets for the Tiana Beach Area.

United States Fish and Wildlife Service. 1985. "Endangered and Threatened Wildlife and Plants; Determination of Endangered and Threatened Status for the Piping Plover; Final Rule". Federal Register. Vol 50, No. 238 (Wed, Dec 11, 1985): 50726-50733.

United States Fish and Wildlife Service. 1993. "Endangered and Threatened Wildlife and Plants; Determination of Endangered and Threatened Status for Seabeach Amaranth; Final Rule". Federal Register. Vol 50, No. 238 (Wed, April 7, 1993): 18035-18042.

United States Fish and Wildlife Service. 1994 Biological Opinion: West Hampton Interim Storm Damage Protection Project (USACOE).

United States Fish and Wildlife Service. 1995. Biological Opinion: Fire Island Inlet to Montauk Point, New York Breach Contingency Plan (USACOE).

United States Fish and Wildlife Service. 1994 Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitats on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the ESA.

United States Army Corps of Engineers. 1994. Fire Island Inlet to Montauk Point, New York: Emergency Breach Closure at Westhampton (Moriches to Shinnecock Reach). Final Environmental Assessment. New York District.

Weakley, A. and M. Bucher. 1991. Status Survey of Seabeach Amaranth (Amaranthus pumilus) in North and South Carolina, 2nd Edition. USFWS, Asheville, NC

Wilcox, L. 1939. "Notes on the Life History of the Piping Plover". Birds of Long Island. 1:3-13.

Wilcox, L. 1959. "A Twenty Year Banding Study of the Piping Plover". Auk. Vol 76, No 2 :129 -152.

BIBLIOGRAPHY:

Andrle, R.F. and J. Carroll. 1988. The Atlas of Breeding Birds in New York State. Cornell University Press, Ithaca, New York.

Ducey-Ortiz, A. et al. 1992. 1991 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

Ducey-Ortiz, A. et al. 1989. 1988 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

MacLean, D. and T. Litwin. 1987. 1986 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

Maclean, D., et al. 1988. 1987 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

New York State. Department of State. 1987. Significant Coastal Fish and Wildlife Habitats in Nassau and Suffolk Counties. 16, February.

New York State. 1991. Department of State, Division of Coastal Resources and Waterfront Revitalization and The Nature Conservancy. (Draft) Long Island's Beach-Nesting Shorebird Habitat: Protection and Management of a Vulnerable Resource.

Peterson, et al. 1986. 1985 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

United States Army Corps of Engineers. 1977. Fire Island Inlet to Montauk Point, New York: Beach Erosion Control and Hurricane Protection Project. Final Environmental Impact Statement. New York District.

United States Fish and Wildlife Service. 1995 Revised Recovery Plan or piping plovers breeding along the Atlantic Coast. Hadley, MA

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

June 9, 1999

Planning Division
Environmental Analysis

David A. Stilwell
Acting Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, New York 13045

Dear Mr. Stilwell:

This letter is in reference to your letter dated June 2, 1999, regarding Section 7 consultation under the Endangered Species Act, for the proposed Fire Island Interim Project.

Your letter indicated that the project description (enclosure 2) was omitted from the transmittal. Please find enclosed the project description. If you have any questions regarding this matter please contact Mr. Peter Weppler, Project Biologist at (212) 264-0195.

Sincerely,

Frank Santomauro, P.E.
Chief, Planning Division

Encls.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

May 20, 1999

Environmental Analysis Branch
Environmental Assessment Section

Mr. David Stilwell
Acting Field Supervisor
U.S. Fish and Wildlife Service
New York Field Office
3817 Luker Road
Cortland, NY 13045

Dear Mr. Stilwell:

This letter serves to notify the U.S. Fish and Wildlife Service that the New York District has prepared a Biological Assessment on the Federally listed plant species, seabeach amaranth (*Amaranthus pumilus*) and shorebird, the piping plover *(Charadrius melodus)* which occur within the Fire Island Interim Storm Damage Protection Project area.

With the forwarding of the completed Biological Assessment, the District requests to reinitiate formal consultation with the Service as specified in 50 CFR Part 402.14(c) under Section 7 of the Endangered Species Act. If the information provided does not fulfill the Service's requirement for reinitiating formal consultation, we request that you contact Mr. Peter Weppler to arrange a meeting with our respective staffs to resolve any outstanding concerns promptly.

If you have any questions please contact Mr. Weppler at (212) 264-4663.

Sincerely,

/s/

Frank Santomauro, P.E.
Chief, Planning Division

Enc.
CF: Papa, USFWS-LIFO

Biological Assessment

Potential Impacts of the Fire Island Inlet to Moriches Inlet Interim Storm Damage Protection Project (FIIP) on the Federally listed plant species seabeach amaranth (*Amaranthus pumilus*) and shorebird species, the piping plover *(Charadrius melodus)*

1.0 Introduction

The U.S. Army Corps of Engineers, New York District (District), is conducting a study to evaluate Federal participation in providing interim storm damage protection measures for the Fire Island Inlet to Moriches Inlet Reach of the Fire Island Inlet to Montauk Point Beach Erosion Control and Hurricane Protection Project (FIMP).

Portions of the barrier beach within FIIP project area is suffering from severe erosion which threatens the mainland of southern Long Island communities with increased exposure to storm damages. Recent coastal storm damage to the mainland and barrier islands resulting from a series of severe northeasters (i.e. Oct. 1992, December 1992, March 1993) has exacerbated this condition. The New York State Department of Environmental Conservation along with various congressional representatives and affected municipal officials, requested that the District study the feasibility of providing short-term protection until the results of the reformulation study are determined.

The Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 1531 et seq.) mandates the protection from extinction of uncommon or threatened wildlife and plant species. Section 7(a) of the ESA requires Federal agencies to evaluate their actions with respect to any listed or proposed species or listed/proposed critical habitat. Section 7(a)(2) of the Act requires Federal agencies to insure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or results in the destruction or adverse modification of its critical habitat. The responsible Federal agency must enter into formal consultation with the U.S. Fish and Wildlife Service or National Marine fisheries Service if it determines that its action may affect a listed species, or its critical habitat.

Any actions within the Fire Island National Seashore (FINS) shall be exercised in accordance with a plan that is mutually acceptable to the Secretary of Interior and the Secretary of the Army and that is consistent with Public Law 88-587, the enabling legislation creating FINS.

The Atlantic Coast population of piping plover *(Charadrius melodus)* was designated as Federally threatened on January 10, 1986 (Federal Register; December 11, 1985). Seabeach amaranth *(Amaranthus pumilus)* was designated as Federally threatened on May 7, 1993 (Federal Register; April 22, 1993). Both species occur in and around the project area (USACOE, 1996). This Biological Assessment (BA) shall address potential project impacts on the piping plover and seabeach amaranth and measures to avoid or minimize such impacts.

2.0 Project Description

Study Area. The FIIP study area is located entirely in Suffolk County, Long Island, New York, along the Atlantic shore and is within the larger area under study as part of the Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point (FIMP), Beach Erosion Control and Hurricane Protection Project. This area of coastline is vulnerable to storm damage and severe overwashing that may lead barrier island breaching. Great South Bay and Moriches Bay are connected to the Atlantic Ocean through Fire Island Inlet and Moriches Inlet, which are maintained as Federal navigation channels. The project area encompasses the barrier island from Fire Island Inlet to Moriches Inlet, including the bay shorelines, adjacent back-bay areas, and mainland. The study area on the mainland extends from Strong Point in Lindenhurst to Smith Point. The barrier island of the project area is approximately 32 miles in length and includes populated communities as well as Fire Island National Seashore, Robert Moses State Park, and Smith Point County Park.

The basic design of the interim plan consists of beach nourishment. The plan for the project area includes a protective minimum beach berm width of 90 feet (ft) at elevation +9.5 ft NGVD berm and a minimum 25-ft wide dune crest at elevation +15 ft NGVD fronted by advance fill. For a complete description of the proposed project alternative, please see Attachment 1.

The anticipated date of construction has been scheduled for the spring of 2001 for a duration of approximately 18 months. In addition to USFWS' Section 7 formal consultation concerns, FINS has implemented an Endangered Species Habitat Management Plan that will restrict activities March 1 – September 1 in the year 2000 (NPS, 1998). It shall be assumed that 2001 and beyond shall have the same restrictions. Due to the safety concerns and higher costs associated with work performed in the late fall and winter months, construction most likely will occur sometime during the piping plover breeding and seabeach amaranth growing season. It may be possible to schedule the work to initiate in July, after plover nesting areas have been established. This assessment will also be coordinated with FINS to address their concerns as well.

Expected staging areas for construction vehicles and personnel are expected throughout the placement area during various stages of the project. Specific areas are to be determined during the Plans and Specifications stage of the project.

3.0 Pipinq Plover *(Charadrius melodus)*

3.1 Background

The piping plover is a small, sand-colored shorebird approximately 7 inches long with a wingspan of about 15 inches. Breeding birds have white underparts, light-beige back and crown, white rump and black upper-tail with a white edge. Breeding plumage characteristics are a single black breastband, often incomplete, and a black bar across the forehead. The black breastband, is generally more pronounced in breeding males than in females (Wilcox, 1939). Eggs are an average 1.2 x 1.0 inches in diameter. They are laid daily, with four being the usual clutch size; rarely as few as two eggs are found, with eight the highest reported (Hussel and Woodford, 1985). Incubation is shared equally by both sexes, with hatching usually in 27-28 days (occasionally as long as 31 days). Young birds can leave the nest within a few hours, and can fly at 30-35 days of age (Wilcox, 1959).

One brood a season is the average, but if the eggs or nest are destroyed during their initial attempt, the same pair will often rebuild another during the same season usually within 100-200 feet from the first. Wilcox found most pairs did not remain mated together beyond the first year; but that those that did had a much greater tendency to return closer to the previous years nest (average distance of 204 feet between the two years nest, with a maximum of 1,150 feet) than those birds that chose a new partner (average distance of 788 feet between the two years, with a maximum of 8,600 for males, and a much greater separation of up to 82,363 feet for females). Downer and Leibelt (1990) reports an average annual turnover rate of 23-30% among the known nesting sites on Long Island, indicating that plovers regularly shift within the breeding areas. In Wilcox's study of three breeding areas on Long Island, young birds, returning the year after their hatching, were more likely to nest in a different area from which they were hatched. Adults were much less likely to leave their original nesting area, though they frequently change nest sites within the area. It should be pointed out that only one-quarter of Wilcox's banded birds were recaptured. It is likely, that at least some of the banded birds returned to nesting areas other than the three Wilcox concentrated on, while unbanded birds from other areas may have moved into his study area as well.

Piping plovers breed on the northern Great Plains, around the Great Lakes, and along the Atlantic Coast. The Great Lakes population is listed as endangered; the others are listed as threatened (USFWS, 1985). Breeding grounds are occupied from late March to August. Wintering occurs along the Atlantic (North Carolina to Florida) and Gulf of Mexico Coasts, as well the Bahamas and West Indies (USFWS, 1985).

The coastal populations choose breeding habitat that is dry and sandy, open water beaches well above high tide. Grassless areas are traditionally utilized, though openings in grassy dunes as small as 200-300 feet wide may be used (Wilcox, 1959). District biologists have spotted plover nests along the southern shore of Long Island, in grassy areas at the edges of dunes and even behind dunes in blowouts. The 1989 Long Island Colonial Waterbird and Piping Plover Survey reports that Long Island nests are located primarily on peninsulas (30%) and barrier islands (39%). Other breeding areas include shoreline/ocean/estuary (24%) and saltwater non-barrier island (5%). Sand and/or gravel beaches (87%) were the most frequently used nesting areas with dune (7%) being used less often. Sand was the predominant nest substrate (90%), although gravel (11%) was also used. Nests are shallow, scraped depressions, sometimes lined with small pebbles, shells, or other debris (USFWS, 1985). The shell lining is apparently common among the Long Island population (Wilcox, 1959). Densities as great as 20 pairs along a 2-mile stretch of beach just west of Moriches Inlet have been reported by Wilcox (1959) and as much as 31 pairs (between Moriches and Shinnecock Inlet) in 1997.

Adults and chicks feed on small crustaceans, mollusks, marine worms, insects, insect larvae, and other invertebrates. They forage in the intertidal zone of bays and inlets and on oceanfront sand beaches, mud flats, and tidal wrack deposits. Most feeding occurs at low or falling tides during the daytime.

3.2 Piping Plover Status on Long Island

On Long Island, piping plovers begin arriving at the nesting area during the last week of March (Wilcox, 1959). Earliest egg laying is late April. Earliest hatching is late May, with most hatching complete by mid to late June. Brooding is completed within 20 days and all young are gone from the nest by late July. Wilcox (1959) reports that chicks leave the nest soon after hatching, but usually stay within 400-500 feet of the nest until time of flight (30-35 days after hatching). Even very young birds are very agile, Wilcox having timed chicks as young as 2 days old running 81 feet in twelve seconds. Based on data collected in 1996, 256 pairs of piping plovers nested on Long Island, up from 249 pairs in 1995 and 209 pairs in 1994 (Sommers and Alfieri, 1997). Recent increases in plover monitoring efforts acknowledge these as accurate counts. The population of piping plovers in New York over the last 10 breeding seasons is believed to have remained relatively constant .

Because of their smaller size, subpopulations of piping plovers such as those found on Long Island face increased risks of extirpation. This is especially true when productivity is substantially below that which is recognized as the coast-wide average and needed to maintain a resilient population. Unfortunately, this is the present situation on Long Island (except for an area within Westhampton Beach.). These poor rates of reproductive success have been recently documented in what has been described prime plover habitat with very little human disturbance present (Elias-Gerken, 1994).

Plover productivity within the Westhampton area in 1997 was higher than the 0.8 to 1.24 chicks/pair needed to maintain a stationary population (Houghton, et.al., 1997). It is likely that the large increase in piping plover productivity was due to good predator management associated with the recently constructed Corps beach nourishment project at Westhampton. Symbolic fencing and active on-site monitoring of the nesting and foraging areas decreased human disturbance within those areas. Disturbance issues likely will increase as the area becomes more populated and since the project is not presently active, fencing and daily monitoring by the Corps will not occur.

3.3 Piping Plover Status within Proposed Project Area

Piping plovers utilize the habitat found at the study site. However, nesting has not occurred successfully in the last three years and productivity can be assumed low. To create more favorable conditions within the Seashore, the FINS has implemented the Endangered Species Habitat Management Plan that restricts beach driving from April 1 – July 15 this year, and extending them from March 1- July 15, and March 1 – September 1, in 1999 and 2000 respectively (NPS, 1998). As of this writing, one nest consisting of four eggs has been identified near the Old Inlet area.

3.4 Non Activity Factors Affecting Plovers

According to the U.S. Fish and Wildlife Service (1985), there is enough available information to indicate a substantial decline in the species and its habitat, shrinkage of its breeding range, and continued threats to the species, its habitat, and range. As late as the 1920's the piping plover was still considered common along the Atlantic Coast. Since 1972, the National Audubon Society has continued to include the plover on its Blue List of breeding birds in potential trouble. On Long Island alone, the birds have declined from an estimated population of over 500 breeding pairs (Wilcox, 1959) to the present estimate of 249 pairs (Somers, et. al., 1996). Increased beach development and recreational use are considered the major reasons for the decline, with the latter primarily responsible for curtailed breeding success (USFWS, 1985). The 1989 Long Island Colonial Waterbird and Piping Plover Survey reported that on Long Island, human recreation and vehicle use accounted for the greatest disturbances to nesting birds (54% and 41% respectively), with pets (27%), habitation (21%), predation (25%), and flooding (15%) being other current forms of disturbance. One-third of all nesting sites are on private property, and therefore under the potential threat of future development. While habitat on public lands protected by restrictions on development are not free from disturbances, the remaining nesting sites use public recreational beaches. Heightened local and public concern for the plight of shorebirds such as the plover has led to active protective measures and possibly stabilized population estimates in recent years. However, because of the non-colonial nature of piping plovers, their breeding areas aren't as conducive to protection as the colonial species (such as terns). Approximately 25% of the plover nesting areas examined by the aforementioned plover survey had no recorded protection, and just about all nesting areas were in close proximity to human use. Such exposure however, does tend to acclimate birds to human activities, thereby reducing their tendency to permanently abandon nests when startled. Such a phenomenon has been observed by District biologists on a number of occasions when birds disturbed repeatedly by human activity continually returned to their nests and successfully hatched full broods.

3.5 Potential Direct Effects of Proposed Action

It is anticipated that dredging would have no adverse impact on piping plovers, as the material to be removed is taken from the offshore, an area which does not represent a special, unique, or limited habitat for this species. No loss of breeding habitat would occur as a result of the proposed dredging therefore, no threat to the species, continued existence, or decline in its current population is anticipated. Stabilizing the eroding beaches within the proposed project area may have a positive effect on maintaining or increasing suitable shoreline nesting or feeding habitat in the long-term.

Potential adverse impacts to piping plover habitat could result from the proposed filling activities. The sand would be moved through hydraulic pipeline that would extend from the dredging site across the inlet and nearshore. Due to the placement activities, there may be a temporary decrease in the habitat quality of piping plover's food source (macro invertebrates), resulting in a decrease in the value of the foraging habitat until the newly placed beach is stabilized and its faunal community restored. Potential newly hatched and older plover chicks feeding along the shoreline in the vicinity of the placement area (if nesting occurs) could be impacted. If construction begins during the breeding season, activity associated with the laying of the pipeline could disrupt breeding and nesting of plovers, whereas the pipe itself could serve to block access of young chicks to the shoreline. If the pipe is laid along the surface of the beach for its entire route (as normally occurs) this could affect all multiple nesting sites. In a similar situation, all mobile equipment poses direct threats to nests (crushing), chicks (crushing, trapped in tire ruts), as well as direct disturbance to chicks and adults from the presence of equipment and humans.

Beach slope is also a critical factor for piping plover habitat selection and use. It is important not to design a slope greater than the piping plover can utilize. In order to maintain existing habitat conditions, the slope of the placement material shall be consistent with adjacent existing beaches that contain successful brooding areas.

3.6 Potential Indirect Effects of Proposed Action

The increasing of barrier island height and width may be either beneficial or detrimental to piping plovers. However, a stabilized beach should result in longer-term protection of habitat currently being lost to storm-induced erosion. Adversely, early successional habitats formed by way of overwash activities will be decreased due to the reduction of overwashes from occurring.

Impacts associated with the No Action alternative are:

a. An increase in suitable nesting and foraging habitats associated with overwash activities after breach closure.

b. Stability in the number breeding pairs and productivity in non-erosional areas.

c. Increase in the loss of eggs or chicks if breach occurs in nesting season.

d. Reduction in habitat formation associated with inlet creation.

e. Continued loss of beach habitat in erosional areas.

In the severely eroded areas, there is a potential that the number of breeding pairs may increase due to the increase in berm width which will decrease the probability of piping plover habitat loss through major hurricane or major storm activities. Concurrently, there is also the potential that the increased berm width may provide habitat for predatory species and an increase in vegetation establishment.

3.7 Proposed Mitigation/Conservation Measures

Various measures are being proposed to be incorporated into the Plans and Specifications that will minimize potential direct adverse impacts to piping plovers. Many of these are based on measures employed during the Westhampton beach nourishment project with satisfying success. The hydraulic pipeline will be placed offshore as much as possible to allow the plover chicks to forage unobstructed. The pipe will placed in the nearshore zone as much as possible to lessen contact with the beach. A District biologist or designated representative will be present during pipeline construction to ensure the approved alignment is adhered to. If a nest is present prior to pipeline construction activities will be delayed to allow the plover chicks to fledge.

Because of continuous construction activity, it is doubtful that any plover pair would be able to successfully nest along the actual placement site, unless construction is delayed to summer. However, plovers often change nesting sites within a given area and should be able to establish nests in the undisturbed beach areas outside the nourishment site as occurred after filling the Westhampton breach, and the construction of the Westhampton Interim Project. It is still conceivable that a pair could attempt to nest behind the pipe, in a widened area that was formed earlier in the project. This is not likely given the unsettled nature of the recently deposited sand, and the presence of continued construction activity further up the beach. Regardless, should a nest be built in proximity to the pipe, actions would be taken to shield the nest from construction activity in its immediate vicinity until the checks are fledged. Work would be redirected away from the nest via exclosure erection and fencing, which would also keep any chicks away from the placement area being filled.

Dredging will take place continuously, from the time the pipe is laid until completion. If practicable, the District will limit the operation by restricting dredging during the more sensitive, early nesting period (April-July). The noise from sand moving through a pipeline to the placement area would be negligible as a cause of disturbance, as the birds are themselves adapted to louder natural surf sounds.

To ensure that impacts to the piping plover are minimized the following mitigation measures shall occur during each placement cycle:

All fill shall consist of "clean" sand fill material and shall conform with the existing beach substrate and consist of material that is capable of maintaining suitable piping plover and seabeach amaranth habitat. Grain size shall be compatible with existing beach material.

Excavated sediments shall be placed directly into the disposal site. No side casting (double handling) or temporary storage of dredge material at the placement site is authorized.

The storage of equipment and materials shall be confined to within the project work site and or upland areas greater than 75' from the tidal wetland boundary (intertidal zone) .

If present, there shall be no disturbance to vegetated tidal wetlands outside the boundaries of the placement area as a result of the construction activity.

The Service shall be notified of the start and the completion date of the proposed project.

If construction activities are initiated outside the piping plover nesting season, all feasible attempts shall be made to complete the proposed fill activity prior to the start of the nesting season (April 1).

Nest exclosures will be installed (under supervision of Corps biologists or designated representatives) on selected piping plover nests within 660' of the project area.

The contractor and employees shall be adequately informed of Endangered Species Act concerns, and contractor specifications written accordingly. These shall be highlighted prior to construction actions, when possible.

3.8 Monitoring Program

In addition to the above mitigation measures for minimizing impacts within the nesting season, the District will institute a monitoring program designed to assure the protection of the piping plovers during construction. In addition, the program will also be designed to collect data that will add to our understanding of how to implement future actions to further reduce potential for impacting plovers and improve habitat and productivity. The program will consist of the following:

1. If construction activities occur between April 1 and September 1, the District will initiate the following monitoring program:

a. A qualified Corps biologist or designated contract biologist will commence a site survey April 1, three times a week through July 1. If piping plovers are found to nest in the proposed construction area during that time, surveys will be increased to daily coverage (including the full tidal cycle) until the last bird is fledged. The monitor shall maintain field notes, which shall be provided to the U.S Fish and Wildlife Service and New York Department of Environmental Conservation (NYSDEC) as agreed upon. The Service in consultation with the District may modify survey and monitoring specifications based on site specific considerations to avoid any adverse effects. The District shall ensure coordination between its designated contract biologist and the project engineer responsible for the oversight of construction activities.

b. Fencing and/or exclosures will be utilized to protect the nests in the disturbance area until hatching. No placement activities shall be allowed within 660 feet of such fenced area. However, other construction-related activities of lesser extent (i.e. surveying, framing, equipment set-up, etc) will have 300 foot buffers. The District understands that this is below the standard 660 foot construction activity threshold established in other

Biological Opinions. However, as demonstrated with the nests within the Village of Westhampton Dunes, these type of impacts combined with proper protection measures is not as profound on the nesting plovers as actual placement activities. If the designated bird monitor finds that the above procedures are not effective, the buffer will enlarged back to 660 feet. The boundaries of the protected areas shall be adjusted based on monitors observations of plover use should plovers move outside the originally posted area. Areas will be expanded and contracted to accurately reflect the changes in use.

c. Courtship areas, nesting, and brood rearing areas shall be posted immediately (supervised by the monitor) and no disturbance shall be permitted within 660 feet of the designated area. Adult (fledged) foraging areas will also be posted, but the buffer will be 300 feet. The biological monitor will pay special attention to such areas while construction is nearby. The posted areas shall extend from the ocean side low water line to the furthest extent of the natural or man made feature which would prohibit piping plover chicks from traversing the area (e.g. scarp or dune). Monitors shall document any reactions to disturbance from the fill activity to determine the effectiveness of the buffer. When the chicks begin to feed, the monitor will direct the contractor away from the chicks, and if necessary, temporarily stop construction in the feeding area. A reduction or expansion in the buffer may be established, after consultation with USFWS due to observed reactions, changes in use (abandoned nests), or natural/man-made features, which inhibit piping plovers traversing the area.

d. In addition to identifying and posting activities, the monitor shall also be observing for disturbance to plovers from project activities, including survey, stockpiling, access routes, and transportation of new material to construction site. If such an act results in observed disturbances, then the monitor will initiate immediate, if temporary corrective actions to avoid same and report to Corps or Service representatives to establish permanent procedures to address such disturbances. Temporary intrusions into fenced areas (i.e. surveys) shall be accompanied by a monitor and will be curtailed if there is any disturbance observed.

e. A system of notification shall be established. If disturbance of Piping plovers cannot be avoided with the ongoing construction activities, the District shall contact the Service by the end of that working day for further consultation. The monitor shall also notify the Corps' project engineer and biologist, on-site contractors, and the NYSDEC. The on-site contractors shall be notified immediately and activities adjusted or halted by the monitor to avoid or minimize any immediate threat to the birds. In the event that an adult or chick is injured or killed during the construction activities two sets of actions will be undertaken by the monitor: (1) notification of all appropriate personnel (the Corps, the Service, NYSDEC, contractor, managers etc.) and (2) collection of evidence, information and production of a written record. The information will include; the incident, the time and location, maps, photographs (if possible), a written description and names and telephone numbers of witnesses to the incident or the discovery.

f. The Service, the New York State Department of Environmental Conservation, or their designated representatives should be given access to the action area, subject to site safety plans, for the purpose of surveying, monitoring, posting, and/or symbolically fencing piping plover courtship, nesting and brood rearing areas, and, erecting predator exclosures for nests during the plover breeding season (April 1 to September 1). Access shall be given during daylight hours on any day(s) of any given year at the required frequency to accomplish the purposes stated above. Symbolic fencing may be placed in a 50 meter radius around nest sites where pedestrians, joggers, picnickers, fisherman, boaters, or other recreational users are present in numbers that could harm or disturb incubating plovers, their eggs or chicks.

All protection measures will follow and be consistent with the Service's Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitats on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the ESA.

4.0 Seabeach Amaranth (Amaranthus Pumilus)

4.1 Background

Seabeach amaranth is indigenous to Atlantic Coastal Plain beaches, with 13 known populations in New York State. The species occurs on barrier island beaches, where its primary habitat consists of overwash flats at accreting ends of islands and lower foredunes and upper strands of non- eroding dunes. It sometimes establishes small temporary populations in other areas, including bay-side beaches, blow- outs in foredunes, and beach nourishment material. According to Weakley and Bucher (1991), "Seabeach amaranth appears to need extensive areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner. This allows it (seabeach amaranth) to move around in the landscape, as a fugitive species, to occupy suitable habitat as it becomes available."

Seabeach amaranth is an annual plant that germinates from April to July. Upon germinating, the plant becomes a small unbranched sprig, but quickly branches into a clump consisting of 5-20 branches. The stems are fleshy and pink-red with small rounded leaves approximately 2.0 cm in diameter. The leaves are at the tip of the stem and usually a spinach-green color with a small notch at the rounded tip. Flowering begins as early as June, but more typically starting in July and continuing until death in September.

4.2 Non-Activity Factors Affecting Seabeach Amaranth

Seabeach amaranth has been and continues to be threatened by destruction or adverse alteration of its habitat. Although storms and related erosion of beaches threaten the species, non-coordinated efforts to stabilize beaches can be more destructive to the species in the long term. However, beach renourishment projects can have positive impacts on the species.

Unrestricted recreational use of beaches is known to threaten populations of seabeach amaranth. Pedestrian activity occurs during the growing season, but does not usually occur where the species is present because most people will walk around any plant when observed. Off-road vehicle (ORV) use during the growing season has adverse effects if the vehicles are not routed around the plants. The stems of the plant are brittle and are easily broken, therefore killing the plant and reducing seed production. If ORV use takes place in the dormant season, then the impacts are not as significant, unless it degrades or alters the physical aspects of the habitat.

4.3 Potential Direct Effects of Proposed Action

Dredging of the borrow area would have no adverse impact on seabeach amaranth, as the material to be removed does not represent a special, unique, or limited habitat for this species. No loss of habitat would occur as a result of the proposed dredging therefore, no threat to the species, continued existence, nor cause a decline in its current population.

Potential impacts would occur via the beach nourishment part of the proposed action. Direct sand placement onto the plant species, will result in mortality with no chance of seed production. This could significantly impact the local population.

Beach slope is also a critical factor for seabeach amaranth habitat selection and use. It is important not to engineer a slope greater than what is exhibited at seabeach amaranth locations, if present. In order to maintain existing habitat, the slope of the placement material must be consistent as compared to the current habitat.

Overwash areas have been identified as being primary habitat for the seabeach amaranth. Being a temporary species, seabeach amaranth occupies suitable habitat when it becomes available, i.e. washovers, therefore stabilizing these areas before they breach could decrease such overwashes.

Trampling by workers or construction equipment could also destroy the plants directly.

4.4 Proposed Management Practices

A District or contract biologist/botanist or designated representative will survey the area immediately prior to any project activity within the seabeach amaranth growing season (May 1 - November 1). Approximately twice a month, June 15 to October 15 the project area will be surveyed. Records shall include plant locations, numbers of plants and size of plants . If there is any seabeach amaranth present, the District shall record seabeach amaranth locations. If construction personnel or vehicles are at the site or might transit the site, symbolic fencing will be placed in a 10 foot diameter ring.

All construction activities shall avoid all delineated locations of seabeach amaranth where feasible. The District will undertake all practicable measures to avoid an incidental take. In the unlikely event that the species appears at the placement area, and there is a very ~~good~~ possibility that the surrounding placed sand will encroach upon and smother the plant, the District proposes to transplant the individual plant to a similar habitat near or within the project area to lessen the impact of placement. Transplantation will include removal of a sufficiently large enough and intact volume of sand to include the full extent of the roots. This action, when necessary, will occur as soon as possible after the plant is identified and every attempt will be made to include the entire (undamaged) root system.

If present, seeds of all plants transferred will be harvested and stored to be replanted at a later date. A portion of this seed shall be sent to a qualified nursery to attempt germination. If successful, germinated plants will be replanted in suitable habitats in the project area, including sited already nourished. These plants will be monitored to determine its ability to re-establish itself under various conditions for future mitigation efforts under FIMP or other interim projects.

It is understood that this action, when feasible will be undertaken for individual plants whose destruction could not be avoided. The action will be attempted as a means of mitigating such loss but will not be construed as a long-term commitment or research on the part of the District by replanting beyond the second year.

Placement areas shall be finished to a natural grade with compatible material.

A System of Notification similar to the one described above for the piping plover will also be utilized for seabeach amaranth.

5.0 Other Species of Concern

The habitats utilized by piping plovers are dynamic, storm-maintained environments. Other flora and faunal considered threatened or endangered by New York State utilize the same environments. These species include the state-endangered least tern *(Sterna antillarum)*, and state-endangered plant species, seaside knotweed *(Polygonum glaucom)*.

6.0 Summary of Overall Impacts and Proposed Mitigation

Impacts due to project implementation to nesting piping plovers and existing seabeach amaranth are possible. No contractor shall be allowed into nesting areas without being accompanied by a qualified biologist. Dredging will occur continuously, 24 hr/day until placement activities are completed. Sources of loud noise (above that of movement through the pipe, i.e. earth-moving equipment) will be muffled to minimize disturbances.

Additional impacts to the feeding activity of the piping plovers may occur. Piping plover chicks feed on their own almost immediately after hatching, and must have access to a beach or other shoreline until they are able to fly. A pipeline lying across the beach would block access to its food source. Practicable measures (i.e. pipeline burial or elevation) will be undertaken to allow the piping plover chicks to feed undisturbed.

A survey/monitoring effort will be undertaken. District biologists will be on site during laying of the pipeline to ensure it is aligned in the agreed to manner (as designated by the local, State, and Federal agencies involved with project review). During placement operations, the District will conduct on-site monitoring and fence habitat of concern for specific nests or plants, to ensure the activity is not impacting nesting and brooding behavior. Monitoring will be flexible, and include full reporting of finding to the Service and potential consultation to modify any procedures to reflect actual observed impact associated responses.

There is a potential that the number of breeding pairs may increase due to the increase in berm width as that there will be a decrease in the probability of piping plover habitat loss through major hurricane or major storm activities. Concurrently, there is also the potential that the increased berm width may provide habitat for predatory species and an increase in vegetation establishment.

7.0 Conclusions

Given the control measures summarized above and detailed in the earlier sections and the local implementation of existing USFWS protection measures, impacts to either piping plovers or seabeach amaranth associated with the proposed projects will be minimized. The precautions taken will allow dredging or upland source placement of fill and continuous operation, thereby providing the most cost-effective expeditious operation minimizing long-term plover and seabeach amaranth impacts. These conditions are consistent with the findings during previous beach nourishment and breach filling activities between 1994 and 1997.

It is noted that quality piping plover habitat is extremely limited on Long Island. It should be maximized in areas that promise, or are maintained as, low disturbance areas. For Long Island, recent plover seasons showed that the physical existence of an open connection to the ocean is not the feature that promotes habitation by piping plovers. Rather, it is those features that result from the major storm events (severe overwashing, breaching) that attracts plovers. Potential habitats such as this could be created and/or maintained in many areas along the project area. Non-destructive modifications such as the removal of phragmites and dense invasive scrub (which can provide cover for predators), and the creation of overwash fans, spits, and ephemeral pools may be feasible enhancement measures to increase potentially useable habitats. These features are being studied via specific habitat research funded by the District, along the very productive Westhampton portion of the barrier island system. Pending findings and recommendations of the studies, such features could be created and included as part of an enlarged mitigation for construction activities or as separate restoration measures to address past impacts along the southshore estuarine ecosystem. What can be achieved is balance that offers mitigation of beach nourishment activities as a method of propagating and maintaining piping plover habitat while simultaneously creating a solution to the storm induced erosion problem and it's associated safety and economic problems.

REFERENCES:

Downer, R. and C. Leibelt. 1990. 1989 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

Elias-Gerken, Susan.P. 1994. "Piping plover habitat suitability on Central Long Island, New York Barrier Island." M.S. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Hussel, D.J.T., and J.K. Woodford. 1985. "Piping Plover's Nest Containing Eight Eggs". Wilson Bulletin. 77:29A

Leatherman, S.P., and J.R. Allen, eds. 1985. Final Report: Fire Island Inlet to Montauk Point, Long Island, New York - Reformulation Study. National Park Service - North Atlantic Region, Boston, MA. Report to USACOE, NY District.

National Park Service. Fire Island National Seashore. 1998. Environmental Assessment for Endangered Species Habitat Management. 11, February.

New York State. Department of Environmental Conservation. 1997. 1997 Long Island Colonial Waterbird and Piping Plover Survey. Preliminary Tables l.

Somers, et. al. 1996. 1995 Long Island Colonial Waterbird and Piping Plover Survey. The New York State Department of Environmental Conservation, Stony Brook and Delmar, New York.

Somers, L.A. and M.L. Alfieri 1997. 1996 Long Island Colonial Waterbird and Piping Plover Survey. The New York State Department of Environmental Conservation. Stony Brook and Delmar, New York April.

Suffolk County Parks. 1997. Unpublished Maps and Piping Plover Data Sheets for the Tiana Beach Area.

United States Fish and Wildlife Service. 1985. "Endangered and Threatened Wildlife and Plants; Determination of Endangered and Threatened Status for the Piping Plover; Final Rule". Federal Register. Vol 50, No. 238 (Wed, Dec 11, 1985): 50726-50733.

United States Fish and Wildlife Service. 1993. "Endangered and Threatened Wildlife and Plants; Determination of Endangered and Threatened Status for Seabeach Amaranth; Final Rule". Federal Register. Vol 50, No. 238 (Wed, April 7, 1993): 18035-18042.

United States Fish and Wildlife Service. 1994 Biological Opinion: West Hampton Interim Storm Damage Protection Project (USACOE).

United States Fish and Wildlife Service. 1995. Biological Opinion: Fire Island Inlet to Montauk Point, New York Breach Contingency Plan (USACOE).

United States Fish and Wildlife Service. 1994 Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitats on the U.S. Atlantic Coast to Avoid Take Under Section 9 of the ESA.

United States Army Corps of Engineers. 1994. Fire Island Inlet to Montauk Point, New York: Emergency Breach Closure at Westhampton (Moriches to Shinnecock Reach). Final Environmental Assessment. New York District.

Weakley, A. and M. Bucher. 1991. Status Survey of Seabeach Amaranth (Amaranthus pumilus) in North and South Carolina, 2nd Edition. USFWS, Asheville, NC

Wilcox, L. 1939. "Notes on the Life History of the Piping Plover". Birds of Long Island. 1:3-13.

Wilcox, L. 1959. "A Twenty Year Banding Study of the Piping Plover". Auk. Vol 76, No 2 :129 -152.

BIBLIOGRAPHY:

Andrle, R.F. and J. Carroll. 1988. The Atlas of Breeding Birds in New York State. Cornell University Press, Ithaca, New York.

Ducey-Ortiz, A. et al. 1992. 1991 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

Ducey-Ortiz, A. et al. 1989. 1988 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

MacLean, D. and T. Litwin. 1987. 1986 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

Maclean, D., et al. 1988. 1987 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

New York State. Department of State. 1987. Significant Coastal Fish and Wildlife Habitats in Nassau and Suffolk Counties. 16, February.

New York State. 1991. Department of State, Division of Coastal Resources and Waterfront Revitalization and The Nature Conservancy. (Draft) Long Island's Beach-Nesting Shorebird Habitat: Protection and Management of a Vulnerable Resource.

Peterson, et al. 1986. 1985 Long Island Colonial Waterbird and Piping Plover Survey. The Seatuck Research Program and the New York State Department of Environmental Conservation, Delmar, New York.

United States Army Corps of Engineers. 1977. Fire Island Inlet to Montauk Point, New York: Beach Erosion Control and Hurricane Protection Project. Final Environmental Impact Statement. New York District.

United States Fish and Wildlife Service. 1995 Revised Recovery Plan or piping plovers breeding along the Atlantic Coast. Hadley, MA

DEIS Appendix F
Draft Clean Air Act
Conformity Statement

CLEAN AIR ACT
STATEMENT OF CONFORMITY

ATLANTIC COAST OF LONG ISLAND,
FIRE ISLAND INLET TO MONTAUK POINT, LONG ISLAND, NEW YORK
REACH 2
FIRE ISLAND INTERIM PROJECT
INTERIM PLAN FOR STORM DAMAGE PROTECTION

Based on the conformity analysis in the subject report, and comment from the New York Department of Environmental Conservation, I have determined that the proposed action conforms to the applicable State Implementation Plan (SIP). The Environmental Protection Agency had no adverse comments under its Clean Air Act authority. All air quality concerns were fully addressed, and the project will not lead to greatly increased air emissions as compared to the no-action alternative. Thus the project will comply with Section 176 (c)(1) of the Clean Air Act Amendments of 1990.

DATE: ______________

William H. Pearce
Colonel, Corps of Engineers
District Engineer

APPENDIX A

PERTINENT CORRESPONDENCE

New York State Department of Environmental Conservation
Division of Water
Bureau of Flood Protection, Room 388
50 Wolf Road, Albany, New York 12233-3507
Phone: (518) 457-3157 • **FAX:** (518) 485-7786
Website: www.dec.state.ny.us

John P. Cahill
Commissioner

November 30, 1999

Mr. Stuart Piken, P.E.
Deputy District Engineer for
Project Management
New York District
U.S. Army Corps of Engineers
26 Federal Plaza
New York, New York 10278-0090

RE: Fire Island Inlet to Moriches Inlet - Fire Island Interim Project

Dear Mr. Piken:

At the 1 October, 1999 Issue Resolution Conference (IRC) for the above-cited, storm damage reduction project, New York State representatives were asked to provide an updated letter of intent to continue forward with planning and public review for the proposed interim effort. At that time we all agreed that the earliest possible public review and comment on the proposed interim project was important for all interested parties.

We further agreed to release of the Draft Decision Document and the Draft Environmental Impact Statement as soon as the agreed upon revisions had been made. Among those revisions were the rewritten sections dealing with New York's Coastal Erosion Hazard Area (CEHA) law and the State's Coastal Management Program (CMP). With the provision of those rewritten sections in my letter of 29 November, 1999 all of the pre-conditions for release of the draft document have been met.

As I stated at the IRC, the State of New York raised a number of issues with the draft interim plan. Most of those have been adequately addressed with release of the appendices to the Draft Decision Document and revisions made to that document subsequent to the IRC. We all agreed that some of the State's issues might well be resolved through the public review and comment process, and these were not the subject of revisions to the draft documents.

Assuming that all of the issues raised by New York State are satisfactorily resolved, and further comments received during the public comment period do not raise new concerns on the part of the State, our Region 1 office would be in a position to issue a Water Quality Certificate for the proposed project. The Department of State would similarly be in a position to concur with a Corps of Engineers' Determination of Consistency with New York's Coastal Management Program. New York State has been an active participant in seeking appropriate storm damage protection for Great South Bay and the mainland shoreline of Long Island shielded by the Fire Island barrier, and will continue its active involvement throughout the public review process. As always, we will continue to work jointly with the New York District in any public presentations scheduled during that period.

In all of our joint shore protection efforts, execution of a Project Cooperation Agreement (PCA) and appropriation of the capital funding required to meet the non-federal share of project costs are ultimately decisions of the Governor and the Legislature.

Sincerely,

William W. Daley

William W. Daley, P.E.
Chief
Coastal Erosion Management

c: N.G. Kaul
R. Cowen
J. Pavacic
G. Stafford
S. Couch
F. Anders
F. Nuffer

WWD/te

FIRE ISLAND, NEW YORK
INTERIM PROJECT
PARTNERSHIP AGREEMENT

The Army Corps of Engineers is committed to completing the Reformulation Study by the end of calendar year 2003, and is scheduled to complete a draft decision document and draft environmental impact statement (DEIS) for the Fire Island Interim Project in the near future. The Department of the Interior (DOI) is committed to be a cooperating agency for the purposes of NEPA compliance on the Reformulation EIS. The Corps has responded and will continue to make every reasonable effort to respond to concerns that have been expressed by the DOI. The DEIS will disclose uncertainties about environmental effects and coastal processes, discuss with- and without project scenarios, and any potential mitigation. In addition, the Army and the DOI agree to the following:

1. The Corps will propose a minimum duration project that can be justified economically, a project defined as initial placement (with advance nourishment), and one scheduled renourishment episode. The duration of the interim project will not exceed 6 years. The 6-year time frame will be used for the preferred alternative in the DEIS.

2. The proposed scheduled renourishment would not occur unless the environmental impact statement (EIS) for the Reformulation Study is completed and that renourishment is consistent with the preferred alternative in this EIS. Both agencies agree to work cooperatively to ensure that the EIS for the Reformulation Study is completed before the date of the scheduled renourishment. Unscheduled renourishments within the 6-year duration of the interim project may have to be considered as a result of unanticipated storm events, or a series of storm events, that affect the Interim Project design. The Army and DOI will consult on the need for and magnitude of any subsequent unscheduled renourishments.

3. The Corps will support and facilitate discussions with the National Park Service and the New York State Department of Environmental Conservation that address concerns about the expansion of existing development and new development as a result of implementation of the FIIP (see enclosure). The goal of the discussions would be to ensure that the FIIP does not promote development that is not in conformance with the Coastal Erosion Hazard Areas Management Program designations or National Park Service Policy.

4. The DOI and Army agree that two full field seasons (as determined by the technical advisory groups) of baseline data will be collected for the Reformulation EIS prior to implementation of the FIIP. The Corps will chair, and convene within 15 days of the signing of this agreement, the Reformulation Study technical advisory groups to discuss data collection efforts for the field. The Corps Project Study Plan, including already

agreed upon completed and ongoing data collection efforts, will be the basis for discussions and be revised, as necessary, prior to data collection for each field season.

5. The Army and DOI share concerns about potential impacts to Federal lands as a result of beach nourishment. In this regard, the Corps District and National Park Service Fire Island National Seashore staff will continue to meet and cooperatively frame issues, identify and evaluate impacts, and make preliminary recommendations on how to address issues.

6. The Army and DOI share concerns regarding the need for continued and enhanced coordination, mutual support, and cooperation between agencies. Therefore, the Corps District and DOI regional, Park and field offices agree to exchange information during the development of components of and drafts of relevant documents. The goal is to develop mutually acceptable draft documents, and cooperatively address other issues as they arise. Army and DOI agree to work together to achieve the current schedule for completion of the Reformulation Study and EIS. Field level representatives of the DOI and the Corps will meet with the sponsor and other appropriate study team members on a quarterly or as needed basis to exchange information and assess study progress with a goal to ensure timely study components or products. The Army and DOI will, as a separate agreement, cooperatively develop a mutually acceptable dispute resolution process within 30 days of the signing of this Partnership Agreement.

7. Nothing in this agreement supersedes the responsibilities of Army and DOI under applicable federal law.

Michael L. Davis — June 1, 1999
Michael L. Davis (date)
Deputy Assistant Secretary of the Army
(Policy and Legislation)

Bill Leary — 5/28/99
Bill Leary (date)
Senior Counselor to the Assistant Secretary
for Fish and Wildlife and Parks
Department of the Interior

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

May 20, 1999

Planning Division
Coastal Section

Mr. Andrew L. Raddant,
Regional Environmental Officer
U.S. Department of Interior, Office of Policy and Compliance
408 Atlantic Avenue - Room 142
Boston, MA 02210-3334

Dear Mr. Raddant:

This letter is a follow up to our discussions with the National Park Service, Fish and Wildlife Service, and New York State on 3 March 1999, and a subsequent meeting with Fire Island National Seashore (FIIS) representatives on 30 March 1999, regarding the proposed Fire Island Interim Project, currently under evaluation.

At these meetings, we discussed a number of issues, including: 1) work which is allowable within the boundaries of the Park Service Federal land holdings, 2) the potential impacts of the project on new development, and 3) a mechanism to accommodate existing dune cuts into the project design. I have enclosed the meeting minutes from the 31 March 1999 meeting, which summarizes the issues discussed. Based upon these meetings, we have also refined the proposed plan to accommodate, to the extent possible, these discussions. Based upon a review of the design requirements, we have reduced the linear extent of fill within the Federal tracts of land, by 10,000 ft. However, we are not able to eliminate the fill completely, and still ensure adequate protection to the mainland of Long Island. The description of the proposed plan, as refined to incorporate these discussions, is also enclosed.

We are currently finalizing the Fire Island Interim Project Decision Document and EIS, scheduled to be released by 31 May 1999, which will provide a full description, and analysis of the proposed interim project. I am enclosing the current project description as advanced notification of the project description, which will eventually be contained within the interim report. If you have any questions, please contact Mr. Stephen Couch, Project Planner at (212) 264-5439.

Sincerely,

Peter R Blum

for Frank Santomauro, P.E.
Chief, Planning Division

Encls.

Cf:
Constantine Dillon (NPS-FIIS)
Steve Mars (USFWS-LIFO)
William Daley (NYSDEC)
Ray Cowen (NYSDEC – Region I)
William Barton (NYSDOS)

MEMORANDUM FOR THE RECORD 19 Apr 1999

SUBJECT: Fire Island Inlet to Montauk Point, NY – Fire Island Interim Project

1. Meeting was held on 31 March 1999, present were Stephen Couch, CENAN-PL-FC, Thomas Pfeifer, CENAN-PL-FC, Mike Bilecki, NPS-FIIS, Diane Abell, NPS-FIIS

2. The purpose of the meeting was to follow up previous discussions at the 2 March 1999 meeting, regarding limitations of fill placement within the Federal properties, and to address other issues of concern. The topics covered included:

- NPS constraints & overriding policies and regulations governing fill placement
- Development impacts assessment
- General Comments on the Plan
- Identification of dune cuts, extent impacted, and method for resolution
- Issues identified within the paper entitled DOI position on beach nourishment
    - Extent of NPS involvement in EIS preparation
    - Assessment of Feasibility of interim project (attributed to Jim Allen)
    - DOI scientific evidence is that the park is a natural condition

3. A list of tasks as an outcome of this meeting is enclosed as enclosure 1

4. Enclosure 2 includes discussion of the alongshore extent of the Federal properties, and the work which could be allowable within the boundaries. To summarize the contents of the enclosure, there are four distinctions between these areas.

A – Lighthouse tract. Although the EIS to the GMP recommends no fill within this M.F.T.L. FIIS representatives advised that a consideration could be made to balance health and human safety issues, with the concerns for natural resources. The FIIS representatives indicated that consideration of protecting the roadway could allow for a decision to place fill within this area to be made at the discretion of the Superintendent, without requiring a change in the GMP.

B – All non-major Federal Tracts of Land. The GMP does not restrict fill placement within these boundaries.

C – Major Federal Tracts of Land spanning from Sunken Forest to Watch Hill. The EIS to the GMP currently precludes fill within these land holdings (with further restriction imposed upon the Sunken Forest, due to deed restrictions stipulating the area be maintained in a natural state). FIIS representatives indicated that fill placement within these areas would require a change in the GMP.

D – Wilderness Area – Although there are additional policies and specific management plans governing the wilderness area, the wilderness are is identified as the area landward of the seaward toe of the dune. FIIS representatives indicated, therefore that any work proposed fronting this area would be governed only by the policies indicated within the GMP, similar to the above areas (C).

4. In reference to fill tapers into the major Federal tracts of land, the FIIS representatives indicated that the decision document should present the rationale to illustrate the minimal amount of proposed work, and why it is required to ensure that the project design is not compromised. It was explained that if the Corps provided a reasonable rationale for the tapers

into the MFTL, that it could be within the Superintendent's discretion to allow the work element, without a change in the GMP. The FIIS representatives indicated that this condition would apply to any beachfill tapers fronting the Wilderness Area, as well.

5. Enclosure 3 includes identification of the existing dune crossings on Fire Island, and the relative impact of the proposed fill alignment of the existing dune cuts. For purposes of the interim project it was agreed that the locations of the existing dune cuts would remain, in order to ensure a consistent level of access as currently exists. Although relocation of existing dune cuts from Federal properties may be explored further under the reformulation study, it was agreed that the present locations would remain for any interim project. In order to address reconfiguration of the dune cuts, FIIS representatives indicated that they would not want to see gravel, wood palettes, or geotextiles used as a component of the dune crossing structure, but would prefer the existing sand only solution. NYD representatives indicated that they would explore a staggered dune configuration, which could minimize the need for an additional design element, to prevent dune lowering as a result of driving, although they could not discount the need for some element, depending upon the available space, and current configuration of the existing dune cuts.

6. Several specific topics were addressed within the paper entitled "DOI position on Shoreline Protection and Beach Nourishment at Fire Island National Seashore dated January 1999". It was indicated that there appeared to be several inaccuracies or topics of concern, which the Corps agreed to respond to, including a) Jim Allen's Statement of Feasibility, b) that there is no clear evidence that the project will protect mainland of Long Island, c) DOI scientific evidence that this (erosion) is a natural occurrence in a National Park. Discussion on these topics, although clarifying the subject matter, was inconclusive, as the technical adviser to the FIIS was not present.

Tract	Major or Non-M	starting station	end station	Governing Policies	Possible exemptions	Requisite Analysis
Lighthouse Tract	M	233	287	FINS GMP - no fill on MFTL	Protection of Roadway	Consideration of Health & Human Safety vs. Natural Resources Could be within Superintendent's discretion, no change GMP
	NM	296	297			NMFTL - no policies excluding fill within boundaries
	NM	300	303			NMFTL - no policies excluding fill within boundaries
	NM	365	403			NMFTL - no policies excluding fill within boundaries
Sunken Forest / Sailor's Haven	M	531	611	FINS GMP - no fill on MFTL Deed Restriction for natural state		Require a policy change and a change in GMP
Carrington Tract	NM	640	658			NMFTL - no policies excluding fill within boundaries
Talisman	M	720	793	FINS GMP - no fill on MFTL		Require a policy change and a change in GMP
Blue Point Beach	M	803	857	FINS GMP - no fill on MFTL		Require a policy change and a change in GMP
Watch Hill	M	899	937	FINS GMP - no fill on MFTL		Require a policy change and a change in GMP
Wilderness	M	937	1295	FINS GMP - no fill on MFTL		Require a policy change and a change in GMP

	Dune Cuts			
Name	Station Location	Property Ownership	Extent Impacted	Resolution
Lighthouse	282	Federal	Dune	1
Atlantique	377	Islip	Dune	1
Ocean Beach	409	Federal	Dune	2
Ocean Bay Park	488	Brookhaven	Dune	1
Sailor's Haven	537	Federal	No Impact	
Sailor's Haven	588	Federal	No Impact	
Cherry Grove	606	Federal	No Impact	
W. Fire Island Pines	657	Brookhaven	Dune	1
W. Talisman	722	Federal	No Impact	
Barrett Beach	768	Federal	No Impact	
Blue Point	835	Federal	No Impact	
Watch Hill	912	Federal	No Impact	
Smith Point		County	No Impact	
* 1 = Angle Driving, 2 = slant				

Fire Island Inlet to Montauk Point, New York
Fire Island Interim Project
Project Description

General

The interim project has been developed to provide remedial protection for the time period prior to implementation of the results of the Fire Island Inlet to Montauk Point, NY Reformulation Study. The proposed Fire Island Interim Plan is intended to reinforce the existing dune and berm system along portions of the Fire Island barrier island, where the existing cross-section provides limited protection, against storm events. Restoring the natural protective features in these areas, would provide protection to the communities along Great South Bay, and Fire Island. The plan described herein, consists of initial construction, and renourishment, which meet interim project objectives and constraints.

To develop an interim project to address the time period prior to the potential implementation of the results of the reformulation study, the interim project includes a minimum period of time for which the interim project would be maintained. Consistent with the schedule for the reformulation study, there is also a process for considering whether to continue the interim project. The interim project analysis includes engineering, economic, and environmental analysis to support a recommendation for the minimum time period. This report also includes analysis of the engineering, economic, and environmental effects for a maximum time period; and the process and format for a future decision to continue the project. The selected intervals are described below, based upon the schedule for potentially constructing the interim project, and reaching a decision on the reformulation study.

The proposed Fire Island Interim Project is potentially scheduled to implemented in FY 2000, with construction completed within 2 years. The renourishment schedule, to allow for maintenance of the project design, is every three years. Prior to each renourishment cycle, an estimate of the quantity of required fill must be made, and plans and specifications prepared. These are the factors considered in scheduling the minimum period of analysis for the interim project.

The Fire Island Inlet to Montauk Point, NY Reformulation Study final report with Environmental Impact Statement is scheduled to be completed in 2002, with a Record of Decision completed in 2003. The Record of Decision serves as the mechanism for rendering the decision of the study. Currently the outcome of the reformulation study is unknown, as is the actual completion date. At a minimum, the time required to continue the interim project is based upon analyses contained in the reformulation study, includes the need for a new Project Cooperation Agreement, and all permits to proceed with the action, and construction bid documents. At a minimum, several years are required to allow these actions to occur. These steps therefore, necessitate an interim project which is in place for up to 6 years. Based upon the schedule for renourishment, this duration requirement can be met with initial construction and one nourishment cycle, which is estimated to provide six years of protection.

To meet the objectives of the interim project, the recommended duration for this interim project is 6 years. In addition to the minimum, recommended duration, a maximum time period has been identified, over which the interim project might have to be continued, until a future decision point is reached. It is expected that the Reformulation Report, and Environmental Impact Statement would serve as this decision point. In the unlikely instance that the reformulation report is not available, a stand alone analysis would be prepared, including an update of engineering, economic, and environmental effects; based upon new information. Considering the magnitude of the overall Fire Island Inlet to Montauk Point project area, the possible outcome of the reformulation study, and the potential for delay, it is possible that the interim project could be maintained for a period of 15 years, until superseded by reformulation construction. As such, this report evaluates the interim project for a period of 6 years, but also considers the engineering, economic, and environmental effects for a duration of 15 years. Continuation of the interim project for any time period subsequent to the six year recommended time period, would be dependent upon a new decision document to support this recommendation.

Beach Fill Design

The proposed interim project alternative, has been designed to provide minimal protective features along the barrier island, reasonable for an open ocean environment. The protection afforded by the proposed interim project was originally developed based upon a combination of Federal and State requirements for participation in shore protection projects. The State of New York requires a reasonable probability of surviving 30 years. Federal requirements require a design with a minimum of 50% probability of survival for the project duration. Based upon these criteria, a design with a protective capacity against a storm with a return frequency of 44-years is required. In light of the interim nature of the project, and a planning horizon consistent with the time period required for the completion of the Reformulation Study, the interim protective capacity was further considered to determine its appropriateness, relative to a plan with a lesser degree of protection. A sensitivity analysis was undertaken to compare this protection with that provided by lesser plans. Based upon this analysis, an interim plan which provides protection against a storm with a return period of 44-years has been determined to be appropriate for interim protection.

Beach Fill Configuration

For analysis and design purposes, Fire Island has been separated into four reaches based upon physical characteristics and existing land use patterns. Variations in the design cross-section exist amongst these reaches. The interim project features are generally consistent with existing and historic physical characteristics of Fire Island. The reaches and applicable cross-sections are described below, followed by a discussion of the alignment and linear extent of the fill placement area. Enclosed are profile lines, which show the proposed cross-section, overlayed on the existing (Fall 1998) conditions, to demonstrate how sand being added to the system would only be that necessary to bring the existing dune and berm up to the minimum design cross-section, as follows.

<u>Reach 1 (Robert Moses State Park & FIIS Lighthouse tract)</u> - Reach 1 extends from the east jetty at Fire Island Inlet, 26,900 feet through to the eastern boundary of Robert Moses State Park, including the FIIS lighthouse tract. Development in the reach consists of roads, parking areas and recreational facilities. This reach fronts the mainland communities of Babylon, and West Islip.

Along this reach there is generally sufficient back shore dune elevation and width, but the existing beach berm in several areas is insufficient to provide adequate protection to the dune system. The proposed fill cross-section is a minimum beach berm width of 90 ft. at elevation +9.5 NGVD fronting the existing dune. Design beach slopes are 1 vertical to 15 horizontal onshore to -2 ft. NGVD and 1V to 30H offshore.

<u>Reach 2 (FIIS Lighthouse tract to Point O'Woods)</u> - Reach 2 extends from Kismet to Point O' Woods (western boundary of Sunken Forest) and includes 25,200 feet of Atlantic shoreline. This reach includes the most highly developed areas of Fire Island, and fronts the mainland communities of Bayshore and Islip. Development consists primarily of residential structures. In several areas within

this reach the existing configuration of the barrier island is characterized by a low dune, fronting low island areas with elevations less than 8 ft NGVD.

The cross-section for the majority of this reach includes a berm with a height of +9.5 feet NGVD and width of 90 feet. Consistent with the slope of the existing profile, design beach slopes are 1 vertical to 15 horizontal onshore, and 1V to 30H offshore. The beach berm is backed by a dune with crest width of 25 feet, and height of +15.0 feet NGVD. The seaward and landward dune slopes are 1V to 5H. In the areas within this reach, characterized by low back island elevations, the profile described above does not provide the adequate protection, and an additional volume of fill is required to ensure design survivability. In these locations, the design profile includes a berm with a height of +11 ft NGVD with a width of 40 feet. The berm is backed by a dune at elevation +18 feet NGVD. The beach and dune slopes are identical to those described above

Reach 3 (Sunken Forest to Watch Hill) - Reach 3 extends from the western boundary of Sunken Forest, and extends to Watch Hill, including the communities of Cherry Grove, Fire Island Pines, Barrett Beach, Water Island, and Davis Park, covering 43,200 feet of coastline. This area is less developed than Reach 2, with large expanses of undeveloped areas. This reach fronts the mainland communities of Bayport, Blue Point, and Patchogue.

The fill cross-section for this reach is consistent with that described above, including a beach berm width of 90 ft. at elevation +9.5 NGVD, backed by a dune with a crest width of 25 ft. at elevation +15 ft. NGVD.

Reach 4 (Wilderness Area to Moriches Inlet) - Reach 4 includes the Fire Island National Seashore wilderness area and Smith Point County Park and includes a total of 67,800 feet of Atlantic coastline. This reach is generally undeveloped with the exception of parking areas and recreational facilities at Smith Point County Park. This reach fronts the mainland communities of Brookhaven and Bellport.

No protective fill is proposed fronting the wilderness area. The fill cross-section will provide a minimum beach width of 90 feet at elevation +9.5 NGVD. The section will be used in the most eroded portions of Smith Point County Park, where sufficient dune height currently exists, but the fronting beach width is insufficient to ensure the survivability of the dune. The design fill in this area will also act as a feeder beach to downdrift areas.

Fill Alignment

Fill Alignment. The fill alignment is detailed on the enclosed topographic maps, which show the proposed location of the dune and berm. The alongshore extent of fill is approximately 12 miles. The alongshore extent is defined in the enclosed table, labeled C-24.

Fill Volumes

The fill volumes for the interim project consist of the following:

Design Fill. Design fill is the quantity of material required to construct the design template, as described above, as provided in the enclosed figures, based upon comparison with the existing barrier island condition.

Tolerance Fill. Tolerance fill is the quantity of material to account for construction limitations, and variations in fill requirements between completion of the feasibility analysis, and potential implementation. A 15% tolerance has been used for this analysis.

Advance Fill. Advance fill is the quantity of material that is placed to offset long-term erosion and storm induced erosion, to ensure the survivability of the design section described above. An advance fill volume is placed during initial construction.

Overfill. Overfill is the quantity of material which is placed to account for variability between the native fill material and material from the offshore borrow area. A comparison of the mean grain size, and grain size distribution results in an overfill ratio of 1.0, meaning no overfill material is required to account for material differences.

Renourishment Fill. In order to ensure the survivability of the design cross-section, renourishment fill material is placed at intervals subsequent to initial construction. The renourishment cycle for this plan is approximately every 3 years.

Initial Construction Volumes

The volumes for initial construction of the proposed interim project are provided in the enclosed table labeled C-25.

Renourishment Schedule

Based upon the schedule for completion of the reformulation study, the interim project life period includes initial construction and one nourishment cycle, estimated to require approximately 2,300,000 CY of material, on an approximate 3-year cycle. Renourishment schedules and quantities vary depending upon storm activity and beach profile response, and will be adjusted accordingly, but 3-years has been estimated for project planning purposes.

Real Estate Requirements.

Real Estate requirements include the lands, easements, and rights-of-way to construct and maintain the proposed interim project. The lands, easements, rights-of-ways, and relocations necessary for implementing the project are described below. The two types of easements required for the interim project include a perpetual beach storm damage reduction easement, and a temporary work easement. A perpetual beach storm damage reduction easements would be obtained along all areas where beachfill material is placed, or could be potentially placed, during renourishment operations, to allow continual access to construct, operate, maintain, patrol, repair, renourish, and replace the beach berm and dune. This easement precludes development, other than approved dune crossings and ensures that the design section, including 25 feet landward of the landward toe of the dune, would be held inviolate from future development. The second easement type is a temporary work area easement, which would be obtained to allow right of way in, over, and across the land for a period of three years for construction operations. The responsibility for the acquisition of the necessary lands and easements are a responsibility of the local sponsor.

New York State Department of Environmental Conservation
Division of Water
Bureau of Flood Protection, Room 388
50 Wolf Road, Albany, New York 12233-3507
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John P. Cahill
Commissioner

May 11, 1999

Mr. Charles R. Smith
Assistant for Environmental and Regulatory Affairs
U.S. Department of the Army
Office of the Assistant Secretary of the Army (Civil Works)
108 Army, Pentagon, 2E569
Washington, DC 20310-0108

Mr. Willie R. Taylor, Director
Office of the Environmental Policy and Compliance (PEP)
U.S. Department of the Interior
1849 C Street, N.W., Room 2024
Washington, DC 20240

RE: Fire Island Interim Project

Dear Mr. Smith and Mr. Taylor:

I am Chief of the Coastal Erosion Management Section, New York State Department of Environmental Conservation. I understand that a question has arisen regarding the proposed Fire Island Interim Project and its possible effect on additional development. Please be advised that I have reviewed and slightly modified the attached which accurately reflects the official position of my office on this issue. If you have any questions, please do not hesitate to call me at (518) 457-5620.

Sincerely,

William W. Daley

William W. Daley, P.E.
Chief
Coastal Erosion Management

Attachment

cc: C. Jones
R. Cowen
L. Liebesman

Enclosure

FIRE ISLAND INTERIM PROJECT AND DEVELOPMENT

The New York State Department of Environmental Conservation (DEC) is the principal non-Federal partner in shore protection projects in New York. As such, it is the agency responsible for securing from the municipality in which the project is to be constructed ownership of, or easements upon, lands upon which construction takes place. DEC also administers the State's Coastal Erosion Hazard Areas Management Program, which regulates construction and other activities within such areas seaward of a line demarking the areas's primary protective feature. The law provides for relocation of that line by the DEC Commissioner to reflect the new location of a protective feature one year following a natural or manmade event that has the effect of moving the feature. The location of the boundary line is not revised in the absence of a commitment to maintain the feature in that location for 30 years.

1. Since the FIIP will not have a life guaranteed beyond six years, the CEHA boundary line will not be relocated seaward based on the FIIP. [Environmental Conservation Law Article 34, Coastal Erosion Hazard Areas and 6NYCRR Part 505, Coastal Erosion Management Regulations, Section 505.9]

2. No lots that are currently undevelopable will become developable as a result of implementation of the FIIP.

3. Three of the four municipalities (2 townships, 2 villages) involved are developing regulatory program in strict conformance with State guidelines, and these programs must be in place and functioning before implementation of the FIIP. Identified hazard areas in the fourth municipality will be regulated by the DEC in the absence of local regulation. All of the programs are scheduled to be in place by September 1999.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue – Room 142
Boston, Massachusetts 02210-3334

September 17, 1998

ER 97/ 98

Colonel William H. Pearce
District Engineer
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Post-it® Fax Note 7671	Date 9/25	# of pages ▶
To Steve Couch	From A. R[illegible]	
Co./Dept. ACOE	Co. DOI	
Phone #	Phone #	
Fax # 212-264-6040	Fax #	

Dear Colonel Pearce:

On behalf of the Department, I would like to thank you and your staff for organizing the June 18 Environmental Impact Statement (EIS) Workshop for the proposed Fire Island Inlet to Moriches Inlet Interim Plan for Storm Damage Protection (Fire Island Interim Plan or FIIP). As a Cooperating Agency in the Fire Island Interim Plan EIS process, we appreciate the opportunity to provide our input, and welcome the continued exchange of information between our agencies. The Department of the Interior has also supported, as a Cooperating Agency, the Breach Contingency [Interim] Plan; is participating as a Cooperating Agency in the Reformulation Study EIS; and has acknowledged on numerous occasions over the past three years the potential for a truly interim plan for Fire Island.

By this correspondence we would like to accomplish the following: 1) provide feedback on the draft EIS outline prepared by the Corps, the subject of the June 18 workshop; and 2) provide initial, [illegible] comments on the "Preferred Alternative/Proposed Action" for the Fire Island Interim Plan. The Proposed Action, briefly introduced during the June 18 Workshop and subsequently described in more detail in the Corps' letters of July 16 and 17 to the U.S. Fish and Wildlife Service, will be addressed below under Alternative 4.3.(c) "Interim (44-year) Protection Plan, incorporating non-structural measures." Additional comments on the Proposed Action may be needed pending the Department's review of the detailed maps for the proposed FIIP (recently requested). We may wish to schedule follow up meeting(s) at that time to continue the productive interactions between our agencies.

Please note that comments herein on the Proposed Action do not constitute the Fish and Wildlife Service's response to the Corps under the Fish and Wildlife Coordination Act (FWCA), or consultation pursuant to the Endangered Species Act (ESA). Such information will be provided directly to the Corps by the Fish and Wildlife Service in accordance with any previously agreed upon schedules.

Annotated Outline for a Fire Island Interim Project:

1.0 PROJECT HISTORY

This section should clearly identify the organizations requesting development of the FIIP, if not specifically identified in the 1960 authorized plan or subsequent modifications to the Water Resources Development Act.

2.0 PROJECT DESCRIPTION

It should be stated that over 90% of the project will directly affect lands within the jurisdiction of the National Park Service's (NPS) Fire Island National Seashore. The design reaches should be described in terms of the NPS' designations for these areas, e.g., seashore districts, community districts, Federal Wilderness Area, etc. The percentage of the project which is planned for Federal in-holdings versus community districts should also be provided. In addition, the EIS should identify areas that will be indirectly affected by the project.

The project description should also include a discussion and maps of any areas where environmental mitigation might be proposed. The project description should also include a discussion of the duration of initial construction, all proposed vehicle and construction access/dune crossing routes, renourishment cycles and associated time frames, and construction requirements (e.g., access routes, [illegible]).

In addition to identifying the different "political subdivisions," a map should also be provided which shows the location of ecologically sensitive or rare natural resources surrounding, and on, Fire Island and the mainland, in relation to the proposed construction. This map might also include a depiction of commercially and recreationally important finfish and shellfish habitats.

3.0 NEED FOR PROPOSED ACTION

There needs to be more sensitivity regarding the use of the terms "damage" and "erosion." To some "damage" is the same as the beach *changing* on a yearly basis. "Damage" should be reserved for use in conjunction with structures. As we stated in the June 18 workshop, these words need to be used carefully and correctly.

It follows that the basis for this action needs to be clarified. Clearly, there has been erosion at Fire Island, but, since barrier beaches maintain their intrinsic function through periodic rollover and backshore deposition, the initial question which must be addressed is why this project is being proposed at all. The Proposed Action is described as "remedial protection," thus implying that there is something wrong that needs to be remedied. The U.S. Geological Survey scientists have already indicated that the erosion in the western communities is not appreciably attributable to effects from the Moriches Inlet project. This proposal cannot rest upon a need to repair the perceived effects of man made structures to the east. East of the Smith Point Bridge, there appears to be no scientific doubt that the only significant reason for shoreline change is natural processes.

In the absence of any evidence that the observed erosional trend is other than natural, the Purpose and Need analyses in the NEPA sense, and the justification for action in a NPS authority/policy sense, must be premised upon the communities' desire for governmental assistance for development sited in an identified hazardous area.

The interim project objectives should be fully articulated in this section. Related, if project objectives are to reduce storm damages and costs, the EIS should clearly identify how the project will not contribute to storm damages as a result of increased development in flood and erosion prone areas (e.g., Corps of Engineers analysis to date has shown the project has potential to open 56 lots to new development resulting from the beach fill in combination with the Coastal Erosion Hazard area delineation process proposed by New York Department of Environmental Conservation).

This section should discuss the probability of breaching and overwashing of the dune system within each design reach, defining the criteria or factors that were considered in this assessment and an indication of whether this assessment was employed at other sites outside the project area with any accuracy. The EIS should describe, based on its coastal monitoring data, any relationship between the computed probabilities of breaches and residential/infrastructure development on the island. The EIS should state whether the dune construction as proposed in the plan is necessary because of past development practices (encroachment on the dunes), and if there will be a lower level of protection provided by this project if the proposed constructed dune features are unprotected from impacts due to barrier island development. The EIS should provide an introductory comparison of the state of the beaches in natural versus developed areas, and how those natural areas function in a coastal ecosystem. Also, in this section or under Project History, a discussion should be included that portrays the relationships between development of the floodplain and need for the FIIP.

This section should also provide a discussion of the flooding which occurs on the mainland due to overwashes, water entering through the inlets, and breaches, as well as their respective contributions to the increase in bay tidal levels up to and exceeding a 44-year level storm.

This section should include a discussion on how the FIIP is different from, or similar to, other shoreline protection projects proposed for barrier islands on Long Island. For example, the proposed Long Beach Island project provides no protection to the mainland and back-bay communities. The Corps (1998) stated, "...the back-bay area at the project site will also be flooded by the increased water level due to flood flow through the inlets. It is anticipated that the induced flooding in the back-bay will be the same for both existing and improved conditions since there will be no hurricane barriers introduced in the current improvement plan."

According to the draft outline, this section will include statements indicating how the "FIIP is independent of the reformulation plan" (due for completion in 2002). Though we appreciate the Corps' efforts to investigate structural alternatives of lesser magnitude and duration, the Proposed Action/Preferred Alternative has a planning horizon in which 13 of its 15 year duration, including 4 renourishment cycles, extends beyond the scheduled completion of the Reformulation Environmental Impact Statement/Record of Decision (EIS/ROD). As currently described, the Proposed Action represents the implementation phase of the Reformulated Plan, and, therefore, cannot be accurately described as "justified independently." Given that the environmental impact analyses conducted for the FIIP EIS will not be supported by field studies, the substantive, policy and procedural issues outlined in our February 20, 1998, correspondence still apply.

Notwithstanding the substantive environmental concerns identified herein, the Department believes that the procedural issues described above can be resolved. As we have recommended over the past three years, the Corps must redefine its approach to the development of an Interim Plan, evaluating short-term projects (the period between initiation of an interim plan and completion of the Reformulation Study in 2002), that can be extended based on the Reformulation EIS/ROD outcome, rather than long-term projects that may be "reversed." There is a fundamental difference between the two projects.

In terms of benefit-cost analysis, we suggest that the Corps consider identifying a range of benefit-cost scenarios, reflecting potential outcomes of the respective planning/EIS processes now under way, rather than a single outcome, e.g., the benefit-cost ratio at the Reformulation EIS/ROD completion (2002); at completion of the implementation phase (2016); at 30 years. Not only does this fully disclose the risks, such as the possible selection of a no-action or non-structural alternative under the Reformulation Study EIS, but also potential benefits that could, hypothetically, accrue over a longer horizon due to decisions based on the Reformulation Study. The Corps has not yet approached the Department for the purpose of estimating potential mitigation costs.

With regard to the Corps' mention in this section of potential delays to the Reformulation Study EIS, the Department must express its concern that such delays may now be occurring, possibly as a result of the resources directed to the multiple interim plans under investigation. The Corps needs to thoroughly reevaluate the "supplemental NEPA documentation" referred to in its June 11 response to the Department, since the suggestion appears to revisit the scenario leading to the 1978 CEQ referral. Absent an adequate Reformulation EIS, the long-term strategy for all reaches considered under the Reformulation Plan is uncertain.

4.00 ALTERNATIVES

This section should include an appropriately thorough discussion of the reasons for eliminating alternatives.

During the June 18, 1998, EIS workshop, the Corps noted that all alternatives had been vetted in the selection of the Proposed Action/Preferred Alternative. Given the many questions posed below regarding the "rejected" alternatives, it is unclear whether an adequate alternatives analysis has been undertaken.

4.1 No Action

There needs to be an analysis in the plan about whether or not future local projects like beach scraping, or local beach nourishment would be allowed. This question should also be addressed in the Impact Analysis section.

The Breach Contingency Plan (BCP) should be described as an existing interim plan and should be identified as an alternative separate from the FIIP. The BCP will close breaches and provide a level of storm damage protection to the mainland within the envelope of the Reformulation Study.

The EIS should mention that under the "No Action" alternative, planning and analysis to determine the feasibility of Federal involvement in shoreline protection along the south shore of Long Island will continue via the Reformulation Study.

4.2 Non-Structural Alternatives

In its June 11 letter, the Corps stated that "acquisition will be discussed, however, such a plan would likely be inconsistent with interim project objectives." The EIS should provide an appropriately thorough discussion as to why various acquisition alternatives were rejected, especially in view of the comparable investment being contemplated under the structural alternatives. It is not clear why the planning schedule cannot either currently accommodate, or be restructured to accommodate, an evaluation of non-structural alternatives.

4.2.a Condemnation through Fire Island National Seashore Authorization

During the June 18 workshop, the Corps and New York Department of Environmental Conservation, Flood Protection Bureau, suggested that *NPS* condemnation authority could be relied upon for acquisitions necessary to implement the FIIP. This alternative has not been developed with the NPS. Further exploration of this alternative must be developed jointly with the NPS, taking into account the full range of fiscal and regulatory issues, if it is to be considered as a truly viable option. In fact, any condemnation of land in NPS jurisdiction must ultimately be approved by NPS.

4.2.b Non-Structural Plan

See section 4.2, above.

4.3 Beach Nourishment Alternatives

The 30-year life of the interim project is still an issue that needs to be resolved. Through numerous exchanges between the Department, the Corps, and New York State Department of Environmental Conservation and Department of State, has come acknowledgment that there is flexibility in the standard 30-year requirement under the New York Coastal Erosion Hazard Regulations, notwithstanding the fact that the "reasonable probability" of a 30-year project life cannot be guaranteed without presupposing the outcome of the Reformulation Study/EIS. Therefore, from an "interim" standpoint, the 44-year recurrence interval is not an absolute design standard (refer also to the BCP). This section of the draft EIS should clarify this point. Also, in the description of the Proposed Action/Preferred alternative, the Corps indicated that a project of lesser magnitude would result in modest cost savings (15%), but with "greatly diminished" mainland protection. This section of the draft EIS should include the data (sensitivity analysis) supporting this conclusion, and clarify what is meant by "greatly diminished" (e.g., the level of protection remaining).

As stated in the June 18 workshop, it is important that the draft EIS provide an adequate description of the current capacity of the barrier island to withstand storms, in a geographically specific fashion, and to demonstrate why a dune designed to withstand the 44-year storm is appropriate for the interim storm damage reduction evaluation period.

Also, since the beach surveys document that the dunes in the natural zones are generally in better condition than those in front of the communities, identifying measures to reduce any human caused contribution to erosion problems in front of the communities should be addressed as an alternative. This might include closure of the beach to vehicles whenever tide conditions approach 25 feet seaward of the dune grass (to prevent inadvertent shearing of the rhizomes due to vehicles avoiding higher tides) and more rigorous state, local and federal efforts to address the impacts from, and location of, shorefront development. Dune and shoreline change is a natural state. But, if there are impacts caused by people which exacerbate baseline natural erosion, then the alternative analyses should address them directly.

This section should provide a summary of the preliminary offshore sand borrow area investigations which are being conducted under the Reformulation Study/EIS. As a result of the preliminary investigations, questions have been raised about the total volume of sand which may lie off-shore, and, thus, whether borrow sources which would naturally resupply the island will be exhausted early in the project, thereby depriving the Seashore of normal supply for future years. The implications for the viability of multiple renourishment cycles should also be discussed.

<u>4.3 (a) Interim (44-year) Protection Plan with a renourishment duration of 30-years.</u>

All issues identified in our February 20, 1998, correspondence apply.

<u>4.3 (c) Interim (44-year level) Protection plan incorporating non-structural measures.</u>

Comments on this section are organized according the format used in the "Project Description 7/98" forwarded to the U.S. Fish and Wildlife Service for FWCA and ESA purposes. Many of the points raised herein also apply to the alternative identified in section 4.3.(b).

General

First, for purposes of clarifying the administrative record in this case, the statement in the Corps' July 17 letter, that the Proposed Action was identified "as a result of the June 18, 1998, EIS workshop," is incorrect from our perspective. Prior to the workshop, Corps staff notified the Department that a Proposed Action/Preferred Alternative had been identified and would be presented on June 18. Moreover, during the workshop Corps staff noted that all alternatives had already been vetted, and the Proposed Action/Preferred Alternative was then briefly presented.

As noted in Section 3.0, the proposed Interim Plan can be defined in a manner that is consistent with NEPA, the 1978 CEQ referral, and does not prejudice the Reformulation Study/EIS.

Beach-Fill Configuration

There are some notable gaps in the description of the areas covered by the project, notably the Lighthouse tract, the Sunken Forest and Watch Hill. The Corps needs to clarify absolutely that it does not intend to undertake any project activities, at any time, in these areas of Federal ownership. If the Corps intends to include them but just didn't identify them specifically, or may choose to include them at some point over the project life, then all the compliance/evaluations involved in the underlying the NEPA process, ROD, special use permits, consistency findings with NPS policy, and easements would apply (see also below). Therefore, we must clarify that these areas are not at issue because no work is contemplated there at any point in time. To the extent that the Corps intends to include these areas, then the comments below under "Federal lands" apply.

Federal Lands

The Corps will need several different easements before it can proceed with the proposed project. The grant of any easements on NPS owned lands must be handled through the Land Resources Office, abiding by all their standard procedures.

It is our understanding that the local sponsor will be the State of New York. Is the Corps therefore proposing to have the NPS convey all of these easements to the State? This point must be clarified.

As the underlying landowner, and as a National Park managed for certain Congressionally specified purposes, before permitting such uses of Park lands, there will need to be a carefully documented administrative record showing how these beach manipulation activities are consistent with NPS and Fire Island National Seashore statutes, plans, and policies. The Corps must discern, in cooperation with the NPS, whether NPS will be able to make findings that this proposal is consistent with its governing criteria. A Special Use Permit (SUP) will be required for a project like this to occur anywhere within the boundary of the park. The Corps has been previously notified of this potential issue.

Non-federal lands

On non-Federal lands within the boundary of the park, the NPS would be issuing a SUP to allow this use to take place within the park. Before such permit is issued, it would have to be found to be consistent with NEPA, NPS policies, statutes etc. This would be documented as an administrative record culminating in an NPS ROD. Much of the same material for the act of issuing easements on the Federal lands would apply to the special use permit. The NPS has prepared administrative records for some of the local beach fill projects undertaken by individual communities, but since this is a far more significant action, this administrative record would need to be more comprehensive than those.

Again, it is the Department's understanding that New York State is the local sponsor. If not, there are a host of questions that need to be addressed well prior to the preparation of a draft EIS, ranging from policy limitations, capabilities, and funding.

The Corps should be aware of the NPS' limitations with the authority to acquire lands. In any community which has an approved local zoning ordinance, and if the land is consistent with the local laws and federal standards, the NPS is statutorily forbidden from acquiring any interest in land without the consent of the owners. After all the title verification work is performed, and the current owners are identified and the properties appraised, then those who would be unwilling to sell for the appraised value would be able to stop the entire project. Given that the beaches are platted in front of most of the communities, and that, above mean high water, those titles are still sound even if the lot is unbuildable, there is a clear potential that some landowner would refuse to convey his/her rights.

While the NPS does have the right to condemn lands and waters in the communities for beach access, the NPS is not going to seek beach access through the existing communities, but will confine itself to its major public access areas. Therefore, it would be inconsistent with the General Management Plan or other documents to attempt to use the beach access exception to cover NPS condemnations.

In addition, the NPS is prevented from acquiring any interests in land left in its natural state by the landowner if the property is within the Dune District. Of course, it could be acquired by voluntary sale, but such undeveloped property must remain in its natural state, and then the Corps project itself would raise serious questions about whether it would be illegal to do all this manipulation as it would be a change from its "natural state." This problem can be avoided entirely if no part of the project area involves alteration of any lands in the Dune District or if the NPS is not the acquisition agency.

Thus, the Corps needs to clarify in the EIS whether the local communities or the State will be the local sponsor and, therefore, responsible for acquiring all the non-Federal easements.

The EIS description for the Proposed Action should, as expected, clearly illustrate the width of the dune/beach/berm configuration before impacts are assessed and any acquisition is begun. It is our understanding that the Corps is proposing to place the dune seaward of the current dune in order to reduce acquisition costs by not having to acquire houses. However, the NEPA process, as well as any NPS decision process, needs to address the structural integrity of creating an artificial dune seaward of the current dune line. Since dunes, in their natural state, continually roll over, the proposal is apparently an attempt to recreate a situation which existed at some point in the past, and not even "freezing" the current dune line.

If the effort to place the dune in front of the current dune is truly intended to reduce costs, then, given the realities of the acquisition process and the difficulties inherent in identifying the platted landowners or heirs with extant rights, as compared to acquisition from known landowners, the process will not be significandy delayed nor appreciably more expensive than by placing the project more in line with present or anticipated dune configurations.

<u>Reach 1 (Robert Moses State Park)</u>

Lighthouse Tract is omitted from Reach 1 and Reach 2, and is left as a gap in the plan.

<u>Reach 2 (Kismet to Point O'Woods)</u>

Lighthouse Tract is omitted from Reach 1 and Reach 2, and is left as a gap in the plan.

<u>Reach 4 (Wilderness Area to Moriches Inlet)</u>

In prior communication, the Department has discussed the legal problems presented by alterations to the Wilderness Area. It is unclear in this project description whether the intention is to do any manipulations west of Smith County Park. If a project proposal still includes work within or affecting the Wilderness Area, our concerns regarding the Wilderness Area are still relevant. (See first comment above.)

Fill Volumes

"Advance Fill" seems to be a way of adding to the *finished* fill volume without "adding" to the proposed fill volume. This confuses the discussion. A better explanation is needed in the EIS.

Renourishment Schedule

This section should also discuss why the interim projects can be planned, designed, and constructed under a much shorter time scale than any implementable solution resulting from the Reformulation Study (currently estimated at 15 years post ROD).

See also comments under "General" above, concerning project life concerns.

Land Use

Public Access has yet to be addressed in any meaningful way.

Easements.

The perpetual easements defined under this interim project are described as if the Corps will have the perpetual right to rebuild, without any end articulated, regardless of what the outcome of Reformulation may be. A SUP would be required by NPS for work on such "easements," regardless of what the EIS may call "perpetual." SUP's are not issued to anyone as, or for, perpetual rights of use and occupancy.

Perpetual beach nourishment easements

Perpetual beach nourishment easements are already primarily beachfront lands that belong to the state, with concurrent jurisdiction of NPS. However, there are a number of private properties within the community (not all) that have property descriptions that extend to the high tide line. All of the resulting land would be subject to Public Trust Doctrine as open space. Except for "dune," this land would be open to all public for recreational use and enjoyment. Continual access for the Corps to re-nourish, repair, etc. is subject to discussion, as described below.

Perpetual restrictive dune easements

Perpetual restrictive dune easements, "generally including a distance 25 feet landward of the landward toe of the dune. . . would preclude development which would violate the integrity of the dune." The only way that this could be obtained is to place the entire fill 25' seaward of the existing development and existing dunes that the development is built upon. The draft EIS should clearly document the additional fill volumes and subsequent costs to construct them. As noted in

Corps' documents, this alignment will open 56 lots for development, and would shift the responsibility (fiscal and environmental responsibilities associated with maintaining structures in a high hazard area for 30 years) for all oceanfront development, existing as well as the resulting 56 lots, to the government, instead of the property owners and builders.

Temporary work area easements

Temporary Work Area Easement is the only easement that is consistent with a short-term interim nature of the project, being defined as only for a 3-year duration, and actually may describe the other two easements.

Acquisition/Relocation.

See prior discussion on acquisition under Beach Fill Configuration.

Non-Structural Aspects.

The July, 1998, Project Description also states that "recommendations will be made" to determine that building does not occur on the 56 lots which would potentially be developed as a result of this project. This language is very vague. What entity will be responsible for ensuring that these lots are not built upon? The only avenue that the NPS has to ensure that lands remain undeveloped is the willing sale for fair market value, as long as the Town maintains an approved zoning ordinance. The Towns will proceed to issue building permits if the structures are consistent with Town law. Therefore, a special zoning district would need to be adopted that forbids construction in this new dune zone. This might withstand local judicial challenge, but the Town of Islip, for instance, has had a very difficult time attempting to enforce its first Dune District and was frequently sued under New York law. So, even if the ordinance were adopted in each of the four zoning entities, it is uncertain that it would survive challenge from one of these 56 landowners. Again, if the local ordinance were found to result in a "taking," will the Corps provide the acquisition funds? Given the very high value that ocean front property on Fire Island has, it is unreasonable to assume that 56 landowners will abstain from developing their lands absent a funded buy-out program and coordinated state, local and Federal (like a new Dune District) regulatory programs effectively prohibiting development uses within such a zone. In other Corps projects, when the Corps wanted to acquire flooding rights or prohibit stream alterations, it directly conducted its own acquisition program. A similar approach should be explored for the FIIP.

In view of these issues, including the concerns raised in our February 20 correspondence, the EIS must provide a clear and thorough rationale, not provided to date, for why the New York State Flood Protection Bureau intends to establish the Coastal Erosion Hazard line according to where the natural dune is now located, and then move the line seaward coincident with a man-made "interim" dune, especially given the pending outcome of the Reformulation Study. The EIS should explain how such an approach will not result in irreversible impacts which, in turn, may limit the alternatives to be explored under the Reformulation Study.

5.0 AFFECTED ENVIRONMENT

The EIS should provide a basis for the claim that the FIIP will be "reversible," pointing to examples in published or gray literature and/or field data. The EIS should provide a time frame for reversibility (reflecting the residual post-renourishment economic benefits). This is an important factor when attempting to estimate the environmental impacts associated with the period of reversion. If mitigation is needed, will that also be termed interim or will mitigation proceed for as long as the reversion is taking place?

Human Development

The majority of this section deals with Fire Island. Since the benefits are claimed for the mainland there should be an equivalent or higher degree of discussion for this area.

5.01 *Transportation*

This section should include routes used by commercial fisherman, party fishing boats.

5.02 *Land Use*

See above comments under **Human Development**

5.03 *Coastal Barrier Resources Act*

See above comments under **Human Development**

5.04 *LWRPs*

See above comments under **Human Development**

5.05 *Utilities*

This section should include a discussion of the utilities in the entire project area and not just on Fire Island.

5.06 *Environmental Justice*

It is appropriate to map minority populations and low-income populations on the mainland since this is where most of the claimed benefits are derived.

Natural Resources

The Corps has stated that no field studies will be conducted for this project. Therefore, there cannot be a current environmental baseline presented in the EIS from which to predict or measure any environmental impacts.

The three zones which have been arbitrarily chosen do not clearly represent all of the habitats which are within the extent of project area (which extends up to the 20' NGVD contour on the mainland).

5.07 ***Offshore***

The EIS needs to discuss marine mammals and turtles in this section.

5.07.1 Einfish

The EIS should specify the methods it will employ to describe finfish populations. Are they quantitative or qualitative? In addition, what life stages will be described, eggs, larval, juvenile, adult or all? How will catch data provide information on species which are not economically important but which provide an important ecological function?

5.07.2 Benthic Invertebrates

How is the benthic data being analyzed? Were reference sites chosen? What type of analysis will be employed to measure impacts to the borrow area should the project be constructed? Is there a mitigation strategy being developed to avoid, minimize or compensate for any negative impacts which might arise?

5.08 ***Barrier Island***

5.08.2 Benthic Invertebrates

The annotated outline does not include a brief description of the study design the Corps will employ to gather information on the invertebrate resources which occur in the "placement area." The EIS should also make comparisons between this information to information collected from other barrier islands on Long Island in its discussion of the relative importance or quality of beach habitat.

5.08.3 Avifauna

The importance of Fire Island to migrating and breeding avifauna should be discussed relative to other barrier islands systems or beach habitats on Long Island.

5.08.4 Wildlife

Why have deer management issues have been targeted?

5.09 Back-bay Environment

The extent of the back-bay habitat should be defined. Are all interconnected back-bays and associated tributaries to be covered in the analysis?

5.09.1 Submerged Aquatic Vegetation

The EIS should indicate whether the data are current enough to project the extent of seagrass habitat which may be impacted by the project.

5.09.2 Finfish

The EIS should indicate whether the data are current enough to project the extent of finfish habitat which may be impacted by the project.

5.09.3 Benthic Invertebrates

The EIS should indicate whether any invertebrate surveys have been collected in the project area, and, if so, state whether the data are current enough to predict impacts to the resource.

5.09.4 Avifauna

In addressing the bird life in the back-bays, the EIS should include a discussion on the species use by habitat, the current state of that habitat, and the factors that have affected, or are affecting, that habitat or those species.

5.10 Rare and Endangered Species

A discussion of the threats to these species in the project area is also warranted. This section should also provide an introductory discussion of whether any of their alternatives are recommended or supported in the species' recovery plans.

5.12 Cumulative Actions in the Interim Project Area

The cumulative analysis section be broad enough to include an ***analysis of past actions***, in conjunction with on-going or planned activities.

This section should be more than just a listing of actions. It should also include a discussion as to what methodologies will be used to assess cumulative impacts.

6.00 ENVIRONMENTAL IMPACTS

In the impact section, the statement needs to be made up front that the analysis was completed using existing data that may be out of date. No new studies were accomplished as part of the decision document.

The environmental impacts section being prepared seems to have already pre-judged alternatives with the statement "These are the most likely alternatives..."

NEPA regulations at section 1502.14 state that the section on alternatives including the proposed action "should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among the options by the decision maker and the public." The Corps' proposed approach, in which the technical analyses for human development, natural resources, cultural resources, and cumulative impacts will be "presented separately for only the preferred alternative and the No Action Alternative", may not meet this objective, and should be revised in the draft EIS.

As communicated to the Corps on numerous occasions over the past three years, to the extent that the Corps provides the Department with an impact analysis which does not fully address the anticipated impacts from a 15 to 30 year project, the Department will not be able to rely upon such analyses for its own reviews. Likewise, predictions of impacts on biological resources, whether marsh vegetation, shellfish or other wildlife, must be based upon the assumption that the project will continue for 15 to 30 years and be renewed every three years. Therefore, the studies and analyses that are needed to evaluate these impacts must be in hand in order to support any decision to proceed with the action.

<u>6.01 Impacts of the No Action Alternative</u>

<u>*6.02 Human Development*</u>

<u>6.02.1 Transportation</u>

This analysis is based on some predictions of where a breach might occur. The EIS should state that there are no roads within the Fire Island National Seashore. This assessment should be done under a BCP alternative.

A breach might effect only a shift in the type of transportation. For example, a seasonal shift in the mode of transportation for some locally operating entities or residents on Fire

Island was necessitated by implementation of the NPS' Endangered Species Habitat Management Plan.

6.02.2 Land Use

The EIS should identify to the agencies what the "projected demands from the interim project" are so that they may use this information during the planning process.

The time frame used for the assessment covering "potential decreases in recreational uses on the barrier island" should be clearly stated in the EIS. A definition of the types of recreational uses that will be lost, and why they would be lost, needs to be very clear.

What types of "effects" due to continued erosion on both developed and undeveloped areas will be described? Will there also be a description of the effects of accretion?

An assessment should be made on the increase or decrease in wildlife populations in the project area and how this might also effect passive recreational uses.

Unless there is wide scale breaching of the island, how will more than one facility be affected at a time?

Are the undeveloped areas which are mentioned undeveloped lands within community districts or seashore districts?

6.02.3 Environmental Justice

Same as 5.06

6.02.4 Utilities

Same as 5.05

6.03 Natural Resources Impacts of the No Action Alternative

The first sentence is characteristic of barrier islands. Where will the "standard" breach occur and how will it affect the results of this assessment? How will the assessment be made if there is no current environmental baseline in place?

An objective discussion should be provided on the changes in the biological and physical characteristics of the barrier island in relation to a breach or overwash.

6.05 Cumulative Impacts

The Corps should consider assembling an interagency team to determine the methodologies which would be employed to measure cumulative impacts (as well as indirect and direct effects).

The cumulative impacts analysis should also look at future private or local actions to nourish beaches in the project area and not just development issues.

Impacts of the Various Non-Structural Alternatives (Either Alone or in Combination with Beach Nourishment)

<u>6.07</u> ***<u>Buy-Out Plan</u>***

There is no mention of where the buy out plan would be located. Why would waterfront access be lost? Lost to whom, the private property owners?

<u>6.09</u> <u>Impacts of the Beach Nourishment Alternative</u>

<u>6.10</u> ***<u>Human Development</u>***

The Corps has notified the Department that it will "identify methods to reduce development within the area, which may be created as a result of project construction, and the movement of the CEHMA line." Subsequently, in the DEIS outline, it was stated that "changes [in human development] would be noted ... quantified ... and the ability of the human systems to accommodate these anticipated uses will be estimated." Does this mean that no effort will go into reducing resulting development, other than the "exclusive" condemnation authority of NPS? If so, there seems to be an inconsistency between the Corps' descriptions of the same project in the two different documents, which should be resolved.

<u>6.10.2 Land Use</u>

The EIS should discuss the potential increases in recreational uses of the mainland and the associated environmental effects. How will the project affect uses of public beaches, marinas, and infrastructure on the mainland?

<u>6.10.4 Utilities</u>

There is no mention of whether this project will increase demands on the mainland utilities.

<u>6.11</u> ***<u>Natural Resources Impacts of the Proposed Fire Island Interim Project</u>***

There is no discussion of impacts on the barrier island interior, especially related to the flora of the island interior, and the freshwater wetlands in the interior areas of the island.

The EIS should state where the "build scenario" has been implemented on the barrier island over the last fifty years and by whom, what potential affects did the "build scenario" have on the barrier island and back bay resources, and if any of the build scenarios either individually or cumulatively comparable to the present interim project.

If breaches or overwashes are not expected to occur over the project life, then it would be hard to say that any impacts to the system would be "trivial," since the system is influenced by these mechanisms.

How will the level of environmental impacts be assessed in the EIS without developing an environmental baseline? It has been noted by the National Research Council (1995) that no studies have been conducted on the recovery rates of supralittoral and intertidal invertebrate populations following beach nourishment above 36 degrees North latitude. In addition, there have been no studies on the indirect effects following beach nourishment activities on shorebird foraging patterns (NRC, 1995). What types of pilot projects has the Corps proposed to address these fundamental data deficiencies?

What will this project mean in terms of maintenance of the Fire Island Inlet navigation channel? Will more periodic maintenance be needed? If so, how will these increased dredging events effect resources in the channel and downdrift disposal areas?

The EIS needs to identify all offshore borrow areas which may be used as a source of sand material.

If, as an indirect effect of this project, additional shorebird nesting habitat is formed and utilized, will the EIS present implementable management measures to protect those species from human induced disturbance and will the Corps fund, or assist the NPS in funding, those management measures?

6.14 Cumulative Impacts

As noted in our comments under section 6.05, above, the Corps should consider assembling an interagency team to determine the methodologies which would be employed to measure cumulative impacts (as well as indirect and direct effects).

The cumulative impacts analysis should also look at future private or local actions to nourish beaches in the project area and not just development issues. Isn't the reason that the Reformulation Study cannot be included in the cumulative analysis section, is because it is incomplete, and not because it will supersede the 30-year interim plan?

7.0 COORDINATION AND COMPLIANCE WITH PROTECTION STATUTES

Coordination with cooperating agencies and the need for an NPS permit will require that the NPS prepare a separate ROD bearing on the Corps' final EIS. This in no way indicates that the NPS/Department of the Interior will be agreeing with any determination that the Corps makes in its ROD.

The Corps' EIS and ROD should also indicate how it is reaching the development of a plan for beach nourishment that is mutually acceptable to the Secretary of the Interior and Secretary of the Army. The Corps should describe how the preferred alternative meets the NPS' policy on these types of actions

Thank you for the opportunity to comment on the draft EIS outline for the proposed Fire Island Interim Plan. While we will be contacting your office in September to discuss the need for additional meetings on this proposal, please do not hesitate to contact me if you or your staff have any additional questions. I can be reached at (617) 223-8565.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

cc: Willie Taylor, DOI/OEPC
William Leary, DOI/OS/FWP
Sherry Morgan, FWS/NYFO
Robin Lepore, SOL/NE
Robert McIntosh, NPS/NFA
Constantine J. Dillon, NPS/FINS
Frank Santomauro, USCOE/NY
Chip Smith, USCOE/OS
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Alexander F. Treadwell, NYS/DOS
Steven Resler, NYS/DOS
Hon. Rick Lazio, c/o John Tepedino
Hon. Michael Forbes, c/o Alexis Mathios
Hon. Alfonse M. D'Amato, c/o Peter Phipps
Hon. Daniel Patrick Moynihan, c/o Richard Pouyat
Dinah Bear, CEQ

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

June 11, 1998

REPLY TO ATTENTION OF

Planning Division
Environmental Assessment Section

Mr. Andrew Raddant
Regional Environmental Officer
U.S. Department of the Interior
Office of Environmental Policy and Compliance
408 Atlantic Avenue - Room 142
Boston, Massachusetts 02210-3334

Dear Mr. Raddant:

This correspondence is a follow-up to our April 9, 1998 letter responding to your February 20, 1998 comment letter on the Notice of Intent to Prepare a Draft Environmental Impact Statement (DEIS) and the Scoping Paper for the proposed Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Fire Island Inlet to Moriches Inlet Interim Plan for Storm Damage Protection Project. Attached (Enclosure 1) is our responses to the comments discussing the Scoping Paper. I have condensed the points raised in your letter to nine issues, to be addressed. Responses to comments regarding the resources of the project area were discussed previously in our October 10, 1997 letter.

An outline of the Draft EIS and an agenda for the EIS workshop are also enclosed for your review. The annotated outline describes how the EIS will be prepared and will be the basis of the workshop. The EIS workshop is scheduled to occur at 10:30 a.m. on June 18, 1998 at the U.S. Fish and Wildlife Service Long Island Field Office in Islip, New York.

If you have any questions on this matter, please contact Mr. Steven Sinkevich at 212-264-2198 or Mr. Peter Weppler at 212-264-5396.

Sincerely,

Frank Santomauro

Frank Santomauro, P.E.
Chief, Planning Division

Enclosure

RESPONSE TO COMMENTS

The issues addressed in the response to comments include the following:

1. Project Life (30 Years)
2. Impact Assessment for
   a. Development Impacts
   b. Direct Placement Impacts
   c. Coastal Processes Impacts (breaching / overwash)
   d. Estuarine Environment Impacts
3. Studies and Information necessary for impact assessment
4. Procedural issues related to interim project
5. Plan Formulation, including:
   a. Description of problem and need
   b. Development of non-structural alternatives
   c. Beach nourishment alternatives
   d. Level of protection provided
   e. Project economics
   f. Project costs
6. Cooperating agency discussion, including:
   a. Incorporating FINS requirements
   b. Connected Action including FINS permitting
   c. Staffing issues of cooperating agencies
7. Public Access Plan
8. Scoping Meeting / Post-Scoping Requirements
9. Cultural Resources Concerns

1. **Project Life (30 Years).** The DOI has raised a number of concerns related to an interim plan with a project life of thirty years. The Corps is currently investigating alternative beach nourishment plans of shorter durations. The discussion of interim project over a shorter duration would clearly identify a second decision point, (either the outcome of reformulation or supplemental NEPA documentation). This duration would be established to ensure time necessary for approval and possible implementation of the outcome of reformulation, and to be consistent with Federal benefit-cost requirements. We are currently updating project volumes and costs, based upon new survey information. In addition we are updating project economics to consider residual benefits associated with fill placement after renourishment is halted.

2. Impact Assessment for a) Development Impacts, b) Direct Placement Impacts, c) Coastal Processes Impacts (breaching and overwash), d) Estuarine Environment Impacts

a. New development as a result of project construction. The DOI has raised a number of concerns regarding redevelopment, specifically the impact of a new dune feature on the regulatory CEHMA setback line. The report and EIS will reference and discuss pertinent local, state and Federal policies, laws and regulations that govern development on dunes and beaches. The number of newly buildable lots will be identified, as a result of project implementation, and moving the CEHMA line. Alternatives, which could be incorporated with the beachfill alternatives, will be identified for reducing or eliminating development on these lots. To date, efforts have already been undertaken to locate the fill alignment as far landward as possible, to reduce fill quantities, while balancing real estate costs.

b. Direct removal / placement impacts. As discussed in the EIS outline, direct impacts associated with fill removal and placement will be based upon existing information, data collected specifically for the interim project, and information available from the Reformulation analysis.

c. Coastal Processes Impacts (breaching and overwash)

The main report and EIS shall discuss the efforts undertaken for the design of the interim project, including the interactions of the barrier island physical dynamics and the corresponding ecological effects they pertain to a storm damage protection project.

A discussion of the aeolian transport, its importance to barrier island ecology and the relationship between this process and the interim project will be provided in the EIS.

d. Estuarine Environment Impacts

Numerical hydrodynamic modeling for all three bays was performed by Coastal Engineering Research Center (CERC) to investigate storm surge water levels under the various alternatives, and under various breaching scenarios (CERC report in preparation). Water quality modeling is being undertaken for the Reformulation Study, the results of which will be available for the interim EIS. The model is designed to investigate the water quality responses under existing conditions and various breaching scenarios.

The Corps also recognizes the serious problems that presently afflict the entire barrier island system, which occur independently of the proposed interim project, including:

a. Loss of beach habitat and shallow water habitat due to development and recreational use.
b. Water quality and turbidity problems due to overwhelming developmental impacts, i.e. runoff and nutrification, loss of filtering marshes and eel grass beds, and increased depth of areas within the bays.
c. Loss and decline of economically important shellfish and finfish resources due to over fishing (and the above), as evidenced by the abundance of clams found in uncertified (unharvested waters).
d. Relatively rapid degradation of the barrier island and bay ecosystems which evolved over thousands of years.

3. Studies / Information necessary for impact assessment

The Corps is confident that all impacts pertaining to an interim storm damage protection project can be adequately assessed utilizing existing data, data collected for this project, or information which will be available from the reformulation analysis.

4. Procedural issues related to interim project

An interim storm damage protection plan for the project area is being formulated to comply with the requests of local, State and Federal representatives concerned about maintaining the integrity the protective features of the Fire Island barrier beach while the FIMP Reformulation Study is underway. The Corps is not compartmentalizing the overall Reformulation Study.

The Corps points out that the FIIP is severable from, and hence not a component of, the Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point Project authorized by Congress in 1960, now subject to reformulation. The EIS will screen out alternatives that could have an adverse environmental impact or limits the choice of alternatives. The FIIP would be justified independently of the Reformulation Project, is to be analyzed by an environmental impact statement, and will not prejudice any ultimate decision on the Reformulation Project. Hence, proceeding on the FIIP is in accordance with CEQ regulations and NEPA.

In addition to 40 CFR 1506.1(c), subpart (a) applies to the Interim Study. These subparts specify conditions that must be met if an agency is to undertake an action related to a proposal for which the Record of Decision has not been issued. These paragraphs are transcribed below. Together, they describe the relationship between the Reformulation Study and the interim project.

> a) Until an agency issues a record of decision as provided in 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:
>
> (1) Have an adverse environmental impact; or
> (2) Limit the choice of reasonable alternatives.
>
> (c) While work on the required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:
>
> (1) Is justified independently of the program;
>
> (2) Is itself accompanied by an adequate environmental impact statement; and
>
> (3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision when it tends to determine subsequent development or limit alternatives.

The Interim Project is being formulated pursuant to conditions set forth in 40 CFR 1506.1. As required by 40 CFR 1506.1(c)(1), the Interim project is independently justified as to the purpose and need. Pursuant to 40 CFR 1506.1(c)(2) the EIS is being prepared. Additionally, the range of alternatives being considered by the Reformulation Study is not constrained by the Interim Project as required by 40 CFR 1506.1(c)(3). The interim project is beachfill only and readily reversible, since without renourishment, the area will revert to pre-interim conditions. Additionally, the formulation and evaluation of the alternatives for the reformulation study is based upon a no action alternative, which is a pre-interim condition to ensure that the interim project not prejudice the outcome of the reformulation study.

5. Plan Formulation, including:

a. Description of problem and need. A discussion on recent erosion shall be included in the EIS and Main Report. The existing level of protection will be identified and explained within the body of the EIS and Main Report.

The purpose of the project (discussed on page 3 of the Fire Island Interim Scoping Paper, dated November 1997) will be further defined in the main report and EIS. The purpose of the proposed Fire Island Interim Project is to reduce potential storm damages to the mainland and barrier island by providing a limited degree of protection to the barrier island, from high-frequency storm events, until the completion of the Reformulation Study. However, the DEIS will clarify the position further by incorporating the following language: "Coastal storm damage resulting from a series of recent severe northeasters, in combination with long-term erosion indicated a need to develop an interim plan for the project area prior to completion of the FIMP Reformulation Study. Erosion of the beach within portions of the project area limits has narrowed and lowered the corresponding section of the barrier island system (including the natural dune system) to the point where remedial low-cost efforts are insufficient in maintaining an adequate protective beach. In addition, political interest from local, State and Federal representatives in maintaining the integrity of Fire Island has also prioritized the formulation of an interim storm damage protection plan. The intent of the Interim Project is merely to provide a stopgap measure that could be maintained modified or halted based on the results of the Reformulation Study.

The following paragraphs refer to specific technical issues raised regarding description of the existing condition:

Page 13, last paragraph. The source of the stated December 1992 storm data is NOAA Technical Memorandum NOS OES 006-Effects of December 1992 Northeaster on Water Levels Data Report, May 1993. Additionally, for the Interim Feasibility Study design, modeling of the benefits of storm protection was accomplished using the hydrodynamic model ADCIRC in conjunction with the stochastic modeling methodology, Empirical Simulation Technique. Actual storm data (including water level, time, and history) are used as input, so there is no predetermination of recurrence interval based on maximum surge. In addition, the storm surge erosion model used incorporates storm duration, therefore, the evaluation is valid.

Page 14, 1st paragraph, last sentence. The surge results show nonlinear variability with respect to proximity of Fire Island Inlet. Specifically, areas closest to the inlet have higher stages than those located halfway to the east end of the bay, and areas at the east end show the higher stages due to confluence of geometry.

Page 14, paragraph 3. Sea level rise was incorporated into the storm damage modeling over the next three decades. In addition, based on analysis through 1994, there is no evidence of significant change in the frequency and magnitude of coastal storms.

b. Development of non-structural alternatives

Within the Main Report and EIS, the Corps will discuss the evaluation of non-structural plans to a sufficient level of detail. Based upon discussion with the New York State Department of State, it was determined that the time frame for the interim project would preclude new legislation allowing for non-structural measures. The non-structural alternatives will: 1) identify existing municipal, county, state, and Federal programs for non-structural solutions, and 2) discuss possible implementation of these alternatives. The implementation of alternatives will include a discussion of the number of structures, which are not in compliance with Federal zoning standards, which could be condemned utilizing Park Service authority. The relative costs and benefits of the acquisition of these structures will be discussed. In addition, a non-structural plan, consisting of relocations, house raising, and acquisition will be discussed, however such a plan would likely be inconsistent with interim project objectives.

Additionally, the beachfill alternatives will identify non-structural components, which could be incorporated into beachfill solutions. Based upon conversations with NYSDOS, these will focus on a) locating the beachfill cross-section as far landward as possible through structure acquisition, and b) methods to reduce development within the area which may be created as a result of project construction, and movement of the CEHMA line.

c. Beach nourishment alternatives.

DOI states that the interim project is not a true interim project; rather, it represents a proposal for the construction of the project that was referred to the CEQ in 1977 or possibly a larger one. The proposed interim project will not be the same proposed in 1977. One alternative for the interim project is a beach and dune nourishment plan without hard structural features. However, the magnitude, configuration, and linear extent of that alternative are smaller, and function to provide a lesser degree of protection than the original authorized project. A project of that magnitude with the absence of hard structural features is not anticipated to have any major impacts on the barrier island coastal processes.

The authorized project (House Document 425) includes a dune at elevation +20 ft, with a dune crest width of 25 ft, fronted by a beach berm at elevation +14 ft, with a width of 100 ft, fronted by a beach slope at elevation 1:20. For construction, the 1977 EIS proposed construction placement of a dune at elevation +16 ft, which would grow to an elevation of +20 ft, within two years, primarily due to the aeolian transport and capture of material. See enclosed Figure 1 comparing cross-sections.

There is no project sand fencing and beach grass on the berm or foreshore slope for this project or would there be for any project. Some scarping was evident after a series of winter 1997-98 northeasters on the Westhampton Interim Project, which had a berm elevation of +9.5 NGVD.

Depending on the wave conditions as the storm passes, the scarps do become more gently rounded with time.

Beachfill losses are minimized when tapers of not more than 6% are used. Therefore, placing fill only in front of the barrier island communities would result in unacceptable end losses, and an inability to maintain the design protection. Beachfill is only proposed in areas that currently have profiles less than the design cross-section. Therefore, we do not concur with pursuing the indicated alternative.

d. Level of protection provided

Erosion has seriously reduced the cross-section of the barrier island, and its capacity to provide protection to the mainland areas north of Great South Bay from damages due to the effects of storms. The level of protection of the existing and improved conditions is provided by the combination of the dune height, beach berm width and height, and foreshore slopes. The level of protection is generally defined as the ability to withstand storm-induced erosion of the design level event. The criteria used to determine adequate protection was wave run-up, wave overtopping, and the ability to withstand storm-induced erosion of the design level event (44-year return period), as predicted by the storm-induced erosion model SBEACH. The main report and EIS will fully discuss the existing level of protection, and improved levels of protection.

e. Project economics

Several specific comments were raised in reference to the method used for generating project economics. The approach is based upon Water Resources Council Guidelines. Responses to specific concerns are as follow:

On Page 15, DOI recommends that the median rather than the mean should be the preferred measure of damage. The mean, or Expected Annual Damage (EAD), is the proper measure of storm damage. As defined by the Water Resource Council Guidelines (USWRC, 1983), the benefit stream is the pattern of expected benefits over the period of analysis. The analysis of expected damage and benefits must consider the probability of occurrence for all storms. The median damage presented in the Economic Appendix implicitly includes only damages from storms having at least a 50% chance of occurring during the period of analysis. Additional discussion of the calculation and use of expected damages is provided in Chapter 2 of EM1110-2-1619, Risk Based Analysis for Flood Damage Reduction Studies.

Page 15, states that the application of the Unit Day Value Methodology introduces substantial uncertainty into the analysis of recreation benefits. It is acknowledged that the Unit Day Value approach to recreation valuation provides only an approximation of the potential benefits and that a CVM or TCM approach would provide a more reliable assessment. The UDV approach, however, was considered reasonable for the Interim Project since the plan formulation and selection is based on the immediate need for storm damage reduction. A CVM analysis is currently being developed to provide a more comprehensive assessment of recreation opportunities in the reformulation study.

f. <u>Project costs</u>

If, in the preparation of an EIS, mitigation is required, costs will be developed to an appropriate level of detail to be utilized in the benefit cost comparison.

6. Cooperating agency issues, including:

a. <u>Incorporating FINS requirements</u>

The EIS will address that the project falls within the jurisdiction of the Fire Island National Seashore. The EIS will also reference and take into account all pertinent laws, regulations, policies, and regulations of the National Park Service as well as the Corps and local government jurisdictions. The information to be utilized for the Seashore is the FINS General Management Plan and EIS, Legislative History of FINS, FINS Resource Management Plan, The Wilderness Act, and The Eastern Wilderness Act.

b. <u>Connected Action including FINS permitting</u>

Since FINS is a cooperating agency, and since FINS will decide whether to issue permits for work to be undertaken within the boundaries of the Seashore, (which could require its own NEPA documentation), issuance of the permit will be considered as a connected action to be addressed within the EIS.

c. Staffing Concerns

The District looks forward to working with all cooperating agencies and would like to see staffing issues resolved. This has been a topic of discussion at several meetings and letters. The Corps will provide assistance as it can within its jurisdiction.

7. Public Access Plan

The Corps has been coordinating with the NYSDEC, NYSDOS, and FINS to prepare a public access plan. Preparation of a public access plan is a local sponsor requirement. A public access plan is a requirement for Federal participation in a beach nourishment project.

8. Scoping Meeting / Post-Scoping Requirements

The public meeting was intended to provide information on the study's process and preliminary project information, and to solicit public comment to scope the project's Environmental Impact Statement. The Corps feels that the public poster board session was successful in eliciting public comments. The comments received are being collated and responses are being prepared. Once completed, these comments and responses shall be provided to the DOI.

Based on comments received from FINS staff at the December 4, 1997 scoping meeting held at the Holiday Inn - Ronkonkoma, the Corps prepared an addendum to the Notice of Intent published in the November 26, 1997 Federal Register (Volume 62, Number 228). This addendum appeared in the January 22, 1998 Federal Register (Volume 63, Number 14). The language in the addendum was coordinated with FINS staff and the respective comments were incorporated. Additionally, it was agreed that a post-scoping meeting would be held to give the public another opportunity to comment on the approach being developed for the Fire Island Interim Project. Based upon the current schedule for EIS completion, the Corps would prefer to hold public meetings in conjunction with the draft EIS.

9. Cultural Resources Concerns

Cultural resources will be recorded and the project shall be in full compliance with the National Historic Preservation Act of 1966, as amended.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue - Room 142
Boston, Massachusetts 02210-3334

February 20, 1998

ER 97/698

Colonel Gary Thomas
District Engineer
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Colonel Thomas:

This letter is in response to the U.S. Army Corps of Engineers' (Corps) Notice of Intent to Prepare a Draft Environmental Impact Statement (DEIS) on the proposed Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Fire Island Inlet to Moriches Inlet Interim Plan for Storm Damage Protection (Interim Plan), and the Corps' request that the Department participate in the EIS process as a "cooperating agency" under 40 C.F.R. § 1501.6 (John Sassi, December 2, 1997) . While our comments are triggered primarily by the Notice of Intent and related elements of the scoping process, including the November, 1997, "Scoping Paper," and the December 4, 1997, Scoping meeting, our discussion will also be based on the considerable exchange of information between our agencies over the past two years.

The Interim Plan is one of four beach fill and dune construction projects proposed as "interim" to the completion of the Fire Island Inlet to Montauk Point Storm Damage Reduction Reformulation Study and its accompanying programmatic EIS (Reformulation Study/EIS). The other three are the Shinnecock Inlet Interim Project (SIIP), the Westhampton Interim Project, and the Breach Contingency Plan. Overall, these encompass 48 miles of barrier beach. All of these proposals are within an interconnected coastal bay and barrier island ecosystem. While the Interim Plan is proposed as an interim project, it has 30 year project life.

The location of the proposed Fire Island Interim Plan represents the first barrier island segment of the original Fire Island to Montauk Point, New York Beach Erosion Control and Hurricane Protection Project (FIMP), which was authorized in 1960. The Interim Plan occurs substantially within the boundaries of the Fire Island National Seashore, which is administered by the National Park Service. The enabling legislation for Fire Island National Seashore stipulates that beach nourishment projects within the boundaries of the Seashore must be "in accordance with a plan that is mutually acceptable to the Secretary of the Interior and the Secretary of the Army...." P.L. 88-587, September 11, 1964.

GENERAL COMMENTS

It is important to recognize that the Department of the Interior has, for many years, acknowledged the possibility of supporting "interim" measures for providing storm damage protection while a long term strategy is formulated and evaluated under the ongoing Fire Island Inlet to Montauk Point Storm Damage Reduction Reformulation Study and its accompanying EIS (Reformulation Study/EIS). As you know, this Department is currently an active participant (cooperating agency) in the Reformulation Study/EIS process, and provided similar support in the development of the Breach Contingency Plan (BCP) for Fire Island, a preplanning strategy for the rapid closure of a breach to Fire Island, should it occur. Although the degree of our involvement will be seriously constrained by a lack of resources, it is appropriate that the Department also participate as a cooperating agency in the EIS process for the Interim Plan (see also Public Participation and Input, below).

Relying on the recently initiated Reformulation Study/EIS and NEPA (e.g., Section 102 of NEPA, and 40 C.F.R. § 1506.1© of the implementing regulations) as sideboards, a truly "***interim***" plan would be, by definition, of short duration (including impacts) and limited scope, such as a one-time placement of sand. An interim plan would be sensitive to natural, cultural and recreational resources associated with Fire Island and the Fire Island National Seashore, and, consistent with 40 C.F.R. 1506.1, would not presuppose the overriding decisions to be made under the Reformulation Study/EIS. For instance, the Breach Contingency Plan does constitute one existing, viable, "interim" plan of action.

However, project as currently proposed, a "14-mile complex of man-made dunes, berms, and advanced fill, the majority of which will occur within Fire Island National Seashore...", is not an interim plan. The dimensions of the proposed Interim Plan and costs (approaching $120 million), are predicated on a ***30 year project life***, even though, if constructed, the Interim Plan will be in place for little over one year before completion of the Reformulation Study/EIS. The 30 year project life has been presented by the Corps and New York State Department of Environmental Conservation (NYDEC) as stipulated under New York State's Coastal Erosion Hazard Regulations.

On numerous occasions over the past two years, the Department has notified the Corps that if the project has the potential to be in place and maintained for 30 years, then the impact analysis must reflect the project life. The EIS should, therefore, include the in depth field analysis necessary to understand the impacts of altering coastal processes and the physiography of a National Seashore over a 30 year period, and to determine appropriate mitigation.

The Corps' response to our concerns, reflected in the Scoping Paper and other project related materials, is that the Interim Plan, because it is comprised entirely of sand, is a "soft solution" and therefore "reversible:" The periodic renourishment necessary to maintain project performance can simply be ceased depending on the results of monitoring the Interim Plan, or the outcome of the Reformulation Study/EIS. As such, the Corps has decided that the in depth field analyses necessary to determine environmental impacts over 30 years will be undertaken under the Reformulation Study/EIS.

We are concerned that the project approach advocated by the Corps in this case will result in significant negative environmental impacts, which, contrary to the purpose of NEPA, will not have been fully evaluated prior to construction and a major long term investment of pubic funds. A DEIS prepared according the Corps' recommended approach is likely to be deficient in terms of its environmental analyses and consideration of mitigation (40 C.F.R. § 1502.9). Moreover, as noted in the Department's response to concerns raised by U.S. Senator Alfonse M. D'Amato (Bonnie R. Cohen, Assistant Secretary, Policy, Management and Budget, March 5, 1997), the long term commitments required under the proposed Interim Plan could prejudice the Reformulation Study/EIS, and are inconsistent with the Council on Environmental Quality's (CEQ) 1978 directive against segmenting the original FIMP. Consistency with the Coastal Zone Management Act (CZMA) is also of concern.

It must be recognized that New York's Coastal Erosion Management Regulations do not preempt, nor are they at odds with, NEPA. Moreover, as recently as in the February 3 interagency meeting between representatives of the Corps, NY DEC, and this Department, allowable and appropriate variances to the 30 year requirement (6 NYCRR Part 505.13) were discussed. The fundamental issue, reported by your staff and NY DEC, is that a project of smaller size or shorter duration (benefit stream) may not be cost effective (benefit cost ratio less than 1.0). The 30 year commitment, in terms of materials, maintenance and funding, extends more than 20 years beyond 2003, when the overriding, long term decisions about storm damage reduction are to be made under the Reformulation Study/EIS.

In the more detailed information that follows we will address additional procedural and substantive questions and concerns we have regarding the proposed Interim Plan, including but not limited to the following:

- Although the scope and magnitude of the Interim Plan approximates the proposal for Fire Island under the original FIMP, a similar level of environmental analysis is not being considered (CEQ's segmentation determination notwithstanding).
- The Corps did not undertake a Reconnaissance Phase for the Interim Project, instead moving directly to the Feasibility Phase, thus eliminating critical elements of the Corps' standard planning process which might have identified many of the project planning issues well before this point (Six Steps to a Civil Works Project, EP 1105-2-10, May, 1988).
- The Corps does not propose to undertake any field level environmental analysis (except for benthic borrow area data collection and cultural resource surveys) for the Interim Plan, including an alternatives analysis, relying instead on data from dissimilar projects (e.g., the Westhampton Interim Project and the Breach Contingency Plan), and yet to be identified studies under the Reformulation EIS.
- The feasibility study for the Interim Plan ("Fire Island Inlet to Montauk Point, Long Island, New York: Fire Island Inlet to Moriches Inlet Reach - Interim Plan for Storm

Damage Protection, Draft Main Report," June, 1996), can not be considered a complete decision document absent a public access plan.

- The economic analysis presented in the feasibility study for the Interim Plan is incomplete, flawed, does not consider the potential costs of mitigation in its benefit/cost calculations, and does not consider the fiscal uncertainty represented by the overriding alternatives analysis in the Reformulation Study/EIS. Based on the information presented, the Corps cannot reach its conclusion that the project has a benefit/cost ratio of 1.26.
- The Corps may not be able to complete its environmental analysis until New York State implements and enforces its Coastal Zone Management Plan on Fire Island; specifically, the Coastal Erosion Management Regulations.
- The Project will result in major changes to the physical and regulatory landscape of a National Seashore. The implications of these changes, including changes to public access, natural coastal processes, aesthetics, and development pressure, must be fully evaluated in order to avoid impacts inconsistent with the purpose of the Seashore and respective management policies, plans and guidelines.

The comments of the Department, organized in general along the outline in the Scoping Document for the Interim Plan, reflect its duty to effectuate this and other governing legislation (National Park Service Organic Act, Fish and Wildlife Coordination Act,, Endangered Species Act, Migratory Bird Treaty Act, Coastal Zone Management Act).

SCOPING PROCESS

We request that the Corps prepare a "post-scoping" document which, as suggested in CEQ's General Counsel Scoping Guidance (1981), might provide the interested agencies and general public with feedback prior to the DEIS. The document would, in addition to providing a more a more comprehensive portrayal of the issues related to the proposed Interim Plan, outline the decisions that have been about the issues to be evaluated further in the DEIS process. A post-scoping document is appropriate for a number of reasons: the keen interest in, and strongly held opinions of the proposed Interim Plan; absence of critical information provided in the Scoping Document and the Scoping Meeting (e.g., cost, scope, duration); and, therefore, the emphasis on written comments.

SCOPING PROCESS

The scoping meeting for the Interim Plan that was held on December 4, 1997, did not achieve the basic intent of NEPA related to scoping meetings. The meeting essentially consisted of a poster session; the Corps did not make any formal verbal presentations on the proposed Interim Plan. Presentations were not made on the known, complex issues, nor was information presented to the public or interested agencies that would be necessary to explain alternatives to the proposed Plan. For a project with many complicates issues including but not limited to storm damage protection, land use regulations, ecosystem impacts, or recreation, we do not feel that this scoping meeting provided the appropriate forum to transmit and receive information and comments from concerned agencies and the public. The scoping process is often the first opportunity for the general public to become informed about a proposed project. Individuals in receipt of documents or attending a scoping meeting need to receive enough information "to make an intelligent contribution to the scoping process" (General Counsel Scoping Guidance, 1981).

In addition, the particular format did not allow for a detailed record to be kept of public and agency verbal comments. The Department, as a cooperating agency, would prefer that the scoping process be conducted in a forum which invites participation by all and a complete record of comments. This is particularly important in the current case, in which the proposed project is located within a National Seashore. As discussed further herein, the Department has its own NEPA compliance and permitting requirements to consider if such a Plan is to be implemented. The development of an adequate record of the public and agency concerns is extremely important.

SCOPING DOCUMENT

General Comments

1. We think it important that reference be made to Public Law 88-587 (Fire Island National Seashore Act) in future Corps documents pertaining to the Interim Plan and the DEIS process. In establishing this unit of the National Park System, Congress provided in pertinent part:

> *"Be it enacted by the Senate and House of Representatives of the United States of American in Congress assembled,* That (a) for the purpose of **conserving and preserving** for the use of future generations certain **relatively unspoiled and undeveloped beaches and other natural features** within Suffolk County, New York, which **possess high values to the Nation as examples of unspoiled areas of great natural beauty in close proximity to large concentrations of urban population**, the Secretary of the Interior is authorized to establish an area to be known as the 'Fire Island National Seashore'."
>
> * * *
>
> "Sec. 7. (a) The Secretary shall administer and protect the Fire Island National Seashore with the primary aim of conserving the natural resources located there."
>
> * * *
>
> "Sec. 8. (a) The authority of the Chief of Engineers, Department of the Army, to undertake or contribute to shore erosion control or beach protection measures on lands within the Fire Island National Seashore shall be exercised in accordance with a plan that is **mutually acceptable** to the Secretary of the Interior and the Secretary of the Army and that is consistent with the purposes of this Act." Enabling legislation for Fire Island National Seashore, P.L. 88-587, September 11, 1964 (emphasis added).

It was recognized early on that there may be conflicts between the mission and goals of the

National Park Service and those of the Army Corps of Engineers. It is, therefore, crucial that any and all projects affecting Fire Island National Seashore be clearly defined, well justified, duly noted for the general public, and reflected in all proposed alternatives. Potential conflicts between the project and other "land use plans, policies and controls..." must be discussed in future documents (40 C.F.R. 1502.16 (c)).

2. Specifically, there is a general lack of discussion of the need for the project. A detailed justification is required. The Department has expressed to the Corps, for nearly two years, its belief that the Fire Island Interim Plan as proposed will likely result in significant environmental impacts and perpetual commitment of Federal resources, and, moreover, that insufficient data is available to draw a different conclusion. The need for further study has also been stated in the Breach Contingency Plan and in the Governor's Coastal Erosion Task Force, Final Report Volume One, Emergency Response to Coastal Storms, October, 1994.

3. Future documents should, also, reference the General Management Plan (GMP) for Fire Island National Seashore. The GMP is a NEPA document that underwent public review and comment. Page 117 of the GMP states the relationship between the National Park Service and the Army Corps of Engineers with regards to beach erosion projects as "Sand nourishment programs proposed for Fire Island beaches and dunes will be evaluated following final Corps of Engineers feasibility analyses. If limited sand nourishment programs appear feasible, work will begin on the western segment of Fire Island beaches. Initial efforts will be evaluated for impacts and effectiveness prior to additional work. Sand nourishment on beaches of major federal landholdings will not be undertaken." This plan must address the relationship to the GMP and any variation from this plan. It should also be noted that a National Park Service permit or permits will be necessary for any work to occur and such permits may require additional information.

4. As you know, the 1978 CEQ request for reformulation of the "1960 Fire Island Inlet to Montauk Point, New York, Combined Beach Erosion Control and Hurricane Protection Project" referenced a need to consider the Fire Island Inlet to Montauk Point coastal reach as a system instead of a series of discrete locales. Compartmentalizing the 83 miles of shoreline into a series of reaches and proposing a series of Interim Plans confounds the analysis of the interconnections of the system, both internally and externally. The broader understanding of this ecosystem is of the utmost importance and essential to developing a shoreline protection strategy which is both economically and environmentally sound. You may need to reconsider your decision to separate this effort from the broader Reformulation Study currently underway (see "Plan Formulation and NEPA Process/Identification of Project Objectives," below).

5. The National Park Service continues to be concerned that beach nourishment projects such as proposed in the Interim Plan will lead to development which is inconsistent with the Fire Island Federal Zoning Regulations (36 C.F.R. Part 28). The Scoping Report and future EIS related documentation should specifically state the Corps' policies, laws, and regulations that govern development on dunes or beaches constructed with substantial federal funds.

Related, future documents should also note the influence on development resulting from implementation of the New York State Coastal Erosion Management Regulations, a critical element in New York's Coastal Zone Management Program, delegated to NY DEC. NY DEC has yet to implement and enforced these regulations on Fire Island. Thus, the role of regulating coastal development consistent with the purposes of the New York Coastal Management Program and Federal Coastal Zone Management Act has been inappropriately transferred to the towns of Fire Island and the Fire Island National Seashore. The zoning regulations implemented in accordance with the Fire Island National Seashore enabling legislation are not intended to replace New York's Coastal Management Program, nor are they adequate for purposes which include protection of human life and property.

NYS DEC (Mr. William Daley) has stated its intent to implement the Coastal Erosion Management Regulations, including identification of "natural protective feature areas" prior to implementation of the Fire Island Interim Project (as required by the Corps). However, Mr Daley has also stated that implementation is to be a two step process: pre-project hazard area identification based on existing features, followed by a realignment of the hazard area designations seaward, based on the new man-made dune, following implementation of the Project. With the hazard designation based on new dune, land previously designated as a natural protective feature and subject to respective development restrictions, will be landward of the new "dune" and buffer, subjecting them to redevelopment.

A new protective feature will encourage development. Moving the natural protective feature seaward may compound the pressure to develop. A situation will be created in which Fire Island towns either adopt zoning restrictions seaward of, and inconsistent with, the Seashore's dune district, or exacerbate the existing situation in which the burden of regulating coastal development has been left to the Fire Island Towns and the National Seashore. Since the Towns and Seashore are limited in their ability to enforce the dune district zoning though condemnation, the costs, in terms of funds, structures, and controversy, may be significant.

Designation of the man-made dune as a natural protective feature will require "justification" (6 NYCRR part 505.22). It is unclear at this time what the justification for movement of the hazard area seaward of the natural dune would be, especially if the action is based on an "interim" man-made feature requiring continued maintenance, and the potential impacts and regulatory issues mentioned.

Given NY DEC's intent on identifying the man-made dune as a natural protective feature, the Corps must identify the potential impacts that may result in its DEIS on the proposed Interim Plan. See also the sections on "Identification of Potential Interim Alternatives" and "Fire Island National Seashore," below.

Executive Summary

1. There needs to be an up front statement that this project has the potential to include 100%

of the ocean beach of Fire Island National Seashore. It should also reference PL ~~88-587~~ as noted above and include this wording from that law to explain the role of the National Park Service: "The Secretary (of the Interior) shall administer and protect the Fire Island National Seashore with the primary aim of conserving the natural resources located there."

2. The last sentence in this paragraph states that the project will "...address critical areas along Fire Island...." This sentence should be followed by an explanation of what is meant by "address critical areas." This could mean anything from creating new habitat concurrent with the Reformulation Plan needs, to building dunes because the island will breach in the next storm.

3. Last paragraph. This is where the main discussion of "interim" comes out in the Executive Summary. It is here that the document should reflect what time frame is being considered for the Interim Plan and that the EIS impact analysis will deal specifically with that time frame.

Location

1. First paragraph. There should be a reference to the fact that 100% of the project falls within the boundary of Fire Island National Seashore. The document needs a map and at various places in the document, there should be references to the map.

Plan Formulation and NEPA Process/Identification of Project Objectives

1. Objective #1 states that the interim project must provide no less than a 44 year level of protection. To adequately evaluate the proposed alternative, a more detailed definition of "protection" is warranted. What is being protected? Is the proposal to protect all dwellings, residences, commercial activities on Fire Island and the Long Island mainland fronting Great South Bay? What elevation of storm surge (relative to NGVD) within Great South Bay will be tolerated?

2. A short discussion should be included about what may occur if the Reformulation Plan is not completed for 10 years. Will the Interim Plan be the guiding plan until the reformulation plan is completed?

3. It is important to state what the objectives are, if you reference them (e.g., Reformulation Plan objectives).

4. In future documents the Corps must clarify the project time frame (project life) for a 44-year level of protection. The general public has no idea what this means in reference to how long continued beach nourishment will go on after the initial placement of sand. As described in the feasibility study for the Interim Plan, the 44-year level of protection represents the "minimum design level" having a "50% chance of survival over the 30 year project life...." New York State's Coastal Erosion Management Regulations do not stipulate a 44 year design level per se,

but, variances notwithstanding, call for a 30 year project life. The flexibility inherent in New York's regulations is discussed in detail below.

5. As currently proposed, the Fire Island Interim Plan has a 30 year project life, will involve a major capital expenditure prior to completion of the Reformulation EIS; will require a benefit stream extending well past (nearly 20 years) the completion date of the Reformulation EIS in order to be considered economically justified; and, though designed to alter coastal processes, will not include any field level environmental analyses. We are concerned that the proposed 30 year project life is inconsistent with NEPA and CEQ's 1978 directive against segmenting the original FIMP, and will inappropriately limit the alternatives to be evaluated under the Reformulation Plan.

According to Corps documents and personal communication (Bill Daley, NY DEC), a project smaller than the proposed Interim Plan may not be justifiable from the standpoint of Federal funding. Yet, the Interim Plan as proposed will not achieve a benefit/cost ratio of greater than 1.0 unless the initial construction/investment ($60 million) is maintained (at an additional cost of $60 million) for a period of about 30 years. As NEPA case law has shown, it may not be in the public interest to abandon such an investment once it has been made, "soft solution" or not. Arlington Coalition on Transportation v. Volpe, 458 F.2d 1333, 1334 (4th Cir.) (Citations omitted), cert. denied 409 U.S. 1000 (1972). Therefore, the environmental analysis is to be undertaken before construction, in order to avoid the disconcerting scenario in which the public is faced with having to decide whether it wishes to live with environmental consequences only learned after the fact, or to stop the project and take a loss, so to speak, on the investment. In either event, an "irretrievable commitment of resources," has taken place. This case is further complicated by the fact that the long term decisions to be made under the Reformulation Plan/EIS could be impermissibly bound by such a long term project/investment.

It must be noted that this Department has made repeated attempts to provide the Corps with strategies to expedite consideration of a truly "interim" plan, one that is designed to provide an appropriate level of storm damage protection until the Reformulation Plan and the associated EIS process is completed in 2003, while also allowing for the appropriate level of environmental analysis.

For example, we provided comments in April, 1996, outlining the characteristics of a project that ***could***, with appropriate planning and mitigation, possibly meet the threshold standards of a "finding of no significant impact" (FONSI) under section 1508.13 of NEPA. In addition to specific construction requirements and limitations, and avoidance of work within the Wilderness Area, our comments included the recommendation that the Corps shorten the duration of the Project to reflect the "interim" time period, approximating the period between construction of the Interim Project and completion of the Reformulation EIS (it is also important to note that the Department's April, 1996, comments were based on extremely limited, draft project information provided by the Corps, and no project specific environmental analysis):

"The attached recommendations are designed to minimize the potential for significant

> negative impacts that would otherwise result from the proposed [30 year] ~~project~~--based on work described by the Corps in February, 1996, performed as a one-time interim project pending completion of the Reformulation Plan." (Emphasis added)

In Stuart Piken's June 5, 1996, reply to our April, 1996 recommendations, he notified the Department that the Corps would adopt most of the Department's construction requirements (e.g., time of year limitation), and would consider other options concerning the Wilderness Area (New York State reservations notwithstanding). However, Mr. Piken stated that the Corps could not support a recommendation to shorten the duration of the Interim Plan to initial construction only:

> "The Corps of Engineers cannot recommend a project, to be supported by the State of New York, unless it contains provisions to minimally ensure a 30-year project life. New York State law requires involvement in a coastal storm damage reduction project for a minimum of 30 years. In order to ensure a 30-year project life, this project will require periodic renourishment to realize full economic benefits."

Similarly, the New York DEC also found our recommendation to shorten the duration of the project to be unacceptable (William Daley, personal conversation and August 9, 1996 correspondence). The primary basis for Mr. Daley's objection is that the State's Coastal Erosion Management Regulations require that the project has a design life of 30 years.

Our categorical concerns about long term "interim" projects being potentially in conflict with CEQ's decision are noted in all of our letters on the Fire Island Project (October, 1995, April, 1996, August, 1996, March, 1997, April, 1997).

An "irretrievable commitment of resources" is to be avoided through adherence to Section 102 of NEPA, and, as shown below, 40 C.F.R. Section 1506.1(c) of the implementing regulations:

> "While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:
>
> (1) Is justified independently of the program;
> (2) Is itself accompanied by an adequate environmental impact statement; and
> (3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives."

In subsequent documents, the Corps must indicate how the Interim Plan can be considered "independent of the program" [Reformulation] EIS, when, for example, the investment necessitates a project life that is dependent on a particular outcome of the Reformulation

Study/EIS, and its environmental studies are to be conducted under that same programmatic EIS (the Interim Plan is specifically referenced in the Reformulation Study/EIS Project Study Plan). The relationship/interdependency between the Interim Plan and the Reformulation Study/EIS appears to meet the definition of "Connected actions" under 40 C.F.R. §1508.25, "which means that they are closely related and therefore should be discussed in the same impact statement."

6. In future documents, the Corps needs to clarify the requirements of the New York State Coastal Zone Management Program and the Federal Coastal Zone Management Act. Coordination with Mr. Steven Resler, Statewide Supervisor of Consistency Review, New York Department of State (518-474-6000), is essential regarding the issues outlined below:

- In future documentation, the Corps should note the flexibility inherent in the "30 year project life requirement" under New York's Coastal Erosion Management Regulations. The appropriateness and applicability of the variance process (6 NYCRR Part 505.13) should be clearly and accurately reported.

  The Corps should note that the State Regulations and NEPA are not at odds. Any conflict between the Interim Plan and the Reformulation Plan, and the relative adequacy of the EIS for the Interim Plan, does not reside with the respective regulatory requirements.

- The information presented to date has not illustrated that the project as proposed will "minimize adverse affects on...natural resources including, but not limited to, significant fish and wildlife habitats and shellfish beds." Nor has there been an investigation of non-structural alternatives. 6 NYCRR Part 505.6.

- Considering the sand-based composition of the Project (entirely weatherable materials, in contrast to an "individual component"), the dynamic nature of barrier islands and coastal process, and the obvious interaction between the sand and the sea, the Fire Island Interim Plan as proposed may not meet the design standard of 6 NYCRR part 505.9(d).

Of interest, this Department voiced its concern about the 30 year maintenance requirement during its review of the Draft EIS for the New York Coastal Zone Management Program in 1982:

> "It is very difficult, if not impossible, to ascertain what is a "reasonable probability " of erosion control success. Erosion protection structures, even if effective for 30 years, could adversely influence natural dynamic systems. We do not believe that the State or this CZMP can establish a scientifically justified success probability."

7. It follows then that objectives 1. and 2. are inconsistent with each other by reason of having different purposes. A 44-year level of protection/30 year project life is different than an interim plan of action. In future documents the Corps must clarify the purpose of the proposed

project and the objectives.

8. We explained in the February, 1996, Issue Resolution Conference between representatives of the Corps, NY DEC, and this Department, that this Department has fiduciary responsibilities for various natural, cultural, and recreational resources, which in this case flow most directly from the NPS Organic Act, and legislation establishing Fire Island National Seashore, the Fish and Wildlife Coordination Act, Endangered Species Act, and the Migratory Bird Treaty Act.

Our responsibilities are particularly visible when the proposed action is to occur within a National Park. The necessary permitting process undertaken by NPS may constitute a "major Federal action" in and of itself; the NPS will also have to issue the appropriate NEPA documentation for public and agency review, and will be held equally accountable. As in the case of the Breach Contingency Plan, the NPS can adopt, with minimal changes, the environmental analysis (EA/FONSI or EIS) prepared by the project proponent (see 40 C.F.R. § 1506.3). However, it is unlikely that the Department would undertake a level of analysis greater than the proponent's, unless the Department was to initiate its own actions over and above the original project. Therefore, the Corps and the Department need to come to agreement regarding the scope and level of the NEPA analysis. The Department will follow standard NEPA procedure in its determination about the level of environmental analysis associated with the Project, and will rely on relevant sections of the NEPA regulations, including but not limited to the following: §§ 1501.4, 1502.4, 1506.1, 1507.2, 1508.7, 1508.9, 1508.25, and 1508.27

See also "Additional Information" below.

<u>Existing Conditions of Study Area</u>

Beach and Dune Characteristics

1. Second paragraph, first sentence, "...the vulnerability caused by erosion." There are many factors that cause erosion. Is this sentence supposed to be just referring to wave/ocean erosion, or all erosion concerns. The scientific data and references supporting island "erosion" is needed.

2. Development. The +16 feet NGVD should be part of the overall objectives of the project. Also, third sentence, "The barrier is undeveloped...", seems to indicate that there is no development at Davis Park, which is not true. There is significant NPS residential and public use development at Watch Hill, significant NPS and County public use development at Smith Point.

3. Table 1, Location Column, Great South Bay. Is this referring to south shore of Long Island development? For the Fire Island Storefront, is this both bay and ocean? What is the source of these data?

4. In addition to comments pertaining to the brief discussion of dune and beach characteristics in the Scoping Document, the following information was derived from ongoing

research, the feasibility study for the Interim Plan, and discussions with the Corps.

At the February, 1997 IRC, Corps staff stressed that they intend the Interim Plan to reduce response costs under the BCP, not to prevent hurricane damage. Corps staff stated that 95% of the Fire Island Interim Plan benefits would result from flood prevention on Long Island, not on Fire Island. The project must be evaluated in light of these stated goals.

The beach construction height of +11.5 feet NGVD in Reach 2, Kismet to Pt. O'Woods is higher than occurs naturally along the island and will cause some problems to beach users when beach scarps form due to an erosional event. The scarps are typically a couple of feet high on the seaward portion of the beach but can be several feet high in the backbeach area near the toe of the foredune. Scarps will be two feet higher with this construction elevation and pose dangerous obstacles to vehicular traffic. Pedestrian use for recreation and access will also be impeded.

In general, we found the feasibility study for the Interim Plan to be reasonably well crafted in its approach to decreasing the chance of barrier breaches at vulnerable locations on Fire Island, and in the time available for its development. However, there is a strong reliance upon in-house data that is not available for review by the scientific community and upon engineering model studies done by the Corps' Coastal Engineering Research Center but unpublished. The Main Report's evaluation of the hazards of coastal erosion at Fire Island, alternatives, and design criteria employ information not provided for review. We are familiar with the Seashore's condition and agree with several of the Corps' assessments: that storm erosion in the early 1990's has drastically decreased the protective function of the foredune to many valuable features along the Fire Island and that there is a substantially greater risk of island breaching and inlet formation at several sites west of Watch Hill, than before. With the exception of the beach height in Reach 2, the project dimensions are within the range found naturally along the barrier island.

However, there are numerous statements that are either oversimplified technically or overstated, subjectively. In particular, the arguments regarding overtopping imply that any breaching of the foredune (overwash) will reach the bayside and raise water levels throughout Great South Bay are draconian and of a very low probability. The Corps also states that overtopping is also expected to erode the barrier (p. 21) and increase the likelihood of breaching. The U.S. Geological Survey's data for Old Inlet indicates that where overwash has occurred, vertical building has resulted. Where cross-island overwash has occurred, bayside building has resulted. Implementation of the project design should lower the frequency of overwash penetrating only partially cross-island and decrease the probability of island breaching or inlet formation but it will not prevent any of these events from occurring as a result of especially severe storms.

The evaluation of the December 1992 storm dimensions is misleading and factually erroneous: at the Sandy Hook gage (nearest to Fire Island) there was a peak storm surge of 4.85' above the predicted high tide and the surge exceeded 1' for ten successive high tides. This storm's flood stage frequency may have a recurrence interval of twenty some years but its duration made it much more erosional than that. Extreme erosion of the bed at the nearby Mud Dump Site occurred in depths of 80'; the EPA assessed flow records of deployed current meters and suggested that the extreme values could only be generated by a storm recurrence interval of a couple hundred years. Modeling the benefits of storm protection is thus quite simplistic in both concept and execution although the stage vs. damage curves were generated for different erosion distances, a substantial improvement to the bivariate relationship. No assessment of the damages to Moriches and Narrow Bay margins by a breach in Smith Pt. County Park are made, although several dune breaches and overwash fans are present in areas with quite narrow island widths. Similarly, the surge modeling in Great South Bay is essentially linear in an East-West direction despite known spatial variability largely due to proximity to inlets during most storms.

The sediment budget analysis, if correct, suggests that there is a major increase in sediment transport westward, in the westward half of the island and that the offshore sediment reservoir is being depleted by this process. Such a phenomenon would accelerate erosion in the future and require increasing amounts of beach nourishment to offset the trend. There is no mention, let alone discussion, of this concept's relevance to future maintenance needs.

In essence, the project design is to return the beach/dune system to its state in 1990 and then to stabilize it for 30 years to provide additional storm protection to the mainland, Great South Bay, and Fire Island, beyond what is afforded now by the present barrier configuration and the Breach Contingency Plan. Although the project's dimensions mimic nature's, reflect the envelope of storm, seasonal, and annual change, and thus natural processes would reverse short term alterations, this proposed arrested state is of a much longer time span. Over three decades, especially the future ones, significant changes in relative sea level rise and coastal storm frequency/magnitude may occur but are not discussed in the planning context. The long term implication of stabilizing Fire Island require substantial research to provide the improved understanding of potential impacts.

Economic conditions/Economy

The Scoping Document does not provide any of the known information on potential project costs, benefit cost analyses conducted to date, or, related, duration of the maintenance requirement for the project and associated costs. Our comments, therefore, will be based on the feasibility study for the Interim Plan, used by the Corps used for determining the "Federal interest" in the proposed Interim Plan. A more detailed review will be undertaken on the methodology, assumptions, and data prepared for the DEIS or related environmental documentation.

As stated previously, it is our understanding that the 30 year lifespan of the Fire Island Interim Plan is not necessitated simply because of New York State's Coastal Erosion Management Regulations, but in recognition that a project of lesser size or lifespan may not be economically justifiable in terms of Federal (Corps of Engineers) participation: In order for the Fire Island Interim Project to achieve a benefit/cost ratio greater than or equal to 1.0, it must be sized large enough to provide storm damage reduction benefits to Long Island, and maintained at its design profile long enough to capture a sufficient benefit stream, a period extending about 30 years. As presented in the feasibility study, the project will require an initial capital outlay of approximately $60 million, and an additional $60 million (10 projected renourishment cycles), over its life.

- A Monte Carlo simulation was used to derive a distribution of damages. Without analyzing the mathematical models, and other relevant assumptions, used in this simulation for their applicability to the estimation problem, it is noted that the mean of the resulting distribution of damages was used in the cost-benefit analysis of the interim protection plan. (See Table D8, page D30, of the Economic Appendix, and Table 8 of the Main Report.)

  The Economic Appendix reports on page D29 the following observation:

  > "Statistical analysis indicates that the distribution of results has a strong positive skew, i.e. the mean damage is substantially larger than the median damage. This pattern of results is due to the potential for catastrophic damage if some extreme event, such as a 100 year storm, were to occur during the 30 year analysis period."

  The median is a better measure of central tendency than the mean since it is less sensitive than the mean to extremely large or small measurements. This appears to be the case in the present analysis. This point is all the more relevant in that the interim plan is intended to provide protection from the medium to small sized storm events, rather than the very large events. As acknowledged in the Economic Appendix, it is these very large events that exert an undue influence on the mean. For instance, the mean value of damages (without project, Table D8, Economic Appendix) is $10 million more than the median damage value. The median, therefore, should be the preferred measure of damages in this analysis, and is likely to result in a smaller value of benefits derived from the project.

- The use of the "unit day value" methodology introduces substantial uncertainty to the analysis regarding the magnitude of recreational benefits. This methodology has no empirical basis and appears to disregard basic economic tenets.

  - No literature citations or economic demand studies are referred to as the basis of the dollar amounts assigned.

  - The use of points assigned to weight the importance of factors affecting the demand for recreation is not based on any survey or research of recreational participation, and is therefore arbitrary.

  - The simple addition of points in the calculation of unit day values suggests an assumption of linearity that is not supported by surveys or research.

  - The analysis is based on the assumption that the with- and without-project attendance at the Seashore will be equal. This assumption cannot be made, given that the Corps has yet to present a public access plan for the Fire Island Interim Project. The Department has already received a request from a Suffolk County citizen, requesting that the Fire Island Project be developed in a manner that improves public access to Fire Island National Seashore. Increased attendance (crowding) may offset other benefits.

- The Principles and Guidelines, which govern the economic analysis of water projects, permit the use of economic methodologies, such as travel cost or contingent valuation, which have been demonstrated to be reliable in the estimation of recreational benefits. This was not done.

The unit day value method was developed in the early 1960s when the valuation of recreation was considered difficult. Since that time, improved methods to value recreation such as travel cost and contingent valuation have been developed and widely accepted. Using the unit day value method can lead to sizable errors in estimating the benefits of recreational activities that do not meet the assumptions of average conditions. This method is also problematic because of the age of the unit day values and guidelines (last published in 1983). This method should be used only when other options are not available.

- The Economic Appendix omits any discussion or estimation of non-use values. In its review of the Glen Canyon Dam EIS, the National Research Council recommended that non-use values be included in the economic analysis. See "Review of the Draft Environmental Impact Statement on Operation of Glen Canyon Dam" by the National Research Council (April 1994).

- The analysis does not take into account the costs of environmental impacts resulting from the Fire Island Interim Project or the costs of mitigation.

It is our understanding that the Corps may describe the post-Reformulation period of the analysis as "deferred construction." Without predetermining the outcome of the Reformulation Study/EIS, it follows that the pre- and post-Reformulation economic analyses are separable, and, therefore, should be evaluated independently.

This review suggests that the current analysis cannot support an informed decision. Future evaluation should also take into consideration fishing, both commercial and recreational and the recreational use of public lands.

Please also see the discussion under "Selection of Recommended Interim Plan," below.

Transportation

Long Island Tourist Bureau information states that over 4.5 million visitors come to the Fire Island National Seashore. Most of these come by Ferry, therefore the 1 million number may be low. Where did the information come from?

Environmental Resources

1. Fire Island National Seashore needs to be mentioned, not just the Wilderness Area. The Seashore has jurisdiction from mean high water to 1000 feet into the Atlantic for the entire beach face from the western boundary of Robert Moses State Park to Moriches Inlet. The Seashore has jurisdiction on all federal lands of the island.

2. Last sentence, first paragraph, "The stability of these communities...." Please note that the term stability should not be used with natural systems. Natural systems are inherently dynamic. Human development is what impacts natural processes.

3. In future documents, the phrase "Atlantic Flyway" can be used instead of "Atlantic Migratory Flyway."

Great South Bay

Future documents and evaluations should take into consideration that the Fire Island National Seashore has jurisdiction up to 4000 feet into the Great South Bay.

Moriches Bay Area

The Fire Island National Seashore has jurisdiction on significant salt marsh areas of the William Floyd Estate which is on the south shore of the Shirley-Mastic area.

Barrier Island

This section of the document does not mention Fire Island National Seashore. There should be a reference to Village of Bellport Beach in the eastern section description. There also needs to be made mention of Robert Moses State Park as part of the western section of Fire Island. This would be a great place to reference an included map to show community, town, village and park lands.

Borrow Area

This would also be a good place to show a map reference of the borrow areas.
Data on seabird abundance and use of food items in the borrow area should also be collected.

Cultural Resources

The Scoping Document does not mention cultural resources within the boundaries of Fire Island National Seashore. There are significant sites on the island that are on the National Park Service

List of Classified Structures. There are also these sites classified by the National ~~Park~~ Service as significant archeological sites:

Point O'Woods Refuse Midden
Blue Point Life Saving Station
Whale House Point
Smith Point Coast Guard Station
Forge River Life Saving Station
Fire Island Lighthouse Tract I
Fire Island Lighthouse Tract II
Camp Cheerful
Razed factory
Greenburg House Site
Saltaire Dump
Casino Site

Compliance with the National Historic Preservation Act is necessary in dealing with these sites.

Submerged Cultural Resources

Second paragraph, third sentence. Without substantial funding, Fire Island NS will not be able to complete the tracking/survey that had been initiated.

Identification of Potential Alternatives

We are concerned that the Corps may not conduct a thorough analysis of alternatives, based on the following statement included in correspondence of April, 1995 from the Corps to NY DEC:

> "The proposed course of action, however, does not include an evaluation of alternatives nor optimization for the selection of an NED plan. In order to reduce study costs and decrease the study time required for this interim project, the New York District will instead only demonstrate that the plan is economically justified."

The above statement notwithstanding, we have the following comments about the discussion of alternatives in the scoping document:

No Federal Action

1. The description of "No Federal Action" is not an accurate characterization and should be rewritten in future documents. The BCP should not be considered in this section, as it constitutes a "Federal Action." The BCP should also be described as a specific alternative. We also concur with NY DOS statements made in its December 30, 1997 comments on the Reformulation Scoping Document: Federal programs will remain in place, such as implemented by FEMA. The

evaluation of the no-Interim Plan scenario should be conducted in a manner that assumes implementation of the New York Coastal Erosion Management Regulations.

Non-Structural Alternatives: Buy-out Plan

1. The discussion on "buy out" seems to indicate that only a wholesale purchase of all areas within the floodplain will be considered. The Corps should, as also recommended by NY DOS in its December, 1997, Reformulation comments, consider the possibility of selective purchases in combination with other strategies.

2. New York State's Coastal Management Policies stipulate that non-structural alternatives are to be explored prior to construction of structural erosion protection measures.

Beach Nourishment Alternatives

1. First paragraph. Generally speaking, the discussion of this alternative seems to be evaluating the alternative in a positive manner related to a perceived need. The term "adequate protection" is used. What criteria was used to determine adequate? Maybe the best way to utilize this term would be that the plan/analysis will determine criteria for "adequate protection"?

2. Additional Beach Nourishment Alternatives. Consistent with language in the Fire Island National Seashore General Management Plan that sand nourishment on beaches of major federal land holdings will not be undertaken (e.g., the beach adjacent to the Wilderness Area, Sailor's Haven, etc.) we suggest two additional Beach Nourishment Alternatives:

   a. Beachfill and dune creation along only critical reaches. This alternative would only widen the beach and/or enhance the dune in the most critical areas, such as portions of the barrier island that are especially susceptible to breaches and where protection of property is necessary (e.g., communities).

   b. No action adjacent Federal Wilderness Area, but recognize the Breach Contingency Plan. This alternative could provide necessary protection (beachfill and dune enhancement) to the developed portions of Fire Island, while allowing for natural geomorphic processes to influence the federal wilderness. This would, also, be more consistent with wilderness values. If a breach which would lead to inlet formation were to occur it would be closed under the Breach Contingency Plan and specifically allowed in the Fire Island Wilderness Act of 1980.

3. The first sentence also uses "...to restore its form...", restore to what? Should this reference go back to the NGVD objective? If so why this 16 foot NGVD?

4. Last sent., mentions "...periodic placement of sand..." over what time frame, how often etc.? Should state here whether or not this is a one time placement of sand or not. And once

stated here, should also be stated in the Executive Summary.

Selection of a Recommended Interim Plan

1. Are the study goals/objectives based on 16 foot NGVD all the way to Montauk? Is this realistic?

2. This sounds like a build alternative has already been determined. Other alternatives, such as a buy-out alternative, are important considerations. It might be better to state item 2 as: must demonstrate sound responsible environmental planning and implementation practices.

3. The Scoping Document indicates that the selection of a recommended interim plan will be based in part on whether or not the alternative is "economically justified based on storm damage reduction benefits. The criterion is that the project benefits outweigh the project costs." In light of the preceding comments such as on the potential for conflict between the Interim Plan as currently proposed and the Reformulation Plan, the Corps should clarify the apparent inconsistencies between the feasibility of a truly interim plan, and the Interim Plan as now designed.

Potential Areas of Environmental Concerns for Considered Alternatives

1. The first paragraph states "...geographic boundaries and time frames." There is never a delineated time frame for this project. Nor is there a definition of interim. These need to be related to the public, in order for the public to better understand the project and its duration.

2. Invertebrates need to be added to the list of Biological Resources and related habitats. The effects of burying on the beach fauna, depend on complex factors (e.g., timing of the beach nourishment activity, extent, etc.) which are not well studied. The invertebrate fauna are an essential food source for those species which forage on the beach. The fauna and their habitat need to be characterized and impacts on this community needs to be assessed

3. In general the list of potential concerns is reasonably complete, primarily because the categories are quite broad. It is not clear, from this list, which elements of the listed categories will be studied, and how the assessments will be performed. It is, therefore, difficult to assess whether all areas of concern have been addressed.

4. A discussion of the likely impact of this project on the vegetation communities of the project. Art (1976. NPS Sci. Monogr. #7) demonstrates the importance of atmospheric nutrients to the Sunken Forest. Presumably, this applies to other areas of Fire Island National Seashore as well. The effects of a modification of aeolian transport of nutrients due to changes in dunes and beach on back dune and swale vegetation must be evaluated.

5. Numerous scientific studies conclude that attempts to "stabilize" coastal barriers such as

Fire Island, a dynamic coastal ecosystem, will have adverse impacts on these ecosystems. The document needs to acknowledge the body of science which concludes that storm-induced changes are part of natural processes which do not lead to "damaged" resources or systems.

6. The Great South Bay estuary is a tremendous resource. Numerical hydrodynamic and circulation models of Great South Bay are necessary to predict storm surge water levels and water quality responses under the various alternatives. If a breach were to occur on Fire Island, how would storm surge water levels be influenced, both vertically and spatially? Given a breach, what would be the spatial influence of water quality changes (i.e., influx of ocean waters) and what would be the temporal response (i.e., how would residence time in Bay be influenced by a breach)? The National Park Service (through SUNY-Stony Brook) is developing a numerical model for Great South Bay to address some of these hydrodynamic and circulation issues. This model is still under development. Upon completion and review, it may be determined that additional storm surge modeling, perhaps conducted by the Corps CERC is warranted.

7. Compatible with comment number 6, the ecology of shallow lagoon estuarine systems, with long flushing rates as Great South Bay, may be dependent on episodic "pulsed" flushing. The EIS should describe the interactions among physical/circulation dynamics (e.g., tide levels, storm surge levels, residence time,. physical/chemical responses (e.g., water clarity, sedimentation, and sediment redistribution, salinity) and the ecological effect (e.g., brown tide, eel grass and benthic distribution, salt marsh responses, etc.). The following questions, among others, should be addressed in the EIS for the various alternatives:

* How will the distribution and primary productivity of seagrass beds be altered?
* In response to seagrass alterations, what will be the response of fish and decapod crustacean communities?
* As sedimentation processes are altered by the various alternatives, how will benthic communities (particularly shellfish) respond?

8. The impact of the project on the Federal Wilderness Area and the wilderness values for which the area was designated needs to be addressed in detail.

Please also refer to the detailed discussion under "Fire Island National Seashore" and "Fish and Wildlife Resources," below.

Public Participation and Input

1. Cooperating Agency Status. The Corps has asked the Department to participate in the Interim Plan EIS process as a cooperating agency (40 C.F.R. §1501.6). Our concerns with the proposed Interim Plan notwithstanding, cooperating agency status is appropriate given the "special expertise" the Department brings to the table in this case, and given that the proposed project will be located within Fire Island National Seashore. However, as you know, the Department lacks the staff necessary to assist the Corps at the level either of us would prefer.

But, we would be a "cooperating agency" under the following conditions:

1. We will assist the Corps during the scoping process with the objective of trying to formulate issues, identify and describe studies needed, and by attending and presenting information at public meetings. We will also assist in review of all written material as it is completed and before any public review phase.

2. Other substantial involvement for data gathering, undertaking studies, data analysis, preparation and writing of the document or monitoring of critical resources will require financial support from the Corps as allowable. Further communication on this need should be directed to the Superintendent, Fire Island National Seashore.

3. Fire Island National Seashore, similar to other national park units, has formed the Fire Island Science Advisory Board. This is a group of government and non-government scientists formed to provide independent, scientific, and technical support to the park. They are scientists with extensive knowledge of Fire Island and adjacent ecosystems. We will be requesting their assistance periodically to review and assess the proposed projects that have the potential to affect the park. If there are particular questions that you would like to have the Board review please notify the park Superintendent.

History

The Fire Island to Montauk Point Reformulation Study

The Fire Island Inlet to Montauk Point Combined Beach Erosion Control and Hurricane Project (FIMP) was conceived over 35 years ago, and is now being "reformulated" by direction of the Council on Environmental Quality.

The Environmental Impact Statement for the FIMP was referred to CEQ in 1978 by the Department of the Interior and EPA. CEQ, in Gus Speth's 1978 correspondence to the Corps, (attached) found the programmatic EIS deficient, lacking in alternatives analyses, and disagreed with the Corps' strategy of conducting reach by reach EISs in the "absence of an overall framework" especially considering that "...each facet of the proposal is likely to affect other parts, as well as the whole highly dynamic barrier beach system...." CEQ also stated to the Corps:

> "We also agree, therefore, that the evaluation of alternative courses of action and their environmental impacts and acceptability is required for the entire system and must be presented in a single statement, prior to proceeding with any part of the proposal."

Several issues specifically raised by CEQ and the Department of the Interior in 1978 remain relevant, including the potential for the project to result in increased coastal development, impacts to fish and wildlife resources, impacts to Fire Island National Seashore, and the potential to accelerate erosion and other damage to the barrier island (see also discussions herein on Fire

Island National Seashore, and Fish and Wildlife Habitat). The Department disagrees with Corps staff assertions that subsequent development in Long Island floodplains somehow vitiates CEQ's concerns. To the contrary, that continuing development highlights the need for a system-wide evaluation of erosion processes.

In the Department's referral of the FIMP to CEQ (1978), included concerns about how questions concerning the project either went unanswered, or were to be answered in another document at some date in the future. This issue is now being repeated on the Fire Island Interim Plan, where questions about cumulative impacts or mitigation are responded to with assurances that such considerations will be adequately satisfied by the Reformulation EIS should funding continue. The Fire Island Interim Plan is identical to or larger than the originally proposed project except for a reduced berm height and a reduction in project design life from 50 to 30 years.

Breach Contingency Plan

The Fire Island to Montauk Point Breach Contingency Plan (BCP) represents another instance where the Department, the Corps, and New York State worked in full cooperation in order to prepare and implement an interim storm damage protection plan. Not only was the Environmental Assessment/Finding Of No Significant Impact (EA/FONSI) for the BCP prepared with the cooperation of the National Park Service, but the National Park Service/Fire Island National Seashore acted as a catalyst in bringing together the important agency stakeholders.

The BCP was developed in part to avoid a recurrence of the situation in 1992, in which a breach at Pikes Beach in Westhampton was not closed immediately, resulting in considerable damage and increased costs.

The BCP allows for stockpiling of sand in strategically located areas and the close monitoring of breaches that might occur as a result of severe storms. If monitoring indicates that a breach is becoming an inlet, it will be filled within a period of three months under the BCP. The Breach Contingency Plan represents an interim protection plan ready to be implemented by the Corps and New York State DEC.

Additional Information

1. The public needs to be aware that the NPS and the USFWS feel that there are priority studies that need to be accomplished in order to provide appropriate information for a truly interim project impact analysis, including, but not limited to the following:

- Baseline environmental data on biological resources;
- Airborne nutrient transport;
- Water circulation and nutrient budget;
- Role of overwash in Bay energy web;
- Carrying capacity;

- Shellfish ecology;
- Brown tide research;
- Ecology of eelgrass meadows;
- Endangered species;
- Role of overwash and breaching in habitat creation and maintenance;
- Ecological succession;
- Morphology studies; and,
- Bathymetry/Topography Studies: 9 months concurrent with other studies.

For additional information please see the following sections on "Fire Island National Seashore" and Fish and Wildlife Resources." It is appropriate that the Corps form a technical management group similar to the effort now underway under the Reformulation Study/EIS.

2. Also, there are important NPS permitting requirements that will need to be accomplished before the project can be implemented. These permits will take some time and may require additional information. A coordinated effort between the Department and the CORPS will be necessary to ensure that the permitting process is accomplished appropriately.

The material that follows includes a detailed discussion of issues and concerns pertaining to resources for which the Department has particular expertise or responsibility.

FIRE ISLAND NATIONAL SEASHORE

The potential for FIMP related projects to impact the National Seashore and to create development pressures in unsuitable areas has been known for 20 years:

> "An important objective of the proposed project is to reduce the threat of flooding to the barrier beaches and south shore of Long Island...In addition, the threat of damage to structures and facilities will be reduced. Both of these factors will lead to increases in land value and pressure on municipalities for rezoning or relaxation of development stipulations. Included in this category are development on the dunes, on tidelands, on wetlands, and increases in allowable population density. Historically, local governments have been unable to withstand development pressures of this type...An increase in development will place further pressure on ecologically sensitive areas and will have a non-beneficial impact." Draft EIS, Fire Island Inlet to Montauk Point Combined Beach Erosion Control and Hurricane Project (FIMP), 1977.

Congress established the regulatory protection for Fire Island National Seashore with the recognition that the local zoning authorities will have the primary responsibility for zoning enforcement within the Seashore. The legislation provided that the private property within the Community Development District may be retained by its owner as long as it is maintained in accordance with approved local ordinances and the Federal standards. Developments that are inconsistent with the Federal Zoning Standards are subject to the condemnation authority of the Secretary of the Interior:

> "...the Secretary shall not acquire any privately owned improved property...without the consent of the owners so long as the appropriate local zoning agency shall have in force and applicable to such property a duly adopted, valid, zoning ordinance that is satisfactory to the Secretary." P.L. 88-587, September 11, 1964.

However, not only are appropriated funds insufficient for such purposes, but having to resort to condemnation proceedings is highly controversial. It would be inappropriate for the Corps to place the Department in such a reactive and costly situation, having to rely on condemnation or acquisition, in order to prevent nonconforming development resulting from the Fire Island Interim Plan.

A new dune, of any life span, has been shown to encourage development. The magnitude of the issue has, thus far, gone unexplored. We need to ensure that we understand, and cost out all ramifications of this expected environmental impact so that the National Park Service is not saddled with nonconforming structures, and associated costs.

The National Park Service has clear evidence that existing beach scraping and renourishment projects have resulted in inconsistent development on sand fill projects: There have been 6 applications for reconstruction on the sand project in Fair Harbor/Dunewood section of beach. One house is already built, one is under construction, all are expected to receive permits, and all will be built. This development pattern illustrates that development of the front row of lots is presently underway. Hence, it is our concern that once the Interim Plan is implemented, the entire front row of lots will be built upon. Implementation of the New York Coastal Erosion Management Regulations, and designation and enforcement of the Coastal Erosion Hazards Area (CEHA) would have precluded the issuance of these building permits. Just how the CEHA will be implemented remains unanswered (see II.G. Coastal Zone Management, below).

The Fire Island Interim Plan, upon review by New York Department of State, Coastal Management Program, must meet Coastal Management Program consistency requirements. It is unclear that the Fire Island Interim Plan, as proposed, can meet these requirements.

The new dune/berm/fill complex will exacerbate the existing problem described above. The implications for new development following construction of the Fire Island Interim Project are noted by the Fire Island Association in its newsletter (Vol X, No. 3):

> "There are two elements in the real estate area that must be dealt with. The first is determining the fate of property lots that are now unbuildable (they are on the beach face or the dune line) but become buildable as a result of the project...In other words, the northern limit of the project boundary will be south of the present building line. This could make it possible for gaps in the present line to be filled with new construction, assuming the property taxes have been paid and there is sufficient area to build a house."

Construction of structures on or behind the new dune or fill project may result in development that is inconsistent with the Federal standards and local codes:

- *Federal Dune District*, as an overlay of the Community Development District, extends from mean high water, northward to 40 feet landward of the crest of the primary dune.
- A *lot* means "a parcel of land which meets the minimum acreage and frontage requirements of the zoning authority...but in no case does a lot include lands below the toe of the natural foredune line."

The potential impacts from new development may include the following:

- The destruction of new structures by storm events resulting in flotsam and jetsam within Federal properties;
- Public expectation that the new structures will be protected, and the public costs incurred by such protection;
- Limitation of the natural and/or artificial dune-building processes over time due to the construction on top of the fill (in some current cases deed covenants have never been

complied with, nor enforced; in other cases they have never been filed);

- Loss of available vegetation habitat required for dune integrity
- Diminished public access to the beach as private interests "claim" the rebuilt upland (southern boundaries of properties are defined by deeds as mean high water).

Implementation of the Interim Plan must not exacerbate development within Fire Island National Seashore, particularly new or restored structures that do not conform to the zoning regulations in place within the National Seashore. Given that the new protective dune may encourage development in areas remaining under restrictive zoning (e.g., the Seashore's Dune District), the Corps, the National Park Service, New York DEC and the communities within the National Seashore, will have to work together in order to ensure consistency between respective land use regulations, in word and application.

Issues to be answered include the following: 1) increased costs incurred in the administration of the National Park Service's land use protection policies; 2) the appropriate source of funding to pay those costs; 3) "reversibility" of the Interim Project (new nonconforming structures conflicting with outcomes of the Reformulation Plan/EIS); and, 4) regulatory consistency.

This is not an uncomplicated process, and must be addressed prior to implementation of even a truly "interim" project. A long term strategy may be appropriately incorporated into the General Management Plan for the National Seashore, an action requiring at least an EIS, and possibly Congressional approval if it necessitates updating the Seashore's existing zoning districts.

Wilderness Area

With regard to Mr. Piken's two questions in his October, 1996 correspondence pertaining to the Wilderness Area within Fire Island National Seashore, a reach your staff had eliminated from the project description months before our meeting in July, 1996, please refer to the Department's letters of April 23, 1996 and August 1, 1996. If you or your staff have any additional questions concerning "emergency" situations requiring us to revisit prior decisions regarding work in the Wilderness Area (e.g., the existing Breach Contingency Plan), please see NEPA regulations at 40 C.F.R. § 1506.11. It would be inappropriate for the Department to supplant CEQ's regulations in response to "what if" scenarios not anticipated by the Corps' own modeling.

Although the Wilderness Area within Fire Island National Seashore is not currently included in the proposal for initial construction, the Corps proposes to treat this as deferred construction. Construction in this Area may result in the following:

- Alter the wilderness values of the area.
- Old Inlet may be the best example of threatened and endangered species habitat on Fire Island, and is important to many other shorebird and plant species as well, due to the bayside sand flats and related saltmarsh areas. This would not be the case if (ephemeral) breaches were not allowed to occur.

Natural processes

The project as proposed may

- Limit natural processes such as breaches, overwashes, and inlet formations, with no examination of the importance of these processes to natural barrier island maintenance (i.e., Talisman to Barrett Beach overwash);
- Stress threatened, endangered, rare, indicator species, including, among others, piping plover, roseate tern, least tern, common tern, seabeach amaranth, seabeach knotweed, eastern mud turtle, eastern spadefoot toad;
- Foraging, breeding, germination disruptions may result (i.e. sand deposition on historic seed sites);
- Off-shore sand may differ in character from natural beach sand, affecting species with preferences (e.g., different grain size affects compactness which in turn affects erosion and the invertebrates inhabiting the beach);
- Breaches (estuaries) -- having no natural breaches is likely to greatly alter natural productivity; naturally disturbed areas allow for colonization by a larger variety of species;
- Eelgrass -- greatest concentration has been in the area of breaches; overwashes, or inlets (i.e. Old Inlet, Barrett Beach, Atlantique Beach).

Biological diversity

- Interrupting habitat formation and maintenance for several of the species that live on Fire Island will impact the majority of species; many of these species are already stressed due to incompatible use of the barrier island

Cultural resources

- Deposition over submerged cultural resources has an affect of protection of these sites, but also will make it more difficult to access the sites for future research and interpretation.

FISH AND WILDLIFE RESOURCES

The following comments focus on both the biology relevant to this proposed interim project, specifically the proposed beach fill/dune construction nourishment proposals. These proposals include the potential construction of a berm with attendant beach nourishment in a 32 mile area stretching from Fire Island Inlet to Moriches Inlet. The proposals are anticipated to have a 30-year project life. The proposed beach nourishment alternatives could potentially have significant ecological impacts upon the barrier islands, the back bays, and upon their fish and wildlife communities.

Constructed and Proposed Interims

The Corps has constructed 15 groins along 4 miles of beach in Westhampton and 2 miles of dune and berm and buried steel sheet pile at the Village of Westhampton Dunes. The Interim Plan beach nourishment alternatives and the proposed West of Shinnecock Inlet Interim Project, in combination with the Westhampton projects, will result in beach stabilization and construction along 20 miles of the shore with the potential for construction along a total of 40 miles over the next 30 years should the Corps determine that additional work in the identified project areas is necessary.

Potential Impacts

Over the short term, construction activities associated with implementation of the Interim Plan beach nourishment alternatives will have direct and indirect adverse impacts on fish and wildlife resources and their supporting ecosystems. Beach fill may cover up to 14 miles of near shore intertidal and subtidal marine habitats and beach habitat. Dredging of the borrow areas will disturb benthic resources, which could affect the amount of food available to higher order species.

Overwash can contribute to sand accretion on the barrier island thereby keeping the barrier island above water and protecting Long Island's south shore from direct influence of ocean waves. Coastal processes also create and maintain various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife habitat. In particular, flood tidal deltas, overwash fans, and sandspits are created and perpetuated by overwashes, breaches and inlets. Such areas provide prime loafing, foraging, and nesting habitat for most of Long Island's waterfowl, shorebird, and wading bird species.

By precluding normal coastal processes, bare beach and sparse grasslands will tend to be replaced by dense grasslands and thickets, a habitat comparable to the suburban mainland of Long Island, with a concomitant change in animal species. As typical suburban mixed grassland/thicket species are abundant on Long Island, and seashore species populations are declining, this is likely to represent a loss of biological diversity at the community level for all of the Long Island ecological region.

The Interim Plan beach construction alternatives are designed to prevent the occurrence of coastal processes that maintain and create such habitats and that support fish and wildlife species, and preserve the integrity of the barrier island. The Corps' EIS for the Interim Plan should evaluate the adverse effects that such ecosystem manipulation may have on Long Island's barrier islands and associated south shore bays.

Importance of the Study Area

Public Emphasis on the Area

As recently as January, 1997, in its announcement of the "Embayment area along the south shore of Long Island, New York: Reconnaissance study -- Environmental Initiatives," the

Corps identified the value of this area stating:

> "The bays represent a vital link in the region's coastal ecology. Together, they provide critical nesting habitat for a variety of shorebirds, including several endangered species, as well as a primary stopover along the Atlantic Flyway, a major migratory route for east coast waterfowl. They also provide spawning and nursery habitat for shellfish and many species of commercially or recreationally valuable anadromous and estuarine fish (Corps 1997). "

All of the bays and several tributary and marsh systems along Long Island's south shore are designated as a Significant Coastal Fish and Wildlife Habitat by New York State as documented in the New York State Department of State report entitled "Significant Coastal Fish and Wildlife Habitats Program", dated July 1992. Recognizing this area's unique importance, New York State passed the South Shore Estuary Reserve Act of 1993, creating a Council to produce a comprehensive management plan for restoration, maintenance, and protection of the bays from Hempstead Bay east to Shinnecock Bay. Robert Moses State Park occupies the western end of Fire Island, with Captree State Park extending into Great South Bay on the eastern tip of Jones Beach Island. Gilgo State Park is located several miles to the west of Captree along Jones Beach Island. Hecksher State Park and Connetquot River State Park extend north from the Great South Bay's north shore. Sections of the Connetquot River have been designated as Scenic and Recreational Rivers under the New York State Wild, Scenic, and Recreational Rivers Act. New York State also maintains a number of conservation areas along the north shore of the bay, including one that adjoins Wertheim National Wildlife Refuge.

Fire Island is an outstanding example of a barrier island, a strip of land dividing the Atlantic Ocean from Great South Bay and Moriches Bay. Design Reaches 2, 3, and 4 of the proposed Interim Plan lie within the boundaries of the Fire Island National Seashore. In 1980, the 7-mile long section of Fire Island from Smith Point County Park west to Watch Hill was designated a wilderness area in accordance with section 3© of the Wilderness Act. The Fire Island National Wilderness Area is the only federally designated wilderness area in New York State. Wilderness areas provide an opportunity to focus management attention on natural processes, not only to maintain natural conditions, but to maintain natural dynamics for its own sake.

Great South Bay, Moriches Bay, and Shinnecock Bay are identified as Significant Habitat Complexes in the Service's "Significant Habitats and Habitat Complexes of the New York Bight Watershed" dated November, 1996. Great South Bay including Fire Island and Moriches Bay are Federally identified Significant Coastal Fish and Wildlife Habitat as published in the "Northeast Coastal Areas Study: Significant Coastal Habitats of Southern New England and Portions of Long Island Sound, New York", (NECAS) dated August 1991. Part of Fire Island has been designated and mapped as an undeveloped beach unit as part of the Coastal Barrier Resources System pursuant to the Federal Coastal Barrier Resources Act, which set limitations on Federal assistance or flood insurance. Other parts of Fire Island have been mapped as otherwise protected units under the Coastal Barrier Resources Act. In addition to these designations, the Service maintains the Wertheim National Wildlife Refuge and the Seatuck National Wildlife Refuge on the northern shore of the Great South Bay. Several wetlands have been identified as protection priorities under the Federal Emergency Wetlands Resources Act of 1986, including Swan River, Beaverdam Creek, and the Carmans River. The Atlantic Coast Joint Venture of the North American Waterfowl Management Plan recognizes the south shore marshes as a focus area.

There are a large number of county, town, and private conservation holdings along the Great South Bay's north shore. They include Indian Island County Park, Gardiner County Park (abutted to the east by a New York State Conservation area and a property owned by The Nature Conservancy), Islip Town Beach (backed by an Audubon Society property to the north and adjoining Seatuck National Wildlife Refuge), Islip Meadows County Nature Preserve, and the undeveloped Smith Point County Marina North. The Nature Conservancy manages four preserves in Great South Bay including the Finlay-Wolf Preserve, Hollins Preserve, Orr Preserve, and Thorne Preserve.

Ecological Significance and Uniqueness

Barrier islands contain unique and faceted ecosystems that are not found anywhere else (Herbst 1982). They provide habitats and food for hundreds of species of coastal birds, fish, shellfish, reptiles, and mammals (Clark 1977; Herbst 1982). Barrier island chains operate as a unit, passing sand, water, animals, and even plants (through seed transport) from island to island and form a common pool for resource replenishment (Clark 1977). Gregg (1982) states that in order to insure the health of this ecosystem, we must insure the health of all of the ecosystem elements, as well as the flows of energy and materials between them. If any one of the components is disturbed, the whole system reacts by becoming less well-ordered and less productive in one or more of its functions (Gregg 1982).

The waters that surround barrier islands are very productive, compared to other estuarine or marine ecosystems. This may be due to their position between marine and terrestrial habitats (Beatley 1991). In temperate environments, such as the U.S. mainland, coastal ecosystems support greater biological resources than most inland habitats (Beatley 1991). Many forms of life throughout the world depend entirely or partially upon coastal shorelines (Beatley 1991). Society derives tremendous direct benefit from coastal flora and fauna, including considerable medical, scientific, and commercial benefits (Beatley 1991).

Great South Bay is the largest shallow saltwater bay in New York State and one of the largest in the northeastern United States. Open water merges into an extensive series of saltmarshes, saltmarsh islands, and intertidal sand flats along the protected northern edge of the barrier beach that separates Great South Bay from the Atlantic Ocean. These habitats were all created and are maintained by coastal processes involving the interaction between the ocean, barrier island, and the back bay.

Primary productivity, the production of plant biomass, in the Great South Bay is among the highest for any estuary in the world (Schubel 1991). Because of the very shallow depth, the contribution to the total primary production by rooted plants such as eelgrass is large (Schubel 1991). The sheltered tidal wetlands of the bay are highly productive and provide regionally significant habitat for fish, migrating, wintering and nesting waterfowl, rare plants, and other species associated with open water marshes, estuarine watersheds, and the largest undeveloped barrier beach in the New York Bight watershed.

There are 210 species of special emphasis in the Great South Bay complex, including 43 species of fish and 101 species of birds (U.S. Fish and Wildlife Service 1996b). Species of special emphasis are those either protected by Federal or State law or regionally rare, declining, or otherwise regionally important species.

The Great South Bay is a focal area for State and Federally listed plants and animals, including the Federally endangered peregrine falcon (*Falco peregrinus*), roseate tern (*Sterna dougallii*), and Kemp's ridley sea turtle (*Lepidochelys kempi*), the Federally threatened piping plover (*Charadrius melodus*), loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*), the State-endangered least tern (*Sterna antillarum*), and the State-threatened common tern (*Sterna hirundo*) osprey (*Pandion haliaetus*), northern harrier (*Circus cyaneus*), and eastern mud turtle (*Kinosternon subrubrum*), and five State species of special concern, northern diamondback terrapin (*Malaclemys t. terrapin*) and black rail (*Laterallus jamaicensis*), the short-eared owl (*Asio flammeus*), coastal barrens buckmoth (*Hemileuca maia maia*) and eastern bluebird (*Sialia sialis*). Although only one Federally-threatened plant is found in this area (seabeach amaranth, *Amaranthus pumilus*), the area contains seven State-endangered, 13 State-threatened, and 13 State-rare plant species.

The Great South Bay supports the largest wintering waterfowl concentrations in New York State, including greater and lesser scaup (*Aythya marila* and *A. affinis*), American black duck (*Anas rubripes*), red-breasted merganser (*Mergus serrator*), brant (*Branta bernicla*), and common goldeneye (*Bucephala clangula*). Dabbling ducks concentrate in the shallow water and marsh areas behind Fire Island, the shoals near East and West Fire Islands, Sexton Island, and Captree Island, as well as in the Carmans and Connetquot River estuaries. Diving ducks tend to be distributed more uniformly throughout the bay.

The marshes also provide foraging habitat for thousands of migrating raptors each year, including the Federally listed peregrine falcon, the State-listed osprey and northern harrier, and two State species of special concern, the short-eared owl and Cooper's hawk (*Accipiter cooperii*). Other species of special emphasis include the Federally endangered roseate tern, the Federally threatened piping plover, the State-endangered least tern, and the State-threatened common tern. The area is also an important wintering waterfowl area for such species as greater and lesser scaup, American black duck, red-breasted merganser, brant, and common goldeneye. It is also an important migratory shorebird concentration area during spring and fall migrations, when large numbers of shorebirds use the flats and marshes behind the barrier beaches. A large number of raptors migrate along the barrier beaches of Long Island, especially during the fall migration. The most abundant raptors counted at Fire Island during the fall migration are American kestrel *(Falco sparverius)*, merlin *(Falco columbarius)*, sharp shinned hawk *(Accipiter striatus)*, northern harrier, osprey, peregrine falcon, and Cooper's hawk.

Great South Bay has the largest sport catch of winter flounder on Long Island. The bay provides both nursery and spawning habitat for winter flounder and summer flounder. Winter flounder (*Pleuronectes americanus*) support a very modest commercial fishery, on the order of 1,000 to 3,000 pounds per year. The recreational fishery for winter flounder is several orders of magnitude larger (New York Sea Grant Institute 1993). Summer flounder or fluke (*Paralichthys dentatus*) is the main focus of the recreational fishery in Great South Bay during the summer. Bluefish (*Pomatomus saltatrix*) has been among the top five species landed by recreational fishermen each year since 1979 (New York Sea Grant Institute 1993). The bay also provides an especially significant nursery habitat for young-of-the-year and juvenile Hudson River striped bass (*Morone saxatilis*) and juvenile bluefish, while Atlantic sturgeon (*Acipenser oxyrhynchus*) and American shad (*Alosa sapidissima*) use the area during migration (NECAS 1991). Inlets and adjacent areas are generally recognized as having relatively high fish abundance and provide for high recreational fishing opportunities (Cashin Associates 1993).

Hard clams account for 60% of average annual seafood (shellfish and finfish) landings in Great South Bay (NMFS landings data 1985-1994). The hard clam shellfishery of Great South Bay is the largest in the State in terms of total value and percentage of harvest. In 1992, the total value of the State's harvest was just over $2 million (NYSDOS in review). The area also supports a commercial and recreational shellfishery for soft shell clam (*Mya arenaria*), blue mussel (*Mytilus edulis*), hard-shell clams (*Mercenaria mercenaria*), bay scallop (*Argopecten irradians*), and blue crab (*Callinectes sapidus*). Oyster populations have declined drastically in the subtidal areas of Great South Bay. Hard clam landings peaked in the mid-1970's and declined substantially over a 10-year period from 1975 to 1985.

Physical Structure

Overwash causes vertical sand accretion and horizontal migration of the barrier island, which, with aeolian reworking, keeps the barrier island above water during periods of rising sea level, and so protecting Long Island's south shore from direct influence of ocean waves. Coastal processes also create and maintain various terrestrial and estuarine habitat types, vegetation cover types, and fish and wildlife species. In particular, flood tidal deltas, overwash fans, sandspits, and tidal marshes are commonly created and maintained by breach and overwash events. Long Island's waterfowl, shorebird, and wading bird species require the loafing, foraging, and nesting habitat that such areas provide. The beach construction alternatives proposed in the scoping paper are designed to a significantly affect coastal processes that maintain and create such habitats and that support fish and wildlife species.

Beach construction alternatives have the potential to reduce habitat diversity on the barrier beach and result in the loss or degradation of rare natural communities, including interdunal swales and maritime oak-holly forests. The species composition in these and other barrier beach ecological communities is dependent in part on natural coastal processes such as overwash and salt spray pruning.

Along the south shore of Long Island, the normal evolution for an inlet after formation results in sediments and geomorphic features moving both northward (landward) and westward (downdrift) (Leatherman 1985). This inlet migration in two directions over time gives rise to complex sedimentary patterns involving a variety of different inlet related environments: bay bottom, deep to shallow inlet channel, active and relict flood and ebb tidal deltas, spit platform, and spit (Leatherman 1985). Each of these sedimentary forms has specific niche functions in the ecology of Great South Bay (New York Sea Grant Institute 1993), Moriches Bay, and Shinnecock Bay. The outstanding biological diversity and abundance of Long Island's south shore estuary is, in part, a consequence of the variety of habitat types within the system.

A constantly evolving and changing habitat complex, unusual in other landforms, is typical of barrier islands. Changes in the islands' shape and position occur from season to season, and even day to day. The sandy ocean beachfront constantly adjusts to the balance between two factors: (1) the erosive forces of storm winds and waves, and (2) the restorative powers of prevailing geological, oceanic, and meteorological actions. In response to the interplay of these forces, the whole system of beaches, barrier islands, and dunes shift more or less continuously (Clark 1977).

Over a longer time span, the mass/energy interaction has resulted in a relatively continuous, though intermittent, landward migration (Panageotou et al. 1985) of Long Island's barrier island system. The force driving the islands landward is rising sea level. The relative sea level rise in the New York area has averaged about 2 mm (O. 1 in.) per year during the past 50+ years (Leatherman et al. 1985). However, higher rates of sea level rise have been predicted for the next century (Beatley 1991). Globally, sea level may rise between 10 in. and 6.5 ft. (between 25 and 200 cm) in the next century (Bokuniewicz and Schubel 1991; Beatley 1991), suggesting a 3 in. to 2 ft. (7.5 to 60 cm) rise during the 30-year project life.

Inlet formation on Fire Island

A number of factors need to coincide in order to induce the formation of an inlet. This fact is emphasized by fact that few washover ever cross the island completely, to say nothing of producing new inlets. A storm in 1963 produced four washovers on eastern Fire Island. A storm in 1953 caused seven or more, while nine washovers were reported after a storm in

1960. Thirteen washovers were found after a storm in 1949, 50 after another in 1962, and 63 after a hurricane in 1944. The hurricane of 1938 washed over the entire beach between Democrat Point and Ocean Beach and many other places as well (Bokuniewicz and Schubel 1991). None of these washovers resulted in a permanent inlet. For inlet formation to occur, certain geophysical and meteorological conditions must be met. Leatherman (1982) points out that overwash is a relatively common event, happening during most major storms, but that inlets are relatively rare, occurring only once in fifty to seventy-five years along some shorelines. This implies that the opportunity for inlet-based habitat formation is an equally rare occurrence.

Inlets of varying size and number have developed at various times in Fire Island's history, particularly in eastern Fire Island. Other parts of Fire Island, particularly the central portion, have been stable for hundreds of years. For example, Fire Island's Sunken Forest, a true maritime forest, could only have developed under conditions of prolonged limitation of environmental stresses, particularly salt spray and salt water flooding (Leatherman et al. 1985). The development of the Sunken Forest is due to the fact that it is protected behind a high secondary dune. Washovers do not penetrate the secondary dune, which is also effective at screening backbarrier vegetation from salt spray.

The western part of Fire Island has not migrated landward but has narrowed while following the migration of Fire Island Inlet to the west. The evidence for this is a series of arcuate backdunes found west of Davis Park (Leatherman et al. 1985), and in simultaneous ocean and bayside shoreline retreat. No new inlets have opened in this area during the historical period. During the past four decades, no new permanent inlets have opened on Fire Island, but several ephemeral breaches have occurred on eastern Fire Island during major storm events (Kana and Krishnamohan 1994).

Inlet development/habitat formation

A new inlet represents a new habitat area. Several fish and bird species take advantage of this inlet and shoal habitat, including bluefish, common terns, and roseate terns. Expedited breach closure under the BCP will tend to curtail these effects; new inlets that are cut in the Long Island barrier beach tend to shoal to closure within a relatively short period of time (Cashin Associates 1993).

Through time an unstabilized inlet achieves a net downdrift migration and eventually becomes choked with sand and closes. Marsh islands develop in the bay if the new substrate (flood tidal delta) achieves sufficient elevation, while eelgrass beds may develop below the mean low water line of the flood tidal delta, at a depth controlled by turbidity and bay wave turbulence. The presence of these salt marsh islands and the wide bayside marshy plains on the northern shore of Long Island's barrier islands can effectively preclude future inlet activity because of the resistance of the marshy substrate to erosion.

The barrier islands have widened and strengthened at historical inlet sites, and this has also led to habitat formation. Inlet processes are mainly responsible for providing sediment to the barrier bayshore, causing a widening of the island at inlet locations and therefore promoting landward migration (Leatherman et al. 1985). The sediment from the ocean side of the barrier island which is washed through the channel forms a flood tidal delta. When the inlet finally closes, this large sedimentary deposit becomes an excellent substrate for potential salt marsh colonization (Gregg 1982; Leatherman 1982; National Park Service 1995). The marsh islands in the bay and most, if not all, of the bayshore marshes formed atop flood-tidal delta sediments (Leatherman et al. 1985; New York Sea Grant Institute 1993) in locations where bay wave energies are sufficiently small.

Salt marsh is essential habitat for waterfowl, shorebirds, forage fish, and such avian predators as the northern harrier and the short-eared owl. Much of the present salt marsh along the bay side of Long Island's barrier islands exists where flood tidal deltas were created by breaches. The deposition of sediment on the north (bay) shore of the barrier island occurs via sediment transport through inlets of by washover events. Washovers and the formation of new inlets can substantially alter the distribution of habitats, for example, by converting shallow shoals to intertidal marshland, marshland to subaerial beach, or deeper-water habitat to shoal areas (New York Sea Grant Institute 1993).

Breaches and inlet formation also promote spit growth along the margins of their channels. Bayside sand spits are especially productive for shorebirds and wading birds. A new spit and shoal complex formed following the 1992 breach at Westhampton has become a highly productive nesting and forage area for shorebirds, including black skimmer (*Rhynchops niger*), American oystercatcher (*Haematopus palliatus*), willet (*Catoptrophorous semipalmatus*), least tern, common tern, and piping plover. This area produced one of the highest nesting densities of piping plover in New York State during 1995,1996, and 1997. Indirect impacts due to the Westhampton Interim Project will likely reduce the value of this beach habitat over time.

Both overwash fans and flood tidal deltas are prime spawning grounds for the horseshoe crab (*Limulus polyphemus*) (New York Sea Grant Institute 1993), whose eggs are an important food source for migrating shorebirds. Intertidal beaches are used by several fish species as a spawning site. The Atlantic silverside deposits its eggs in filamentous algae (*Enteromorpha* spp.) or other vegetative material in the upper intertidal zone of salt marshes and open beaches (Conover and Kynard 1984). The mummichog also deposits eggs in the upper intertidal zone either on stems of *Spartina*, within empty mussel shells, or amongst filamentous algae (Able and Castagna 1975; Taylor et al. 1977). The unvegetated stretch of sand between mean high water and the upper tidal limit is also prime feeding habitat for numerous species of shorebirds, especially during spring and fall migrations, and prime nesting habitat for several beach nesting birds, including piping plover, common and least terns, black skimmer, and American oystercatcher (Bull and Farrand 1977).

Long-term Federal efforts to prevent breaches will be a detrimental alteration to this environment. According to Leatherman and Allen (1985a), available evidence suggests that the dominant mechanism for maintaining the barrier's integrity while migrating is flood tidal sediment deposition through inlets which provides for basal sediments and salt-marsh development. Large, infrequent storms may be the most important sources of sediment to the back bay (Schubel and Hirschberg 1978). Inlets facilitate the influx of great quantities of sediment into the bay, which then serve as a substrate for new marsh growth, while washover deposits determine marsh colonization and burial cycles (Crowell and Leatherman 1985). Rising sea levels are expected to drown existing marshes, eelgrass beds and shallows. Preventing breaches will also prevent the creation of new habitats to take the place of those lost to rising sea level.

While inlet formation is an infrequent process in this barrier island system, there can be no question that it is within the range of natural variability of that system. It is gradually becoming apparent that major disturbance events, such as avalanches, fires, and floods, are integral to the effective function of dynamic systems that are prone to such disturbance (Sousa 1984; Holling and Meffe 1996; Murray 1996).

Overwash and Aeolian processes

Sediment accretion due to overwash processes serves to keep the barrier island above water during extreme high storm tides as well as in the face of rising sea level. In locations where integrity of the dunes is maintained during a catastrophic storm, washover deposits are negligible, and the dominant sediment transport direction is seaward. In locations where the dune is absent or breached, overwash processes are uni-directional, delivering sand to the island surface, but not removing sand from the littoral system as an inlet would (Leatherman 1985). These rare but potentially large overwashes generally result in localized accretion on the bay side (New York Sea Grant Institute 1993).

Overwash prevention could cause serious damage to the barrier island. Leatherman and Allen (1985a) state:

> "Without sand deposition on the backbarrier area, the island interior will become progressively lower relative to [a rise in] mean sea level. Since inlets are now stabilized, overwash is the only means of promoting landward barrier transgression so that this option would set the stage for *in situ* drowning, the exact timing depending upon the rate of sea level rise and the concomitant (ocean and bay) shore recession in the absence of landward barrier migration. "

The option referred to was the construction of a 16 foot (NGVD) high dune with a 14 foot (NGVD) high berm, with optional groin placement later if necessary to prevent excessive sand loss. With the development of the Breach Contingency Plan (BCP), new inlets will be filled promptly, preventing most of the landward movement of the island's base, which can only accelerate the relative loss of elevation of the island's interior and the other consequences described above.

Overwash contributes in several important ways to maintaining barrier islands and their ecosystem functions, especially as habitat for many plant and animal species. In the process of the barrier island's vertical growth through overwash, several important unique landforms are produced, including overwash channels, overwash fans, vegetated and non-vegetated subtidal flats, and backdunal swales. Overwash that crosses the entire barrier island leaves behind distinct corridors known as washovers (Kana and Krishnamohan 1994). These areas are important biological corridors, linking ocean and bay habitat. Several species, especially the piping plover, are known to take advantage of the increased access to bayside forage areas afforded by overwash corridors. Overwash areas produced the highest densities of piping plover nesting in New York State during the 1995 and 1996 breeding seasons.

Overwash maintains unvegetated intertidal sand flats by providing a vital clearing function, similar to naturally occurring forest fires and river bank floods. An important consequence of building up the Fire Island foreshore would be to greatly reduce overwash (Leatherman and Allen 1985a). Overwash prevention would lead to species change, with woody plants (e.g., shrubs and thickets) replacing grasslands, which in turn impacts native fäunal habitat (Leatherman and Allen 1985a). This change has been observed behind stabilized dunes on Cape Hatteras, North Carolina (Leatherman 1982).

Overwash provides unconsolidated sedimentary deposits to the north side of the island that are good sand sources for dune building by aeolian processes (Leatherman et al. 1985). The Corps has not indicated what factors explain the present-day absence of a dune in this location. Dune growth does not depend on the amount of sand on the beach, but rather by the occurrence of wind (and wave) events (Zimmer 1991) of suitable duration and direction. Leatherman and Allen (1985a) also suggest that dune growth rates in the barrier island system east of central Fire Island are limited by sparse vegetation, which cannot hold enough wind-blown sand in place to encourage dune growth. Also, the presence of housing itself interferes with beach and dune dynamics (Nordstrom and McCluskey 1985). Intensive urban development of much of the area in the past half-century now precludes much of the overwash/aeolian process of vertical accretion (Leatherman and Allen 1985a). Stabilizing the dune and constructing a dune/dike will likely cause a steepening and narrowing of the beach. This will make the habitat less suitable for piping plover, seabeach amaranth, and other species that rely upon shoreside habitats.

The Corps should also address the conditions that could cause a breach in Fire Island and the probable effect of the proposed Interim Plan on this process. Kana and Krishnamohan (1994) suggest that a 50-year or larger model storm (a storm with an annual probability of 2% or less) would be required to breach Fire Island. New York Sea Grant Institute (1993) offers a 1 in 250 (0. 4%) probability of breach occurrence based on the historical rate of breach occurrence.

Another important issue is the role of sediment inputs into Great South Bay, how they form and maintain habitat, and what protection this sediment affords the mainland of Long Island. Long Island is protected, to a great degree, by the shallow, gentle slope which is typical of the continental shelf slope along much of the Atlantic Coast and which is present along the south shore of Long Island's mainland. This shallow depth and relatively level topography tends to reduce wave energy before it reaches the shore (Bascom 1964). Sediment, when formed into flood tidal deltas, provides the substrate for clam beds, eelgrass meadows, and tidal marshes. These deltas are always found behind historic inlet channels. A study should be considered to determine, first, if the Interim Plan is capable of preventing inlet formation, second, where the prevented inlet would have occurred in the absence of the Interim Plan, and the size and shape of the flood tidal delta that would have formed without the project.

Potential Impacts of the Beach Construction Alternatives of the Fire Island Inlet Interim Plans on Fish and Wildlife Resources

Open Water/Non-Vegetated Bay Bottom

Barrier island and coastal processes may positively affect water quality in the back bays by reducing the number of water borne pathogens, reducing turbidity, and moderating bay temperatures. All of these could prove favorable to the production of shellfish, especially the hard clam. However, the Corps' recommended plan is designed to prevent such processes up to a 44 year storm event, and the BCP will close any breaches that may occur. A new breach would have the potential to improve water quality.

The Corps (1995) has expressed concern that a breach may cause changes in bay salinity that would be damaging to shellfish. Salinity will tend to rise with or without the Interim Plan as rising sea level forces more ocean water into the bays. This is unlikely to have much impact on the hard clam industry, however. Increased salinity allows for an accelerated rate of shellfish growth and improved larval development (Cashin Associates 1993). Higher salinity appears to be more favorable to hard clam growth at non-optimal temperatures (≥30 or ≤20°C) (Malouf 1991). Seasonal temperatures in Great South Bay range from 0 to 30°C (Lively et al. 1983)

Increased tidal flushing in the bay could reduce the number of water-borne pathogens in shellfish growing areas, leading to a possible reduction in the number of areas now closed to commercial and recreational clamming (Cashin Associates 1993). Cashin Associates (1993) also notes that increased flushing reduces turbidity, which may have positive effects on both shellfish and eelgrass. As light penetration is a major limiting factor affecting the primary productivity of submerged aquatic vegetation in the bays (U.S. Fish and Wildlife Service 1996b), reduced turbidity could increase light penetration and with it, primary productivity and the habitat structure that submerged aquatic vegetation provides.

As light penetration is a major limiting factor affecting the primary productivity of submerged aquatic vegetation in the bays (U.S. Fish and Wildlife Service 1996), reduced turbidity could increase light penetration and with it, primary productivity and the habitat structure that submerged aquatic vegetation provides. Turbidity also affects the feeding efficiency of filter feeders such as the hard clam (Schubel 1991). Many bivalves, including hard clams, have the ability to sort the food particles (phytoplankton) from the nonfood particles (silt) ~~that~~ they filter out of suspension (Kiorbe et al 1980; Newell and Jordan 1983; Bricelj 1984; Bricelj and Malouf 1984), but hard clams tend to respond to increasing silt loads by reducing their filtration rates (Bricelj 1984; Bricelj and Malouf 1984). Therefore, it appears that hard clams are less well adapted for survival in a turbid environment than many other bivalve species (Bricelj 1984).

The introduction of additional ocean water through a breach might also moderate bay temperature (Cashin Associates 1993), as the annual temperature range for ocean water is from 4 to 21°C (U.S. Fish and Wildlife Service 1981a), narrower than the bay water temperature range of 0 to 30°C. Hard clam growth is disrupted outside of the optimal temperature range, approximately 20-23°C (Malouf 1991). Moderation of bay temperature would tend to reduce these disruptions (Cashin Associates 1993).

Finfish would be largely unaffected by a breach, although the new channel might provide attractive habitat for certain species. Unvegetated bay bottom is the preferred habitat of several benthic fishes. Sogard (1992) found that juvenile winter flounder were more abundant in unvegetated habitats than in eelgrass habitats; there was also some suggestion that winter flounder may grow faster in unvegetated habitats with coarse sediments. However, flounder populations are not limited by any shortage of non-vegetated bottom habitat (New York Sea Grant Institute 1993), and the flounder population would not be increased by the creation of more non-vegetated bottom area.

Inlet Channel

Inlet channels, and their attendant physical features, appear to be preferred habitat for bluefish. Associated beach habitat may provide essential foraging habitat for black skimmers, common terns, and roseate terns. The roseate tern is a Federally listed endangered species. Safina (1990 a,b) found that common terns were able to take advantage of prey that had been driven to the surface by bluefish, which tend to congregate near inlets, while roseate terns relied on physical features associated with inlet channels, such as shoals, which cause prey to move up into their diving range.

The Interim Plan beach construction alternatives do not reduce the amount of currently available channel habitat, but are intended to reduce the likelihood of formation of any new inlet channel habitat. Although the interim Breach Contingency plan is intended to close any new inlet quickly, short term impacts of a breach may be ecologically important, including the habitat provided by the temporary existence of the new channel itself and the changes in bottom topography due to delivery of new sediment to the bays.

Among possible ecological benefits due to inlet formation are potentially increased recruitment of juvenile and larval fish to the bay. Inlets and adjacent areas are generally recognized as having relatively high fish abundance and provide for high recreational fishing opportunities (Cashin Associates 1993). This suggests that a new inlet channel might have ecological and economic value that would be specifically prevented by a potential nourishment project. Inlet channels appear to be preferred habitat for bluefish, which has been among the top five species landed by recreational fishermen each year since 1979 (New York Sea Grant Institute 1993). Young-of-the-year bluefish use inlet channels to migrate into back bays from continental shelf waters.

Vegetated Bay Bottom

Eelgrass beds are important habitat for life stages of bay scallops, tautog, winter flounder, and waterfowl. A reduction in this habitat would reduce the productivity of these species, which would translate directly into an economic loss as well. However, the net impacts of the Interim Plan on vegetated bottom habitat, specifically eelgrass beds, are difficult to determine at this time; there is a lack of recent data on the distribution and biomass of eelgrass meadows in Great South Bay, as well as Moriches Bay and Shinnecock Bay. It is not possible to state with certainty whether the Interim Plan will result in more or less eelgrass habitat, and certainly not possible to say how much more or less.

Over the long term, sea level rise with increasing water depth in Great South Bay represents a potential negative impact upon eelgrass. Much of the eelgrass and salt marsh habitat in the bays has developed on top of relict flood tidal deltas; the formation of these deltas is discussed in the preceding section on physical habitat. Due to anticipated sea level rise of 2 in. (5 cm) to more than 6.5 ft. (2 m) over the next 20 to 100 years, some of these deltas will be submerged too deeply to support their present plant community. Eelgrass is primarily found in areas less than 6.5 ft. (2.5 m) deep in Great South Bay, and rarely found in areas deeper than 13 ft. (4 m).

Sediment passing through a new inlet would create sand flats elevated above the bay bottom, potentially compensating for some of the eelgrass area that will be lost to increased water depth. A new inlet could be beneficial to the eelgrass population of the bays by providing new substrate for growth. It is also known that the densest eelgrass beds in Great South Bay are near the existing inlets (Cashin Associates 1993). This has been attributed primarily to the clearer water available in these locations. It is possible that a new inlet could more than compensate for short-term physical damage with a long term improvement in conditions. The Interim Plan could prevent these potential benefits. This loss of benefits represents a significant environmental impact.

Eelgrass beds represent a critical habitat for at least one species, the bay scallop (*Argopecten irradians*) (New York Sea Grant Institute 1993). The rock crab (*Cancer irroratus*) was found to be restricted to thick eelgrass areas during the study by WAPORA, Inc. (1982). The blue mussel and hard clam are species also observed in moderate to dense vegetation (O'Connor 1972). Eelgrass beds provide hard clams with protection from whelks (*Buscyon* spp.) and possibly other predators as well (Peterson 1982). *Gemma gemma* is an extremely abundant, suspension feeding bivalve found in especially high abundance in eelgrass regions (WAPORA 1982). It is an important forage species for shorebirds.

Eelgrass beds are also noted for high densities of fish, in part because of the abundant food supply (Heck et al. 1989). The importance of eelgrass (*Zostera marina*) as a habitat for the juvenile and adult stages of numerous marine fishes has been frequently documented (New York Sea Grant Institute 1993). Many studies have shown that eelgrass beds support significantly higher faunal densities than other habitats (Orth et al. 1984).

New York Sea Grant Institute (1993) concluded that juvenile tautog (*Tautoga onitis*) and cunner (*Tautogolabrus adspersus*) depend strongly on eelgrass habitat as a shelter and/or nursery. Winter flounder also appears to use eelgrass beds as nursery areas (Heck et al. 1989). Again, forage fish species critical to the bay food web, particularly the sticklebacks (*Apeltes quadracus* and *Gasterosteus aculeatus*), also depend upon this habitat.

Eelgrass is an important foraging resource for avian species, especially brant. The distribution of major waterfowl feeding and nesting areas in Great South Bay (Marine Sciences Research Center 1973; Beck et al. 1978; New York Sea Grant Institute 1993) closely corresponds to the distribution of eelgrass meadows.

Tidal Marsh

The Interim Plan has the potential to alter the balance between marsh creation and marsh burial. The degree of impact depends upon the extent to which the Interim Plan achieves its goals of reducing overwash and inlet formation. To the extent that the project is effective, the Interim Plan tends toward loss of salt marsh without offsetting effects. Loss of plant detritus producing regions of the estuary such as *Spartina* marshes will greatly lower the productivity of the estuary and directly limit its potential to produce commercially important species of fish and crustaceans (Odum 1970).

Cashin Associates (1993) points out that tidal marsh areas near active, migrating inlets will stay in the early stages of vegetative succession, maintaining their highest rate of organic production and export to the estuary. In comparison, long-term stability will result in decreased productivity. The dredging of flood tidal deltas at existing inlets reduces the potential for the creation of new wetlands (Cashin Associates 1993). Without inlet formation to compensate for wetland loss, tidal wetlands will eventually decline.

If the Interim Plan prevents inlet formation without preventing overwash, overwash will bury existing marshes. Where this occurs, vegetation changes from marsh to barrier-flat vegetation. The ground elevation rises above the tidal range and barrier-flat grasses and shrubs colonize the washover surface (Leatherman et al. 1985). As discussed in more detail in the following section on subaerial beach habitat, if the Interim Plan prevents overwash there is likely to be a major change in both the plant and animal communities of the barrier islands. If the Interim Plan prevents both overwash and inlet formation, marsh will still be lost to rising sea level and bayside erosion, again without compensating marsh formation.

In many locations, the transitional area between Fire Island and Great South Bay is occupied by salt marsh. This is particularly evidenced in the eastern section of Fire Island. Salt marshes are tidal marshes of brackish or salt water, along estuaries and behind barrier beaches. Tidal marsh generally consists of dense stands of herbaceous wetland vegetation dominated by *Spartina alterniflora* and *S. patens* and subject to variation in water depth during each tidal cycle (McCormick and Associates 1975). Salt marshes are among the most productive communities known. Most of the tremendous production of salt marshes is used in the form of organic detritus (Odum 1961). This organic detritus, mostly *Spartina* wrack (New York Sea Grant Institute 1993), is then distributed throughout the system (Odum 1961). Coastal marshes are also important in stabilizing shorelines and as wildlife habitat (New York Sea Grant Institute 1993).

Key invertebrate species in salt marshes include the mud snail (*Ilyanassa obsoleta*), the salt-marsh snail (*Melampus bidentatus*), the ribbed mussel (*Geukensia demissa*), the marsh crab (*Sesarma reticulatum*), and the fiddler crabs (*Uca pugilator* and *U. pugnax*) (New York Sea Grant Institute 1993). These species are an important forage resource for mammals and birds. Salt marshes are nurseries for a variety of forage fishes as well (Weinstein 1979, Rountree and Able 1992). The primary finfish found in tidal mid-Atlantic salt marshes are Atlantic silverside (*Menidia menidia*) and mummichog (*Fundulus heteroclitus*) (Rountree and Able 1992). New York Sea Grant Institute (1993) speculates that the relatively low abundance of mummichogs in Great South Bay is probably a reflection of the shortage of salt marsh habitat. Sheepshead minnow (*Cyprinodon variegatus*) and bay anchovy (*Anchoa mitchilli*) are abundant, but less so than the above species (New York Sea Grant Institute 1993).

The Great South Bay supports the largest wintering waterfowl concentrations in New York State. Consequently, creation and continued productivity of back-barrier wetlands would tend to be of long-term benefit to the avian species (Cashin Associates 1993), such as greater and lesser scaup, American black duck, red-breasted merganser, brant, and common goldeneye. Dabbling ducks, especially mallard (*Anas platyrhynchos*), American black duck, and gadwall (*Anas strepera*), concentrate in the shallow water and marsh areas behind Fire Island, the shoals near East and West Fire Islands, Sexton Island, and Captree Island, as well as in the Carmans and Connetquot River estuaries. Smaller numbers of snow goose (*Chen caerulescens*) and American bittern (*Botaurus lentiginosus*) also rely on the Great South Bay for overwintering habitat. Shinnecock Bay is important overwintering habitat for scaup, American black duck, brant, and common goldeneye.

Migratory shorebirds rely on these backbarrier salt marshes for roosting and feeding areas. This is especially important during high tides when intertidal flats are underwater. During the spring migration (April to June), the backbarrier marshes of Shinnecock Bay have some of the highest concentrations of migratory shorebirds on the south shore of Long Island.

Subaerial Beach

"Stabilization" of the shoreline could mean not only the loss of the present beach strand community, but the loss of the seashore habitat itself, particularly sparsely vegetated overwash areas and inter-dunal swales. The engineered shoreline would not provide the range of habitat features critical to species diversity on Fire Island. If the islands were stabilized, environmental conditions would become more similar to those prevailing on the mainland of Long Island. Inevitably, the vegetation would also come to resemble the more mature vegetational stages, with more grassland, thicket, and forest at the expense of bare or sparsely vegetated shore habitat.

This would represent a loss of biodiversity at the community level, if not at the species level. Denser grassy vegetation, combined with encroaching habitat for mammals, could make Fire Island and the west of Shinnecock area unsuitable for shorebirds. In addition, several species of reptiles that use the seashore, especially the Eastern mud turtle, the spotted turtle and the diamondback terrapin, could be adversely affected by this predicted habitat change.

Seashore community

The seashore habitat includes open sandy beaches, sand flats, mudflats, and dunes, the latter covered with beach grass (Bull and Farrand 1977). Nesting shorebird populations have declined severely and several shorebird species are either in danger of or threatened with extinction. A number of birds that are known to use this habitat are either Federally listed (roseate tern and piping plover) or State listed (least tern and common tern). Other breeding birds, such as the American oystercatcher (Melvin et al. 1991), and black skimmer (Safina and Burger 1983), are also affected by human activity on Atlantic Coast beaches. Though not State or Federally listed, their reliance on this habitat puts them at risk for population decline.

Species are classified as "endangered" when they are in danger of becoming extinct throughout all or a significant portion of their ranges. Species are listed as "threatened when they are likely to become endangered throughout all or a significant portion of their ranges. When a species gets to the point of being listed, tremendous effort, and often sacrifice, are required to recover the population to self-sustaining numbers. For example, the modeled scenarios that most closely approximate the current status of the Atlantic Coast piping plover population--a population of 1,200 or 1,500 pairs with average productivity of 1. 25 chicks per pair per year--showed, respectively, extinction probabilities of 35% or 31% over the next 100 years, and 95% and 92% probabilities of the population dropping below 500 pairs during the same time period. The precarious state of the piping plover on Long Island has resulted in beach management to minimize disturbance to breeding plovers. Every summer since 1986, thousands of hours of paid and volunteer time have been invested to protect these birds, including Service, NYSDEC, and Nature Conservancy biologists, Service Law Enforcement Special Agents, NYSDEC environmental conservation officers, and New York State Park Police, Department of the Interior solicitors and U.S. Department of Justice attorneys. On Long Island, two lawsuits involving the birds have been settled out of court, and a third one is pending. If present trends continue, similar efforts may be required to save other shorebird species from extinction.

Loss of habitat is a major problem for all of the State- and Federally-listed birds found in the project area. Piping plovers, for example, are threatened by cumulative impacts of habitat loss and alteration, human disturbance, and predation. Breeding and wintering habitat for piping plovers along the Atlantic coast has been lost as the result of a variety of coastal development and coastline stabilization activities (U.S. Fish and Wildlife Service 1996a). Coastal stabilization activities, such as installation of snow fencing and placement of Christmas trees, can degrade plover nesting habitat by altering or impeding coastal processes (U.S. Fish and Wildlife Service 1996a). Beaches and dunes have been altered to the point of being unacceptable to plovers through construction of recreational and residential dwellings, commercial buildings, boardwalks, piers, roads, and parking lots (Melvin et al. 1991).

Several studies have shown that piping plovers favor a complex beach habitat that includes ephemeral pools (Elias-Gerken and Fraser 1994), overwash corridors that provide access to bayside forage areas (Loegering and Fraser 1995), and dune blowout areas (Strauss 1990). Strauss (1990) specifically noted that piping plovers did not nest seaward of steep foredunes. These results suggest that the simplification of the shoreline proposed in the Interim Plan would greatly reduce present and future habitat quality on Fire Island. The Piping Plover Atlantic Coast Population Recovery Plan (U.S. Fish and Wildlife Service 1996a) specifically identifies the maintenance of natural coastal formation processes that perpetuate high quality breeding habitat as "an action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the future."

The amount and type of vegetation on the surface of the barrier islands is largely controlled by the amount of sea spray and overwash. The amount of salt-water exposure defines the type of vegetation that can survive in a given location on Fire Island, contributing to habitat patchiness and diversity. Several shorebirds, including the piping plover, the least tern, and the black skimmer, and reptiles such as the northern diamondback terrapin, must nest in areas where overwash regularly thins or clears away the vegetation. By preventing overwash, the Interim Plan would also eliminate this ecologically critical beach clearing function.

The project area contains a Federally-listed threatened plant, seabeach amaranth *(Amaranthus pumilus)*, which colonizes areas disturbed by overwash and breaching. The Recovery Plan (U.S. Fish and Wildlife Service 1995a) for this species states that "any stabilization of shoreline is detrimental for a pioneer, upper beach annual whose niche or 'life strategy' is the colonization of unstable, unvegetated, or new land, and which is unable to compete with perennial grasses." On North Carolina's barrier islands, the zone where seabeach amaranth is absent corresponds almost exactly with the presence of an artificial barrier dune built and maintained by various Federal agencies from the 1930's to 1950's. Because seabeach amaranth survives by colonizing new patches of suitable habitat, these new patches must be extensive enough and close enough to each other for the plant to occupy suitable habitat as it becomes available. Fortifying a lengthy portion of the barrier island shoreline could be enough to preclude the survival of seabeach amaranth and similar plants, such as seabeach knotweed *(Polygonum glaucum)* throughout the barrier island system.

Vegetated Beach Community

Most likely there will be a change would be from sparsely vegetated beach to vegetated beach and grassland. This too would alter the competition among species for this area, favoring bird species which have adapted to more heavily vegetated beach areas elsewhere, particularly black-backed gull (*Larus marinus*), herring gull (*Larus argentatus*), and ring-billed gull (*Larus delawarensis*). Common species able to tolerate denser stands of beach grass would tend to displace and prey upon rarer species requiring bare or sparsely vegetated sand, which represents a potential loss of species diversity for the barrier beach/back bay community.

Thicket/Woodland Community

An increase in thicket vegetation over sparsely vegetated beach would change the species that could survive on Fire Island. As there are already thickets and forests on Fire Island, fauna inhabiting these areas would most likely spread out into similar new habitat areas. The net result would favor mammals, which have already adapted relatively well to the human presence on Fire Island, and the sorts of birds and reptiles found on the Long Island mainland, over the remaining examples of seaside species. The suburbs of Long Island resemble a thicket habitat in many locations as thickets naturally follow the land clearing associated with suburban development (Bull and Farrand 1977).

Birds observed in the thickets of Fire Island resemble those routinely found in the suburban yards of Long Island. They include: American robin (*Turdus migratorius*), song sparrow (*Melospiza melodia*), mourning dove (*Zenaida macroura*), and gray catbird (*Dumetella caroliniensis*). Development of thickets on wetland edges may also be advantageous for several tree-nesting species associated with marshes, including green-backed heron (*Butorides striatus*). During the winter, the barn owl (*Tyto alba*) and the loggerhead shrike (*Lanius ludovicianus*) make use of this habitat.

McCormick & Associates (1975) identified the following reptiles as using thickets on Fire Island as probable breeding habitat: box turtle (*Terrapene carolina*), Eastern hognose snake (*Heterodon platyrhinos*), and black racer (*Coluber constrictor*). They tend to favor moist, shaded environments. The black racer is the most indiscriminate predator, eating rodents, small birds, lizards, snakes, frogs and insects (Conant and Collins 1991). The eastern hognose snake is a New York State species of special concern.

The mammals of Fire Island would be afforded a great increase in nesting and forage habitat by any increase in dense, woody vegetation. The following mammals have been identified as breeding in thicket or woodland habitat (McCormick & Associates 1975): Opossum (*Didelphis marsupialis*), short tailed shrew (*Blarina brevicauda*), Norway rats (*Rattus norvegicus*), red fox (*Vulpes fulva*), long tailed weasel (*Mustela frenata*). Several of these animals are omnivorous, and all will eat birds if they can catch them (Godin 1977). Unfledged birds are particularly vulnerable to this predation. There are also several herbivorous mammals on Fire Island, including Eastern cottontail (*Sylivilagus floridanus*) grey squirrel (*Sciurus carolinensis*), and white-tailed deer (*Odicoileus virginianus*). Populations of these species are already large enough to cause complaint in the Fire Island communities, and a deer contraception program was established on Fire Island in 1995 in an effort to control the size of the herd. Small mammals are often consumed by migrating birds of prey during the spring and fall.

<u>Ocean Shore</u>

Shoreface

Fire Island is an important habitat for shorebirds. Both the biomass and species composition of the shoreline community are critical for supplying the nutritional needs of migrating shorebirds and wintering seabirds, but data defining the biomass and species composition of the Long Island barrier shoreline community are lacking. Studies examining the effects of beach nourishment on migratory shorebirds are lacking in the scientific literature. The Department is concerned that birds migrating or wintering along newly created beaches would be at risk of not meeting their nutritional needs, which are particularly high during these periods. It is not known how long it will take infaunal communities to recover after the proposed placement of dredged sand material. Impacts would occur to birds if they encounter too much sterile (recently buried) area or if their preferred prey have failed to recover from nourishment activities.

The magnitude and duration of direct impacts of beach projects on intertidal organisms are uncertain. While some may migrate through the fill material, a project of this size, involving 12 million cubic yards during initial construction, is likely to displace or bury most intertidal organisms. Decimation of food-chain organisms by heavy deposition of sediment could be equally devastating to birds, fish and some invertebrate populations, but this impact has not been studied. Although marine bottom communities survive periodic change related to the natural erosion and accretion, near shore communities are in a more stable environment and are less adaptable to such perturbations (Naqvi and Pullen 1982). Some infaunal bivalves and crustaceans can migrate vertically through sediments, but their survival depends not only on sediment depth, but also on length of burial time, season, particle size distribution, and other habitat requirements of the animal.

While adult fish are unlikely to be affected by project construction, planktonic life stages will be unable to avoid the increased turbidity near shore. It is not possible to estimate the impact of the activity on larval fish populations. Any species that may undergo a dormant phase in the near shore area would be unable to escape burial.

Recovery of macrobenthic animals varies and differs from one site to another. Reilly and Bellis (1978) and Parr, Diener, and Lacy (1978) noted that when nourishment ceases, the recovery of the macrofauna is rapid and complete recovery might occur within one or two seasons. Recovery will depend on the season of the year of the nourishment operation and the recruitment of larval fauna. Meiofauna recover very slowly from a major disturbance, perhaps due to their slow reproduction, limited ability to migrate, and their highly specialized adaptations to a restricted environment (Naqvi and Pullen 1982).

Most studies, which generally involve the placement of less sand per mile than the originally proposed Interim Plan, have shown that moderate to complete recovery of motile animals will occur within a year. Studies have shown that motile animals generally leave an area of perturbance temporarily, but return when the disturbance ceases. The motile animals which have a stringent requirement for biological activities, e.g., habitat requirements or food source, are most likely to be affected. It appears that motile fauna are generally not affected adversely by dredging at the borrow area or sand placement along the shore unless a major food source or habitat is removed or the quality of the area is severely degraded.

Turbidity, while comparatively unimportant to benthic organisms, may be relatively more important to fish and the fish community structure. Suspended solids in water can affect the fish population by delaying hatching time of fish eggs (Schubel and Wang 1973), killing the fish by coating their gills, and by anoxia (O'Connor et al. 1976). O'Connor et al. (1974) found that demersal fish are more tolerant to suspended solids and filter-feeding fish are least tolerant, giving an advantage to demersal fish and a disadvantage to filter feeders. High turbidity may provide temporary protection from predators (Naqvi and Pullen 1982). This is an advantage to populations of forage fish and a disadvantage to predatory fish.

Borrow Area

The Service (1993, 1995b) has expressed concern in regard to the medium and long term impacts of the loss of benthic infauna and the potential for reduced dissolved oxygen concentrations. However, the Corps (1996) has committed to monitoring the borrow area during and after construction to avoid the creation of anoxic areas. Given the extensive, shallow geometry of the proposed borrow area, it does not appear likely that anaerobic conditions will prevail in these pits. The issue of benthic fauna impacts remains a concern, however.

The Corps states that "no significant environmental impacts are anticipated because recolonization is expected within approximately 12-18 months. " However, the project as proposed has a two year renourishment cycle, and the Corps has not indicated that previously dredged areas less than 20 feet in depth will be avoided. This suggests that some areas may not be able to recover fully during the life of the project.

In addition, initial recolonization is expected to consist primarily of pioneer, early successional species, which may not be the preferred forage of local fish populations. There is no baseline data on the borrow area benthic community which could be used to compare with post-construction monitoring results. A change in available forage species over an area of several hundred acres could be detrimental to fishery stocks. In addition, the Corps has provided no information as to whether any commercially valuable species inhabit the proposed borrow area, and whether these animals could be moved to another location nearby.

Study Needs

In order to gauge the potential environmental impacts of the recommended 30 year beach fill/dune construction plan, a number of information and data needs should be filled so that impact assessments can be effectively conducted. Among the data Buckley (1982) saw as necessary are:

> "(1) site-specific geomorphic analyses of barrier island dynamics;
> (2) authentic cost estimates of the various alternatives identified as feasible following the geomorphic analyses;
> (3) sensible analysis of the actual impacts (environmental and economic) of the feasible alternatives;
> (4) realistic comparison of the economic and environmental benefits and costs over both the short term (one to twenty years) and the long term (twenty to one hundred years). The reason for the long term/short term distinction is the inexorable rise of sea level. . . one hundred years is not beyond the design lifetime of many structures."

Basic questions which should be answered relative to this proposal include the following:

1) In terms of the islands' geomorphology, will the islands be more or less likely to breach 30 years from now in light of sea level rise and its impacts on the barrier island? In addition, what are the conditions that cause a barrier breach and how will the 30 year beach fill/dune construction project affect this process? What is the predicted condition of the islands without the project?

Our review of numerous reports relative to fish and wildlife resources and back-bay/barrier island environments identified the following: 1) there is little information concerning plankton and water quality on the bay side of Fire Island, 2) there is a need for a comprehensive bay-wide water quality sampling program, 3) there is a shortage of information about the relationship between benthic organisms, including commercial shellfish, and their habitat, 4) inlet forming processes are still very poorly understood (Kana and Krishnamohan 1994), 5) scientific studies which specifically address impacts of inlet formation to adult fish are lacking (e.g., Cashin Associates 1993), 6) no studies are currently being carried out on the seagrass meadows in the Great South Bay, and no published data on seagrass fauna within the FIMP Reformulation Study project area have been made available since 1986, 7) intertidal beaches are the least studied marine habitat in the Fire Island National Seashore (New York Sea Grant Institute 1993), and 8) animal communities along the shore face and in the borrow area should be surveyed before, during, and after dredging and nourishment (Naqvi and Pullen 1982). In addition, studies should address the basic ecology of eelgrass meadows within Great South Bay, Moriches Bay, and Shinnecock Bay, especially the identification of which species and life stages makes use of this habitat.

The following provides some of the relevant environmental questions surrounding the beneficial or adverse effects of preventing or allowing breaches and overwashes on the fish and wildlife resources of the barrier islands.

In light of the fact that there is little quantitative data available that would permit an accurate assessment of the relative impact of most human activities compared to the effect of natural processes on water quality and local habitats of the Fire Island National Seashore (New York Sea Grant Institute 1993), what is our understanding of the coastal processes affecting Shinnecock Bay?

A. Open Water/Non-Vegetated Bay Bottom

1) What are the flushing rates with and without breaches and overwashes, and the potential effects on water quality including pathogen loads? How will the presence or absence of breaches and overwashes affect important shellfish resources such as the hard clam or species which may impact this resource such as brown tide?

2) What are the existing primary and secondary productivity levels in the back bay and ocean nearshore areas and what are the anticipated effects of preventing or allowing breaches and overwashes?

3) How will the presence or absence of breaches and overwashes affect the suitability of the back bays as habitat for juvenile fish, benthic and mobile invertebrate intertidal and subtidal species, shorebird species, wading birds, and waterfowl?

4) What is the existing distribution and abundance of the species mentioned above within the back bay system (and ocean nearshore system)?

5) How does the presence or absence of breaches and overwashes affect the distribution and abundance of shellfish predators within the back bays.

B. Inlet Channel

1) What are the anticipated effects of leaving inlets open, artificially closing them, or creating new ones to enhance the bay environment on the back bay habitats including mainland habitats?

2) What is the anticipated probability, size, and location of a new inlet opening at Fire Island. How long will time it will it remain open and what are the predicted effects of a new inlet on biological and physical properties of the water column, food chain dynamics, and water exchange.

3) How many inlets might form with or without the proposed 30 year beach fill/dune construction plan?

4) How much new habitat would form or be lost by preventing or allowing breaches and overwashes?

C. Vegetated Bay Bottom

1) What is the distribution and biomass of eelgrass habitat in the back-bays? What is the role of eelgrass beds and other vegetated and non-vegetated bottom habitats in supporting the recruitment of fish to the back bays (e.g., New York Sea Grant Institute 1993) and providing winter habitat for fish.

2) What are the anticipated impacts of preventing or allowing breaches and overwashes on eelgrass distribution and biomass, and the fauna which utilize this habitat?

D. Tidal Marsh

1) What is the importance of overwash sand to the development of back bay salt marsh and how the prevention of breaches and overwashes will affect the rate of marshland formation on the bay side of the barrier islands.

2) The investigation of the dynamics of Bayside flooding and storm erosion, including the role of marshes, eelgrass beds, and channels in the process of inlet formation (New York Sea Grant Institute, 1993).

3) In order to have a baseline by which the impacts of a shoreline stabilization project could be measured, what is the baseline distribution and abundance of salt marsh fauna?

4) Populations of benthic resources, including shellfish, need to be assessed in each of the major habitats including salt marshes and intertidal beaches (e.g., New York Sea Grant Institute 1993).

5) What are the roles of overwash, breaching, and inlet formation relative to salt marsh creation, maintenance, and destruction. What are the anticipated changes in salt marsh acreage if these coastal processes are prevented or allowed?

6) What will be the source of sediments to the back bays with and without breaches and overwashes? How will wetland, intertidal and subtidal habitats be formed and maintained if these processes are interrupted?

E. Subaerial Beach

1) What is the distribution and abundance of beach invertebrates? How will these change relative to allowing or preventing breaches and overwashes.

2) What are the effects of preventing or allowing breaches and overwashes on salt-

spray and overwash maintained dune-swale plants/communities.

3) What are the predicted proportional changes in habitats and species with or without breaches and overwashes?

4) What are the anticipated impacts related to changes of moisture on vegetation and infauna due to increases or decreases in beach elevations.

5) What are the ecological and/or geological impacts of creating a uniform dune line?

6) What is the present distribution and abundance of bay-side intertidal macrofauna and forage fish species and how will these fluctuate with or without breaches and overwashes?

7) What are the short and long term impacts of overwash and breach prevention/allowance on rare species and their habitat on the barrier beach?

F. Ocean Beach/Nearshore Communities

1) What is the effect of beach construction on the feeding habitat of migratory birds?

2) What are the effects of dredging the borrow area and burial of the nearshore area on the supply of forage organisms for local fish populations?

3) What are the biological impacts, either beneficial or adverse, of beach fill/dune construction on nesting shorebird habitat areas. What are the potential shorebird nesting areas with and without breaches and overwashes?

CLOSING

It is our belief that the course of action proposed by the Corps for the Interim Plan is liable to result in significant negative environmental impacts, and that the approach chosen will fail to fully identify and evaluate these impacts. Such an approach is inconsistent with the National Environmental Policy Act (NEPA), and raises questions about the purpose and need for the Interim Plan as currently proposed, particularly given the 30 year project life and its relationship to the Reformulation Study/EIS.

It is my hope that the discussions between our agencies will continue in an effort to resolve the outstanding issues pertaining to the Interim Plan. The formation of interagency working groups, such as those developed for the Reformulation Study/EIS, will facilitate our meeting this goal.

Thank you for the opportunity to comment on the proposed Interim Plan. Please call me if you have any questions regarding this correspondence, or if I can be of any assistance. ~~I can be~~ reached at (617) 223-8565.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

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CITATIONS

Able, K.W. and M. Castagna 1975. Aspects of an undescribed reproductive behavior in *Fundulus heteroclitus* (Pisces:Cyprinodontidae) from Virginia. Chesapeake Sci. 16:282-284.

Bascom, W. 1964. Waves and Beaches. Doubleday & Co. Garden City, NY. 267 pp.

Beatley, T. 1991. Protecting biodiversity in coastal environments: Introduction and overview. Coastal Management. 19:1-19.

Beck, R., P. Schettig, D. Geismar, and S. Feter. 1978. Nassau/Suffolk Bi-County Region Water Quality Management Planning: South Shore Bays. Energy Resources Co., Inc., Cambridge, MA and Washington, DC.

Bokuniewicz, H.J., and J.R. Schubel. 1991. The origin and development of the Great South Bay: A geological perspective. *in* Schubel, J.R., T.M. Bell, and H.H. Carter, eds. The Great South Bay. State University of New York Press, Albany, NY. 107 pp.

Bricelj, V.M. 1984. Effects of suspended sediments on the feeding physiology and growth of the hard clam, *Mercenaria mercenaria* L. Ph.D. Thesis, Marine Sciences Research Center, SUNY, Stony Brook, NY. 157 pp.

Bricelj, V.M. and R.E. Malouf. 1984. The influence of suspended sediments on the feeding physiology and growth of the hard clam, *Mercenaria mercenaria* L. Mar. Biol. 84:155-165.

Buckley, P.A. 1982. Reconciling structural and non-structural solutions to coastal erosion problems. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service, 207 pp.

Bull, J., and J. Farrand Jr. 1977. The Audubon Society Field Guide to North American Birds. Alfred A. Knopf, New York. 778 pp.

Cashin Associates, P.C. 1993. The environmental impacts of barrier island breaching with particular focus on the south shore of Long Island, New York. Unpublished report prepared for State of New York, Department of State, Albany, NY. 44pp.

Clark, J.R. 1977. Coastal Ecosystem Management: A Technical Manual for the Conservation of Coastal Zone Resources. John Wiley & Sons, NY. 928 pp.

Conant, R., and J.T. Collins. 1991. The Peterson Field Guide Series: Reptiles and Amphibians of North America (Eastern/Central North America). Houghton Mifflin Company. Boston, New York. 450 pp.

Conover, D.O., and B.E. Kynard. 1984. Field and laboratory observations of spawning periodicity and behavior of a northern population of the Atlantic silverside, *Menidia menidia* (Pisces: Atherinidae). Environmental Biology of Fishes. 11:161-171.

Crowell, M, and S.P. Leatherman. 1985. Quantitative shoreline and environmental change. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic Analysis of South Shore of Long Island Barriers, New York. National Park Service, Boston, MA.

Elias-Gerken, S.P. and J.D. Fraser. 1994. Piping plover foraging ecology on Pike's Beach, Southampton, New York. Final report submitted to U.S. Fish and Wildlife Service, Sudbury, MA. 61 pp.

Godin, A.J. 1977. Wild Mammals of New England. The Johns Hopkins University Press. Baltimore, MD. 304 pp.

Gregg, W.P. 1982. Development alternatives: New directions. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service, 207 pp.

Heck, K.L., Jr., K.W. Able, M.P. Fahay, and C.T. Roman. 1989. Fishes and decapod crustaceans of Cape Cod eelgrass meadows: Species composition, seasonal abundance patterns and comparison with unvegetated substrates. Estuaries. 12:59-65.

Herbst, R. 1982. The year of the coast. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service, 207 pp.

Holling, C.S., and G.K. Meffe. 1996. Command and control and the pathology of natural resource management. Conservation Biology. 10: 328-337

Kana, T.W., and R. Krishnamohan. 1994. Assessment of the vulnerability of the Great South Bay shoreline to tidal flooding. Unpublished report prepared by Coastal Science and Engineering, Inc., Columbia, SC, for New York Coastal Partnership, Babylon, NY. 127 pp.

Kiorbe, T., F. Mohlenberg, and O. Nohr. 1980. Feeding, particle selection, and carbon absorption in Mytilus edulis in different mixtures of algae and resuspended bottom material. Ophelia 19:193-205.

Leatherman, S.P. 1982. Non-structural approach to coastal problems. *in* Mayo, B., and L. Smith, eds. Proceedings of Barrier Island Forum and Workshop, Provincetown, MA, May 1980. Boston, U.S. National Park Service, 207 pp.

Leatherman, S.P. 1985. Stratigraphic correlations. *in* Leatherman, S.P. and J.R. Allen, eds.

Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Leatherman, S.P., C.E. Johnson, and D.C. Joneja. 1985. Morphological analysis. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Leatherman, S.P. and J.R. Allen. 1985a. Discussion and Synthesis. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Leatherman, S.P. and J.R. Allen, eds. 1985b. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Lively, J.S., Z. Kaufman, and E.J. Carpenter. 1983. Phytoplankton of a barrier island estuary: Great South Bay, New York. Estuarine, Coastal and Shelf Science. 16:51-68.

Loegering, J.P. and J.D. Fraser. 1995. Factors affecting piping plover chick survival in different brood-rearing habitats. Journal of Wildlife Management. 59:646-655.

Malouf, R.E. 1991. The Hard Clam: Its biology and the natural processes that affect its success. *in* Schubel, J.R., T.M. Bell, and H.H. Carter, eds. The Great South Bay. State University of New York Press, Albany, NY. 107 pp.

Marine Sciences Research Center. 1973. Final Report of the oceanographic and biological study for southwest sewer district #3, Suffolk County, New York. Prepared for Bowe, Walsh and Associates, Huntington Station, NY, by Marine Sciences Research Center, SUNY, Stony Brook, NY. 269pp.

McCormick & Associates 1975 Environmental inventory of the Fire Island National Seashore and the William Floyd Estate. Contract No. 2000-4-0010. Submitted to National Park Service, Denver, CO.

Melvin, S.M., C.R. Griffin, and L.H. MacIvor. 1991. Recovery strategies for piping plovers in managed coastal landscapes. Coastal Management. 19:21-34.

Murray, M.P. 1996. Natural processes: Wilderness management unrealized. Natural Areas Journal. 16:55-61.

Naqvi, S.M. and E.J. Pullen. 1982. Effect of beach nourishment and Borrowing on Marine Organisms. Miscellaneous Report No. 82-14. U.S. Army Corps of Engineers Coastal Engineering Research Center. 43 pp.

National Park Service. 1995. Fire Island Official map and guide. Government Printing Office:387-038/00166 Reprint. Multi-fold pamphlet.

New York Sea Grant Institute. 1993. Estuarine resources of the Fire Island National Seashore and vicinity. Report No. NYSGI-T-93-001. New York Sea Grant. Stony Brook, NY.

New York State Department of State. 1992. Significant Coastal Fish and Wildlife Habitats Program. New York State Department of State, Albany, New York.

New York State Department of State. in review. Wetlands technical report for South Shore Estuary Reserve. New York State Department of State, Albany, New York.

Newell, R.I.E. and S.J. Jordan. 1983. Preferential ingestion of organic material by the American oyster *Crassostrea virginica*. Marine Ecological Progress Series. 13:47-53

Nordstrom, K.F., and J.M. McCluskey. 1985. The effect of houses and sand fences on the eolian sand budget at Fire Island, NY. Journal of Coastal Research 1:39-46

O'Connor, J.S. 1972. The benthic macrofauna of Moriches Bay, NY. Biological Bulletin. 142:84-102

O'Connor, J.M., D.A. Neumann, and J.A. Sherk, Jr. 1976. Lethal effects of suspended sediments on estuarine fish. TP 76-20, U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA.

Odum, E.P. 1961. The role of tidal marshes in estuarine production. Contribution Number 29 from the University of Georgia Marine Institute. Information leaflet. New York State Conservation Department. 4pp.

Odum, W.E. 1970. Insidious alteration of the estuarine environment. Transactions of the American Fisheries Society. 90: 836-847.

Orth, R.J., K.L. Heck Jr., and J. van Montfrans. 1984. Faunal communities in seagrass beds: A review of the influence of plant structure and prey characteristics on predator-prey relationships. Estuaries. 7:339-350

Panageotou, W., S.P Leatherman, and C. Dill. 1985. Geophysical interpretation. *in* Leatherman, S.P. and J.R. Allen, eds. Geomorphologic analysis of south shore of Long Island barriers, New York. National Park Service, Boston, MA.

Parr, T., D. Diener, and S. Lacy. 1978. Effects of beach replenishment on the nearshore sand fauna at Imperial Beach, California. Miscellaneous Report No. 78-4. Prepared for U.S. Army Corps of Engineers Coastal Engineering Research Center, Fort Belvoir, Virginia. 125 pp.

Peterson, C.H. 1982. Clam predation by whelks (Busycon spp.): experimental tests of the importance of prey size, prey density, and seagrass cover. Marine Biology. 66: 159-170

Reilley, F.J., Jr., and V.J. Bellis. 1978. A study of the ecological impact of beach nourishment with dredged materials on the intertidal zone. Inst. for Coastal and Marine Resources, East Carolina Univ. Tech Rpt. No. 4. East Carolina University, Greenville, North Carolina

Rountree, R.A. and K.W. Able. 1992. Fauna of polyhaline subtidal marsh creeks in southern New Jersey: composition, abundance, and biomass. Estuaries 15:171-185

Safina, C. 1990a. Foraging habitat partitioning in roseate and common terns. The Auk. 107:351-358.

Safina, C. 1990b. Bluefish mediation of foraging competition between roseate and common terns. Ecology. 71:1804-1809.

Safina, C. and J. Burger. 1983. Effects of human disturbance on reproductive success in the black skimmer. Condor 85:164-171.

Schubel and Wang. 1973. The effects of suspended sediment in northern Chesapeake Bay. Powder Technology. 6:9-16.

Schubel, J.R. 1991. Introduction. *in* Schubel, J.R., T.M. Bell, and H.H. Carter, eds. The Great South Bay. State University of New York Press, Albany, NY. 107 pp.

Schubel, J.R., and D.J. Hirschberg. 1978. Estuarine graveyards, climatic change, and the importance of the estuarine environment. *in* Wiley, M.L., ed., Estuarine Interactions, pp/ 285-303. New York. Academic Press.

Sherk, J.A., J.M. O'Connor, and D.A. Neumann. 1974. Effects of suspended and deposited sediments on estuarine organisms , phase II. Reference No. 74-02, National Research Institute, Solomons, MD.

Sogard, S.M. 1992. Variability in growth rates of juvenile fishes in different estuarine habitats. Marine Ecological Progress Series. 85:35-53

Sousa, W.P. 1984. The role of disturbance in natural communities. Annual Review of Ecological Systems. 15:353-391

Strauss, E. 1990. Reproductive success, life history patterns, and behavioral variation in a population of piping plovers subjected to human disturbance (1982-1989). Ph.D. Dissertation. Tufts University, Medford, MA. 143 pp.

Taylor, M.H. L. Di Michele, and G.J. Leach. 1977. Egg stranding in the life cycle of the mummichog, *Fundulus heteroclitus*. Copeia. 1977:397-399.

U.S. Army Corps of Engineers. 1995. Fire Island to Montauk Point draft breach contingency plan, executive summary and draft environmental assessment (revised). U.S. Army Corps of Engineers, New York District, North Atlantic Division. 45 pp.

U.S. Army Corps of Engineers. 1996. Fire Island to Montauk Point, Long Island, New York. Reach 1: Fire Island Inlet to Moriches Inlet. An evaluation of an interim plan for storm damage protection. U.S. Army Corps of Engineers, New York District, North Atlantic Division. 97 pp.

U.S. Army Corps of Engineers. 1997. Embayment area along the south shore of Long Island, New York: Reconnaissance study -- Environmental Initiatives. Letter from Colonel Gary Thomas promulgated through South Shore Estuary Reserve Technical Advisory Committee.

U.S. Fish and Wildlife Service. 1981a. Environmental Inventory for the Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project Reformulation Study. U.S. Fish and Wildlife Service, Cortland, New York. 64 pp. + Appendices

U.S. Fish and Wildlife Service. 1991. Northeast Coastal Areas Study: Significant Coastal Habitats of Southern New England and Portions of Long Island Sound, New York. U.S. Fish and Wildlife Service, Charlestown, RI. 245 pp.

U.S. Fish and Wildlife Service. 1993. Fish and Wildlife Coordination Act Report, Section 2(b): Atlantic Coast of New Jersey--Sea Bright to Ocean Township Beach Erosion Control study. Sandy Hook to Barnegat Inlet: Section II--Asbury Park to Manasquan Inlet. Analysis of the Corps of Engineers selected plan. Pleasantville, NJ. 30 pp.

U.S. Fish and Wildlife Service. 1995a. Seabeach Amaranth Technical/Agency Draft Recovery Plan. Atlanta, GA. 75 pp.

U.S. Fish and Wildlife Service. 1995b. Fish and Wildlife Coordination Act Report, Section 2(b): Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York. Storm Damage Reduction Project. Islip, NY. 31 pp.

U.S. Fish and Wildlife Service. 1996a. Piping Plover *(Charadrius melodus)*, Atlantic Coast Population, Revised Recovery Plan. Hadley, MA. 258 pp.

U.S. Fish and Wildlife Service. 1996b. Significant Habitats and Habitat Complexes of the New York Bight Watershed. U.S. Fish and Wildlife Service, Charlestown, RI.

WAPORA, Inc. 1982. Impact assessment on shellfish resources of Great South Bay, South Oyster Bay, and Hempstead Bay, NY. Draft report submitted to U.S. Environmental Protection Agency, Region II, New York, NY, by WAPORA, Inc. 115 pp.

Weinstein, M.P. 1979. Shallow marsh habitats as primary nurseries for fishes and shellfish, Cape Fear River, North Carolina. Fisheries Bulletin. 77:339-357

Zimmer, R.L. 1991. Sand supply to coastal dunes Long Island, New York. M.S. Thesis. State University of New York, Stony Brook, NY. 86 pp.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue – Room 142
Boston, Massachusetts 02210-3884

August 1, 1996

ER 96/439

Mr. Stuart Piken, Chief, Planning Division
U.S. Army corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Stuart:

It was a pleasure meeting with you, your staff and Mr. Daley in Albany on July 9, 1996. I believe that we had a productive exchange of information about the timing and anticipated procedures of our respective agencies concerning the continuing development and implementation of the Fire Island Interim Project. As we indicated, the purpose of this letter is to summarize and confirm the essence of that meeting.

At the onset, let me reinforce our statements of satisfaction and relief with your information that the scoping for the research projects for the Reformulation Plan will commence this fall, that an overall project consultant has been hired, and that you expect that the Reformulation studies and EIS will be completed by 2002. As we are all aware, it has been some 18 years since CEQ tasked the Corps of Engineers to conduct the Reformulation Plan. Our respective agencies can not begin to craft a long-term response to questions of shoreline protection in New York without better information about such issues as the likely location, duration and impact of breaches, the economic and physical alternatives for protecting the south shore of Long Island depending upon different breach scenarios, the ecological responses to breaches in terms of tidal flushing and wildlife habitat, as well as the impacts of the project alternatives themselves.

As we indicated, we intend to have our constituent agencies (the National Park Service, the United States Fish and Wildlife Service, and the National Biological Service) in partnership with, we assume, with the National Marine Fisheries Service, participate closely with your agency in the development of the research studies, scope of work, peer review, or other tasks necessary for the individual investigations to be conducted under the Reformulation Plan effort. We also reiterate our offer to have our technical resource staff, including ecologists, coastal geomorphologists and economists, work with your staff or the consultants where feasible in defining and executing these studies.

The question of timing for various planning and construction activities was discussed in some detail. Clearly, there is inadequate information at this point to be able to conclude that the Interim Project, with ten renourishment cycles over thirty years, will not have a significant effect on the environment. However, we did agreed in our meeting that the National Park Service would issue a special use permit to the Corps for five years, commencing at the start of construction (1998). The work you propose to conduct within the five year time frame would entail the two-year construction cycle of dune, berm and sacrificial fill, and two-year monitoring phase, but with a single predicted renourishment cycle for specific spots where erosion was most severe. The five year permit will be issued based upon the present assumption that the on the resources within the communities resulting from the work outlined above, can be determined to be under the threshold of significance as that term is understood under NEPA. At the time that the special use permit is to expire, this Department will reevaluate whether another permit is appropriate, being able to utilize, by that time, answers to the many open questions which the Reformulation Study and its EIS will have provided.

It is our understanding that there does not appear to be a problem with the special use permits encompassing a period less than your minimum 12 year project planning time frame, or New York State's 30 year time frame.

Your agency has previously indicated and confirmed at the meeting that the time of year or other construction conditions which we described in Appendix A of our letter of April 23, 1996 for the work in front of the communities would be accommodated within your construction schedules. However, you expressed concern about restriction of work in the Wilderness Area. While the matter was discussed at some length, we believe that the most salient points concerning the Wilderness Area were as follows.

First, the Park Service is bound by a number of different statutes, designations and policies, either prohibiting sand nourishment activities or man-made alterations within the Environmental Protection/Primitive Zone/Wilderness Area or requiring a full EIS to do so. Mindful of these factors, as well as the unique ecology of this area and our uncertainty as to the effects that an alteration of this natural system would have absent more study (e.g., microclimate factors that within an overwash area), we indicated that the significance of the environmental effects would require our agency, and certainly yours as well, to conduct a full NEPA EIS analysis before we could proceed with beach manipulations within this area.

Second, we have all acknowledged that if a breach occurs in the area commonly known as Old Inlet, it is not likely to develop into a permanent breach, due to the wide overwash fan and shallow water depths in this area. However, should a breach develop and be found not likely to close on its own, our agency has supported and facilitated all NEPA compliance steps to implement the Breach Contingency Plan.

Third, we indicated in our meeting that there is room, both within the emergency action provisions of NEPA, and the emergency response language of the Fire Island Wilderness Act, to respond to an emergency, over and above that which is currently planned for under the Breach Contingency Plan, should it occur.

Let me close by reiterating our offers to freely exchange technical information amongst our agencies. We anticipate continuing to work with you as this project develops and trust that we will continue to keep the lines of communication open.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

cc: W. Daley, NYS DEC
J. Hauptman, NPS/FINS
R. McIntosh, NPS/NEFO
D. Clark, NPS/NESSO
M. Foley, NPS/NESSO
J. Allen, NBS
R. Leporé, SOL/NE
S. Morgan, FWS/NYFO
D. Stillwell, FWS/NYFO
B. Murray, FWS/LIFO
R. Abele, FWS, R5
A. Rosenberg, NMFS
D. Bear, CEQ

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

June 5, 1996

Planning Division

Mr. Andrew L. Raddant
Regional Environmental Officer
U.S. Department of Interior, Office of Policy and Compliance
408 Atlantic Avenue, Room 142
Boston, MA 02210-3334

Dear Mr. Raddant:

Thank you for your April 23, 1996 letter regarding the Fire Island Inlet to Moriches Inlet Interim Storm Damage Protection Project and for your participation in our many conversations and meetings. The continued close coordination between our agencies has enabled us to identify potential concerns early in the planning process so that a mutually acceptable plan can be achieved. Your appreciation of the critical need to provide storm protection to the Long Island mainland in a timely manner has greatly advanced this process. The schedule developed to meet this goal assumes that environmental issues associated with the interim plan, which is a fill-only, reversible design containing no hard structures, can be adequately addressed through a fully coordinated Environmental Assessment. Our challenge has been to reconcile the need to provide storm protection to communities facing tremendous risks from flooding and inundation with an environmentally responsible design. We feel strongly that, with your assistance, the interim plan now proposed achieves this purpose.

I appreciate your latest recommendations as they have enabled us to refine our environmental strategy. However, two of the recommendations are problematic for us and for our local sponsor, the New York State Department of Environmental Conservation. The first issue is the elimination of beach fill adjacent to the Federal Wilderness Area east of Watch Hill in the vicinity of Old Inlet. Shoreline modeling indicates that some fill placement in the area of Old Inlet is recommended to optimize an effective project design. Without fill placement in this area, the project will have a vulnerable point and the back bay and mainland will remain highly susceptible to storm damage. Recognizing the importance of maintaining the natural quality of the Wilderness Area, we have proposed several alternative methods to achieve this design requirement while minimizing environmental impacts. Our most recent proposed solution includes a feeder beach and stockpile sited outside the limits of Wilderness Area. However, New York State has some reservations over the ability of this design to provide protection across the entire seven-mile reach. To finalize an effective plan for this valuable natural area, we would like to meet with you and the State at your earliest convenience.

The second major issue relates to your recommendation that the project require only one fill placement contingent on the completion of the Fire Island to Montauk Point Reformulation Study. Our intent in developing an interim plan for the area between Fire Island and Moriches Inlet was to allow for the incorporation of any needed modifications identified by the system-wide analyses programmed for the Reformulation Study. The reversible nature of the interim plan reflects our recognition that the reformulation process could result in a recommendation for a "no further action" alternative.

Each Corps of Engineers' project must be economically justified independently of any other project. To compute the economic costs and benefits of a project, a project life must be defined. In order for New York State to participate in a shore protection project, the project's economic life must be at least thirty years. In order to ensure the integrity of the interim project design cross-section for this period of time, periodic renourishment on an average of every three years will be needed. It is likely that renourishment will be required prior to the approval of the Reformulation Study and completion of the NEPA process. At that juncture, however, we would have the benefit of many years of environmental monitoring, coastal monitoring, and in depth coordination with your office and other environmental agencies. All feasible adjustments to project design arising from those analyses will be made to the interim project including renourishment requirements. Should you continue to have concerns over this aspect of the project, I would like to resolve them at our meeting with New York State.

I have enclosed a more thorough discussion of these topics and your other recommendations. I am also providing a current project schedule with an updated description of the interim project plans incorporating your input. Currently, we are scheduled to submit our Feasibility Report in December 1996. To meet this schedule, your final Coordination Act Report is needed no later than November 1996.

The project plans have been adjusted to reflect the results of recently completed shoreline modeling. This study indicates that to meet minimum levels of protection for State and Federal participation, the minimum dune and berm heights between Kismet and Points O' Woods required reconfiguration to +18 feet National Geodetic Vertical Datum (NGVD) and +11.5 NGVD, respectively. To maintain as much as possible the same "footprint" of sand placement and minimize environmental impacts, the berm width was reduced. Previously these project features were to have berm elevations of +9.5 feet NGVD and a width of 90 feet, in combination with a dune at elevation +15 feet NGVD. The new cross-section will result in a lateral extension of the fill . The revised cross-section and plan views are provided as Enclosure 2, with a description of the fill increase. Although the dune height has been increase to +18 feet NGVD, the overall size of this feature still remains substantially smaller than the authorized plan. The interim project provides a 44-year level of protection, whereas the authorized project provides a 200-year level of protection. The work is primarily confined to heavily developed areas and can be accomplished in a manner that protects to the fullest extent practical, sensitive environmental resources.

With these revisions and in the final discussions at our forthcoming meeting, I am confident that we will have defined a project which is environmentally responsible and provides protection to extremely vulnerable communities. Please contact me or Joe Vietri, (212) 264-9219, to coordinate our meeting with New York State.

Sincerely,

Stuart Piken

Stuart Piken, P.E.
Chief, Planning Division

Enclosures

Copy Furnished:

Mr. William Daley
New York State
Department of Environmental Conservation

FIRE ISLAND INTERIM PROJECT
Response to Department of Interior (DOI)
Letter dated April 23. 1996
Appendix A

New York District, Corps of Engineers (District) response to DOI recommendations on the Fire Island Interim Project (FIIP) contained in Appendix A of the DOI's April 23, 1996 letter. Our responses are organized into two sections addressing reach-specific concerns and general comments. The District and the DOI will incorporate all current natural resources and shoreline data in finalizing project plans and reach-specific conditions.

Reach-Specific Recommendations:

1) Time of Year Restrictions on Construction Activities:

The District concurs with the time of year construction restrictions to ensure protection for Piping Plover and Least Terns and will incorporate these restrictions into the project description and plans and specifications for construction. The District does not usually support seasonal restrictions as they extend the total time of construction thereby increasing the period of environmental disturbance and delaying the initiation of habitat recovery. The FIIP is 30 miles in length and time of year restrictions will not measurably increase the overall construction schedule as work can proceed in other areas not effected by the restrictions. Protection measures for Seabeach Amaranth will be coordinated during the formal Section 7 coordination process.

2) No Construction Restrictions:

a. Fire Island Inlet to Robert Moses Westernmost Parking Lot

No construction is proposed for this reach. The restriction does not apply.

b. Watch Hill Campground to Smith Point Visitor Center (National Wilderness Area)

This restriction eliminates fill placement in seven miles of the 30-mile project, a reach which includes Old Inlet. This area is currently vulnerable to storm damage particularly in the vicinity of Old Inlet, which can be termed an erosional "hot spot". The most effective plan for this area would be a dune fronted by beachfill in the area of Old Inlet. In recognition of the Federal Wilderness designation and our mutual desire to further enhance endangered species habitat, we have proposed placing beachfill only, seaward of the existing dune line. The fill would have an elevation of +9.5 feet NGVD comparable to existing elevations within the Wilderness Areas. The wider beach would provide additional shorebird habitat.

It is the opinion of the District and the State of New York (State) that the latter alternative provides the best interim design for storm protection while minimizing impact to the Federal Wilderness Area. However, in light of the DOI's recommendation that a "no construction" restriction be applied to this reach, we have evaluated the feasibility of establishing a feeder beach and a stockpile updrift of the Old Inlet area, in Smith Point County Park. The stockpile will allow for an accelerated breach closure response. This solution adequately addresses engineering concerns for existing conditions within the reach with an erosional "hot spot" sited at Old Inlet. However, it provides no mechanism for dealing with a future condition in which the erosional "hot spot" could have expanded or migrated. This concern is magnified in those portions of the reach with greater bay water depths. If the erosional "hot spot" should migrate or expand into an area with deep bay water the risk of breaching will be much more severe than at Old Inlet which has relatively shallow bay water. The proposed locations of the feeder beach and stockpile may be too distant to allow for a timely breach closure response if the erosional "hot spot" has migrated to a different location within the reach. To compensate for this uncertainty and minimize future with-project damages, the District and the State would have to revisit the no construction requirement should conditions deteriorate to the point that the mainland is jeopardized.

c. Smith Point County Park Access to Moriches Inlet

No construction is proposed for this area. The restriction does not apply.

3) No Dune Construction:

a. Fire Island Lighthouse to Kismet:

No construction is proposed for this area. The restriction does not apply

b. Sailors Haven to Cherry Grove (Sunken Forest)

Within this reach, there is one 500-foot long dune area where augmenting existing the elevations would be beneficial. This location has an existing elevation of +14.5 feet, which we propose to raise this to an elevation of +15 feet. Due to construction tolerances no fill would be required at this time.

General Recommendations:

1) The DOI recommends that the National Park Service (NPS) issue the NPS Special Use Permit as a one time action. The District does not concur with this recommendation. The Corps of Engineers cannot recommend a project, to be supported by the State of New York, unless it contains provisions to minimally ensure a 30-year project life. New York State Law requires involvement in a coastal storm damage reduction project for a minimum of 30 years. In order to ensure a 30-year project life, this project will require periodic renourishment to realize full economic benefits.

The first renourishment cycle is scheduled for 2002/2003. By this time, the Reformulation Study should be close to completion, pending the continued appropriation of Federal money. The results of the Reformulation Study are anticipated prior to the first renourishment cycle assuming continuing Federal involvement and funding appropriations. The Interim Project is a reversible plan with no hard structures subject to modification or termination depending on the results of the Reformulation Study. All data generated by Reformulation analyses and Interim monitoring programs will be used to adjust renourishment activities. Therefore, the Corps recommends that the NPS Special Use Permit be granted for a 10-year period for the Interim Project. This will allow for sufficient time for the completion of project review by higher authority, initial construction, and any renourishment placements needed prior to the completion of the Reformulation Study. The Special Use Permit could be extended, based upon the original Environmental Assessment and supplemented by coastal processes and environmental monitoring programs, and full inter-agency coordination.

2) Concur. The District is currently developing a biological assessment for the Seabeach Amaranth to be forwarded to the US Fish and Wildlife Service (FWS) for preparation of the biological opinion.

3) Concur. The District will implement endangered and threatened species management plans using the VWHD Rapf Stipulation.

4) Concur. Prior to construction of the Fire Island Interim Project, New York State must implement the Coastal Zone Hazard Management Law for Fire Island. A stipulation of Federal and State involvement in construction will be that no construction is allowed on or fronting the dune, and that a 25 foot easement will be established landward of the dune, to allow for construction and renourishment of the dune. In addition, the New York State Department of Environmental Conservation is currently working with the Town of Brookhaven, the Town of Islip, and the Federal Emergency Management Agency, to redefine local zoning ordinances.

5) It should be noted that construction of this Interim Project will be cost-shared with the State, the County, and with local municipalities, and that it is not based solely on Federal participation. As part of the Reformulation Study, we are evaluating all protection alternatives available including the use of alternative sources of sand from increased inlet bypassing and dredging of bay channels. Dredging and placement of this material would be contingent on the material's compatibility with sand on the existing beach and with environmental acceptability. If found to be suitable, these alternative sand sources would minimize impacts at offshore borrow areas, as required. Assessing any impacts associated with channel dredging or inlet bypassing would be fully evaluated through extensive physical and environmental studies.

6) I believe this question is in reference to our August 10, 1995 and August 4, 1995 correspondence with the US FWS. The question was whether "the analysis of the differences in the degree of protection, including delineated tidal regimes and potential flood regimes will be assessed for the breach fill elevations, the Fire Island Interim elevations, and the Fire Island Inlet to Montauk Point Project." Our response indicated that "delineated tidal regimes and potential flood regimes will not be available until the Reformulation Study". In actuality, flood stage frequencies have been determined for the ocean and bay along Great South Bay, for existing conditions, interim project conditions, and authorized project conditions. In addition, we have updated our economic structure inventory conducted in 1981 in order to determine damages due to flooding, and the benefits derived from flood protection for the both the Authorized and Interim Projects. The benefits for each of these projects has between evaluated, based on the reduction in damages to mainland flooding. During the Reformulation Study we will consider the effectiveness, and the extent of flooding for a wider range of alternatives than those currently considered for the interim plan.

FIRE ISLAND INLET TO MORICHES INLET INTERIM PROJECT
SCHEDULE FOR COMPLETION

Draft Report (W/O NEPA Documentation)	June 1996
Negotiate SOW for FWCA	June 1996
Biological Assessment (Seabeach Amaranth)	Late June 1996
Draft FWCA Report	August 15, 1996
Draft EA for review	September 1996
Public Review	October 1996
Biological Opinion (Seabeach Amaranth)	November 1, 1996
Final FWCA Report	
Respond to Comments	November 1996
Finalize Technical Support Document w/ EA	December 1996

FIRE ISLAND INLET TO MORICHES INLET INTERIM PROJECT

PLAN DESCRIPTION

General. The proposed interim fill plan would reinforce portions of Fire Island that form a barrier land mass sheltering Long Island communities along Great South Bay to provide the area with adequate protection throughout the 30-year project life. This plan provides additional protection along approximately 50% of the island's length. The level of protection afforded by the plans must be technically feasible for implementation. The project design is based on a probability of providing 30 years of erosion control as required under New York Environmental Conservation Law Article 34, the Coastal Erosion Hazards Act. Based on this probability, and the Corps survivability criteria, the design storm has a return period of approximately 44 years. In addition, the plans must protect the potential damage area without causing adverse effects to adjacent shoreline or inland areas.

Interim Plan

General. The interim plan consists generally of beachfill with a minimum berm width of 90 ft. at elevation +9.5 ft. NGVD, and a minimum 25 ft. wide dune at elevation +15 ft. NGVD. The proposed dune slopes are 1V:5H, and the design beach slopes are to be 1V:15H to MLW, and 1V:30H below MLW. The proposed interim plan cross-section is shown in Figure 4. The beach and dune fill is designed to provide a 15 ft. NGVD dune elevation, following a 44-year storm event. Exceptions are noted at Old Inlet, and in the area ranging from Kismet to Point of Woods. Fill in the Old Inlet area is prohibitive due to the level of environmental documentation required. Breach potential will be lowered at the Old Inlet area by use of a feeder beach and stockpile at Smith Point County Park, however, these measures are not anticipated to provide protection against a 44-year event. In order to provide a 44-year level of protection due to extremely low elevations landward of the dune, the dune and berm elevations from Kismet to Point of Woods were increased to +18 ft. NGVD and +11.5 ft. NGVD, respectively. The detailed plan layout is described in the following paragraphs.

Interim Plan Layout. For the individual design reaches of Fire Island, the various protective measures are described below and are shown in Figures 1 and 2.

Design Reach 1 (Robert Moses State Park). Design Reach 1 extends from the east jetty at Fire Island Inlet, 26,900 feet to the eastern boundary of Robert Moses State Park. Development in the reach consists of roads, parking areas and recreational facilities. For the Interim project, fill placement is recommended between profiles 3 and 3B, which consists of a mile of shoreline protection for the public access road and parking to Robert Moses State Park. A minimum design berm of 90 ft. at elevation +9.5 ft. NGVD fronting the existing dune is recommended to provide protection to the existing dunes.

Design Reaches 2 and 3 (Kismet to Davis Park). Design Reach 2 extends from Kismet to Point O' Woods and includes 25,200 feet of Atlantic shoreline. This reach includes the most highly developed areas of Fire Island. Design Reach 3 includes the communities of Cherry Grove to Davis Park, covering 43,200 feet of coastline. This area is less densely developed than Reach 2. Reaches 2 and 3 feature some of the lowest existing dunes on the island, and sections of the barrier island in these reaches are very narrow and are potential sites for breaching during severe storms. Therefore, the project layout calls for the construction of fronting beach fill along approximately 54,000 ft. and dune along 28,000 ft. over the entire length of the Design Reaches 2 and 3 to provide a 44-year level of protection. The proposed dune protects against overtopping and storm damage to a 44-year level of protection. The recommended fill plan layout in Design Reach 2 provides a minimum berm width of 40 ft. at elevation +11.5 ft. NGVD fronting dune of elevation +18 ft. NGVD. The recommended fill plan layout for Design Reach 3 provides a berm width of 90 ft. at elevation +9.5 ft. NGVD, fronting a dune at elevation +15 ft. NGVD. These dimensions are measures from the baseline generally corresponding to the seaward toe of the existing dune and are required to provide a 44-year level of protection.

Due to the vulnerability of the shoreline in Design Reaches 2 and 3, project losses are expected to be significant. To ensure the condition of the design profile, advance nourishment and renourishment fill will be added to the areas requiring shoreline beach fill placement in these reaches. The renourishment will account for average erosion losses between nourishment cycles in the project area. A 3-year nourishment interval was selected for the interim project due to the area's high erosion rate variability. The average loss, in the erosive sections, is approximately 6 feet per year. To provide sufficient advance fill for a three-year nourishment cycle, an advance fill width of 23 feet was used (which includes a 25% contingency).

Design Reach 4 (FINS to Moriches Inlet). Design Reach 4 includes the Fire Island National Seashore wilderness area and Smith Point County Park and includes a total of 67,800 feet of Atlantic coastline. The reach is generally undeveloped with the exception of parking areas and recreational facilities at the county park. With generally moderate to high existing dune elevations, and moderate berm widths, a 44-year level of protection is provided, except at Old Inlet, where frequent over washing and low beach elevations exist. Fill is recommended at Smith Point County Park in order to protect the existing dune structure and to provide a feeder beach to the Old Inlet area, where design fill is prohibitive due to the level of environmental documentation required. A minimum design berm of 90 ft. at elevation +9.5 ft. NGVD fronting the public facilities is recommended. An additional 120,000 c.y. stockpile at Smith Point Park is recommended to supplement the Smith Point Park feeder beach and provide breach control at Old Inlet as needed.

Quantities

Fill Volume Estimate. The April 1995 beach profile survey was used as existing conditions, forming the basis for the design fill volume estimates. The total initial project fill volume is the sum of the design fill, the advance fill and tolerance fill over the first nourishment cycle. Additional fill (0.2 c.y./ft./yr.) to compensate for the effects of sea level rise was included in the advance fill quantity. The volume of material for the above described stockpile has been included in the advance fill estimate. A typical 1-foot construction tolerance was assumed, which increased the entire initial fill volume requirements by approximately 15%. The total fill requirements for the project also included overfill, however, based on borrow area material investigation performed for this study, an overfill factor of 1.00 was determined for the dredging material, and therefore, no additional fill for overfill is required. Total initial fill volumes for each design reach for the interim and authorized plan are presented in Tables 1 and 2.

Difference in Fill Volumes, and Lateral Extent of Fill based upon Reach 2 Cross-sections. The original configuration called for 23,500 ft of berm fill (+9.5 ft NGVD) in design reach 2, with a total volume of 2,100,000 cubic yards. Of the 23,500 ft, 11,100 ft required dune fill (+15 ft NGVD) in the amount of 100,000 cy. The revised cross-section berm (+11.5 ft NGVD) would extend 25,200 ft in reach 2, with a total volume of 2,480,000 cy. Of the 25,200 ft, 22,200 ft would require dune fill (+18 ft) in the amount of 230,000 cy.

Periodic Renourishment Fill Volume Estimates. Nourishment fill must be continued over the 30-year project life to ensure that the design beach width is not compromised. A three-year nourishment cycle was selected due to the area's high erosion variability. The estimated renourishment fill volume including the stockpile will be replenished every three years. Total renourishment fill volumes for the Interim Plan to be placed every three years are shown in Table 3.

Major Rehabilitation Fill Estimates. Major rehabilitation fill volumes are included to account for impacts to the design profile from major storm/hurricane events with frequencies less than 50% occurrence within the 3 year nourishment cycle. This translates to a 10-year storm and greater. The volumes required for major rehabilitation for each storm frequency are based on SBEACH results for storm erosion for that frequency multiplied by the permanent loss factor which varies with the storm event (increasing with less frequent events).

TABLE 1

TOTAL INITIAL FILL VOLUME ESTIMATE
FIRE ISLAND INTERIM PROJECT

FILL DISTANCE (FT.)	DESIGN FILL VOLUME (C.Y.)	ADVANCE FILL VOLUME (C.Y.)	15% TOLLERANCE VOLUME (C.Y.)	SUB-TOTAL (C.Y.)	OVERFILL FACTOR	TOTAL FILL VOLUMES (C.Y.)
DESIGN REACH 1						
6,456	353,897	0	53,085	406,982	1.00	406,982
DESIGN REACH 2						
25,212	2,709,668	1,097,960	571,144	4,378,772	1.00	4,378,772
DESIGN REACH 3						
28,574	2,301,575	1,054,367	503,391	3,859,333	1.00	3,859,333
DESIGN REACH 4						
6,768	639,342	120,000	113,901	873,243	1.00	873,243
TOTAL						
67,020	6,004,482	2,272,327	1,241,521	9,518,330		9,518,330

NOTES:
DESIGN FILL VOLUME INCLUDES BERM AND DUNE (DESIGN REACHES 2 AND 3)
ADVANCE FILL BASED ON 3 YR. CYCLE (23 FT.(WIDTH) x 1.35 C.Y./FT.) = 31.05 C.Y. / FT.
ADVANCE FILL VOLUMES INCLUDE ADDITIONAL 0.2 C.Y./FT/YR FILL FOR SEA LEVEL RISE
ADVANCE FILL IN DESIGN REACHES 2 AND 3 INCLUDE STOCKPILE VOLUMES
ADVANCE FILL IN DESIGN REACH 4 IS STOCKPILE VOLUME
TOLERANCE APPLIED TO ENTIRE INITIAL PLACEMENT VOLUME

TABLE 3

PERIODIC RENOURISHMENT FILL VOLUME ESTIMATE

FIRE ISLAND INTERIM PROJECT

FILL DISTANCE (FT.)	ADVANCE FILL VOLUME (C.Y.)	15% TOLLERANCE VOLUME (C.Y.)	SUB-TOTAL (C.Y.)	OVERFILL FACTOR	TOTAL FILL VOLUMES (C.Y.)
DESIGN REACH 1					
6,466	0	0	0	1.00	0
DESIGN REACH 2					
25,212	1,097,960	164,694	1,262,654	1.00	1,262,654
DESIGN REACH 3					
28,574	1,054,367	158,155	1,212,522	1.00	1,212,522
DESIGN REACH 4					
6,768	120,000	18,000	138,000	1.00	138,000
TOTAL TO BE PLACED EVERY THREE YEARS					
67,020	2,272,327	340,849	2,613,176		2,613,176

NOTES:
ADVANCE FILL BASED ON 3 YR. CYCLE (23 FT.(WIDTH) x 1.35 C.Y./FT.) = 31.05 C.Y. / FT.
ADVANCE FILL VOLUMES INCLUDE ADDITIONAL 0.2 C.Y./FT/YR FILL FOR SEA LEVEL RISE
ADVANCE FILL IN DESIGN REACHES 2 AND 3 INCLUDE STOCKPILE VOLUMES
ADVANCE FILL IN DESIGN REACH 4 IS STOCKPILE VOLUME
TOLERANCE APPLIED TO ENTIRE PLACEMENT VOLUME

TABLE 6

MAJOR REHABILITATION QUANTITIES

AUTHORIZED DESIGN - DESIGN REACHES 1-4

RETURN INTERVAL (YEARS)	FREQUENCY (EVENTS / YR.)	FREQUENCY INTERVAL	PERMANENT LOSS FACTOR	EROSION VOLUME (CY/FT)	EMERGENCY FILL (CY/FT)	AVERAGE EMERGENCY FILL (CY)	ANNUAL EMERGENCY FILL (CY/YR)
10	0.1		16%	21.32	3.41		
		0.05				513,787	25,689
20	0.05		22%	22.11	4.86		
		0.03				675,496	20,265
50	0.02		27%	22.28	6.02		
		0.01				830,039	8,300
100	0.01		33%	22.28	7.35		
		0.005				982,213	4,911
200	0.005		38%	22.28	8.47		
TOTAL REHABILITATION VOLUME:						3,001,538	59,166

FILL LENGTH: 124,183 FT.

NOTE: LOSS FACTOR IS THE PERCENT OF ERODED VOLUME PERMANENTLY LOST TO PROFILE
LOSS FACTOR VALUES ARE BASED ON EXPERIENCE AT OCEAN CITY, MD.
EROSION VOLUME IS THE MAXIMUM LANDWARD OF A GIVEN PROFILE POSITION COMPUTED FROM SBEACH
EROSION VOLUME IS ASSUMED TO BE NON-DESCENDING WITH STORMS OF INCREASING SEVERITY

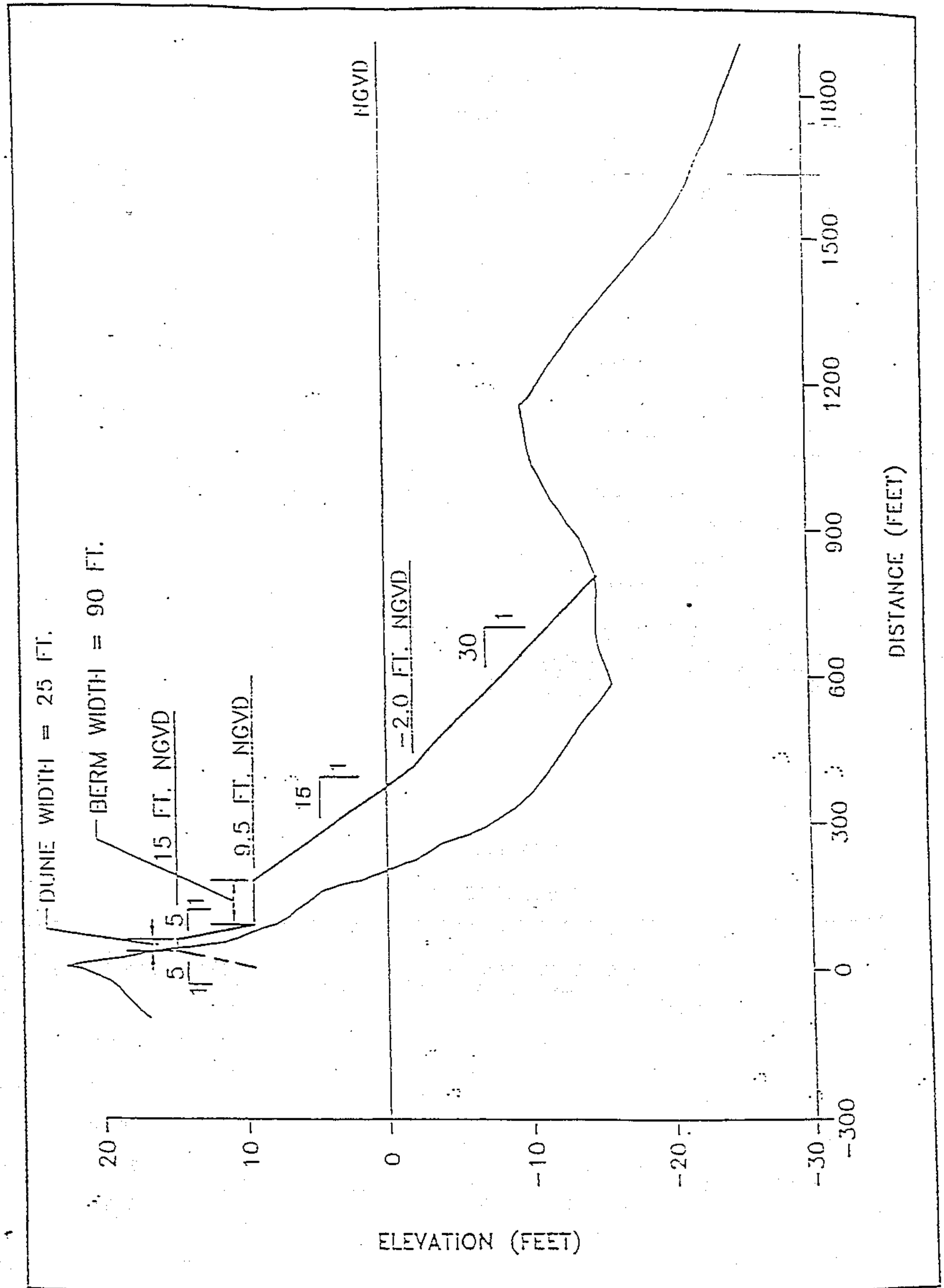
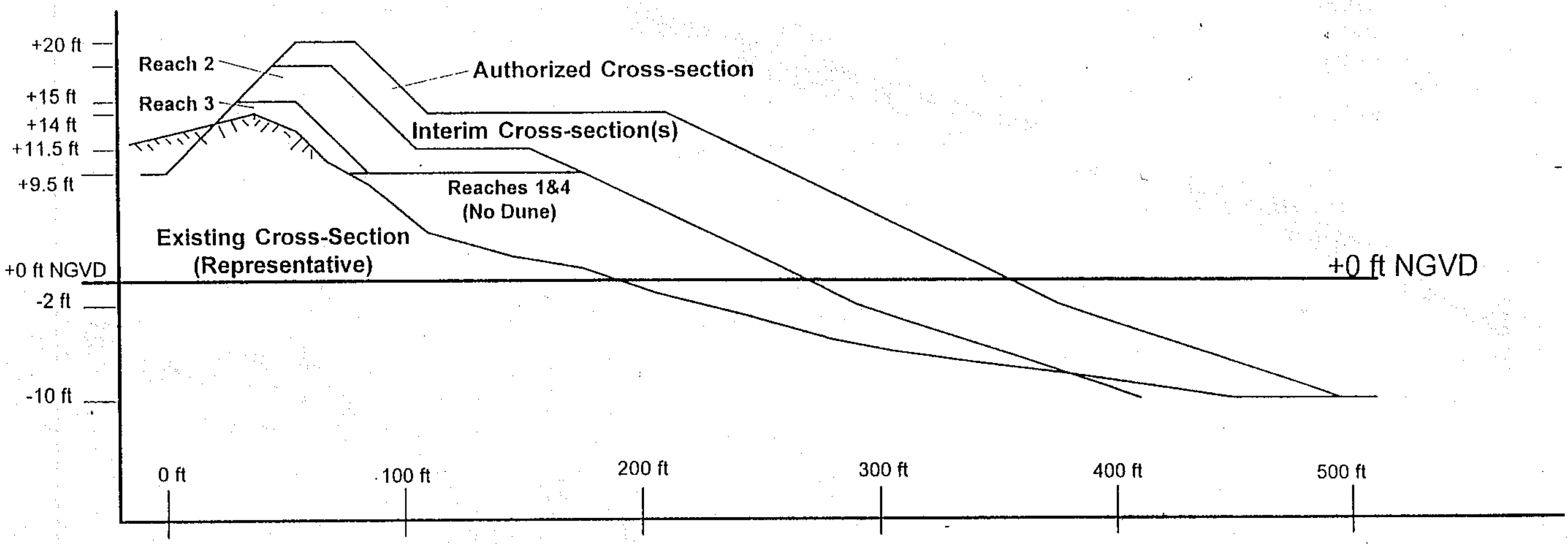
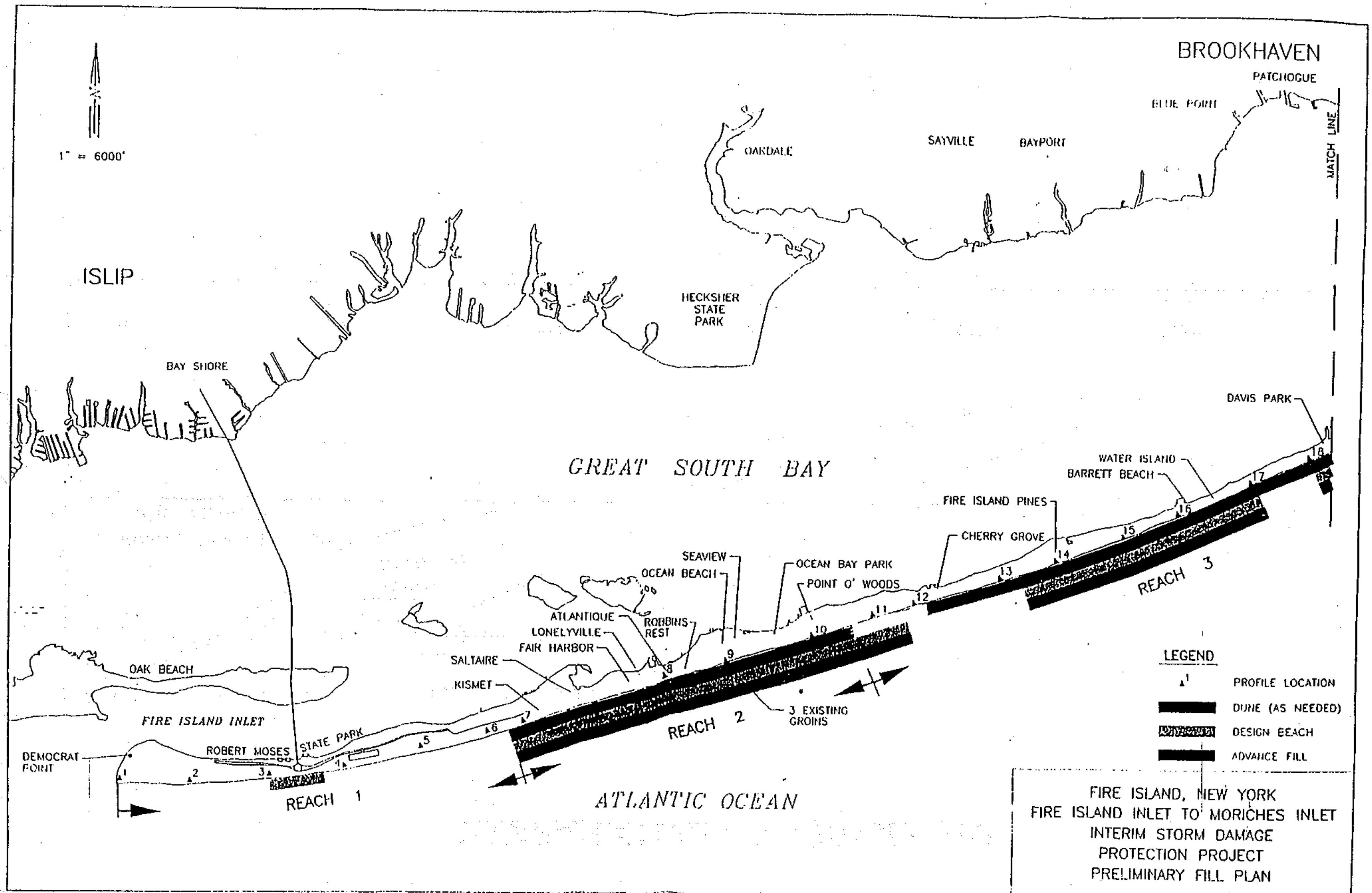


FIGURE 34

FIRE ISLAND
INTERIM BEACH IMPROVEMENT DESIGN

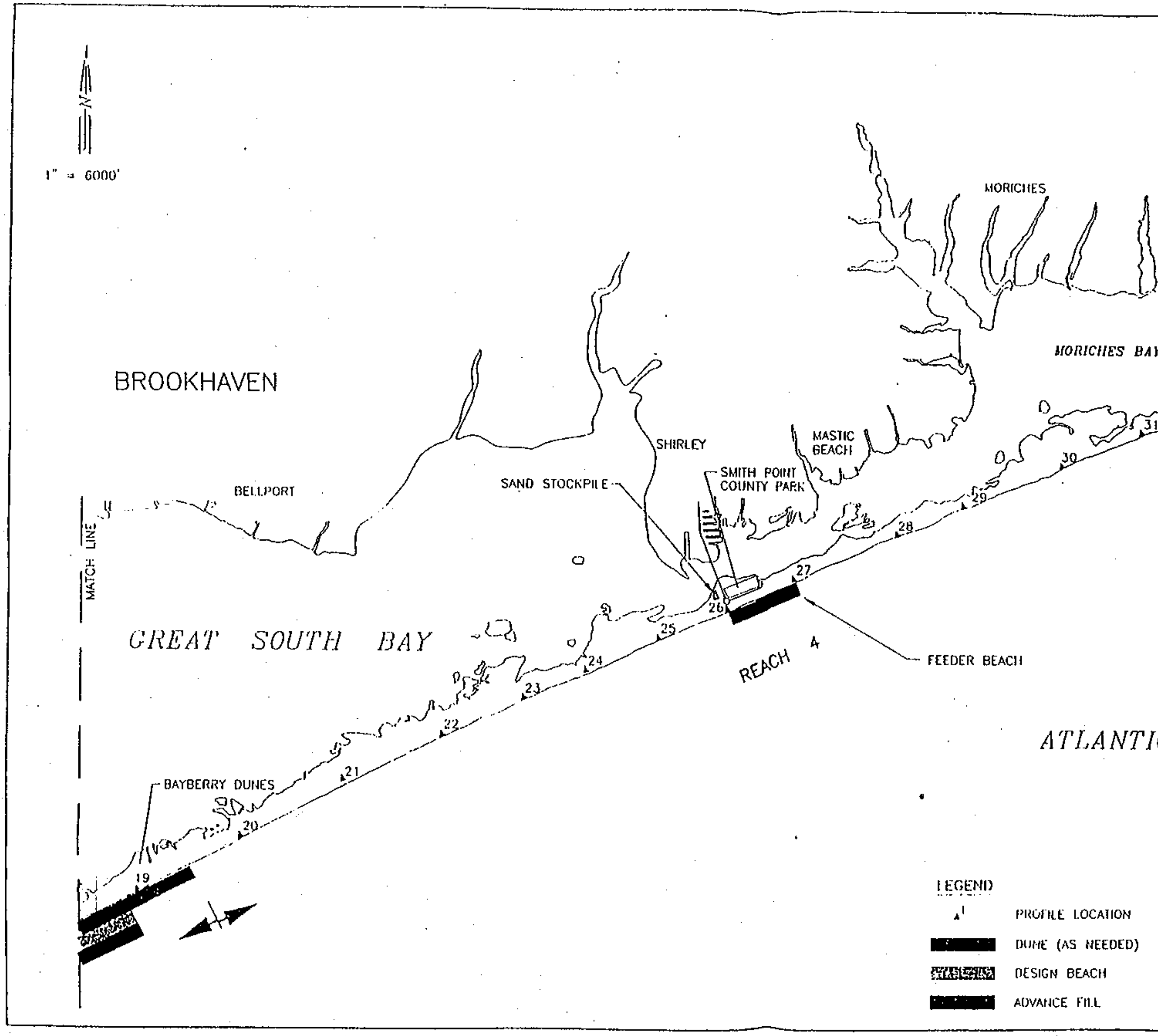
COMPARATIVE CROSS-SECTIONS





FIRE ISLAND, NEW YORK
FIRE ISLAND INLET TO MORICHES INLET
INTERIM STORM DAMAGE
PROTECTION PROJECT
PRELIMINARY FILL PLAN

FIGURE 1A



FIRE ISLAND, NEW YORK
FIRE ISLAND INLET TO MORICHES INLET
INTERIM STORM DAMAGE
PROTECTION PROJECT
PRELIMINARY FILL PLAN

FIGURE 1B

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York, 12233-

Michael D. Zagata
Commissioner

April 29, 1996

Colonel Gary Thomas
US Army Corps of Engineers
New York District
26 Federal Plaza
New York, NY

Dear Colonel Thomas:

This office has received Project Study Plans (PSP) for the Fire Island Interim Project and the West of Shinnecock Interim Project, both areas contained within the Fire Island Inlet to Montauk point project area which is currently undergoing reformulation. We concur in the general scope of work but question the proposed schedules, specifically for the West of Shinnecock project which is projected for an FFY 1999 construction start. The Fire Island project is more realistically scheduled for an FFY 1998 construction start.

Both of these projects are desperately needed now. The area immediately west of Shinnecock Inlet was breached in 1992 and 1993 and we have been barely keeping it together since that time. The State is moving forward with plans to renourish the area as a demonstration of the Dutch "Punaise" dredging system but that effort, too, is being delayed by provisions of the Federal Jones Act. But these remedial efforts simply gain us time. Rehabilitation of the Inlet has created a serious erosion problem immediately downdrift. We must rapidly determine the causes of that problem and move quickly to rectify them. A 1999 Interim project is not an adequate response to the problem. A major breach will not only cause grave economic dislocations to the extensive commercial fishery and related businesses berthed in Shinnecock Bay but would also significantly complicate federal maintenance of Shinnecock Inlet.

None of us need further storm damage and beach loss to realize that stretches of Fire Island are now highly susceptible to overwash and breaching. We must move forward as quickly as possible to strengthen the Fire Island barrier before we have to fill one or more breaches as well as strengthen the island's natural protective features. We learned part of a lesson at Westhampton. Now, with the Breach Contingency Plan we may be able to mobilize more quickly but preventive maintenance is still far better than rapid response to a preventable calamity.

We urge you to do whatever you can to move these two Interim projects forward as quickly as possible. Rapid completion of the necessary Decision Documents might allow for their construction phase being advanced into the preceding fiscal year, particularly in the case of West of Shinnecock project. We understand that these study costs will be incorporated into project costs at that time of construction and will be shared at that cost-sharing ratio.

Sincerely,

Frank J. Dwyer
Director
Bureau of Flood Protection

WWD:jb

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue - Room 142
Boston, Massachusetts 02210-3334

April 26, 1996

Colonel Gary Thomas
District Engineer, New York District
ATTN: Mr. Stuart Piken, Chief, Planning Division
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Colonel Thomas:

Please find enclosed a revised version of the "Appendix A" originally accompanying our April 23 correspondence concerning the Fire Island Interim Storm Damage Protection Plan. The changes pertain to the second half of the recommendations matrix, developed by the National Park Service, and include modifications to format and additional information. I apologize for the inconvenience.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

Enclosure

cc: J. Hauptman, NPS/FINS
R. McIntosh, NPS/NEFO
D. Clark, NPS/NESSO
M. Foley, NPS/NESSO
J. Allen, NBS
R. Lepore, SOL/NE
S. Morgan, FWS/NYFO
D. Stillwell, FWS/NYFO
B. Murray, FWS/LIFO
R. Abele, FWS/R5

<u>Fire Island Interim Project Reach-Specific Prerequisites:</u> **Conditions for acceptance of U.S. Army Corps of Engineers Fire Island Interim Project**

The following prerequisites are based upon March, 1996, natural resources data and April, 1995 beach and shoreline conditions of Fire Island. Should future occurrences of fish and wildlife resources cause us to modify our natural resources data base, or should actual beach and shoreline conditions change ~~prior to~~ the finalization of the USACE planning process, the DOI reserves the right to review any such new plans and develop new reach-specific conditions if warranted.

REACH	REACH-SPECIFIC CONDITIONS
Fire Island Inlet to Robert Moses State Park most westward parking area	No construction <u>JUSTIFICATION</u> No likelihood of breach formation Limited public infrastructure at risk Very High biological value
Robert Moses State Park most westward parking area to Fire Island Light House Visitor Center	No berm or advance fill construction between 4/1 - 9/15 Dune, berm, and advance fill construction permitted between 9/16 - 3/31. No time of year work restriction at the Water Tower area where there are no concerns. <u>JUSTIFICATION</u> Time of year work restriction will ensure protection of Piping Plovers and Least Terns. Low to moderate biological value. Beach construction can protect public infrastructure which is at risk on this section of Fire Island. Low likelihood of breach with moderate possibility breach could remain open.
Fire Island Light House Visitor Center to Kismet	No dune construction. No berm or advance fill construction between 4/1-9/1. Berm, and advance fill construction permitted between 9/2 - 3/31. <u>JUSTIFICATION</u> Time of year work restriction will ensure protection of Piping Plovers. No infrastructure at risk on Fire Island. Low likelihood of breach with moderate possibility breach could remain open. Existing berm and dune already meet design criteria. Moderate biological value.
Kismet (and eastwardly communities) to Sailors Haven	No construction between 5/1 - 9/1 at Atlantique Dune, berm, and advance fill construction permitted between 9/2 - 4/30 at Atlantique No construction between 5/1-11/1 at Dunewood, Lonelyville (This time period encompasses the Least Tern nesting season (5/1 - 4/15) and the Seabeach Amaranth growing season (5/1 - 11/1)). Dune, berm, and advance fill construction permitted between 11/2 - 4/30 at Dunewood and Lonelyville. All other areas: No Federal trust beach strand species of concern; no work restriction. <u>JUSTIFICATION</u> Time of year work restriction will ensure protection of Least Terns and Seabeach Amaranth. Nesting shorebird habitat. Federally listed herbaceous vegetation.

Sailors Haven (including Sunken Forest) to Cherry Grove	No dune construction No berm or advance fill construction between 4/1 - 11/1 (This time period encompasses the Piping Plover and Least Tern nesting season (4/1 - 9/15) and the Seabeach amaranth growing season (5/1 - 11/1)). Berm and advance fill construction permitted between 11/2 - 3/31. JUSTIFICATION Time of year work restriction will ensure protection of Piping Plovers, Least Terns and Seabeach Amaranth. High biological value. Regionally rare maritime forest. Nesting shorebird habitat. Federally listed herbaceous vegetation. Low breach vulnerability, with moderate risk of a breach becoming permanent. Beach profile meets design criteria. No structures on barrier island at risk.
Cherry Grove (including FI Pines) to Talisman	No dune, berm or advance fill construction between 5/1 - 9/15 Dune, berm and advance fill construction permitted between 9/16 - 4/30. JUSTIFICATION Time of year work restriction will ensure protection of Least Terns
Talisman (including Barrett Beach) to Water Island	No Federal trust beach strand species of concern: no work restriction.
Water Island to Davis Park	No dune, berm or advance fill construction between 4/1 - 9/15. Dune, berm and advance fill construction permitted between 9/16 - 3/31. JUSTIFICATION Time of year work restriction will ensure protection of Piping Plovers and Least Terns
Davis Park to Watch Hill Campground	No Federal trust beach strand species of concern; no work restriction. Federal trust beach strand species that are present in this reach nest on bayside habitat.
Watch Hill Campground (National Wilderness Area) to Smith Point Visitor Center	No construction Monitor effects of beach nourishment and advance fill at the "Smith Point Visitor Center to Smith Point County Park Access" reach from point of placement to a minimum 5 miles downdrift. JUSTIFICATION Very High biological value. Maritime Intertidal Swale rare habitat [G3/G4 and S2: less than 6 - 20 occurrences in New York State] FI Wilderness Area is the largest undeveloped and intact barrier beach system in the New York Bight Ecosystem (including the south shore of Long Island). FI Wilderness Area is the only Federally designated Wilderness Area in NY State. Extensive and minimally disturbed habitat for Federally and State listed threatened and endangered species. High value for migratory shorebirds and raptors, over-wintering waterfowl and locally rare plants and animals. Dune, berm, and advance fill will adversely affect barrier island and back bay ecological processes by decreasing the frequency of occurrence of overwash, breach, and inlet formation. The tidal marsh and mudflat system of this area exists as a result of the historic and present day occurrence of overwash, breach, and inlet formation processes, which have maintained this area as one of the largest and most highly productive system in the Great South Bay Estuary. Breaching and overwash processes at Old Inlet create and maintain critical habitat for the Federally listed Piping Plover and Seabeach Amaranth. High probability of storm breach at Old Inlet, however low probability of breach remaining open (restricted tidal prism due to extremely shallow bay bottom and small areal extent of eastern Great South Bay). Low to unlikely probability of breaching elsewhere. No relationship has been developed between storm year protection class and the probability of breaching at Old Inlet or any other areas on Fire Island. New DOI mandate emphasizing biological management of Federal lands to reduce regulatory pressure on private lands. No structures are at risk on this section of Fire Island.

Smith Point Visitor Center to Smith Point County Park Access	No Federal trust beach strand species of concern; no work restriction.
Smith Point County Park Access to Moriches Inlet	No construction Monitor effects of the Moriches Inlet sand-bypassing project from point of placement to a minimum 5 miles downdrift. JUSTIFICATION Very High biological value (shorebirds, vegetation). High value for migratory shorebirds and raptors, over-wintering waterfowl and locally rare plants and animals. Moderate to unlikely risk of breach with moderate risk of permanent inlet formation. No structures on barrier island at risk The tidal marsh and mudflat system of this area exists as a result of the historic and present day occurrence of overwash, breach, and inlet formation processes, which have maintained this area as one of the largest and most highly productive system in the Moriches Bay estuary.

Note: Permanent inlet formation, as discussed in this table, refers to the likelihood of an inlet forming that would not close naturally in a short period of time. Such an inlet would not be permanent in any practical sense due to the existing Breach Contingency Plan, which would close such an inlet within approximately 3 months.

GENERAL PREREQUISITES: Non reach-specific U.S. Department of Interior conditions for acceptance of U.S. Army Corps of Engineers Fire Island Interim Project

General Recommendations

1) Approve of FIIP, and issue NPS Special Use Permit, as a one time action only to ensure that project is truly interim.

2) COE will need to prepare a biological assessment and the USFWS will need to prepare a biological opinion for seabeach amaranth in order to develop a management plan to minimize disturbance to this species.

3) COE shall implement E and T species management plans using the VWHD Rapf Stipulation.

4) Resolve the legal issues surrounding ownership of the constructed dune and berm. No private construction permitted on constructed dunes and berms.

5) Develop a procedure to evaluate Federal barrier island protection plans in conjunction with state, county and private beach nourishment efforts and with bay navigational channel dredging projects. State, county, and private beach nourishment could minimize the role of Federal participation in beach nourishment. North-south channels create pressure points on the Bay side which increase the likelihood of breach. These issues need to be addressed and evaluated.

6) The Corps shall provide the DOI with their study rationale in light of its August, 1995, statement that the effectiveness of the FIIP plan in protecting the Long Island mainland from flooding will not be available until the Reformulation Study is completed.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue - Room 142
Boston, Massachusetts 02210-3334

April 23, 1996

Colonel Gary Thomas
District Engineer, New York District
ATTN: Mr. Stuart Piken, Chief, Planning Division
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Colonel Thomas:

By this correspondence I am following up on our letter of October 20, 1995, and several subsequent meetings and conversations between your staff and representatives of the Department of the Interior, regarding the proposed Fire Island Inlet to Moriches Inlet, Interim Storm Damage Protection Plan. We recognize that the Interim Plan is a work in progress, and note that the Department and the Corps are now actively engaged in discussions that will contribute to refinement of the proposal. Ongoing discussions notwithstanding, it is our intent to provide you with up to date information regarding our concerns about potential impacts to resources under the trusteeship of the Department, as well as recommendations that in many cases will minimize the potential for significant harm.

Background

The goal of the Interim Plan is to "provide for beach erosion control and hurricane protection," thus minimizing the vulnerability of Fire Island and adjacent mainland communities to breaches of the barrier island and potential inlet formation. The 32 mile Interim Plan, in combination with the Breach Contingency Plan (prepared in cooperation with the National Park Service), will provide a limited level of protection until completion and implementation of the larger, 83 mile, Fire Island Inlet to Montauk Point Hurricane and Storm Damage Reduction Reformulation Study.

A brief digression on the history of the Reformulation Plan is warranted here. The Reformulation Plan was originally conceived as the Fire Island Inlet to Montauk Point Combined Beach Erosion Control and Hurricane Project. The Environmental Impact Statement for the Hurricane Project was referred to the Council on Environmental Quality in 1978. CEQ, finding the EIS deficient, provided important guidance to the Corps which remains relevant, including the following:

> "We also agree, therefore, that the evaluation of alternative courses of action and their environmental impacts and acceptability is required for the entire system and must be presented in a single statement, prior to proceeding with any part of the proposal."

CEQ's finding, and the Corps' concurrence, led to the development of the Reformulation Plan.

A second, related, decision by CEQ in January, 1979, allowed the Corps to proceed with an interim proposal in Reach II of the original Hurricane Project, referred to as the Westhampton Project. While CEQ's decision was limited to the Westhampton Project, it outlined several important threshold standards that the Westhampton interim proposal met: The proposal was "...(1) limited to those areas for which it is essential; (2) designed and implemented in an environmentally responsible fashion; and, (3) does not involve actions that are inconsistent with the reformulated project planning."

Thus, in order to assist you in your project planning efforts, we have tailored our recommendations so as to follow CEQ's performance standards for an interim project, which may be interpreted as follows in the current context:

- The project should be truly interim in nature, superseded if appropriate by the Reformulation Plan;
- The project should be of independent utility (e.g., not meeting the definition of "connected" under 40 CFR 1508.25);
- The project will not result in a significant negative environmental impact; and,
- The proposal will ultimately reflect the evaluation of alternatives as required under § 102(2)(E) of NEPA, and 40 CFR 1508.9.

Recommendations

Categorical recommendations were first presented to you in the December, 1995 meeting, which were generally similar to the detailed analysis of the project and associated impacts presented in a reach by reach fashion in Appendix A, along with accompanying recommendations. Given that the geomorphological characteristics of Fire Island are highly changeable, and that the potential exists for project modifications, Mr. Piken invited the Department to identify the areas or issues which would preclude Departmental support for an Environmental Assessment. Thus, you will find that the recommendations in Appendix A are presented so that all three levels of construction (dunes, berms, or placement of advanced fill, singly or in combination) are addressed for each reach.

The attached recommendations are designed to minimize the potential for significant negative impacts that would otherwise result from the proposed project--based on work described by the Corps in February, 1996, performed as a one-time interim project pending completion of the Reformulation Plan. In areas where existing human impacts and alterations have already eroded natural resources to some degree, the reach-specific conditions are generally time-of-year restrictions. In three areas with high biological value, both ends of the island and the Wilderness Area within the Fire Island National Seashore, construction is not recommended because such activities will change, by design, the characteristics that have created these unique and complex wildlife habitats. These habitats support wealth of natural biota, including many species of state concern and the Federally threatened piping plover and seabeach amaranth (please see Appendix A). Based upon existing information regarding barrier beach ecosystems and the species which utilize these habitats, significant negative impacts will result from the anticipated habitat changes.

The Corps' proposal for the reach east of Watch Hill is located both adjacent to the Wilderness Area and within the Fire Island National Seashore boundary. For the proposal to go forward, the National Park Service will have to issue a special use permit to the Corps, which in and of itself constitutes a Federal action triggering NEPA. To evaluate the potential impacts of the proposed permit, the Department must look to the clearly identified management and statutory responsibilities governing this area and those created by the Wilderness Act, including but not limited to the following sections:

- "An area of wilderness is further defined to mean in this chapter an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational scenic, or historical value." P.L. 88-577, 16 U.S.C. § 1131.

- "Except as otherwise provided in this chapter, each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the

> area and shall so administer such area for such other purposes for which it may have been established as also to preserve it wilderness character." §1133(b)

Moreover, the National Park Service expressed its view of the significance of the area as early as March, 1978, prior to the Wilderness designation: "...the area extending from east of Watch Hill to Smith Point has been designated an Environmental Protection/Primitive zone. No direct sand nourishment activities will be permitted in this area, on the beach or the dunes."

With regard to NEPA requirements, the Department will rely heavily on the following sections of 40 CFR 15008.27 in determining the appropriate level of NEPA analysis and documentation:

> "(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas."

> "(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973."

Given the nature of the proposal and associated impacts, the guidance set forth above directs the Department to prepare a full EIS on the permitting action, should it encompass the area east of Watch Hill; the Corps' NEPA responsibilities can be no less.

It is important to mention at this point that the Corps is now exploring an alternative that may preempt the need for construction adjacent to the Wilderness Area, while at the same time addressing concerns over excessive beach erosion, particularly in the area referred to as Old Inlet. The Department has previously made reference to such an approach in our December 6 meeting (item K in the meeting minutes, "alternative placement methods," and in Appendix A: "Monitor the effects of the Moriches Inlet sand-bypassing project from point of placement to a minimum 5 miles downdrift." Department representatives are now working with the Corps on this alternative.

I can assure you that we will also work with you to explore the potential for mitigation of project impacts as alternatives are refined.

Reformulation Plan. In a recent discussion I had with Mr. Stuart Piken about the potential impacts of the proposed project on the Wilderness Area, I inquired as to the timing of the project--actual construction. I was informed that the proposed work probably will not be initiated any earlier than 1998. Under the Reformulation Plan the U.S. Fish and Wildlife Service is in the process of developing a Habitat model for the Federally listed piping plover. When the model is completed, a Habitat Evaluation Procedures (HEP) Study will be undertaken. The results of the HEP, tentatively scheduled for completion in 1997, will improve the ability of the Service and the Corps to quantitatively assess the impacts of beach construction projects on plovers. While the overlapping utility of the HEP study is important, an overarching point is reinforced: The final documentation for the current Interim Project, and all future interim proposals, should explicitly reference the Reformulation Plan. Relationships between project time lines, ongoing or planned studies, and known or anticipated construction proposals, should be clearly identified. Moreover, the potential for delays to the Reformulation Plan, and implications for the interim projects, should also be highlighted.

For instance, as now scheduled, the current Interim Project will have construction initiated sometime in 1998, with a renourishment schedule of three years. This would place the first renourishment schedule in the approximate time frame of the Reformulation Plan completion (2002-2003); any renourishment, should be prefaced by the results of the Plan. Therefore, we recommend that renourishment not be undertaken until the Reformulation Plan is complete. To tie the renourishment schedule to the Reformulation Plan schedule should be advantageous to the Corps, especially considering ongoing studies.

With regard to the Reformulation Plan, the Department will be transmitting to you under separate cover recommendations pertaining to a preliminary list of studies to be conducted under the Reformulation Plan, including studies addressing shoreline shoreline changes, the effects of inlets and overwash on bayside circulation and marsh creation, the relationships amongst plover habitat, foraging resources and productivity, and impacts on the borrow areas.

Last, it is my understanding that the design standards for the Interim Project have recently changed (e.g., increases to dune height). I am requesting that we receive documentation pertaining to the proposed changes, including the geographic extent of work that might have to be conducted according to the new standards.

Thank you for the opportunity to provide you with information about the resources under the Department's trusteeship. The Department is committed to working closely with the Corps on this important project. Please do not hesitate to request additional information or assistance as the project design progresses.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

Enclosure

cc: J. Hauptman, NPS/FINS
R. McIntosh, NPS/NEFO
D. Clark, NPS/NESSO
M. Foley, NPS/NESSO
J. Allen, NBS
R. Lepore, SOL/NE
S. Morgan, FWS/NYFO
D. Stillwell, FWS/NYFO
B. Murray, FWS/LIFO
R. Abele, FWS/R5

__Fire Island Interim Project Reach-Specific Prerequisites:__ **Conditions for acceptance of U.S. Army Corps of Engineers Fire Island Interim Project**

The following prerequisites are based upon March, 1996, natural resources data and April, 1995 beach and shoreline conditions of Fire Island. Should future occurrences of fish and wildlife resources cause us to modify our natural resources data base, or should actual beach and shoreline conditions change prior to the finalization of the USACE planning process, the DOI reserves the right to review any such new plans and develop new reach-specific conditions if warranted.

REACH	REACH-SPECIFIC CONDITIONS
Fire Island Inlet to Robert Moses State Park most westward parking area	No construction JUSTIFICATION No likelihood of breach formation Limited public infrastructure at risk Very High biological value
Robert Moses State Park most westward parking area to Fire Island Light House Visitor Center	No berm or advance fill construction between 4/1 - 9/15 Dune, berm, and advance fill construction permitted between 9/16 - 3/31. No time of year work restriction at the Water Tower area where there are no concerns. JUSTIFICATION Time of year work restriction will ensure protection of Piping Plovers and Least Terns. Low to moderate biological value. Beach construction can protect public infrastructure which is at risk on this section of Fire Island. Low likelihood of breach with moderate possibility breach could remain open.
Fire Island Light House Visitor Center to Kismet	No dune construction. No berm or advance fill construction between 4/1-9/1. Berm, and advance fill construction permitted between 9/2 - 3/31. JUSTIFICATION Time of year work restriction will ensure protection of Piping Plovers. No infrastructure at risk on Fire Island. Low likelihood of breach with moderate possibility breach could remain open. Existing berm and dune already meet design criteria. Moderate biological value.
Kismet (and eastwardly communities) to Sailors Haven	No construction between 5/1 - 9/1 at Atlantique Dune, berm, and advance fill construction permitted between 9/2 - 4/30 at Atlantique No construction between 5/1-11/1 at Dunewood, Lonelyville (This time period encompasses the Least Tern nesting season (5/1 - 9/15) and the Seabeach Amaranth growing season (5/1 - 11/1)). Dune, berm, and advance fill construction permitted between 11/2 - 4/30 at Dunewood and Lonelyville. All other areas: No Federal trust beach strand species of concern; no work restriction. JUSTIFICATION Time of year work restriction will ensure protection of Least Terns and Seabeach Amaranth. Nesting shorebird habitat. Federally listed herbaceous vegetation.

Sailors Haven (including Sunken Forest) to Cherry Grove	No dune construction No berm or advance fill construction between 4/1 - 11/1 (This time period encompasses the Piping Plover and Least Tern nesting season (4/1 - 9/15) and the Seabeach amaranth growing season (5/1 - 11/1)). Berm and advance fill construction permitted between 11/2 - 3/31. JUSTIFICATION Time of year work restriction will ensure protection of Piping Plovers, Least Terns and Seabeach Amaranth. High biological value. Regionally rare maritime forest. Nesting shorebird habitat. Federally listed herbaceous vegetation. Low breach vulnerability, with moderate risk of a breach becoming permanent. Beach profile meets design criteria. No structures on barrier island at risk.
Cherry Grove (including FI Pines) to Talisman	No dune, berm or advance fill construction between 5/1 - 9/15 Dune, berm and advance fill construction permitted between 9/16 - 4/30. JUSTIFICATION Time of year work restriction will ensure protection of Least Terns
Talisman (including Barret Beach) to Water Island	No Federal trust beach strand species of concern; no work restriction.
Water Island to Davis Park	No dune, berm or advance fill construction between 4/1 - 9/15. Dune, berm and advance fill construction permitted between 9/16 - 3/31.* JUSTIFICATION Time of year work restriction will ensure protection of Piping Plovers and Least Terns
Davis Park to Watch Hill Campground	No Federal trust beach strand species of concern; no work restriction. Federal trust beach strand species that are present in this reach nest on bayside habitat.
Watch Hill Campground (National Wilderness Area) to Smith Point Visitor Center	No construction Monitor effects of beach nourishment and advance fill at the "Smith Point Visitor Center to Smith Point County Park Access" reach from point of placement to a minimum 5 miles downdrift. JUSTIFICATION Very High biological value. Maritime Intertidal Swale rare habitat [G3/G4 and S2: less than 6 - 20 occurrences in New York State] FI Wilderness Area is the largest undeveloped and intact barrier beach system in the New York Bight Ecosystem (including the south shore of Long Island). FI Wilderness Area is the only Federally designated Wilderness Area in NY State. Extensive and minimally disturbed habitat for Federally and State listed threatened and endangered species. High value for migratory shorebirds and raptors, over-wintering waterfowl and locally rare plants and animals. Dune, berm, and advance fill will adversely affect barrier island and back bay ecological processes by decreasing the frequency of occurrence of overwash, breach, and inlet formation. The tidal marsh and mudflat system of this area exists as a result of the historic and present day occurrence of overwash, breach, and inlet formation processes, which have maintained this area as one of the largest and most highly productive system in the Great South Bay Estuary. Breaching and overwash processes at Old Inlet create and maintain critical habitat for the Federally listed Piping Plover and Seabeach Amaranth. High probability of storm breach at Old Inlet, however low probability of breach remaining open (restricted tidal prism due to extremely shallow bay bottom and small areal extent of eastern Great South Bay). Low to unlikely probability of breaching elsewhere. No relationship has been developed between storm year protection class and the probability of breaching at Old Inlet or any other areas on Fire Island. New DOI mandate emphasizing biological management of Federal lands to reduce regulatory pressure on private lands. No structures are at risk on this section of Fire Island.

Smith Point Visitor Center to Smith Point County Park Access	No Federal trust beach strand species of concern; no work restriction.
Smith Point County Park Access to Moriches Inlet	No construction Monitor effects of the Moriches Inlet sand-bypassing project from point of placement to a minimum 5 miles downdrift. JUSTIFICATION Very High biological value (shorebirds, vegetation). High value for migratory shorebirds and raptors, over-wintering waterfowl and locally rare plants and animals. Moderate to unlikely risk of breach with moderate risk of permanent inlet formation. No structures on barrier island at risk The tidal marsh and mudflat system of this area exists as a result of the historic and present day occurrence of overwash, breach, and inlet formation processes, which have maintained this area as one of the largest and most highly productive system in the Moriches Bay estuary.

Note: Permanent inlet formation, as discussed in this table, refers to the likelihood of an inlet forming that would not close naturally in a short period of time. Such an inlet would not be permanent in any practical sense due to the existing Breach Contingency Plan, which would close such an inlet within approximately 3 months.

GENERAL PREREQUISITES: Non reach-specific U.S. Department of Interior conditions for acceptance of U.S. Army Corps of Engineers Fire Island Interim Project

General Recommendations

1) Approve of FIIP, and issue NPS Special Use Permit, as a one time action only to ensure that project is truly interim.

2) COE will need to prepare a biological assessment and the USFWS will need to prepare a biological opinion for seabeach amaranth in order to develop a management plan to minimize disturbance to this species.

3) COE shall implement E and T species management plans using the VWHD Rapf Stipulation.

4) Resolve the legal issues surrounding ownership of the constructed dune and berm. No private construction permitted on constructed dunes and berms.

5) Develop a procedure to evaluate Federal barrier island protection plans in conjunction with state, county and private beach nourishment efforts and with bay navigational channel dredging projects. State, county, and private beach nourishment could minimize the role of Federal participation in beach nourishment. North-south channels create pressure points on the Bay side which increase the likelihood of breach. These issues need to be addressed and evaluated.

6) The Corps shall provide the DOI with their study rationale in light of its August, 1995, statement that the effectiveness of the FIIP plan in protecting the Long Island mainland from flooding will not be available until the Reformulation Study is completed.

In addition to those natural resource values identified by U. S. Fish & Wildlife Service (which are fully supported by the National Park Service, the NPS <u>adds</u> the following values which relate directly to its specific legislated responsibilities to managing Fire Island National Seashore.

1. Storm Damage Protection (both Long Island and Fire Island)

2. Access

   a. Recreational Access

   b. Administrative Access (including school buses)

   c. Emergency Access (including fire, police, evacuation, etc.)

3. Infrastructure

   a. Utilities

   b. Private Property

   c. Public Property

4. Aesthetics

   a. Natural (Scenic) Values

   b. Cultural Landscape Values

5. Recreational Opportunities

REACH: Kismet to Sailors Haven

VALUES:

Storm Damage Protection

Very high potential due to density of development in this reach of the island - High potential for damage to Long Island

Access

Recreation - No available existing beach in this reach, little or no recreational access - improvements in beach condition here would significantly enhance recreational access

Administration - Very critical existing situation as this reach provides link to the mainland

Emergency - Evacuation, Police, Fire and Medical Emergencies are critical concerns

Infrastructure

Utilities - Highest within this reach

Private Property - Highest density on island with greatest number of year-round homes

Public Property - Town Beach and marina at Atlantique - Many other community facilities in Kismet, Saltaire, Fair Haven and Ocean Beach, including libraries, schools, medical clinics and public safety facilities

Aesthetics

High cultural landscape values throughout most developed areas

Recreational Opportunities

With little or no beach, most recreational opportunities are related to developed facilities

REACH: Sailors Haven to Cherry Grove

VALUES:

Storm Damage Protection

Potential is low in this reach

Access

Recreation - low (existing)

Administration - critical access route via beach to school and main land for developed communities to the east

Emergency - Evacuation, Police and Fire

Infrastructure

Utilities - Very high at western end of reach

Private Property - No private facilities at risk

Public Property - Few public facilities at risk

Aesthetics

High natural (scenic) landscape values

Recreational Opportunities

Environmental education, Swimming, fishing, Major Visitor Center is located in this reach

REACH: Water Island to Davis Park

VALUES:

Storm Damage Protection

Very HIGH vulnerability for damage to Long Island in the event of a breach - This area has the greatest tidal phase differential within the Great South Bay, has the most narrow cross section. Recurved dune pattern is particularly susceptible to breaching.

Access

Recreation - No interior road in this reach, all access along the beach

Administration - All movement is beach dependent

Emergency - Police, Fire and Evacuation issues are critical, ie., Water Island is dependent upon the emergency service of adjacent communities

Infrastructure

Utilities - serious concern, utility feed lines to eastern portion of the island (including the NPS Visitor Center) passes through this area

Private Property - low density residential development - no year round residents

Public Property - little public infrastructure

Aesthetics

Mix of cultural and scenic landscape values

Recreational Opportunities

No public or private developed recreational facilities

REACH: Watch Hill to Smith Point Visitor Centor

VALUES:

Storm Damage Protection

Old Inlet area has a high to moderate probability of breaching - although potential damage to Long Island is not as great as in other areas.

Access

Recreation - This is the only area within the National Seashore where this activity occurs.

Administrative - Beach provides the <u>only</u> winter access route through this area.

Emergency - Police, Fire and Evacuation concerns are critical

Infrastructure

None

Aesthetics

- Very High natural (scenic) landscape values

Recreation Opportunities

ORV, Fishing Hiking, Birding, Nature Study, etc.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

February 9, 1996

Environmental Analysis Branch
Environmental Assessment Section

Ms. Sherry Morgan
Field Supervisor
New York Field Office
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, NY 13405

Dear Ms. Morgan:

Enclosed for your review is the latest fill layout plan for the New York District's proposed Fire Island Interim Project. The proposed plan includes the beach and dune layout based on the April 1995 topographic maps. The fill baseline is indicated by a thin green line. The beach fill at the 9.5 ft NGVD and 0 ft NGVD contours are indicated by blue lines. The proposed dune construction is highlighted by a thick light green line. In certain areas the dune alignment may be shifted landward or seaward to accommodate for real estate requirements.

Compared to our previous plan, this plan more accurately shows the level of work anticipated for this interim project. As you can see, the currently proposed plan has minimized fill requirements in the Fire Island Wilderness Area. It has been determined that the existing primary and secondary dune elevations for most of the Wilderness Area would provide the necessary level of storm protection over the project's life. You will also notice that a section of Smith Point County Park was included for analysis.

We hope this plan will enable you to finalize the Scope of Work for your Fish and Wildlife Coordination Act Report. As you know, the District wants to move forward and resolve this aspect of the environmental coordination. We would like to schedule another meeting in the near future to resolve any outstanding issues. Mr. Steven Papa of my office will coordinate with your staff to determine a convenient time to meet.

Sincerely,

Stuart Piken, P.E.
Chief, Planning Division

Enclosure

NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

5 February 1996

Planning Division
Coastal Section

Commissioner Michael R. Frank
Dept. of Parks, Recreation and Conservation
Suffolk County
Montauk Highway P.O. Box 144
West Sayville, New York 11796-0144

Dear Mr. Frank:

This is in response to your 10 January 1996 letter regarding your request for the inclusion of Smith Point County Park into the Interim plan currently being proposed for Fire Island as part of the Fire Island Inlet to Montauk Point study. We are currently evaluating the situation at Smith Point Park for inclusion into the project, due to exacerbated erosion in the vicinity of the park facilities.

In your letter, you request a "permanent solution to the coastline erosion". Although this project would reduce the potential for damage to your facilities, it is not intended to provide a permanent solution. It should be expected that the shoreline will continue to erode even with the placement of fill in this area. We are concurrently proceeding with a reformulation study of the entire Fire Island Inlet to Montauk Point project, which is intended to evaluate potential long term solutions for the south shore of Long Island.

As discussed during our meeting on 5 January 1996, enclosed for your use is a copy of the latest topographic mapping for the Suffolk County Park lands at Moriches and Shinnecock Inlets, which is based on an April 1995 flight survey.

If you have any additional questions regarding the status of the interim project at Fire Island, or require any additional information, please do not hesitate to contact Mr. Joseph Vietri, Deputy Chief of Planning Division at (212) 264-0223 or Mr. Stephen Couch, study manager at (212) 264-9077.

Sincerely,

Joseph Vietri

Stuart Piken, P.E.
Chief, Planning Division

cf:
William Daley, NYSDEC
Jack Hauptman, NPS-FINS

Congress of the United States
House of Representatives
Washington, DC 20515

January 16, 1996

Honorable Bruce Babbitt
Secretary of the Interior
Department of the Interior
Washington, D.C. 20240

Dear Mr. Secretary:

We seek your assistance in promoting a speedy resolution to the few issues that stand in the way of a much-needed Interim Project that will provide erosion protection to Fire Island, New York, and flood protection to Long Island's south shore. We understand that there has been difficulty in resolving some issues that have arisen between the action agency [the U.S. Army Corps of Engineers (COE)], and the project sponsor [the New York State Department of Environmental Conservation (NYSDEC)] on the one hand, and the U.S. Department of the Interior (DOI) through the U.S. Fish and Wildlife Service (FWS) and the National Park Service (NPS) on the other.

We are told that the primary concerns of the involved parties center around the relationship between the Interim Project and a future and more comprehensive, longer-term project that will be based on a Reformulation Study covering an 83-mile stretch of coastline. The Reformulation Study and an associated Environmental Impact Statement (EIS) will not be completed until at least 2003, with Study recommendations taking many additional years to implement. Based on the history of storm damage at Fire Island over the past decade, we fear that unless the Interim Project moves forward quickly, the barrier island may be in danger of breaching. This may place the safety of thousands of Long Islanders in jeopardy and may result in damage to property, businesses and infrastructure as well as coastal ecosystems, including portions of the Fire Island National Seashore and Wilderness Area and the Great South Bay. As we understand, the DOI has expressed concerns that the Reformulation Study EIS will not be completed, and that the interim project could be a stand-alone project for 30 years.

Attempts to resolve concerns over the scope and magnitude of the interim project have been ongoing, however, we are told that the parties have come to an impasse over the State's requirement for a 30-year life on the Interim Project, the COE's engineering and benefit analysis over this time frame, and FWS' reluctance to authorize a 30-year "interim" project without an up-front EIS. Further, we have been informed that the COE and New York State have negotiated several potential means for resolving this issue, however, each time that an agreement on the Interim Project appears close, DOI representatives seem to reconsider their position causing further delay.

The parties are committed to proceeding with the more extensive Reformulation Study and to the full EIS that would accompany the Study. However, the short term risk of catastrophic storm damage has fostered a sense of urgency to proceed with the Interim Project as quickly and prudently as possible. We trust that a solution can be found that will satisfactorily address the issues concerning the Interim Project. Therefore, we would appreciate your assistance in helping to resolve any outstanding issues of concern with respect to proceeding with the Interim Project.

Thank you for your prompt attention to this matter.

Sincerely,

ALFONSE M. D'AMATO
UNITED STATES SENATOR

DANIEL PATRICK MOYNIHAN
UNITED STATES SENATOR

RICK LAZIO
MEMBER OF CONGRESS

MICHAEL FORBES
MEMBER OF CONGRESS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930

OCT 27 1995

Mr. Stuart Piken, P.E.
Chief, Planning Division
Department of the Army
New York District
Corps of Engineers
26 Federal Plaza
New York, New York 10278-0090

Dear Mr. Piken:

This responds to your announcement of intent to study beach fill alternatives to provide storm damage protection between Fire Island and Moriches Inlets on the south shore of Long Island. The Planning Division announcement stated that this action and a similar activity between Moriches and Shinnecock Inlets require "critical temporary" measures until the full Fire Island Inlet to Montauk Point reformulation study is completed. Although recent coastal storms have exacerbated coastal erosion in the Fire Island region, we are concerned that the proposal may not be in accordance with earlier guidance on this project from the Council on Environmental Quality (CEQ). We would appreciate an assessment as to why these or other reaches in the Fire Island region are under consideration for "emergency" beach fill, and what the magnitude of the emergency work will be.

We recently discussed this project with Messrs. Steven Pappa and Stephen Couch of the New York District's Planning Division, indicating our concern with the proposed scope of work for the comprehensive reformulation study (Atlantic Coast of Long Island from Fire Island Inlet to Montauk Point). We noted that while some interim activities may be necessary, continuous interim measures would effectively piecemeal the project and associated impacts. The CEQ recommended against piecemealing and the interagency working group agreed to follow these recommendations. Such agreements should not be rejected arbitrarily.

Federally listed marine species occur in the project region and informal consultations pursuant to Section 7 of the Endangered Species Act are necessary for all in-water activities. As we have indicated on previous occasions, the listed species of concern to this agency that occur in the Fire Island region include the threatened loggerhead (<u>Caretta caretta</u>), the endangered Kemp's ridley (<u>Lepidochelys kempii</u>), leatherback (<u>Dermochelys coriacea</u>) and green (<u>Chelonia mydas</u>) sea turtles as well as endangered fin (<u>Balaenoptera physalus</u>), humpback (<u>Megaptera novaeangliae</u>) and right (<u>Eubalaena glacialis</u>) whales.

As you prepare your assessment of potential interactions with federally listed marine species, we offer the following information for your consideration:

1) Because they feed upon pelagic prey, the whales and leatherback turtles are unlikely to be affected by the dredging, but could be susceptible to collisions with the hopper scows or other vessels.

2) The other listed sea turtle species prey upon benthic organisms and could be susceptible to dredging in the borrow areas. In particular, hopper dredges are known to lethally take sea turtles. Accordingly, work planned when sea turtles may be present will require special protective measures that prevent adverse interactions among protected species and the dredging equipment.

New information describing existing conditions is needed to assess the benthic community structure at proposed borrow sites, and to better define the local topography and sediment characteristics in each of those sites. We are especially concerned that much of the existing data describing the proposed borrow areas is approximately 20-25 years old, and may no longer portray the species composition of the benthic community accurately. New information is necessary not only to determine the suitability of the proposed borrow areas, but to assess the potential for adverse interactions between protected marine species and the dredging equipment. Your staff already has been provided with a list of contacts within our Northeast Fisheries Science Center and the private sector from which you might collect additional information to plan or supplement field assessments of the proposed borrow areas.

My staff is available to assist as the New York District completes the feasibility and reformulation studies for the proposed storm damage reduction project. To date, we have received no notification for any upcoming meetings. We would appreciate a projected schedule if available. If other arrangements have not been made, we request that the meeting schedule be coordinated with the regular interagency joint permit processing meetings chaired by the Regulatory Branch at 26 Federal Plaza. Should you wish to discuss this matter further, please contact Diane Rusanowsky at (203) 783-4228.

Sincerely,

Dr. Andrew A. Rosenberg
Regional Director

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue - Room 142
Boston, Massachusetts 02210-3334

October 20, 1995

Colonel Gary Thomas
District Engineer, New York District
ATTN: Mr. Stuart Piken, Chief, Planning Division
U.S. Army Corps of Engineers
26 Federal Plaza
New York, NY 10278

Dear Colonel Thomas:

This letter pertains to the ongoing discussions between the U.S. Army Corps of Engineers (Corps) and Department of the Interior Bureaus (National Park Service and Fish and Wildlife Service) regarding the proposed Fire Island Inlet to Moriches Inlet, Interim Storm Damage Protection Plan (Fire Island Interim Project). The 32 mile Fire Island Interim Project will affect an area which comprises over one-third of the larger 83 mile Fire Island Inlet to Montauk Point Hurricane and Storm Damage Reduction Project Reformulation Study (FIMP). This correspondence represents a unified position of the Department, necessitated by the involvement and concerns of more than one Bureau or Office within the Department.

Background

The Department is cognizant of the Corps' desire to minimize the vulnerability of the barrier island and adjacent communities to storm damage, through an interim design alternative, until the reformulation study is completed. The solution proposed by the Corps includes implementation of the Corps' "Breach Contingency Plan" and the proposed Fire Island Interim Project.

The Department has been communicating with the Corps in order to ensure that proposed actions contain adequate safeguards for resources under our jurisdiction within the FIMP and the Fire Island Interim Projects: fish and wildlife resources, threatened and endangered species, Coastal Barrier resource units, units of the National Park and Fish and Wildlife Refuge systems, and a designated Wilderness Area.

Fire Island Interim Project

We have received a copy of the Corps' September 19, 1995 transmittal to the U.S. Fish and Wildlife Service (Service) which provided a description of the Interim Project layout, cross-section, borrow area and other information. Your letter requested that the Service provide comments on environmental aspects of the proposed plan. Your letter stated that all involved agencies are continuing to work with the Corps in an ongoing process of evaluating coastal, environmental, and economic concerns to minimize the scope of the project, while affording an acceptable level of resource protection. The Department is committed to working with the Corps in a cooperative manner to achieve the stated goal.

Based on conversations with Corps staff, it is our understanding that the proposed Interim Project may not necessarily result in dune and berm construction, built to the design cross-sections, throughout the entire 32 mile length of Fire Island. However, project information provided to us does not include the criteria which the Corps will use to determine those areas in which the actual construction will occur. Further, information provided to us does not contain maps delineating the length or extent of areas where dunes and berms will be constructed. We requested that this information be provided with the beach and dune survey and profile "topo-mapping" that will be made available on October 20. Your staff have confirmed, in subsequent conversations with the Fish and Wildlife Service, that this information is now in transit.

Department Review/National Environmental Policy Act Requirements

As your are aware from the discussions between Corps and Bureau staff, in our review of the Interim Project data, we will be considering a number of important factors as guidance under NEPA, including the Council on Environmental Quality's decisions in 1978 regarding the Fire Island Inlet to Montauk Point Combined Beach Erosion Control and Hurricane Project, and the Westhampton portion of the FIMP project area. Because of the long standing Departmental concerns about project segmentation, it is important that we determine whether the project has independent utility. In addition, the question of whether an Environmental Assessment or Environmental Impact Statement is appropriate, remains unresolved. Upon receipt of the October 20 submission, we will continue our evaluation, working with you on matters including the scope of the project, impacts, and NEPA compliance.

Given that potential environmental impacts of this proposed project cannot be determined until we have more specific, detailed project information, it is not possible for the Service to agree to a Scope of Work for a Fish and Wildlife Coordination Act report at this time. We will be able to make a better determination in this regard upon evaluation of the new information.

We look forward to continuing cooperation with the Corps on this project. While bureau staff will continue to work with Corps staff, we agree that it would be advisable for the Corps, the Fish and Wildlife Service and the National Park Service to meet to discuss the proposed Fire Island Interim Project and coordination efforts on the Reformulation Study. Please contact me at 617-223-8565 to discuss potential meeting dates.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

cc: NPS, NESO (R. McIntosh)
NPS, NESO (D. Clark)
NPS, NESO (M. Foley)
NPS, FINS (J. Hauptman)
FWS, Hadley, MA (C. Short)
FWS, Hadley, MA (R. Pisapia)
FWS, Hadley, MA (R. Abele)
FWS, Hadley, MA (L. Zicari)
FWS, Cortland, NY (S. Morgan)
FWS, Islip (R. Murray)
SOL, NE (R. Lepore)
NBS, C/O NPS, NESO (J. Allen)

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Mr. Michael Ludwig
NMFS-Milford Lab
212 Rogers Avenue
Milford, CT 06460
Attn: Ms. Diane Rusanowsky

Dear Mr. Ludwig:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

Enclosed is a description of the plan currently being evaluated for the Fire Island Inlet to Moriches Inlet interim project. Please note that the only deviation from the previously discussed interim plan is the evaluation of Robert Moses State Park, and the Smith Point County Park (See enclosure). The enclosed information describes the plan currently under consideration, and is intended for use by all agencies and the District in further developing and analyzing this project.

It should be noted that the District, and all involved agencies are currently involved in a dynamic process of evaluating the coastal, environmental, and economic concerns to minimize the scope of the project, while affording an acceptable level of protection. Therefore, we would appreciate any preliminary comments you can provide on environmental aspects of this proposed plan.

It is essential that we work out all issues as they pertain to this study and to ensure that cooperation between the New York District and your agency is maximized, due to the accelerated project schedule. This schedule has been accelerated due to conditions resulting from recent coastal storms. There have been numerous overwashes and excessive shoreline recession in the most recent storm events. The susceptibility of the shoreline to future storm events would be reduced by the proposed interim project, by affording an acceptable level of protection prior to completion of the reformulation study.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Mr. Robert Hargrove
Chief, Env. Impacts Branch
U.S. Env. Protection Agency
Region II
26 Federal Plaza
New York, NY 10278

Dear Mr. Hargrove:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Mr. Paul Weberg
Senior Engineer
Federal Emergency Management Administration
26 Federal Plaza
New York, NY 10278

Dear Mr. Weberg:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Mr. Douglas Beach
National Marine Fisheries Service
Habitat Conservation Branch
One Blackburn Drive
Gloucester, MA 01931-2298

Dear Mr. Beach:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Mr. Fred Anders
NYS, Department of State
162 Washington Ave.
Albany, NY 12231

Dear Mr. Anders:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Mr. Jack Hauptman, Superintendent
NPS, Fire Island National Seashore
120 Laurel Street
Patchogue, NY 11772

Dear Mr. Hauptman:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Dr. Mary K. Foley
Regional Chief Scientist
N.P.S., North Atlantic Region
15 State Street
Boston, MA 02109

Dear Dr. Foley:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

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DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

September 25, 1995

Planning Division
Coastal Section

Mr. William Daley
Flood Protection Bureau
New York State
Dept. of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Dear Mr. Daley:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to look at only a beachfill alternative. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed, which will evaluate the full analysis of alternatives as part of the 10 year effort.

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Our staff is currently coordinating a series of monthly meetings in order to keep all agencies informed of the status of this study. Any questions regarding the currently proposed plan can be directed towards Mr. Stephen Couch at (212) 264-9077. Mr. Steve Papa, (212) 264-6070 is also available for any questions regarding environmental coordination.

Sincerely,

Joseph Vietri

~~STUART PIKEN, P.E.~~
CHIEF, PLANNING DIVISION

Encl.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO ATTENTION OF

June 21, 1995

Environmental Analysis Branch
Environmental Assessment Section

Ms. Sherry Morgan
Field Supervisor
U.S. Fish and Wildlife Service
3817 Luker Road
Cortland, New York 13045

Dear Ms. Morgan:

The U.S. Army Corps of Engineers, New York District (NYD), is conducting a feasibility level study to determine an interim design alternative for storm-damage reduction between Fire Island Inlet and Moriches Inlet until the overall Reformulation Study for the Atlantic Coast of Long Island, Fire Island to Montauk Point, New York is complete. This interim project will look at a beachfill alternative, while the full analysis of alternatives will be conducted as part of the ten year Reformulation Study.

The enclosed conceptual plan presents a description of the proposed project including layout area, cross-section, and the borrow area. The conceptual plan has its limitations in that the definitive layout of the project area is not yet available. The District anticipates a more definitive plan to be available by the end of July, 1995.

The District would like to initiate coordination with the USFWS regarding the potential impacts of the proposed project on natural resources, threatened and endangered species, and Coastal Barrier Resource (CBRS) units by way of preparation of a detailed report in accordance with the Fish and Wildlife Coordination Act (48 Sta. 401, as amended; 16 U.S.C. 661 et seq.). The District requests a meeting with your Long Island Field Office staff to develop a Scope of Work (SOW) concerning the tasks entailed. The SOW will also include milestone dates to mark completion of each task.

Please contact Mr. Peter Weppler of my staff at (212) 264-4663 to discuss the particulars of the meeting or if you have any questions. The District is looking forward to working with your agency on this project.

Sincerely,

Stuart Piken

Stuart Piken, P.E.
Chief, Planning Division

Enc.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

CENAN-PL-FN

NOTICE OF STUDY INITIATION
FIRE ISLAND INLET TO MORICHES INLET
STORM REDUCTION STUDY

The Army Corps of Engineers is conducting a comprehensive Reformulation Study for the Atlantic Coast of Long Island from Fire Island Inlet to Montauk Point, covering 83 miles of shoreline. While the comprehensive effort, which is expected to take 10 years, is underway, studies of interim measures to provide shore protection are being conducted.

This notice announces the initiation of an evaluation of the reach from Fire Island Inlet to Moriches Inlet to determine whether storm damage reduction measures are justified for Federal participation. The barrier island portion of the study area is approximately 26 miles in length, and generally less than 2,500 feet wide. Fire Island is separated from the mainland of Long Island by the Great South Bay. The area which would be protected includes the Atlantic and bay shorelines, the barrier island, bay areas and mainland areas behind the island. The study area includes the mainland communities of Bayshore, Islip, Oakdale, Sayville, Bayport, Blue Point, Patchogue, Bellport, and Brookhaven, which are frequently inundated due to storm impacts.

A plan is currently being developed by the Corps of Engineers, to coordinated with Federal, State, and local government agencies to satisfy the requirements of all parties involved. The proposed plan currently being developed consists of beachfill placement and renourishment from offshore borrow area(s) for the establishment of a beach and dune system along the Fire Island barrier beach. The dune system would likely have a crest height of +15 ft NGVD and a crest width of 25 ft, fronted by a beach berm at a height of +9.5 ft NGVD and a width of 90 ft. The NGVD is a standardized vertical datum which was established as the mean sea level in 1929. At Fire Island, Mean High Water is approximately 1.8 ft above 0.0 NGVD.

Any pertinent information that Federal, State, or local agencies and the private sector can provide will be used to the greatest extent possible. We welcome any assistance and suggestions pertaining to the conduct of this study. All comments should be directed to the above address, attention Stephen Couch, Study Manager, CENAN-PL-FN.

Thomas A. York
Colonel, Corps of Engineers
District Engineer

Michael D. Zagata
Commissioner

STATE OF NEW YORK
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

MAY 2 3 1995

Mr. Stuart Piken
Chief, Planning Division
US Department of the Army
New York District, Corps of Engineers
Jacob K. Javits Federal Building
New York, New York 10278-0090

Dear Mr. Piken:

Thank you for providing a copy of the U.S. Army Corps of Engineers Conceptual Plan for an interim shore protection project for the Fire Island reach of the congressionally authorized Fire Island Inlet to Montauk Point Beach Erosion and Hurricane Protection Project. We appreciate the Corps' willingness to consider interim protection for the severely weakened Fire Island barrier until completion of the Fire Island Inlet to Montauk Point Reformulation Study, in response to our requests for such assistance following the devastating winter of 1992/93 when our shores were battered by three significant coastal storms.

We note that the proposed cross-section is similar to that adopted for the Westhampton Interim Project. Although there is no mention of periodic renourishment of the beach fill, can we presume that it is included as a cost-shared project component similar to the Westhampton Interim Project? While the rate of beach loss may be far less than that anticipated at Westhampton, renourishment will be necessary before whatever long-term solution is identified in the Reformulation Study can be implemented. State participation in an interim project may depend upon the continuation of a federal/state partnership after initial construction.

Mr. William Daley of our Flood Protection Bureau will continue to act as our Project Manager on this effort. He will comment at more length on the Conceptual Plan as well as the proposed Plan of Study which has just been received by the agency for comment. Mr. Daley can be reached at (516)457-5620.

Sincerely,

M Zagata

Michael D. Zagata

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

8 May 1995

Planning Division
Coastal Section

To whom it may concern:

The New York District Corps of Engineers is currently conducting a reformulation study involving the entire Atlantic Coast of Long Island from Fire Island Inlet to Montauk Point. As part of this overall effort, a study is being conducted to evaluate an interim storm damage reduction plan for the area from Fire Island Inlet to Moriches Inlet.

In an effort to keep the public informed, the New York District will distribute periodic status updates with a description of work currently being conducted. This information is provided to ensure that the general populace is aware of the Corps' ongoing effort, so please feel free to circulate this information as you see fit.

Enclosed is a notice of study initiation for the above referred project. Also enclosed is a copy of the letter sent to Mr. William Daley of the New York State Department of Environmental Conservation. This letter gives a brief description of the proposed study schedule, and plan formulation strategy.

If any further information is required, or if you have any information which would be of value to the New York District in conducting this study, please contact Mr. Stephen Couch, study manager at 212-264-9077.

Sincerely,

Joseph Vietri

STUART PIKEN, P.E.
CHIEF, PLANNING DIVISION

Encls.

JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

April 17, 1995

Planning Division
Coastal Section

Mr. William Daley
Flood Protection Bureau
New York State, Dept. of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Dear Mr. Daley:

Enclosed is the Plan of Study for the evaluation of an interim project along the barrier island known as Fire Island, between Fire Island Inlet and Moriches Inlet. In accordance with the Project Management Plan for the Reformulation of Fire Island Inlet to Montauk Point, the study area for this proposed interim project extends from the eastern boundary of Robert Moses State Park to Moriches Inlet.

The plan formulation strategy for this project is to follow a course of action similar to that undertaken for the Westhampton Interim study. New York District will look to develop a conceptual plan, within the limits of the authorized plan, to be coordinated with Federal, State, and local government agencies to ensure that the requirements of all parties involved will be satisfied. The interim study will be conducted by the New York District to determine justification of the project by means of benefit-cost analyses, environmental analyses, and coastal engineering design and analysis.

The proposed course of action, however, does not include an evaluation of alternatives nor optimization for the selection of an NED plan. In order to reduce study costs and decrease the study time required for this interim project, the New York District will instead only demonstrate that the plan is economically justified. The proposed project will also be evaluated by comparison of the interim plan with a larger, potentially NED plan to determine if construction of the larger plan would provide greater net excess benefits.

It is anticipated that a draft decision document will be submitted in May 1996, reviewed, and conditionally approved by Army Corps of Engineers higher authority to allow Federal budgeting for a FY 1998 construction start.

Since the New York State Department of Environmental Conservation has expressed willingness to act as the local sponsor for this project, we are submitting this Plan of Study to your office for review and approval. Upon approval by the State, the Plan of Study will be approved by the district and submitted to higher Army Corps authority for concurrence.

If any further information is required, please feel free to contact either Mr. Clifford Jones or Mr. Stephen Couch, study managers at 212-264-9077.

Sincerely,

Stuart Piken

STUART PIKEN, P.E.
CHIEF, PLANNING DIVISION

Encls.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Mr. Robert Hargrove
Chief, Environmental Impacts Branch
U.S. Environmental Protection Agency
Region II
26 Federal Plaza
New York, NY 10278

Dear Mr. Hargrove:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

Similar to the study conducted for the Westhampton Beach area, we are circulating a conceptual plan to be reviewed by your agency, and all involved agencies, in order to receive your view of the proposed plan, and to determine whether your agency would support such a plan.

The conceptual plan which is enclosed gives a description of the proposed project including layout area, cross-section, and the borrow area. This plan also gives input regarding the authorized plan for this area, and the environmental status of the proposed project.

The enclosed plan has its limitations in that the definitive layout of the project area is not available. The project area is currently being topographically mapped, which will provide the basis for the exact layout required, based on existing conditions.

With the completion of the topographic mapping, and with input derived from our initial coastal modeling studies, we anticipate having a more definitive, yet preliminary plan layout available in June. The input received from your agency would be taken into consideration in order to develop this layout of the proposed project.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Dr. Mary K. Foley
Regional Chief Scientist
N.P.S., North Atlantic Region
15 State Street
Boston, MA 02109

Dear Dr. Foley:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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With the completion of the topographic mapping, and with input derived from our initial coastal modeling studies, we anticipate having a more definitive, yet preliminary plan layout available in June. The input received from your agency would be taken into consideration in order to develop this layout of the proposed project.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT. CORPS OF ENGINEER
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK. N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Mr. Paul Weberg
Senior Engineer
Federal Emergency Management Administration
26 Federal Plaza
New York, NY 10278

Dear Mr. Weberg:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

Similar to the study conducted for the Westhampton Beach area, we are circulating a conceptual plan to be reviewed by your agency, and all involved agencies, in order to receive your view of the proposed plan, and to determine whether your agency would support such a plan.

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NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDI!
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Mr. Douglas Beach
National Marine Fisheries Service
Habitat Conservation Branch
One Blackburn Drive
Gloucester, MA 01931-2298

Dear Mr. Beach:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Mr. Michael D. Zagata
Commissioner
New York State, Dept. of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Dear Mr. Zagata:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Mr. William Daley
Flood Protection Bureau
New York State, Dept. of Environmental Conservation
50 Wolf Road
Albany, New York 12233-0001

Dear Mr. Daley:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Mr. Jack Hauptman, Superintendent
NPS, Fire Island National Seashore
120 Laurel Street
Patchogue, NY 11772

Dear Mr. Hauptman:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Mr. Fred Anders
NYS, Department of State
162 Washington Ave.
Albany, NY 12231

Dear Mr. Anders:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Ms. Sherry Morgan
Field Supervisor
USFWS
3817 Luker Road
Cortland, NY 13045

Dear Ms. Morgan:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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NEW YORK DISTRICT, CORPS OF ENGINEERS
JACOB K. JAVITS FEDERAL BUILDING
NEW YORK, N.Y. 10278-0090

REPLY TO
ATTENTION OF

10 April 1995

Planning Division
Coastal Section

Ms. Nancy Schlotter
USFWS - LIFO
P.O. Box 608
Islip, NY 11751

Dear Ms. Schlotter:

For the feasibility study being conducted for Fire Island between Fire Island Inlet and Moriches Inlet, it is the N.Y. District Corps of Engineers' strategy to develop a conceptual plan for the work to be conducted in this area. This plan formulation strategy is being undertaken because this project is intended to be interim in nature, until the reformulation study from Fire Island Inlet to Montauk Point is completed. Therefore, this interim project will look at only one non-structural alternative, while the full analysis of alternatives will be conducted as part of the 10 year reformulation study.

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Your comments and questions regarding this matter can be addressed to either Mr. Stephen Couch or Mr. Clifford Jones, Study Managers at (212) 264-9077.

Sincerely,

Stuart Piken, P.E.
Chief, Planning Division

Mr. William Daley, NYSDEC
Mr. Michael D. Zagata, NYSDEC
Mr. Fred Anders, NYSDOS
Mr. Jack Hauptman, NPS-FINS
Ms. Sherry Morgan, FWS
Ms. Nancy Schlotter, FWS-LIFO

Mr. Robert Hargrove, USEPA
Mr. Douglas Beach, NMFS
Dr. Mary Foley, NPS

U.S. ARMY CORPS OF ENGINEERS
CONCEPTUAL PLAN
FIRE ISLAND INLET TO MORICHES INLET

PROPOSED LAYOUT - PROJECT AREA

The proposed project encompasses the area from Moriches Inlet to the east boundary of Robert Moses State Park, as shown in Figure 1.

From Watch Hill to Robert Moses State Park, approximately 13.5 miles, the interim improvement plan would be constructed in those areas along the project shoreline which require the beach fill and dune cross-section to provide protection and insure the cross sectional integrity of the barrier island. The beachfill placement will be dependent on the condition of existing shoreline and dune fields. It is anticipated that some areas of the project shoreline may not require fill. In addition, beachfill transitions would be designed to minimize beachfill littoral transport losses.

East of Watch Hill, beachfill and dunes may be constructed, depending on the critical condition of the barrier island cross section.

The location of the improved dune would be dependent on the location of the existing dune, and the alignment constraints of the beachfill, required to minimize littoral transport losses.

PROPOSED CROSS-SECTION

The proposed plan is a beachfill and dune alternative with a cross section as shown in Figure 2. The proposed interim plan consists of a beachfill with berm height of +9.5 ft NGVD and berm width of 90 ft from the seaward toe of the dune, with a nearshore slope of 1 vertical to 20 horizontal to -2.0 ft NGVD, and an offshore slope of 1 vertical to 30 horizontal. The beach berm will be backed by a dune with crest width of 25 ft at a crest height of +15.0 ft NGVD. The seaward and landward dune slopes will be 1 vertical to 5 horizontal.

PROPOSED BORROW AREA

The potential borrow area for this project would be one previously identified by Corps studies. The potential borrow areas are those identified in Figure 3, Areas 1, 2 and 3, which are located at depths between -30 ft and -60 ft NGVD. The most likely borrow area will be a smaller tract contained within Area 2. The suitability of this site location will be determined by further analysis of the area. The analysis will include seismic profiling, core sampling, grain size analysis, compatibility analysis and cultural resources investigations. Additionally, the Corps will conduct a wave refraction study to determine changes in wave climatology due to use of the proposed borrow area.

AUTHORIZED PLAN

Layout: The Authorized Plan, encompasses the entire length of the Atlantic Coast of Long Island, from Fire Island Inlet to Montauk Point.

Cross Section: The Authorized Plan, with a cross section as shown in Figure 4, also consists of a beachfill and dune plan, which is greater in magnitude than the interim plan. The authorized plan has a dune with crest height of +20.0 ft NGVD, and a crest width of 25 ft. The dune is fronted by a beach berm with a height of +14.0 ft NGVD and a berm width is 100 ft from the seaward toe of the dune. The dune and beach slopes are the same as for the proposed plan.

Pertinent Information:
The authorized plan also contains provisions for the construction of groins as deemed necessary, each being 400 ft long, with a maximum height of +14.0 ft NGVD.

The interim plan will not preclude construction of the authorized plan, because it falls within the scale of the authorized plan. Additionally, the interim plan is a "soft" solution, which is reversible, and could be incorporated into the construction of the authorized plan.

Since the interim plan does fall within the authorized plan, a comparison will be made between the authorized plan and the interim plan to demonstrate that construction of the authorized plan would provide net excess benefits.

Environmental Status:
An environmental analysis will be executed to ensure that the environmental concerns regarding this proposed interim project are addressed in accordance with the National Environmental Protection Act (NEPA), and regulations pertinent to the New York District's program of civil works planning. The analysis will include preparation of an Environmental Assessment, coordination under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Coordination, and any other special investigations found to be necessary.

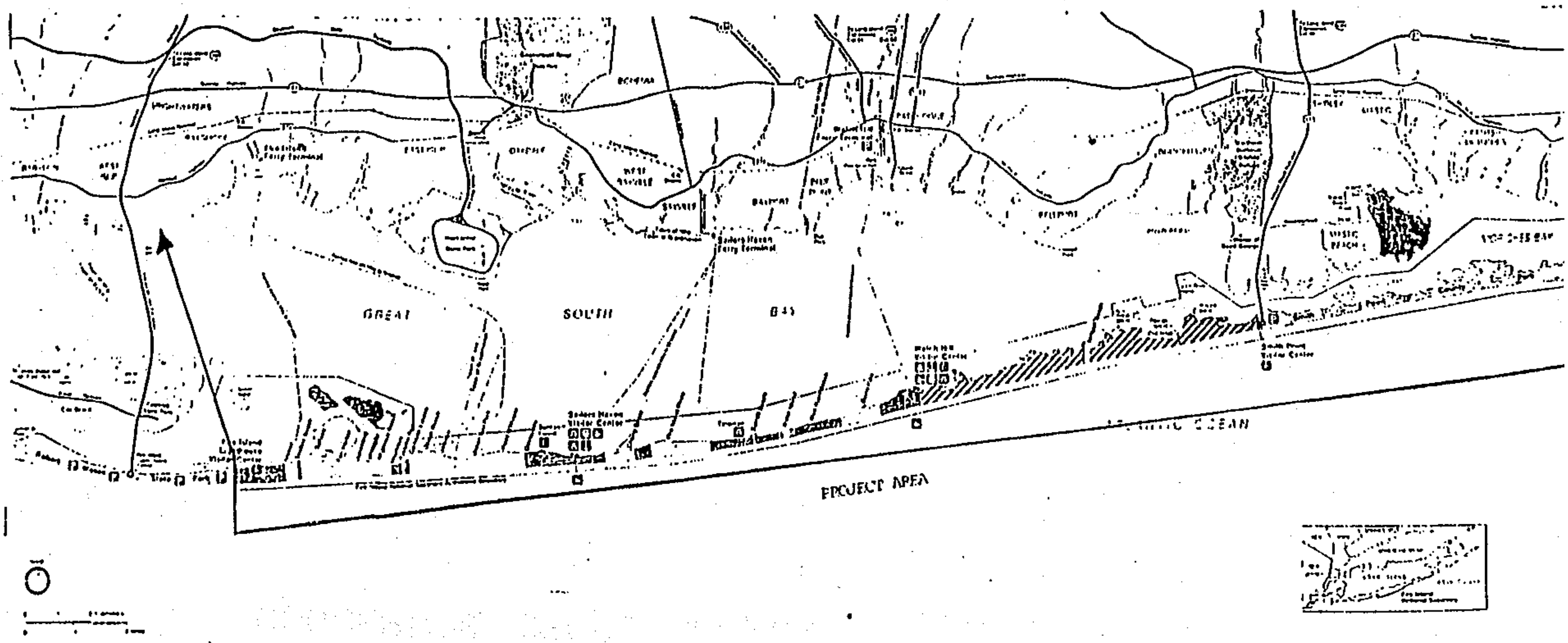


FIGURE 1
FIRE ISLAND INTERIM PROJECT AREA

FIRE ISLAND INTERIM
CONCEPTUAL CROSS-SECTION

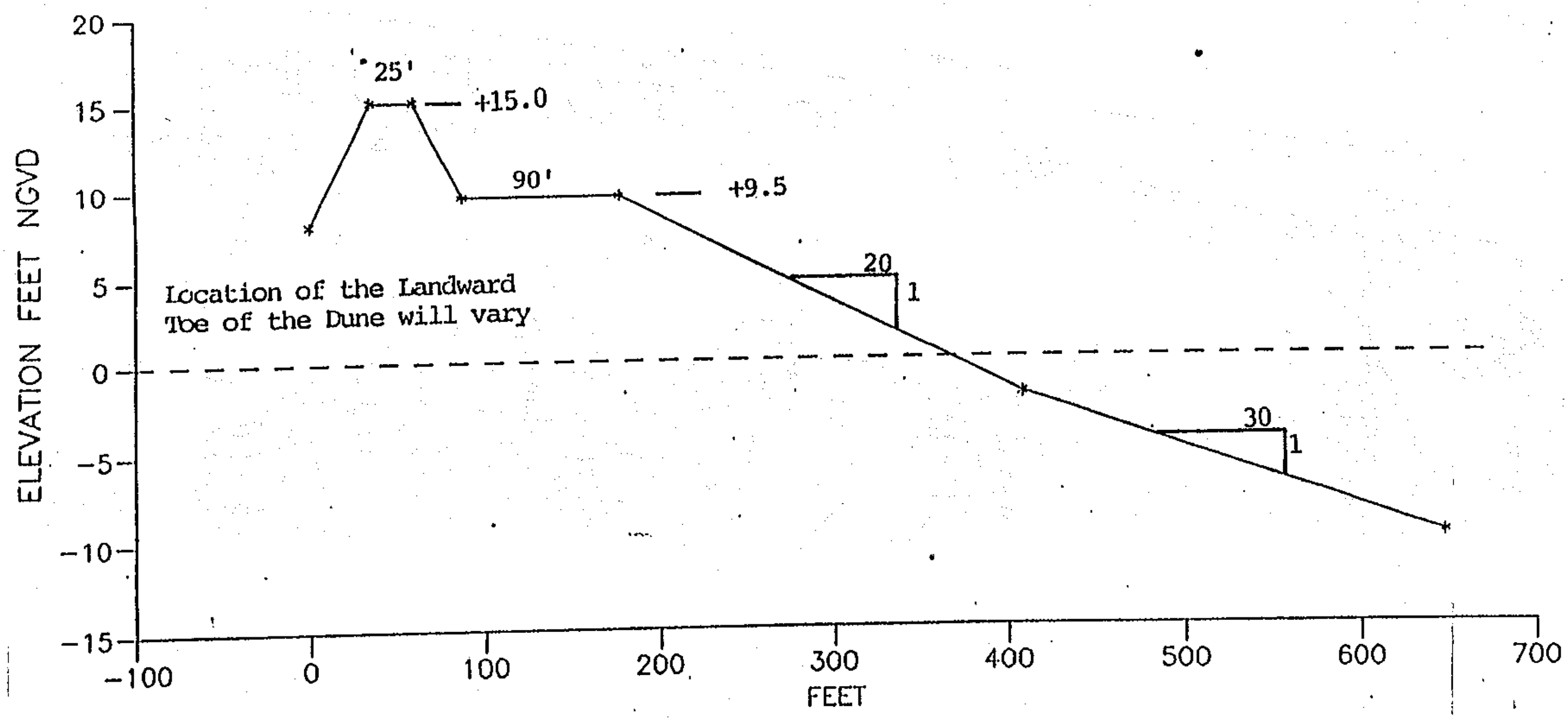
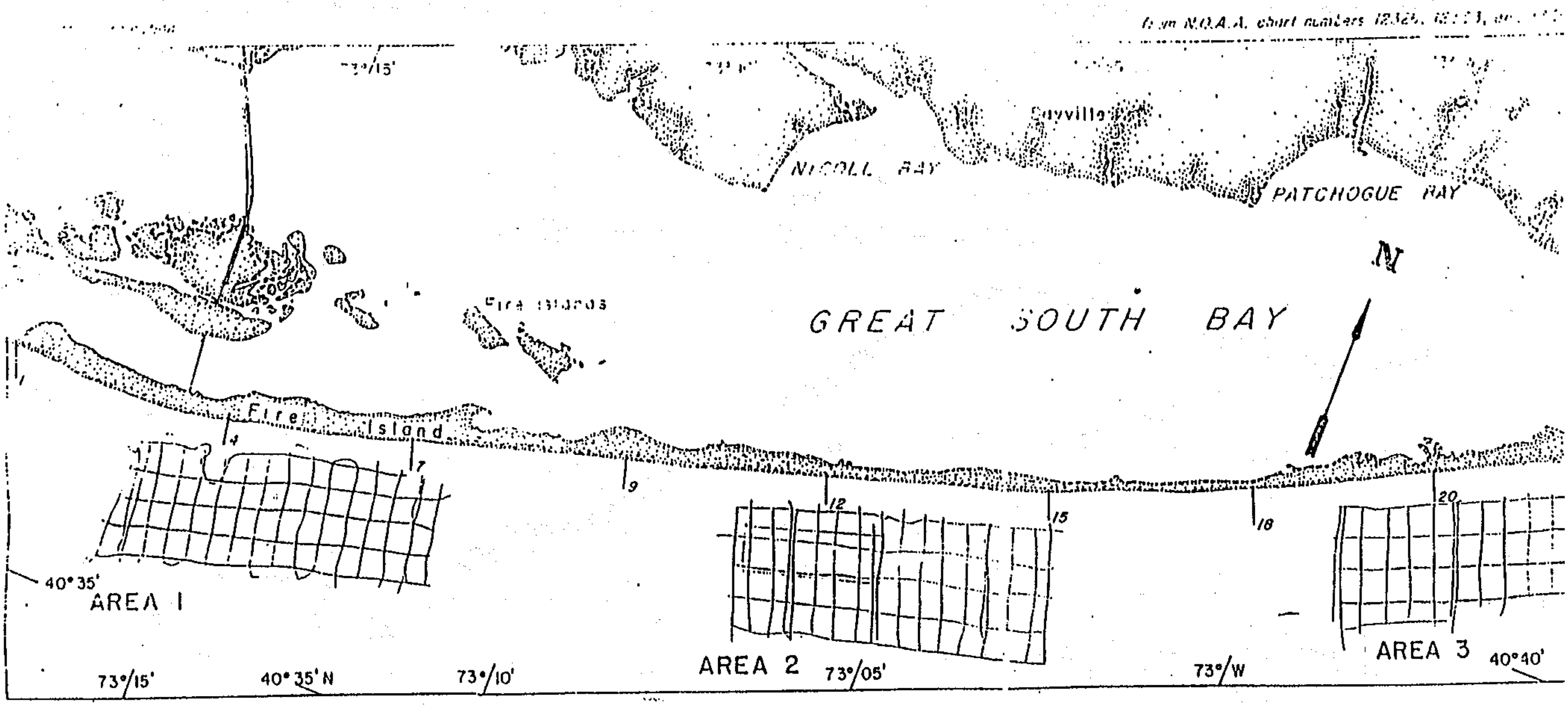


Figure 2



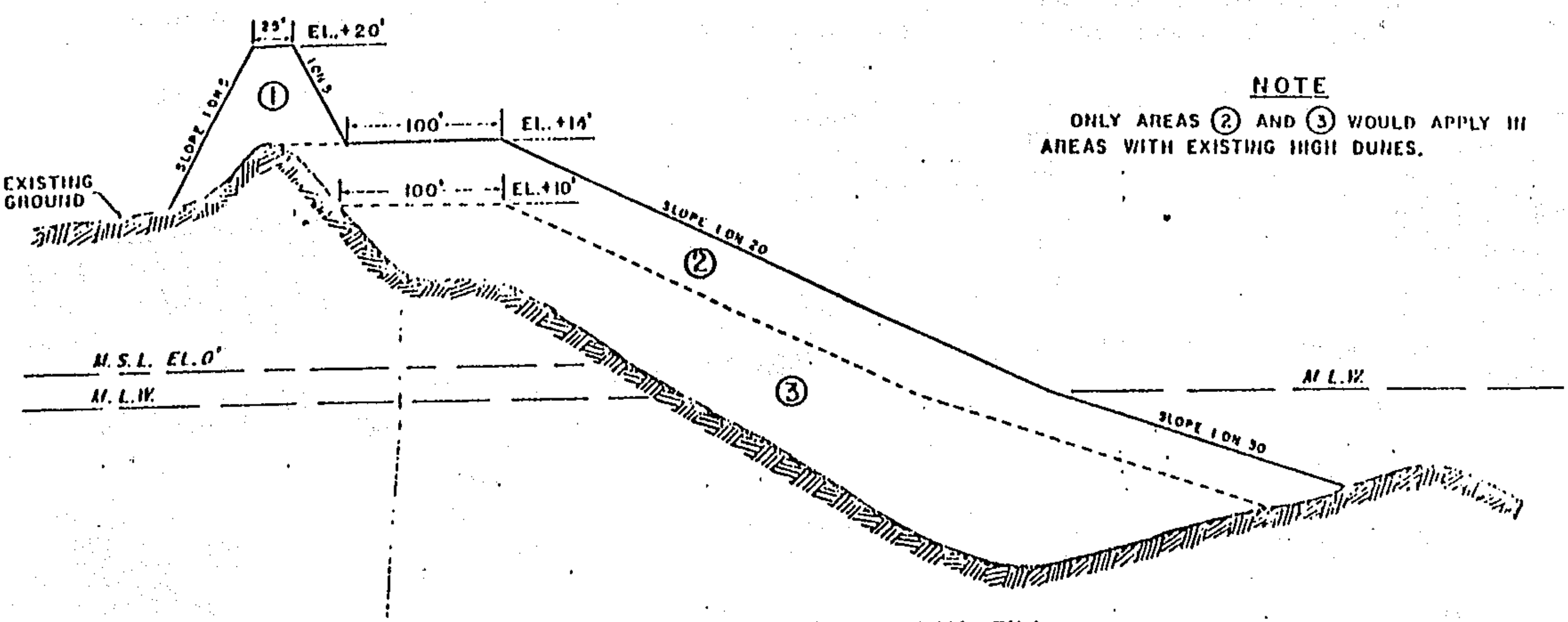
OCEAN/SEISMIC/SUR[illegible] — [illegible], New Jersey

NEW YORK CORPS OF ENGINEERS — [illegible] DACW [illegible]

BORROW AREA DEVELOPMENT — SOUTH SHORE LONG ISLAND, N.Y.

Location Map

Figure 3



TYPICAL PROFILE OF DUNE AND BEACH FILL

SCALE IN FEET

HOR. 100 — 0 — 100
VERT. 10 — 0 — 10

LEGEND

① ② SEPARABLE COST OF HURRICANE PROTECTION

③ { JOINT COST, AND
ALTERNATIVE SINGLE-PURPOSE PROJECT FOR SHORE PROTECTION }

BASIS FOR DIVISION OF COSTS
BETWEEN SHORE AND HURRICANE PROTECTION
SEPARABLE COSTS—REMAINING BENEFITS METHOD

ATLANTIC COAST OF LONG ISLAND, N.Y.
FIRE ISLAND INLET TO MONTAUK POINT

CORPS OF ENGINEERS, U.S. ARMY, N.Y. DIST., NEW YORK, N.Y. JAN. 1958 REVISED MAY 1959

Figure 4

Congress of the United States
House of Representatives
Washington, DC 20515

January 10, 1995

Dr. John H. Zirschky
Acting Assistant Secretary of the Army (Civil Works)
Department of the Army
108 Army Pentagon
Washington, D.C. 20310-0108

Dear Dr. Zirschky:

Through meetings with the Fire Island National Seashore (FINS) and the New York District Office of the Army Corps of Engineers, we have learned that a cooperative Breach Contingency Plan has been submitted to your office for review. Previously, you had indicated that final approval of the Breach Contingency Plan for Fire Island Inlet to Montauk Point could be expected in June 1995. Given the current conditions of the barrier islands, we consider it vitally important that this plan be approved in a more timely fashion.

As you may know, Fire Island and the areas of the Atlantic Coast of New York within the project area were again pounded by severe nor'easters on December 23 and 24 of 1994. While the barrier islands were spared any major breaches during these storms, several overwashes did occur and the potential threat to the integrity of the barrier islands is now greater than ever.

Should a breach occur, it is essential that the concerned federal, state, and local agencies be able to react in a quick and responsive fashion. As the Westhampton breach of 1992 taught us, failure to do so can end up costing homeowners and taxpayers millions of dollars in unnecessary expenses. We do not want to see a repeat of Westhampton.

The Breach Contingency Plan is an innovative approach that will help reduce the devastation and resultant costs that can be caused by breaches. This plan has gained the support of the necessary state and local agencies and we fully support its approval. We ask that you give it your urgent consideration.

While several of the faces in the Long Island Congressional Delegation have changed, our committment to protecting Long

Island's coastline has not. We look forward to maintaining an open dialogue on this issue and remain ready to assist the Corps wherever possible.

With best wishes.

Sincerely,

Rick A. Lazio
Member of Congress

Michael P. Forbes
Member of Congress

Peter T. King
Member of Congress

Gary L. Ackerman
Member of Congress

Dan Frisa
Member of Congress

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

REPLY TO
ATTENTION OF

7 JUN 1994

Honorable Ralph J. Marino
New York Senate Majority Leader
Albany, New York 12247

Dear Senator Marino:

Thank you for your letter of January 11, 1994, which contained a recommendation that the Army Corps of Engineers proceed with five projects while awaiting the completion of an ongoing reformulation study of the Fire Island to Montauk Point shoreline.

We have reviewed the Corps' authority to undertake the emergency works you propose and determined that emergency authority to do such work does not exist. The following paragraphs discuss various Corps efforts which are underway in the five project areas and are being done under existing project authorities.

The Corps shoreline protection study for Westhampton included evaluation of the three most westerly groins at Westhampton Beach. It concluded that a single groin located between groins 14 and 15, and tapering of these two groins, is the most cost-effective engineering plan. The Corps is scheduled to complete a final report on the entire plan in late 1994. Any recommended project resulting from this study would have to be considered in formulation of the President's Fiscal Year 1996 budget, together with other projects nationwide.

Installation of a sand bypassing system at Moriches Inlet was part of a Local Cooperation Agreement (LCA), executed with the New York State Department of Environmental Conservation (NYSDEC) in June 1986, which covered jetty rehabilitation and initial dredging of a channel. Dredged material was to be placed offshore in the littoral zone to maintain sand bypassing at the Inlet. However, while jetty work was in progress, the channel was subjected to natural scouring action and dredging was not required. There has been no need for channel dredging until early 1993 when decreasing channel velocities caused material to accrete in the channel. The Corps and NYSDEC are considering initiating channel dredging using the 1986 LCA. Provided NYSDEC agrees to use the LCA and quickly provides environmental clearances, the Corps could award a construction contract before the end of the year.

Currently, it is not feasible to use sand obtained from the to-be-implemented sand bypassing system and stockpile it at the Fire Island National Seashore for assumed future breach repairs. However, other efforts are underway to evaluate plans for emergency repairs along the National Seashore. The National Park Service (NPS) created a working group to determine appropriate measures for emergency repairs. An NPS report is scheduled for completion in June 1994. To complement this effort, I have asked the Corps to evaluate the economic feasibility of developing a stopgap plan for stockpiling material for emergency repairs along community (e.g. Kismet) shorelines. A Corps report on a plan will be available for review in June 1995.

I have also asked the New York District to develop and test a contingency plan so that the Corps can quickly respond to any washovers along the barrier island. This effort will include discussions with local communities regarding cost-sharing of repairs. Our experience has been that reaching cost-sharing agreements with local governments can delay response measures and we hope to prevent such delays by reaching agreements beforehand.

Emergency placement of sand between the Watch Hill Visitor Center and Robert Moses State Park would require that a study be done to determine the economic and environmental viability of such a comprehensive effort. I have directed the Corps to evaluate existing shoreline conditions and to notify me of the advisability of initiating development of an interim plan. We are also aware that various environmental agencies agreed to permit the Corps to construct an interim plan at Westhampton only, and that any additional interim plan proposals may trigger the need for preparation of an Environmental Impact Statement for the extensive 83-mile-long project area. The Corps' preliminary report will be available in August 1994 and will be used to determine the advisability of proceeding with a follow-on study of an interim protection plan.

Regarding placement of sand on the shoreline between Gilgo State Park and Tobay Beach, renourishment of Gilgo Beach was completed in April 1993 at a cost of $10.4 million. Additional renourishment of Gilgo Beach is programmed for September 1994.

We recognize the commitment of resources that the State and affected shoreline communities have made to maintain these beaches and provide protection against damaging storms. I have requested the Corps New York District to keep you informed of the progress of the above-noted ongoing studies and projects.

Sincerely,

John Zirschky

John H. Zirschky
Acting Assistant Secretary of the Army
(Civil Works)

13 April 1994

FIRE ISLAND TO MONTAUK POINT BEACH EROSION CONTROL AND HURRICANE PROTECTION PROJECT

COSTS AND SCHEDULES FOR CRITICAL AREAS OF CONCERN TO CONGRESSMAN HOCHBRUECKNER

Proposed Project Area	Authority	Cost Estimate Report Prep	Construction Cost Estimate	Schedule For: NEPA Start/Comp	Dec. Doc. Start/Comp	P&S Start/Comp	PCA Start/Comp	Constr. Start/Comp
Interim Shore Protection Plan Westhampton	River & Harbor Act of 1960 as amended for Fire Island to Montauk Pt. Beach Erosion Control & Hurricane Protection Project	$1.8 million*	$32 million*	Nov 93/Nov 94	Apr 93/Jun 94	Jul 94/May 95	Feb 95/Sep 95	Dec 95/Mar 97
*Based on Decision Document dated Feb. 94								
Moriches Inlet Sand Bypassing Sys	River & Harbor Act of 1960 as amended for Moriches Inlet, NY Navigation Project	$150,000*	$1 million (based on 150,000 C.Y. of sand to be dredged -- est.)	Jun 94/Dec 94	Mar 94/Dec 94	Jun 94/Dec 94	Executed LCA In Jun 1986	Jun 95/Oct 95
*Decision Document would accompany P&S and recommend minor modification to 1983 GDM for project to provide for direct placement of sand from navigation channel on downdrift beach.								
Fire Island National Seashore Stockpiling	Reformulation See above authority for Fire Island Inlet	$250,000*	$2 -- 3 million (assumes 2 stckpl. sites 200,000 C.Y. each) Smith Pt. Park & Field "5" Robert Moses	Jun94/Jun95	Jun94/Jun95	July 95/Dec 95	Feb 96/ Sep 96	Dec 96/ Jun 97
*Assumes Decision Document that utilizes existing information								
Long Term Beach Nourishment Plan (12 mile beach sect.)	Reformulation See above authority for Fire Island Inlet	$4 million*	$50 million (100 ft. wide berm at +10 and dune enhancement)	Jun94/Jun97	Jun94/Jun97	Jul 97/Mar 98	Feb 95/Sep 95	Dec 98/Mar 200[illegible]
*Assumes Decision Document similar to Westhampton Interim + 1 mill above Interim effort See ppd.								

Note: all cost and schedules are preliminary estimates except those cited for the Westhampton Interim Project

Br[illegible]h Closure Plan 250K in FY 44
Req. est on the way.

THE SENATE
STATE OF NEW YORK
ALBANY 12247

RALPH J. MARINO
PRESIDENT PRO TEM
MAJORITY LEADER

January 11, 1994

Dr. G. Edward Dickey
Acting Principal Deputy Assistant
Secretary of the Army (Civil Works)
The Pentagon, Room 2E570
Washington, DC 20310

RE: Long Island South Shore Erosion

Dear Dr. Dickey:

We, the undersigned members of the New York State Senate representing the residents of Long Island, wish to acknowledge the work undertaken by the Army Corps of Engineers in developing a strategy to address erosion problems related to storm events, particularly last year's "Nor'easter" and other storms of similar magnitude. The enormity of the destruction depicted in the media and seen firsthand by all of us remains vivid in our minds. It is our belief, however, that there is significantly more which can be done and which must be done before we can say that the particularly precarious situation faced by the entire South Shore of Long Island in its ability to withstand coastal storms has been adequately addressed.

Despite significant commitment on the part of the state and local communities to emergency efforts to maintain the integrity of many South Shore beaches and the United States Army Corps of Engineers' efforts in preparing projects for Coney Island, the Rockaways, Long Beach Island and, to some extent, Jones Island, it is clear that these efforts fall dramatically short of what must be undertaken and what should have been completed by this date. You should be aware that the state and local communities have spent in excess of $12 million on emergency beach nourishment, which includes the state's expenditure of $4 million at Robert Moses State Park. While these projects have been undertaken as emergency responses to severe erosion problems, there should be no impression that all immediate actions have been undertaken and completed.

We urge the Army Corps to complete its Reformulation Study that covers the area from Robert Moses State Park to Montauk Point. While awaiting the study's completion, we have identified certain projects that must be undertaken now as emergency actions. They are as follows:

The reconfiguration of the groins field at Westhampton Beach that will allow for the proper down-drift of sand.

- The immediate undertaking of a sand bypassing project at Moriches Inlet to provide sand to down-drift areas.

- The creation of a stockpile of sand for immediate closure of any breach along the Fire Island Seashore.

- The placement of beach fill from Watch Hill Visitors Center to Robert Moses State Park to rebuild decimated dunes.

- The placement of sand on Jones Island from Gilgo State Park to Tobay Beach to protect the state's highway.

The foregoing actions should be undertaken immediately by the Army Corps of Engineers as emergency interim projects. The State of New York and the localities affected have demonstrated their commitment to combat this problem through the expenditure of significant sums of money to date, as well as through our enactment of the Environmental Protection Act, which will provide ongoing funding for environmental purposes. We respectfully request that you immediately deploy the resources necessary to accomplish these tasks without further delay. Last week's relatively mild storms, which caused comparatively minor damage to tangible real and personal property, only serve to highlight the environmental devastation suffered by the South Shore due to advanced erosion.

We thank you for your attention to this matter and stand ready to assist you in any way possible to achieve these important goals.

Sincerely,

Senator Ralph J. Marino
Senate Majority Leader

Senator Owen H. Johnson
Chairman, Senate Environmental
Conservation Committee

Senator Norman J. Levy

Senator James J. Lack

Senator Caesar Trunzo

Senator Kemp Hannon

Senator Kenneth P. LaValle

Senator Dean G. Skelos

Senator Michael J. Tully, Jr.

APPENDIX B

AUTHORIZING DOCUMENTS

Project Authorization

The Fire Island Inlet to Montauk Point, New York, Combined Beach Erosion Control and Hurricane Protection Project was authorized by the River and Harbor Act of 14 July 1960 in accordance with House Document 425, 86th Congress, 2d Session, dated 21 June 1960, and subsequently modified for the cost sharing of the beach erosion portion of the project in accordance with Section 103 of the River and Harbor Act of 12 October 1962. The project authorization was modified again by Section 31 of the Water Resources Development Act (WRDA) of 1974, which increased the Federal participation to 70% of the first cost of the project. The authorization was further modified by section 502 of the WRDA of 1986 (P.L. 99-662), which directed the Secretary of the Army to apply the cost sharing provisions of Section 31(1) of the WRDA of 1974 (P.L. 93-251) to include periodic renourishment of the continuing construction project for the reach from Moriches Inlet to Shinnecock Inlet for a period of 20 years after the date of enactment of P.L. 99-662. For portions of Fire Island to Montauk Point, other than the portion from Moriches Inlet to Shinnecock Inlet, Section 103 of the WRDA of 1986 (P.L. 99-662) defined the cost sharing of the first cost to be 65% Federal. In addition, Section 156 of the WRDA of 1976, as modified by Section 934 of the WRDA 1986, provides for continued renourishment not to exceed 50 years from initiation of construction of each of these reaches. The WRDA of 1992 further modified the project to extend the period of periodic nourishment to 30 years from the date of project completion for Moriches to Shinnecock Inlet, with the non-Federal share not to exceed 35 percent of the total project cost.

storage dam the Secretary of State, acting through the United States Commissioner, International Boundary and Water Commission, United States and Mexico, is authorized to conclude with the appropriate official or officials of Mexico an agreement consistent with article of the treaty of February 3, 1944, ~~for~~ the construction, operation, and maintenance on a self-liquidating basis, for the United States share, of facilities for generating hydroelectric energy at said dam.

59 Stat. 1221.

If agreement for the construction of separate facilities for generating hydroelectric energy is concluded, the United States Commissioner, International Boundary and Water Commission, United States and Mexico is directed to construct, operate, and maintain such self-liquidating facilities for the United States.

Conditions.

SEC. 3. If a dam is constructed pursuant to an agreement concluded under the authorization granted by section 1 of this Act, its operation for conservation and release of United States share of waters shall be integrated with other United States water conservation activities on the Rio Grande below Fort Quitman, Texas, in such manner as to provide the maximum feasible amount of water for beneficial use in the United States with the understandings that (a) releases of United States share of waters from said dam for domestic, municipal, industrial, and irrigation uses in the United States shall be made pursuant to order by the appropriate authority or authorities of the State of Texas, and (b) the State of Texas having stipulated that the amount of water that will be available for use in the United States below Falcon Dam after the proposed dam is placed in operation will be not less than the amount available under existing conditions of river development, and to carry out such understandings and said stipulation the conservation storage of said dam shall be used, and it shall be the exclusive responsibility of the appropriate authority or authorities of said State to distribute available United States share of waters of the Rio Grande in such manner as will comply with said stipulation.

74 Stat. 361.

Appropriation.

SEC. 4. There is hereby authorized to be appropriated to the Department of State for the use of the United States Section, International Boundary and Water Commission, United States and Mexico, such sums as may be necessary to carry out the provisions of this Act.

Approved July 7, 1960.

An Act authorizing the construction, repair, and preservation of certain public works on rivers and harbors for navigation, flood control, and for other purposes.

74 Stat. 480.
July 14, 1960.
[H.R. 7634]
[Public Law 86-645]

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—RIVERS AND HARBORS

River and Harbor Act of 1960.

SEC. 101. That the following works of improvement of rivers and harbors and other waterways for navigation, flood control, and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and supervision of the Chief of Engineers, in accordance with the plans and subject to the conditions recommended by the Chief of Engineers in the respective reports hereinafter designated: *Provided*, That the provisions of section 1 of the River and Harbor Act approved March 2, 1945 (Public Law Numbered 14, Seventy-ninth Congress, first session), shall govern with respect to projects authorized in this title; and the procedures therein set forth with respect to plans, proposals, or reports for works of improvement for navigation or flood control and for irrigation and purposes incidental thereto, shall apply as if herein set forth in full: 59 Stat. 10.

NAVIGATION

Eastport Harbor, Maine: Senate Document Numbered 98, Eighty-sixth Congress, at an estimated cost of $595,000; Maine.

Southwest Harbor, Maine: House Document Numbered 408, Eighty-fifth Congress, at an estimated cost of $240,000;

Stonington Harbor, Maine: House Document Numbered 36, Eighty-sixth Congress, at an estimated cost of $198,000;

South Bristol Harbor, Maine: Senate Document Numbered 30, Eighty-sixth Congress, at an estimated cost of $97,000;

Wells Harbor, Maine: House Document Numbered 202, Eighty-sixth Congress, at an estimated cost of $340,000;

York Harbor, Maine: House Document Numbered 395, Eighty-sixth Congress, at an estimated cost of $391,000;

Pepperell Cove, Maine: House Document Numbered 284, Eighty-sixth Congress, at an estimated cost of $170,000;

Rye Harbor, New Hampshire: House Document Numbered 439, Eighty-sixth Congress, at an estimated cost of 238,000; New Hampshire.

Cotuit Harbor, Massachusetts: House Document Numbered 142, Eighty-sixth Congress, at an estimated cost of $320,000; Massachusetts.

Apponaug Cove, Rhode Island: House Document Numbered 143, Eighty-sixth Congress, at an estimated cost of $180,000; Rhode Island and Connecticut.

Little Narragansett Bay and Watch Hill Cove, Rhode Island and Connecticut: House Document Numbered ... Eighty-sixth Congress, at an estimated cost of

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Erie Harbor, Pennsylvania: House Document Numbered 199, Eighty-sixth Congress, at an estimated cost of $1,729,000; Pennsylvania.

Buffalo Harbor, New York: House Document Numbered 151, Eighty-sixth Congress, at an estimated cost of $2,232,000; 74 Stat. 482. New York.

Rochester Harbor, New York: House Document Numbered 409, Eighty-sixth Congress, at an estimated cost of $2,445,000;

Los Angeles and Long Beach Harbors (West Basin), California: House Document Numbered 401, Eighty-sixth Congress, at an estimated cost of $1,763,000; California.

Monterey Harbor (Monterey Bay), California: House Document Numbered 219, Eighty-sixth Congress, at an estimated cost of $3,989,000;

Noyo River and Harbor, California: House Document Numbered 289, Eighty-sixth Congress, at an estimated cost of $370,000;

Snohomish River (Everett Harbor), Washington: House Document Numbered 248, Eighty-sixth Congress, at an estimated cost of $3,011,000; Washington.

Kahului Harbor, Island of Maui, Hawaii: House Document Numbered 109, Eighty-sixth Congress, at an estimated cost of $944,500; Hawaii.

Hilo Harbor, Hawaii: The Secretary of the Army is hereby authorized and directed to cause an immediate study to be made under the direction of the Chief of Engineers of a sea-wall to protect against tidal waves and excessive high tides, and the project is hereby authorized as determined to be justified by the Secretary of the Army with the approval of the President, unless within the first period of 60 calendar days of continuous session of the Congress after the date on which the report is submitted to it such report is disapproved by Congress. Hilo Harbor. Study.

BEACH EROSION CONTROL

Wessagussett Beach, Weymouth, Massachusetts: House Document Numbered 334, Eighty-sixth Congress, at an estimated cost of $132,000; Massachusetts.

Pemberton Point to Cape Cod Canal, Massachusetts: House Document Numbered 272, Eighty-sixth Congress, at an estimated cost of $139,200;

Cape Cod Canal to Provincetown, Massachusetts: House Document Numbered 404, Eighty-sixth Congress, at an estimated cost of $178,000;

South Kingstown and Westerly, Rhode Island: House Document Numbered 30, Eighty-sixth Congress, at an estimated cost of $140,300; Rhode Island.

Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York: House Document Numbered 425, Eighty-sixth Congress, at an estimated cost of $19,400,000; New York.

Water Resources Development Act

Lake Texoma, Texas and Oklahoma, utilizing existing roads to the extent feasible. There is authorized to be appropriated not to exceed $1,000,000 to carry out this section.

Rock Island, Ill., toll bridge.

SEC. 29. The Act entitled "An Act authorizing the city of Rock Island, Illinois, or its assigns, to construct, maintain, and operate a toll bridge across the Mississippi River at or near Rock Island, Illinois, and to place at or near the city of Davenport, Iowa", approved March 18, 1935 (49 Stat. 110), is amended—

(1) by inserting after "to reconstruct, enlarge, and extend the approaches" in subsection (b) of the first section the following: "(including the eastern approach in Rock Island, Illinois)",

(2) by inserting after "approaches" in subsection (c) of the first section the following: "(other than the eastern approach in Rock Island, Illinois)", and

(3) by inserting at the end of subsection (c) of the first section the following: "The reconstruction, enlargement, and extension of the eastern approach in Rock Island, Illinois, to such bridge pursuant to subsection (b) of this section shall be commenced not later than December 1, 1974, and shall be completed before December 1, 1977.".

Lavon Reservoir, Trinity River, Tex., project modification. 76 Stat. 1186.

SEC. 30. The project for enlargement of Lavon Reservoir on the East Fork of the Trinity River, Texas, authorized by the Flood Control Act of 1962, is hereby modified to authorize the Secretary of the Army, acting through the Chief of Engineers, to provide a crossing and approaches at Tickey Creek and suitable surfacing to permit all-weather use of Collin County Road 115, at a cost not to exceed $800,000.

Long Island, N. Y., project modification. 74 Stat. 482.

SEC. 31. The project for the Atlantic coast of Long Island, Fire Island Inlet to Montauk Point, New York, authorized in section 101 of the River and Harbor Act of 1960, is hereby modified to [illegible] that non-Federal interests shall (1) [illegible] first cost of the project, including the value of lands, easements, and rights-of-way; (2) hold and save the United States free from damages due to the construction works; and (3) maintain and operate the improvements in accordance with regulations prescribed by the Secretary of the Army.

Citation of section.

SEC. 32. (a) This section may be cited as the "Streambank Erosion Control Evaluation and Demonstration Act of 1974".

National streambank erosion prevention and control demonstration program.

(b) The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to establish and conduct for a period of five fiscal years a national streambank erosion prevention and control demonstration program. The program shall consist of (1) an evaluation of the extent of streambank erosion on navigable rivers and their tributaries; (2) development of new methods and techniques for bank protection, research on soil stability, and identification of the causes of erosion; (3) a report to the Congress on the results of such studies and the recommendations of the Secretary of the Army on means for the prevention and correction of streambank erosion; and (4) demonstration projects, including bank protection works.

Report to Congress.

(c) Demonstration projects authorized by this section shall be undertaken on streams selected to reflect a variety of geographical and environmental conditions, including streams with naturally occurring erosion problems and streams with erosion caused or increased by man-made structures or activities. At a minimum, demonstration projects shall be conducted at multiple sites on—

Project sites.

(1) the Ohio River;

(2) that reach of the Missouri River between Fort Randall Dam, South Dakota, and Sioux City, Iowa;

(4) in the case of a deep-draft harbor, be responsible for the non-Federal share of operation and maintenance required by subsection (b) of this section.

212 SEC. 102. INLAND WATERWAY TRANSPORTATION.

(a) CONSTRUCTION.—One-half of the costs of construction—

(1) of each project authorized by title III of this Act,

(2) of the project authorized by section 1103(j) of this Act, and

(3) allocated to inland navigation for the project authorized by section 844 of this Act,

shall be paid only from amounts appropriated from the general fund of the Treasury. One-half of such costs shall be paid only from amounts appropriated from the Inland Waterways Trust Fund. For purposes of this subsection, the term "construction" shall include planning, designing, engineering, surveying, the acquisition of all lands, easements, and rights-of-way necessary for the project, including lands for disposal of dredged material, and relocations necessary for the project.

(b) OPERATION AND MAINTENANCE.—The Federal share of the cost of operation and maintenance of any project for navigation on the inland waterways is 100 percent.

(c) AUTHORIZATIONS FROM GENERAL FUND.—Any Federal responsibility—

(1) with respect to a project authorized by title III or section 1103(j), or

(2) with respect to the portion of the project authorized by section 844 allocated to inland navigation,

which responsibility is not provided for in subsection (a) of this section shall be paid only from amounts appropriated from the general fund of the Treasury.

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3. SEC. 103. FLOOD CONTROL AND OTHER PURPOSES.

(a) FLOOD CONTROL.—

(1) GENERAL RULE.—The non-Federal interests for a project with costs assigned to flood control (other than a nonstructural project) shall—

(A) pay 5 percent of the cost of the project assigned to flood control during construction of the project;

(B) provide all lands, easements, rights-of-way, and dredged material disposal areas required only for flood control and perform all related necessary relocations; and

(C) provide that portion of the joint costs of lands, easements, rights-of-way, dredged material disposal areas, and relocations which is assigned to flood control.

(2) 25 PERCENT MINIMUM CONTRIBUTION.—If the value of the contributions required under paragraph (1) of this subsection is less than 25 percent of the cost of the project assigned to flood control, the non-Federal interest shall pay during construction of the project such additional amounts as are necessary so that the total contribution of the non-Federal interests under this subsection is equal to 25 percent of the cost of the project assigned to flood control.

(3) 50 PERCENT MAXIMUM.—The non-Federal share under paragraph (1) shall not exceed 50 percent of the cost of the project assigned to flood control. The preceding sentence does not modify the requirement of paragraph (1)(A) of this subsec-

(4) DEFERRED PAYMENT OF AMOUNT EXCEEDING 30 PERCENT.—If the total amount of the contribution required under paragraph (1) of this subsection exceeds 30 percent of the cost of the project assigned to flood control, the non-Federal interests may pay the amount of the excess to the Secretary over a 15-year period (or such shorter period as may be agreed to by the Secretary and the non-Federal interests) beginning on the date construction of the project or separable element is completed, at an interest rate determined pursuant to section 106. The preceding sentence does not modify the requirement of paragraph (1)(A) of this subsection.

(b) NONSTRUCTURAL FLOOD CONTROL PROJECTS.—The non-Federal share of the cost of nonstructural flood control measures shall be 25 percent of the cost of such measures. The non-Federal interests for any such measures shall be required to provide all lands, easements, rights-of-way, dredged material disposal areas, and relocations necessary for the project, but shall not be required to contribute any amount in cash during construction of the project.

(c) OTHER PURPOSES.—The non-Federal share of the cost assigned to other project purposes shall be as follows:

(1) hydroelectric power: 100 percent, except that the marketing of such power and the recovery of costs of constructing, operating, maintaining, and rehabilitating such projects shall be in accordance with existing law: *Provided*, That after the date of enactment of this Act, the Secretary shall not submit to Congress any proposal for the authorization of any water resources project that has a hydroelectric power component unless such proposal contains the comments of the appropriate Power Marketing Administrator designated pursuant to section 302 of the Department of Energy Organization Act (Public Law 95-91) concerning the appropriate Power Marketing Administration's ability to market the hydroelectric power expected to be generated and not required in the operation of the project under the applicable Federal power marketing law, so that, 100 percent of operation, maintenance and replacement costs, 100 percent of the capital investment allocated to the purpose of hydroelectric power (with interest at rates established pursuant to or prescribed by applicable law), and any other costs assigned in accordance with law for return from power revenues can be returned within the period set for the return of such costs by or pursuant to such applicable Federal power marketing law; Energy. 42 USC 71

(2) municipal and industrial water supply: 100 percent;

(3) agricultural water supply: 35 percent; Agricultu agricultur commoditi

(4) recreation, including recreational navigation: 50 percent of separable costs and, in the case of any harbor or inland harbor or channel project, 50 percent of joint and separable costs allocated to recreational navigation;

(5) hurricane and storm damage reduction: 35 percent; and

(6) aquatic plant control: 50 percent of control operations.

(d) CERTAIN OTHER COSTS ASSIGNED TO PROJECT PURPOSES.—Costs of constructing projects or measures for beach erosion control and water quality enhancement shall be assigned to appropriate project purposes listed in subsections (a), (b), and (c) and shall be shared in the same percentage as the purposes to which the costs are assigned, except that all costs assigned to benefits to privately owned shores (where use of such shores is limited to private interests) or to

APPENDIX H

PUBLIC ACCESS PLAN

PUBLIC ACCESS PLAN
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FIRE ISLAND INTERIM STORM DAMAGE PROTECTION PROJECT

PARAGRAPH

PUBLIC ACCESS PLAN

1.01 **Scope**. The Fire Island Interim project proposes constructing beach dunes, and berm, along with periodic beach renourishment, intermittently along the area from Robert Moses State Park to Smith Point Park. This barrier island project area falls within Robert Moses State Park, Fire Island National Seashore (FIIS), and Smith Point Park. The majority of the project area has no public roads, with vehicular traffic, confined to the state and county park areas at either end of the island (Robert Moses State Park is west of the Fire Island Lighthouse while Smith Point County Park is east of the Smith Point Visitor Center). The primary mode of travel between these two points is walking. (A detailed description of the unique infrastructure, transportation, and economic and social interrelationships with the FIIS and the mainland shore is discussed in subsequent paragraphs here to follow.)

2.01 **Purpose**. A public access evaluation requires a two-step process. The first step is to describe and tabulate the existing degree of public access. The second step is to assess whether the existing public access is adequate or if additional facilities are needed with the proposed project in place. Relevant quidelines specifying the criteria under which the adequacy or inadequacy of public access is assessed are contained in:

3.01 **Summary of Federal Policy**. [Department of the Army, ER 1165-2-130, dated 15 June 1989, Federal Participation in Shore Protection, paragraph 6h.] It is Corps policy to participate in the additional costs for placing beach-quality sand or other suitable material onto adjacent beaches or near shore providing that the beaches involved must be open to the public. Project beaches will not be limited for use by only a segment of the public; they must be open to all visitors regardless of origin or home area. Additionally, nearby parking facilities, on free or reasonable terms, should be within a reasonable walking distance to the beach. Lack of sufficient public parking with reasonable public access to the beach will preclude federal participation. Items of local cooperation require the sponsor to provide necessary access roads, parking areas, and other public use facilities open and available to all on equal terms. However, even though the lack of such facilities may constrain beach use, it is not the intent to require that facilities be provided to meet all demand situations, but only that public use and access not be precluded by the lack of existing facilities due to local practices and/or unique situations. Nonetheless, a visitor to an area should be reasonable assured of parking near the access point on an average day. Any evaluation should discuss the availability of access points and public parking along the entire length of shore in which Federal participation is proposed. If reasonable access and parking for non-residential users is not available within reasonable walking distance to the beach, they must be provided by the sponsor, or Federal participation limited to those areas where access and parking area reasonable available.

3.02 **Fire Island National Seashore General Management Plan and Environmental Impact Statement.** The majority of the project area is encompassed within the Fire Island National Seashore Boundaries. Public Access within this area has been established based upon the Fire Island National Seashore General Management Plan, and EIS, which has been developed based upon park guidelines for management of the National Park System. The General Management Plan Addresses access within six management units, including Fire Island Lighthouse, Sunken Forest, Talisman, Watch Hill, Old Inlet, and Smith Point West. The FIIS GMP establishes these areas as low recreational use areas, and has specifically established access to these areas, in promoting usage by visitors seeking this type of recreation.

4.01 **Summary of New York State Policy**. [State of New York Coastal Management Program: Policy 19 – Protect, maintain, and increase the level and types of access to public water-related recreation resources and facilities; and Policy 20 – Access to the publicly-owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly-owned shall be provided and it shall be provided in a manner compatible with adjoining uses.]

> Policy 19: This policy calls for achieving balance among the following factors: (l) the level of access to a resource or facility, (2) the capacity of a resource or facility, and (3) the protection of natural resources. Imbalance among these factors tends to be in the urban areas of the state, and can generally be attributed to limited access. Access to water-related recreational resources, such as public beaches, will be given priority for improvement.
>
> Policy 20: This policy states that access should be provided to coastal areas where there are limited or no recreational facilities that provide specific water-related recreational activities. Access should be provided for numerous activities and pursuits that require only minimal facilities, such as walking, biking, bird watching, photography, and fishing. Furthermore, the State will not undertake or fund any project which increases access to a water-related resource or facility that is no open to all members of the public.

5.01 **Traffic and Transportation**. Access to the project area is provided through a network of state and county roads and privately run ferry lines (see Figures 5-1 and 5-2 in the EIS). The Robert Moses Causeway on the west and the William Floyd Parkway on the east provide vehicular connections between Fire Island and the bay shore of Long Island. Both roads intersect Montauk Highway (Route 27A), which is a major connector through developed areas of the south shore of Long Island. North of Route 27A are two major east-west highways: the Sunrise Highway (Route 27) and the Long Island Expressway (Interstate 495).

5.02 The Robert Moses Causeway provides access over the Great South Bay to Captree State Park, and then over the Fire Island Inlet to Robert Moses State Park. The William Floyd Parkway (County Route 46) provides access over Narrow Bay to Smith Point County Park and the FINS Smith Point Visitor Center. In 1995, the estimated daily traffic count on Route 46 was about 30,000 cars.

5.03 **Access to South Shore/Ferry Terminals.** Approximately 6.3 million visitors travel to Fire Island each year, of which about 1.2 million visitors travel to Fire Island by ferry. Of the Fire Island visitors traveling by ferry each year, approximately 70 percent travel to the ferry terminals by private automobile and 30 percent travel on the Long Island Rail Road. A small percentage of visitors from New York City access the south shore by private coach service.

5.04 Public Transportation. Ferry operators estimate that 30 percent of total ferry traffic arrives via the Long Island Rail Road. The Montauk Route of the LIRR stops at Bay Shore, Sayville and Patchogue, the three terminals from which all Fire Island ferries depart. Diesel trains servicing the Montauk Route seat about 110 people per car and hold up to 1,000 standing passengers. From mid-May through mid-September, 21 trains run per weekday and 19 run per weekend day. On Friday evenings, Sunday afternoons, and Monday mornings in the summer, the trains operate at full capacity. On summer holiday weekends when the regular trains reach capacity, trains are added to accommodate extra traffic. Normal traffic (in off-peak, non-summer months) between Penn Station and Bay Shore, Sayville and Patchogue is about 500 persons per station each day. During the summer, "normal traffic" decreases about 10 percent because fewer daily commuters use the train. The LIRR does not have specific capacity information for summer ridership.

5.05 Suffolk County Transit Service (SCTS) runs a public bus route along Montauk Highway, with stops near the Bay Shore, Sayville, and Patchogue train stations. The Bay Shore and Sayville stops are approximately 1 mile (a 15-minute walk) from the ferry terminals. The Patchogue stop is within walking distance of the ferry terminal at Watch Hill, and 1 mile (a 15-minute walk) from the Davis Park terminal. The bus runs bi-hourly from 6:00 AM until 7:00 PM and costs $1.50 per ride. This service is running at 50 percent capacity and is used primarily by Long Island residents traveling to and from work. SCTS also runs a feeder route to Smith Point County Park, with year-round and seasonal service. The seasonal service on the Route 74 line offers two trips in the morning and three trips in the afternoon, while the year-round service requires a transfer and runs throughout the day.

5.06 Private Transportation. Due to time constraints, many visitors use private taxi services to reach the ferry terminals from train stations. In Bay Shore, Tommy's Taxi provides taxi and bus service between the train station and ferry terminal, coordinating with train arrival and ferry departure times. In Sayville, Colonial Transportation charges $2.00 per person each way for a similar service between the Sayville train station and the ferry terminal, and is currently running at capacity. In Patchogue, four taxi services provide service from the Patchogue train station to the Davis Park ferry terminal and charge comparable rates. Visitors to the Watch Hill ferry departing from Patchogue walk the short distance from the train station to the terminal.

5.07 For New York City residents who want alternative private transportation to Fire Island, several companies provide bus service between Manhattan and the ferry terminals. Approximately 5 percent of the total traffic to Bay Shore is provided by Tommy's Taxi and David's Taxi. These companies run buses of 11-14 passengers at a cost of $16.00 each way. From late June through Labor Day, the buses run about 10-15 times daily (each way). Horizon Coach runs a bus service between midtown Manhattan and the Sayville ferry terminal that costs $20.00 per person each way. The coach runs four times per week from Memorial Day through Labor Day. Horizon Coach buses hold 49-58 persons, and the service is currently operating at 85 percent capacity. In 1999, Colonial Transportation will begin similar service with 11-14-person vans between Man-hat-tan and the Sayville ferries.

5.08 *Private Automobile/Ferry Parking*. About 70 percent of all Fire Island ferry traffic arrives by private automobile. Traffic reaches the three terminals by the extensive network of Long Island highways, and a more detailed description of this system is provided below. Upon arrival in Bay Shore, visitors have the option of parking for $7 per day near the terminal in one of several privately operated lots (Fire Island Ferries estimates capacity at 2,500-3,000 cars, including valet parking) or the Town of Islip's public lot 1 mile north, which holds about 700 cars. The parking is sufficient, although the lots, with capacity for more than 3,500 cars, are full on summer weekends. Anecdotally, ferry operators have said that they have not received capacity shortage complaints and drivers can generally find parking. In Sayville, the many privately operated lots around the terminal provide space for more than 500 cars. Similar to Bay Shore, the parking lots are full on weekends, but capacity is sufficient. When the privately operated lots are full, some visitors use the municipal lot reserved for Islip residents only. Capacity of this lot is unknown. In Patchogue, 154-space parking at the Federal lot for the Watch Hill terminal is free, and the privately operated parking lot at Davis Hill provides space for about 300 cars. Both lots are near capacity on weekends.

5.09 **Access from the Bay Shore of Long Island to Fire Island.**

5.10 Ferry Traffic. According to the US Army Corps of Engineers Navigation Data Center, an annual average of 1.2 million visitors traveled on ferries between Fire Island and the south shore in the years 1995 to 1997. Three public ferry companies operating under federal concessions provide public access to Fire Island: Fire Island Ferries from Bay Shore, Sayville Ferry Service in Sayville, and the Davis Park Ferry Company in Patchogue. Fire Island Ferries services the communities of Kismet, Saltaire, Fair Harbor, Dunewood, Atlantique, Ocean Beach, Seaview, and Ocean Bay Park. Fire Island Ferries accounts for approximately 65 percent of total ferry traffic. The company's 12 boats can carry up to 3,300 passengers. During the summer, the system runs to Fire Island at 75-80 percent capacity on Thursdays and Fridays and at 100 percent capacity on Sunday afternoons. The Sayville Ferry Service transports visitors to Cherry Grove, Fire Island Pines, Sailors Haven/Sunken Forest, and beginning in 1998, to Talisman/Barrett Beach and Water Island. With 7 boats carrying a total of about 1,400 passengers, Sayville Ferry Service accounts for about 25 percent of total ferry traffic. The Davis Park Ferry Company, which services Watch Hill and Davis Park, carries about 10 percent of all ferry traffic. Davis Park Ferry Company has 5 boats with a capacity of about 1,000 passengers. Two privately operated ferry services, between Bay Shore and Point O' Woods (run by Bay Point Navigation, Inc.) and between the Village of Bellport and Bellport Beach, are run exclusively for the residents of those communities, and account for about 1 percent of total ferry traffic.

5.11 Private Transportation. Private transportation is the predominant method of access to Fire Island, with 4.7 million visitors (70 percent of total visitors) accessing the island by auto-mobile. In 1995, 3.2 million visitors traveled to Robert Moses State Park and 1.5 million visitors traveled to Smith Point County Park. Private access is also provided by private boat, water taxi, bicycle and seaplane. Additional information is provided discussed in the "Access" section, below.

5.12 **On-Island Circulation**. The only vehicular traffic currently on Fire Island is at the western and eastern ends of the island. Vehicular access to Fire Island is allowed at Robert Moses State Park and Smith Point County Park; other areas on the island are vehicle-accessible only by a special permit issued by the town. Due to the lack of roadway infrastructure and prohibition of cars, travel around the island is an access issue. While on the island, day visitors can venture to neighboring communities by water taxi or on foot. Vehicles without a special permit are prohibited in the Fire Island National Seashore. In 1997, FINS issued only 250 special permits, including 145 residential, 80 contractor, 30 essential (utilities businesses), and 30 municipal.

5.13 Water taxis provide convenient lateral transportation between the communities. The sandy "Burma Road" provides a route for construction, utility, and pedestrian traffic between the communities. Segments of Burma Road are difficult for pedestrian transportation because of the large distance separating several communities. In addition, the sandy composition of Burma Road makes bicycle use difficult.

5.14 **Land and Water Uses**. This description of land and water uses characterizes the existing conditions in the vicinity of the project site. To determine existing conditions and assess the potential for impacts, primary and secondary study areas within Suffolk County have been defined. The primary study area encompasses Fire Island in its entirety, extending from Fire Island Inlet east to Moriches Inlet. Surrounding Fire Island along its 32-mile length are the Great South Bay to the north, the Atlantic Ocean to the south, and the inlets to the west and east. The secondary study area on the southern bay shore of Long Island was also defined. It is generally bounded by the Montauk Highway to the north, Great South Bay to the south, Robert Moses Causeway to the west, and Harts Cove in East Moriches to the east. The secondary study area also includes the eastern tip of the Jones Beach/Gilgo Beach barrier island and Captree Island, both of which lie north of Robert Moses State Park at the western end of Fire Island. This secondary study area includes parts of the Towns of Babylon, Islip (including the incorporated Village of Brightwaters), and Brookhaven (including the incorporated Villages of Patchogue and Bellport).

5.15 **Land and Water Uses on Fire Island.** The 2,940-acre island is narrow, with widths ranging from a few hundred feet at Talisman to a ½ mile at Saltaire. From west to east Fire Island comprises Robert Moses State Park, 17 residential beach communities, and Smith Point County Park, which are located within FINS (see Figures 5-3 through 5-13 of the EIS). Since World War II, the island has boomed into a renowned summer destination for New York City and Long Island residents. Consequently, its developable land is almost completely built. The uninhabited remainder of the island has been federal park land since Congress authorized enabling legislation for FINS in 1964. This law allowed NPS to acquire land on Fire Island through donations and condemnation, a process that was complete by the mid 1970's.

5.16 Recreation. Visitors appreciate Fire Island for its abundance of recreational land and water activities. Each community has a beach for bay or ocean swimming, and sometimes both. Thirteen communities have lifeguard-protected beaches on the ocean and seven have bayside life-guard protection. Generally, the bayside beaches are roped-off swimming areas near the town's marina or dock; therefore, these areas tend to attract families with children. In Saltaire and Ocean Beach, the beach areas are next to the village parks, bay beaches, and commercial areas. Other than swimming, popular water sports include surfing, sea kayaking, windsurfing, water-skiing, canoeing, and sailing. Area businesses rent windsurfing boards hourly, and stores on the mainland sell and rent other equipment, such as sea kayaks and jet-skis. Several Fire Island communities have organized sailing programs in which participants race each other and groups from Long Island throughout the season.

5.17 The project area features a wide array of fish species plus shellfish and crabs, each of which has a designated prime season. Consequently, local sport fishing in the Great South Bay and Atlantic Ocean is an activity for which the area is well-known. In 1997, FINS registered 1,430 recreational permits for fishing in the wilderness area alone. In addition, several local charter companies on Captree Island and the mainland offer deep-sea fishing excursions in the Atlantic.

5.18 Fire Island has a variety of land sports facilities, such as tennis courts and softball fields. Bicycles are commonly used for access and recreation. Along with the option of riding along the beach, bicyclists can use the concrete or sand paths connecting the communities. Bicycles are available for rental at local markets and hardware stores. Runners and walkers are provided with many opportunities for activity by the miles of beach, inland paths and boardwalks. Each residential community is generally self-sufficient regarding recreation. The convenience of local facilities suggests that residents rarely use the adjacent federal facilities. Following is a description of each public recreation area, and the facilities included in each.

5.19 Robert Moses State Park, at the west end of the island, has public beaches, picnic areas, comfort stations, and concessions (see Figure 5-2 of the EIS). Full lifeguard protection is provided in the summer season, and fishing areas are designated outside the swimming area. Within the Fire Island National Sea-shore, three major recreational areas are open to the public: Sailors Haven, Watch Hill, and Smith Point. Sailors Haven is the site of the Sunken Forest, a

300-year-old preserve, which features an elevated boardwalk for public access. Sailors Haven has a 47-slip marina, snack bar, and souvenir shop. Picnic facilities and lifeguard protection are also provided. Watch Hill is the largest FINS site, featuring a 183-slip marina, restaurant, grocery and souvenir shop. Along with lifeguard protection on its Oceanside beach, Watch Hill has 25 camping facilities open from May through October. Along with these major recreational areas, a small public facility with a picnic area and restrooms exists at Talisman, the island's most narrow point.

5.20 East of Watch Hill is the Otis G. Pike Wilderness Area, which was established by Congress in 1980 (see Figure 5-13 of the EIS). Within this wilderness are several ecosystems through which visitors hike, canoe, kayak and camp. The National Park Service is currently proposing to designate additional property as part of the Wilderness Area, and in the process has removed several residential and agricultural structures from these territories. Back-country hikers and campers register at the Watch Hill visitor center. Smith Point County Park is to the east of the Wilderness Area and is technically within the boundaries of FINS, but is managed by the Suffolk County Parks Department. The 6-mile long park has public beach access, a visitor center, and camping facilities for 75 vehicles. Most of the recreational areas are found in the vicinity of the terminus of William Floyd Parkway.

5.21 The Town of Islip manages several parks on Fire Island exclusively for its residents' use. Atlantique Town Beach offers many amenities such as a 157-slip public marina, restrooms, grill area, basketball court, handball court, and playgrounds. Until recently, the town also managed Barrett Beach, a facility near Tallisman with a marina, playground, and picnic facilities. In 1998, the title for this property was transferred to NPS. Long-term plans have not yet been determined for jurisdiction of the park. The Town of Brookhaven manages two public beaches, Leja Beach in Davis Park and Great Gun Beach in Smith Point County Park. Leja Beach has a public marina, picnic area, swimming beach, and playground. Great Gun Beach has a life-guard-protected swimming area, playgrounds, and restrooms. The municipality of Bellport manages a beach within the wilderness area exclusively for its residents. The area has a private dock, visitor center/concession building, and oceanfront picnic deck. Access to Bellport Beach is provided by the Bellport ferry, a service exclusively for Bellport residents.

5.22 Community Services. The communities have powers that are similar to cooperatives or condominiums. They also act like hamlets. Many communities have individual volunteer fire and ambulance services, and several communities have doctors available. Suffolk County pro-vides police coverage of the island, and the Ocean Beach Police Department and Saltaire Security enforce local ordinances. The National Park Service is responsible for policing conservation laws on federal property, and the U.S. Coast Guard enforces boat safety regulations in surrounding waters.

5.23 Marinas. As shown in Table 5-1, Fire Island has 10 marinas that accommodate a total of 1,000 boats. About ÿ of the slips are leased on a transient basis, and the remainder are leased by the season. Six of the marinas are private and four have public concessions. Only two facilities, those at Robert Moses State Park and at Seaview, operate year-round. Half of the marinas, including both FINS facilities, include amenities such as grocery or supply stores.

Table 5-1
Fire Island Marinas

Name	Location	Season/ Year-Round	Transient Berths	Total Berths	Amenities*
Robert Moses State Park Boat Basin	Robert Moses State Park	YR	40	40	G, I, M
Kismet Inn and Marina	Kismet	S		100	
Atlantique Marina	Atlantique	S	157	157	
Village of Ocean Beach Marina	Ocean Beach	S	17	130	
Sea View Marina	Sea View	YR	50	50	
Flynn's Marina and Restaurant	Ocean Bay Park	S	36	47	G, I
Sailor's Haven Marina	Sailors Haven	S		47	G, I, S
Fire Island Pines Marina	Fire Island Pines	S		85	
Davis Park Marina	Davis Park	S		250	G, I
Watch Hill National Seashore Marina	Watch Hill	S		183	G, I
Total			300	1,089	

Note: * G—groceries, I—ice, M—marine supplies, S—snacks.

5.24 Access. According to the Fire Island Association's 1996 Recreation and Access Plan, approximately 6.3 million persons visited Fire Island in 1995. About 74 percent of total visits were by private automobile to Robert Moses State Park on the west end or Smith Point County Park on the east end. The remaining 26 percent traveled by ferry or private boat to the central area of the island where residential communities and Fire Island National Seashore visitors' centers are found. Three public ferry companies provide public access for approximately 1.2 million visitors to Fire Island, and two privately operated ferries provide service to Point O' Woods and Bellport Beach exclusively for their residents. Although the transportation service to the island is adequate for its current visitor numbers, concern about the high price of travel (on average $11.50 per person, round trip by ferry) between the island and the mainland has been expressed. The presence of a national park that is inaccessible to potential visitors is an important issue.

5.25 Access to Fire Island by automobile is provided by the Robert Moses Causeway on the west and the William Floyd Parkway on the east. Both roads intersect Montauk Highway (Route 27A) and the Sunrise Highway (Route 27), which are two major connectors through the south shore. North of Route 27A are two major east-west highways: the Northern State Parkway and the Long Island Expressway (Interstate 495). The Robert Moses Causeway, which is an extension of the Sagtikos State Parkway, provides access over the Great South Bay to Captree State Park and over the Fire Island Inlet to Robert Moses State Park. Traffic to Smith Point County Park turns south off Route 27A to the William Floyd Parkway (County Route 46), which provides access over Narrow Bay.

5.26 Robert Moses State Park is open year-round. Its four parking fields have a capacity of 5,796 cars, and a $5 per car fee is charged during the summer season. In 1995, attendance at the park was 3.2 million persons, with an average weekday attendance between 20,000-30,000 and a weekend average of 50,000 per day. Occasionally, the beach reaches capacity and overflow traffic is rerouted to Jones Beach. At Smith Point County Park, the lot capacity is 5,000 cars and parking costs $5 per vehicle. During busy summer weekends, the lot is generally about two-thirds full. In 1995, more than 95,000 cars entered the parking lot, and 1.5 million individuals visited the park, making it the most heavily used Suffolk County park facility.

5.27 Docking facilities for private boats are located in many communities, including Atlantique, Seaview, and Fire Island Pines. Talisman/Barrett Beach and Water Island, which were previously accessible only by private boat, are serviced by ferry beginning in 1998; however, private boat remains the most common form of access to that area. Communities, such as Lonelyville and Oakleyville, which have no direct ferry service, are accessible ~~only by~~ private boat.

5.28 Two alternative modes of travel used by a small number of visitors to Fire Island are seaplane and bicycle. The only seaplane landing is the public landing at the Fire Island Pines harbor. The William Floyd Parkway bridge over the Narrow Bay to Smith Point offers the only bicycle access to Fire Island, with a bicycle/pedestrian lane providing access to the county park and FINS Wilderness Area visitors' center. The Robert Moses Causeway to Robert Moses State Park is too narrow to accommodate a bicycle lane.

5.29 Great Gun Beach, a Town of Brookhaven beach at Smith Point, is currently only accessible by private boats, and docking facilities are available for the day only. It is also accessible via 4-wheel drive vehicle or on foot from Smith Point County Park. Brookhaven's 1996 comprehensive plan discusses the possibility of ferry service from Mastic or Center Moriches to this area.

6.01 **Public Access Evaluation**. An evaluation of sufficient public access must recognize the complications associated with the number of criteria, which could be contradictory.

6.02 Robert Moses State Park. The existing level of access into Robert Moses State Park meets the Federal Requirements for access, being open to all visitors regardless of origin or home area.

6.03 Fire Island National Seashore (FIIS) Based upon coordination with FIIS representatives, existing public access on Fire Island is consistent with the management plan for Fire Island National Seashore. This plan involves a careful balance of making federal lands available and usable to the public while protecting and perpetuating the environmental features and values. As a result, the majority of Federal properties are classified as low recreational use areas. Within the remainder of the project area, access to the beach is provided, as discussed above, primarily through ferry access. The available transportation pathways, including trains, buses, private automobile, allow equal access to the mainland ferry terminals and therefore also access to the barrier island. The exception are two ferries, to Point O' Woods and Bellport Beach, which do not allow passengers other than residents. With the exception of these two communities, access to the remainder of the areas is open to all visitors regardless of origin. Beach restoration is presently included in the area fronting the community of Point O' Woods. In reviewing ferry service in the area, an alternative ferry service was identified which provides access to this area within 500 feet of the Point O'Woods ferry terminal. Based upon the proximity, it was determined that access is available to all, equally.

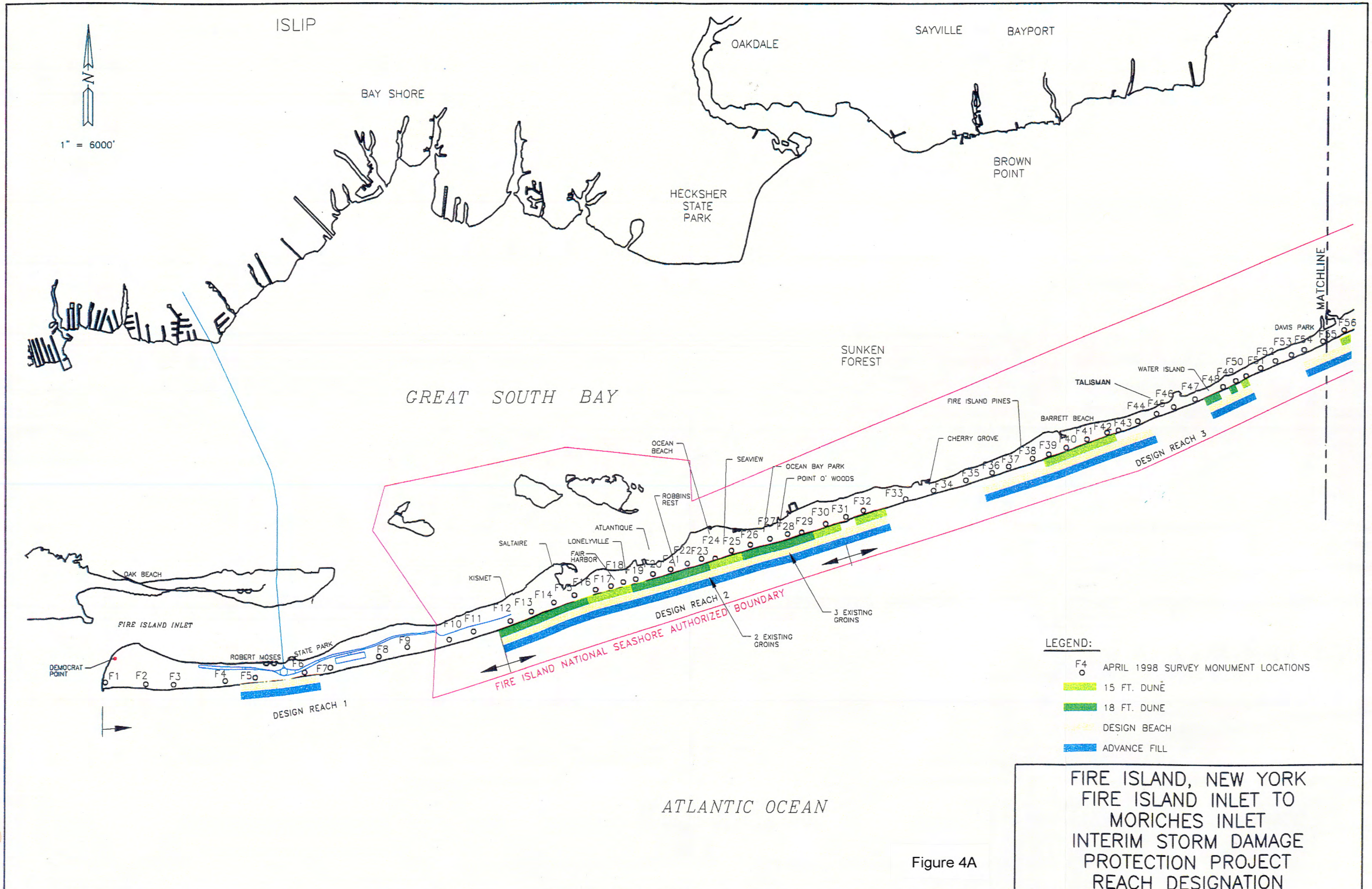
6.04 Smith Point County Park. The existing level of access into Smith Point County Park meets the Federal Requirements for access, being open to all visitors regardless of origin or home area.

6.05 Existing Public Access meets Federal Standards.

Since there is adequate parking facilities for the general public at both the ferry terminals and at Robert Moses and Smith Point Parks, the requirements for parking as specified in ER 1165-2-130, paragraph 6h.(2) meet the federal guidelines.

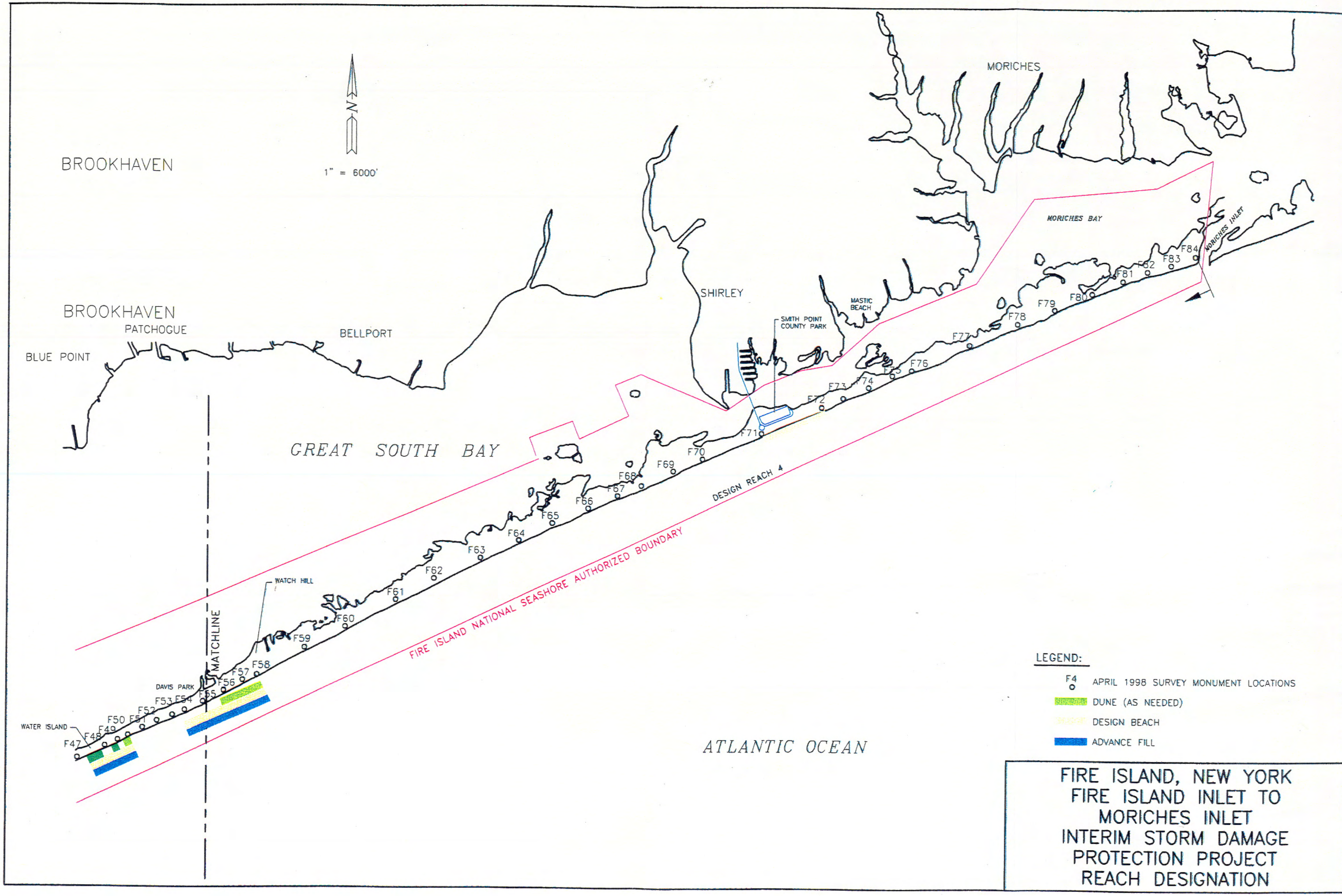
The provisions for access as required in ER 1165-2-130, paragraph 6h.(3) generally specify that public access points be no further than one-half mile from each other in order to justify federal participation. This is obviously not the case for Fire Island, per se. However, paragraph 6h.(3) specifically states that "Reasonable public access must be provided in accordance with the recreational use objectives of the particular area."[*underlining added for emphasis*] Since the recreational use objectives of FIIS are unique, and specifically for low recreational usage, it is therefore concluded that no additional public access is needed with the proposed Fire Island Interim project in place.

7.01 **Conclusion**. In conclusion, the existing conditions Public Access Plan is deemed to be in compliance with all relevant Federal standards for the Fire Island Interim project.



FIRE ISLAND, NEW YORK
FIRE ISLAND INLET TO MORICHES INLET
INTERIM STORM DAMAGE PROTECTION PROJECT
REACH DESIGNATION

Figure 4A



N
1" = 6000'
BROOKHAVEN
BROOKHAVEN
PATCHOGUE
BLUE POINT
BELLPORT
SHIRLEY
MORICHES
MASTIC BEACH
SMITH POINT COUNTY PARK
MORICHES BAY
MORICHES INLET
GREAT SOUTH BAY
ATLANTIC OCEAN
MATCHLINE
WATCH HILL
DAVIS PARK
WATER ISLAND
DESIGN REACH 4
FIRE ISLAND NATIONAL SEASHORE AUTHORIZED BOUNDARY
F47 F48 F49 F50 F51 F52 F53 F54 F55 F56 F57 F58 F59 F60 F61 F62 F63 F64 F65 F66 F67 F68 F69 F70 F71 F72 F73 F74 F75 F76 F77 F78 F79 F80 F81 F82 F83 F84
LEGEND:
F4 APRIL 1998 SURVEY MONUMENT LOCATIONS
DUNE (AS NEEDED)
DESIGN BEACH
ADVANCE FILL
FIRE ISLAND, NEW YORK
FIRE ISLAND INLET TO
MORICHES INLET
INTERIM STORM DAMAGE
PROTECTION PROJECT
REACH DESIGNATION