



Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point



Interim Progress Memorandum



Summary of Data Gap Identification and Overview of Proposed Data Collection Efforts

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INTRODUCTION

Location. The Reformulation Study area encompasses the south shore of Long Island, New York from Fire Island Inlet to Montauk Point. The study area includes the barrier island chain, the Atlantic Ocean shorelines and adjacent backbay waters of Great South Bay, Moriches Bay and Shinnecock Bay. The western and central portions of the study area are primarily low-lying and subject to the effects of tidal flooding from the inlets in the project area (Fire Island, Moriches and Shinnecock), and from ocean storm surge, wave impacts and barrier island overwash and breaching. Distinctly different geomorphic features and topographic relief characterize the eastern portion of the study area (from the Village of Southampton eastward to Montauk Point). Thus, the resulting storm impacts differ, with ocean storm surges and associated wave energy the primary causal factors for shoreline erosion.

Scope. While this report contains a description of the affected environment, such discussions are limited in detail and are not intended to represent a baseline condition assessment. In addition, detailed sampling protocols are not described herein, pending general coordination of study requirements. This document focuses on the current conditions of the study area, and the *primary* impact receptors (e.g., the beach fronts, the barrier island chain and the immediate back bay areas) that may potentially be affected under the project No-Build Alternative. While it is recognized that several alternative actions for storm protection are currently under consideration, possibly resulting in different secondary effects, this document remains focused on the primary impact receptors associated with the Reformulation Project. For example, if local protection, such as levees or floodwalls along the south shore mainland areas, is identified as a highly desirable alternative through Reformulation Mitigation Screening, then additional studies may be proposed in the future to adequately address the associated information needs/data gaps.

Purpose. The Fire Island Inlet to Montauk Point, New York project is a Federally authorized project which was originally 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. The authorized project is currently undergoing reassessment under the Fire Island to Montauk Point Reformulation Study. The following document is designed to identify information collected to date, identify data gaps, and propose scoping of additional studies.

The objectives of this document are: to provide an advance summary of the current available data and the proposed studies concerning the natural resources component of the Reformulation study area; and to solicit comments from the involved agencies with sufficient time to alter the plans, if necessary. Hence, the proposed studies are presented



in a generic fashion; the detailed methodologies will be developed upon receiving input from the agencies. Meanwhile, it can be assumed that all study methodologies will be consistent with sound scientific principles and accepted protocols.

Many field studies have already been proposed to, and reviewed by the US Army Corps of Engineers (USACE) and the Environmental Technical Management Group (ETMG). These proposed studies were judged according to the following criteria:

1. **Applicability** The proposed study had to exhibit a direct, demonstrated relationship to the expected (reasonable) impacts of the potential alternatives.
2. **Data Gap Fulfillment** The proposed study had to fulfill one or more identified data gaps as opposed to simply being a relevant piece of work.
3. **Time and Budget** The proposed study had to be achievable under the available funding and could not be so extensive as to drain funds from other areas of inquiry.

The objective of the natural resource section of this document is to summarize the natural resource data collected so far for the Fire Island Inlet to Montauk Point Storm Damage Reduction Reformulation Study. Several data gaps were identified as a result of this baseline data collection. The field programs that are currently underway to fill these data gaps are summarized below, and additional proposed studies/surveys are also presented. A Natural Resources Bibliography is attached, along with a list of persons contacted for the literature review effort. The human environment section has a similar purpose, and also summarizes data gaps, ongoing studies, and proposed studies.

Format of Report. The main document sections are as follows:

- Literature Search: review and evaluation of available data sources
- Affected Environment: provides discussion of environmental resources potentially impacted by alternative plans.
- Natural Resources Data Gaps and Study Needs:
 - Ongoing Studies
 - Proposed Additional Studies
- Human Environment Data Gaps and Study Needs:
 - Ongoing Studies



-Proposed Additional Studies

- Natural Resources Bibliography
- Human Environment Bibliography (pending)

LITERATURE SEARCH

Natural Resources

The overall natural resources literature search conducted to date has included specific research for the West of Shinnecock and Fire Island Interim Plan studies, along with an undertaking targeted specifically to the Reformulation effort. In-house reference libraries of terrestrial, marine and estuary resources, wetlands, and associated flora and faunal species have been developed by both the New York District and their technical consultants. The US Department of Interior's (USDI) electronic bibliography reference "ProCite" was obtained and reviewed for additional natural resources references pertinent to the study area. Using search engines on the World Wide Web, the Internet was also utilized as a means to obtain historical and current information. Additional research was conducted at the following libraries:

- Marine Atmospheric Sciences Information Center, Marine Sciences Research Center (MSRC) at Stony Brook, New York
- Main library system at the State University of New York at Stony Brook, New York
- US Fish & Wildlife Service (USFWS), Seatuck National Wildlife Refuge, Islip, New York
- US Department of Interior (USDI), Fire Island National Seashore, Patchogue, New York

Agency personnel and libraries (USFWS, USDI and USACE) and were found to be extremely helpful in locating unpublished in-house reports or gray literature. Additional references were requested from the following agencies or organizations:

- USFWS, Cortland, New York office regarding endangered wildlife species
- NY State Dept. of State (NYDOS), South Shore Estuary Reserve Technical Reports
- NY State Dept. of Environmental Conservation (NYSDEC), Natural Heritage Program regarding natural communities, plants and wildlife species listed as unique, rare, protected, special concern, threatened, or endangered by New York State
- NYSDEC, Marine Resources Division regarding finfish and shellfish resources
- Towns of Babylon, Brookhaven, Easthampton, Islip, and Southampton
- New York Sea Grant Extension Program, Stony Brook, New York



- National Marine Fisheries Service (NMFS), Sandy Hook, New Jersey
- Mid-Atlantic Fisheries Management Council (MAFMC), Delaware

As a result of the database search, much available literature (both published and unpublished) dealing with the natural resources of Long Island's south shore, the barrier island chain, and the estuary area of Great South Bay has been identified. Several historic accounts are available documenting the changes to Moriches Bay and inlet area as a result of historic breaching events. However, published literature concerning documented conditions within Shinnecock Bay, the coastal ponds of the South Fork, and the beachfronts/offshore areas along the Montauk peninsula appears to be limited.

Efforts to contact or obtain information directly from the various townships which front the south shore, have had limited success. To date, information has been obtained with the cooperation of the Towns of Babylon, Brookhaven, Southampton and East Hampton; no information has yet been obtained from the Town of Islip, and only limited information was obtained from the Villages contacted.

Human Environment

The literature search for the human environment has several foci. The first is land use and land use regulation. The essence of potential impacts on the human organization is land use, the types of uses, the density of the uses, and the history and future of these uses. During the DEIS preparation of the Fire Island Interim Project (FIIP) study, all of the Towns and Villages within the FIIP study area were contacted as well as the Suffolk County Planning Department. All current regulations and relevant planning studies in the FIIP study area have been obtained. The second focus is socioeconomic data.

These data address the structure of the human environment and the level of its economic development. Data have been obtained from the US Census Bureau and from the Suffolk County Planning Department. A third part of the human environment is the transportation systems; how people get to the area and how people move around the area. The transportation systems include ferries, trains and roadways. Data on the ferries have been collected through Waterborne Commerce Statistics and interviews with the ferry operators. Interviews have also been conducted with the Long Island Railroad for the train transportation. Studies conducted by New York State Department of Transportation for the FIIP study area have been collected. In addition, the Town and Village Planners have been interviewed to determine the types and uses of intermodal transfers, a very important component of the Long Island transportation systems. The final focus has been water quality, which has involved the largest number of data sources. These sources include:

- State University of New York at Stony Brook, Marine Sciences Research Center;



- New York State Department of Environmental Conservation Regional Office and Marine Sciences Division;
- New York State Sea Grant;
- New York State Department of State;
- New York State Department of Parks and Recreation;
- Long Island Regional Planning Board;
- The Nature Conservancy
- Cornell Cooperative Extension;
- Southampton College;
- Dowling College;
- South Shore Estuary Reserve Council;
- Long Island Public Library system;
- New York State Library system;
- Suffolk County Water Authority; and
- various Baymen Associations.

AFFECTED ENVIRONMENT

Alternatives being considered for the reformulation will impact various aspects of the environment. A discussion of these environments would require extensive documentation far beyond the scope of this memorandum. The intent of the following paragraphs is to provide a general overview of the environments that may be impacted. These discussions have been formatted into natural resources and human environment sections.

Physiographic Setting

The project area, extending from Fire Island Inlet easterly to Montauk Point along the Atlantic Coast of Suffolk County, is approximately 83 miles long, and constitutes approximately 70% of the total ocean shoreline of Long Island. The study area is comprised of a diverse geography, ranging from barrier islands, transitional beaches, and headlands. The study area includes three large estuarial bays: Great South Bay, Moriches Bay, and Shinnecock Bay. The project area includes the ocean shoreline, barrier beaches, Fire Island, Moriches and Shinnecock Inlets, bay areas and mainland areas, as well as suitable offshore borrow areas for beach restoration.

The western portion of the study area includes the 32-mile long Fire Island, a narrow strip of land separated from the Long Island mainland by Great South Bay and Moriches Bay. Bridges connect the island with the mainland near the east and west ends. The central portion of Fire Island consists of a series of villages and vacation communities



accessible from the mainland by ferry. The central portion of the project area consists of the barrier island portion of Southampton separated from the Long Island mainland by Moriches Bay and Shinnecock Bay. East of Shinnecock Inlet, a peninsula defines the project area and shelters Shinnecock Bay from the Atlantic Ocean. East of Southampton the barrier island ceases, and the project area consists of headland areas which contain inlets, bays (the largest being Mecox Bay), and coastal ponds.

The beach varies greatly in width in the western portions of the project area. At Westhampton Beach, an area battered by a series of severe storms, the beach is narrow, whereas at East Hampton Town Beach, the beach is very wide. Little development has occurred directly on the beach. Most buildings are separated from the beach by primary and in some cases, secondary or tertiary dunes. In a few places, most notably in Southampton Village, large residences are sited atop the primary dunes.

At the eastern end of the project area, the topography of the beach steepens. At Hither Hills State Park, grassy hillsides adjoin the level land behind the ocean beach. At Montauk Point, a narrow rock-strewn beach adjoins an eroding earthen bluff. Rock revetment has been installed below the Montauk Point Lighthouse to reduce bluff erosion. Most buildings, where present, are sited atop the bluffs and are not visible from the narrow beach below. The project area terminates at Montauk Point, the easternmost point on Long Island.

Natural Resources

The oceanic and nearshore waters of the study area represent a dynamic high-energy environment. The marine organisms that occupy this zone are well adapted to the harsh coastal conditions. The macrobenthic invertebrates, which provide a valuable food source for both terrestrial and aquatic wildlife species, are present within the interstitial spaces of the benthic sediments throughout the offshore, nearshore and intertidal waters of the project area. Wildlife associated with this area include the more pelagic avian species, several species of sea turtles, whales, dolphins, and seals. Finfish and crustaceans move relatively freely between the nearshore areas and offshore waters. Shoreline stabilization measures (e.g., jetties at the major inlets and groins to the east of Moriches Inlet) provide hard bottom structure to an otherwise soft, sandy substrate in the intertidal zone. While these structures may provide an additional habitat which attracts a wider diversity of finfish and crustaceans than might otherwise occur, they may also impede the lateral nearshore movements of these species parallel to the seashore. The Mid-Atlantic Fisheries Management Council (MAFMC) has nominated the offshore waters within the project area for federal designation as Essential Fish Habitat for bluefish. This is currently under review by the National Oceanic and Atmospheric Administration (NOAA).



On the Long Island barrier island chain, plant diversity and height generally increase with distance from the oceanfront (Art, 1971). Progressing landward, the area between the surf zone and the toe of the primary dune is typically devoid of vegetation. It is here that the rare plant seabeach amaranth (formerly listed as Federally threatened) typically occurs. This zone also provides critical habitat for the Atlantic Coast population of the piping plover (listed as Federally Threatened and State Endangered) and least tern (listed as Endangered by the State). Piping plovers generally nest alongside least tern colonies in the upper portion of the sandy beach close to the toe of the dunes. Piping plovers are typically dependant upon the feeding opportunities derived from a heavy wrack line (the vegetation and debris that accumulates at the uppermost reach of a high tide) and ephemeral pools on the ocean beach. As a result of several years of study of piping plovers, it has been determined that these two habitat requirements are limited within the project area; thus, the local population relies heavily upon unobstructed access (created by an overwash) to the backbay marshes to feed (Elias-Gerken, 1994). Gradually sloping overwash fans which extend from the beachfront into the backbay waters provide optimal conditions for adults raising chicks (e.g., direct linkage between nesting habitat and prime feeding habitat).

A typical profile view through the barrier consists of a primary dune closest to the ocean beach, followed by an interdunal swale, and then a secondary dune (several are located in more stable portions of the barrier). The maritime freshwater interdunal swale community, which occupies the low-lying and wetter pockets between the dunes, generally supports a variety of rare and unique plants. This community has been designated by the New York State Department of Environmental Conservation (NYSDEC) Natural Heritage Program (NYNHP) as a Significant Habitat. Beachgrass, being a true pioneer plant, dominates the dune and swale community, especially in areas most exposed to wind and salt spray (e.g., the ocean face of the foredune and crests of dunes). A shrub thicket typically develops on the lee side of the primary dune and covers the less exposed areas on the secondary dune(s). Between and behind the protective barrier of the dune system, a maritime forest may develop, which may contain isolated freshwater bogs. The 200-300 year old Maritime Holly Forest, characteristic of the Sunken Forest area on the Fire Island National Seashore, has also been designated by the NYNHP as a rare and Significant Habitat. It should be noted that the Maritime Holly Forest occupies only one linear mile of the approximate 50 linear miles of the Fire Island barrier beaches. The northerly edge of the barrier islands are generally fringed by emergent tidal wetland vegetation. The backbay wetlands and transitional areas may also support a variety of rare plants (Stalter et al, 1986).

More than 150 species of songbirds, about 40 different shorebirds, and various raptors utilize the barrier islands within the project area either for breeding, feeding, over-wintering or as a stop-over during their migration through the area. In addition to the piping plovers mentioned earlier, over 35 additional avian species are Federally listed as Endangered or Threatened, and listed as Special Concern, Threatened, or Endangered by the State of New York. In particular, least terns, roseate terns, common terns and northern harriers may frequently be found foraging in the nearshore waters or over the barrier islands.



Vegetated marsh islands and non-vegetated tidal flats are present in the bays to the north of the barrier islands. Several dredge spoil islands are also present within the Reformulation project area. These islands often provide isolated and highly desirable nesting habitat for various shorebirds and wading birds, including the Federally Endangered roseate tern and State Threatened common tern. Abundant eelgrass beds are also present throughout most of Great South Bay, in the clear shallow waters ranging in depth from 1-1/2 to 5-1/2 feet (Greene et al, 1978). This estuarine zone is extremely productive and serves as a nursery habitat for finfish, crustaceans and shellfish. Published information concerning eelgrass and other submerged aquatic vegetation (SAV) distribution in Moriches and Shinnecock Bays is lacking. However, there are anecdotal accounts of lush SAV beds occurring along the northerly extent of these embayments. The MAFMC has nominated the backbay waters within the project area for Federal designation as an Essential Fish Habitat for summer flounder. This nomination is currently under review by NOAA.

Nuisance algal blooms have historically occurred in Great South Bay and Moriches Bay, caused by excess nutrient loadings commonly attributed to duck farm wastes. Conditions favoring these blooms were exacerbated during periods of decreased tidal flushing (e.g., closure of Moriches Inlet). Brown tide blooms continue to occur in Great South Bay during the summer. These algal blooms may significantly impact shellfish growth and development and indirectly affect eelgrass vigor due to increased turbidity (NYSDOS, October 31, 1997).

The large open, shallow bay waters and protective marshes provide cover and feeding areas for a plethora of wading birds, shorebirds and waterfowl. Since the project area lies within the Atlantic Flyway, it is particularly important to migratory waterfowl that seek a safe haven during the winter. All of the backbay waters within the project area (Great South Bay, Moriches Bay and Shinnecock Bay) have been designated as *Significant Coastal Fish and Wildlife Habitats* by the New York State Department of State (NYSDOS); and as *Significant Habitats and Complexes of the New York Bight Watershed* by the US Fish and Wildlife Service (USFWS, November 1998).

The project area lying east of the barrier island chain is characterized by relatively narrow beaches, low dune elevations, and farmland or suburban development immediately behind the dune line. A more extensive dune and swale community occupies the easterly portion of this reach in Amagansett, immediately west of the Montauk headlands. A series of inland and coastal ponds occupy this reach of shoreline. These ponds include both estuarine, brackish, and freshwater systems, which serve as important waterfowl wintering areas (USFWS, November 1997). According to anecdotal accounts, these ponds support euryhaline benthic and fish species, as well as eelgrass and widgeon grass growth. The inlet spits on the larger coastal ponds (Mecox, Sagaponack, and Georgica Ponds) are frequently subject to washovers, and provide nesting habitat for piping plovers. The coastal pond inlets are periodically enhanced/opened by the Town Trustees to reduce back-beach flooding conditions and to promote tidal flushing.



The nearshore waters through this reach are characterized by gradually sloping (and nearly featureless) bottom grades. The finfish and benthic resources are expected to be similar to those found along the barrier island chain further west.

The Montauk Peninsula (which extends roughly from Napeague Beach eastward to Montauk Point) has been identified by the USFWS as a Significant Habitat Complex, and is comprised of a wide diversity of upland, wetland and shoreline communities. These maritime communities are characterized by moderated temperature regimes, ocean winds and salt spray. An open canopy type of vegetative cover (comprised of grassland, heath land and shrub land) predominates across this area, which is sometimes referred to as the Montauk Moorlands. These areas also provide essential habitat for a number of regionally and globally rare plant species. The Federally listed endangered sandplain gerardia (*Agalinus acuta*) has been historically recorded as occurring within the project area, along with other rare plants such as seabeach knotweed, and saltmarsh spike rush (USACE, February 1993).

Along certain stretches, the eastern shoreline is dominated by steep bluffs or large dunes and sparsely vegetated sandy to cobbly beaches.

Human Environment:

The human environment of the south shore of Long Island is extremely complex and rich in its interactions. The area is densely populated, and many forms of government are in effect. Five towns, seven villages, and an Indian reservation all have forms of land use control, as do the federal, state and county governments. These jurisdictions overlap, and their controls are often contradictory. Socioeconomic conditions vary widely. In certain areas, land is extremely expensive, and property prices are well above average levels, while in other areas a significant percentage of the population has household incomes below the poverty level.

All major modes of transportation are found on Long Island. The roadways are often congested, and long delays in travel can be encountered. Rail transportation facilities for commuters are very extensive in the east-west direction, but are non-existent in the north-south direction. Water transportation is commonly used to reach the barrier island and to travel east-west along the back bays. This water transportation can be by scheduled ferries, water taxis for hire, and by privately owned vessels. The local general aviation airports are heavily used, especially during the summer weekends. The intermodal nodes are only of fair quality, making transfers difficult in certain areas. This is especially true for transfers from rail to ferry in the Fire Island area.

Water quality in the back bays varies over both space and time. The increasing population density has undoubtedly had an effect on the water quality, but quantifying the effect is very difficult, if not impossible. Septic systems, runoff



from impervious surfaces, such as roadways, parking lots, and nutrient loadings from fertilizers all have contributed to changes in water quality. However, other natural factors, such as changes in the flow of the Gulf Stream and unusually volumes of precipitation, also affect the local water quality. Overall, the water quality has remained good, without fish kills or hypoxia.

NATURAL RESOURCES DATA GAPS AND STUDY NEEDS

Data Gaps

The New York Sea Grant (December 1993) report entitled *Estuarine Resources of the Fire Island National Seashore and Vicinity* presented numerous data gaps and monitoring needs with regard to the area's natural resources. Similar needs may be considered for the entire estuarine complex located to the north of the barrier islands. Based upon the literature search conducted to date, it appears that many of these database needs have not changed or been addressed by recent studies. The abbreviated list follows:

- Water quality monitoring including temperature, salinity, secchi disc, chlorophyll a, and dissolved inorganic nutrients (including nitrogen and phosphorous);
- Submerged Aquatic Vegetation (including both seaweeds and seagrasses) both qualitative (species present and distribution) and quantitative (abundance and seasonal variation) accounts;
- An inventory of the benthic resources associated with the following back-bay habitats: salt marshes, intertidal beaches, vegetated and unvegetated bay bottoms;
- Reports on the finfish resources of the back-bay are all dated (circa 1950's to 60's), and the use of the area as a nursery and wintering habitat warrants further investigation.

The Town of East Hampton has identified several habitat areas for which a poorly documented database, or none at all, exists. These habitats may or may not be directly impacted by the Reformulation Study, depending upon the nature and extent of the alternative treatments that are finally selected. In any case, sufficient ecological detail is currently lacking from which to draw any future comparative analytical conclusions. The habitat areas of concern and their associated flora and fauna are listed below:

1. *The rocky intertidal and subtidal habitat along the Montauk headlands* Besides providing habitat for commercially important finfish, this habitat is often utilized by extra-tropical fishes (e.g., triggerfish and others), not normally associated with the northeastern coastline. Thousands of diving birds, sea ducks and other waterfowl utilize this habitat as a staging or over-wintering area, in addition to large seal populations. The



Montauk Point area is highly visited and regarded as a hot spot by avid bird-watchers; however, the significance of this area for pelagic avian species is not well documented. There are anecdotal accounts of lush kelp (*Laminaria* sp.) beds in this habitat; but the type, extent and ecological or economic importance of submerged aquatic vegetation (SAV) has not been thoroughly studied or well documented. There have also been historical accounts of ghost crab (*Ocypode quadrata*) populations within the interstitial beach habitat associated with the rocky Montauk headlands.

2. *The frequency of overwash and ecological importance of the coastal ponds* Apparently, Mecox, Sagaponic and Georgica Pond experience frequent (possibly annual) washovers, which affect the water quality and drive the benthic community structure of these ponds. Frequent washovers also help maintain open sandy spits that are highly valued as piping plover and tern habitat. The ponds support various SAVs (including widgeongrass *Ruppia maritima*), however; their extent/density has never been studied. The ponds are also believed to be important wintering areas for waterfowl, but their use has not been adequately documented.

3. *Alewife (Alosa pseudoharengus) runs into Shinnecock Bay and associated ponds* This species is commercially important as a baitfish, and forage species for striped bass (*Morone saxatilis*). Apparently, the anadromous alewife makes an annual migration from the ocean up into Shinnecock Bay, Halsey Pond, Agawam Lake and the associated drainage systems to spawn. Larval fishes then return within the year to the bay and coastal marine waters.

4. *Submerged Aquatic Vegetation of the Back-Bay Ecosystem* According to several sources, including NYSDEC and the Town of Southampton (which has been an active participant on the South Shore Estuary Reserve Council), the identification of back-bay SAV beds would be extremely valuable natural resources database information. There are several dated reports, which discuss eelgrass densities and abundance in Great South Bay, but similar studies of SAVs have not been published for Moriches or Shinnecock Bays. The most recent study conducted by the National Park Service (August 1997) contained limited documentation on SAV beds located in close proximity to the bay side of the FIIS.

5. *Terrestrial insects associated with the beach ecosystem* Site-specific data is lacking on the insects that characterize the wrack line, upper beach, and dune areas of the Reformulation Study area. Information on these insects, and the wildlife species that are dependent upon them further up the food chain, is important in the analysis of shorefront protection alternatives (including beach replenishment and dune creation/enhancement). Additionally, the presence or absence of Federally Endangered or Threatened Species should be confirmed.



Ongoing Studies

The following is a brief summary of the various studies currently underway that are pertinent to the Reformulation Project. These listings have been separated based upon the funding sources; those that are wholly or partially funded by the USACE appear first, followed by those studies that are funded by other agencies or organizations:

USACE Funded Studies:

Placement Area Benthic Invertebrate Sampling (Work Order 10): (Present Fall 1999)

This study entails the collection and processing of macrobenthic resources and water samples from eight (8) proposed offshore borrow areas associated with the Reformulation effort. Up to 240 grab samples will be taken. Physical chemistry parameters (temperature, salinity, dissolved oxygen, pH and secchi readings for an indication of relative transparency) will be measured at the water surface, mid-water and bottom. Both benthic and epibenthic species will be sorted, enumerated and identified down to the lowest practical taxa.

Westhampton Dunes Intertidal Benthic Invertebrate Survey (1998-1999)

During April and May of 1998, EEA, Inc. 72 core samples were collected from the intertidal zone associated with the 1992-1993 breach, the nearby groin field, the backbay environment, and a control area located up-drift of the breach area. Samples were collected in the wrack line, at the mid-tide line, and the upper reach of the sub-tidal area. All samples were washed through a 0.5 mm sieve, preserved in 10% formalin solution, sorted, enumerated, and identified to the lowest practical taxa. Draft report of findings are currently being reviewed by the USACE New York District.

Surf clam study: (Summer 1999 and pre-dredging event)

Surf clams will be collected with modified commercial gear at potential borrow locations associated with the West of Shinnecock Interim project area. The purpose of the study is to determine clam densities and size distribution in the site-specific area. Sampling will be conducted twice under the routine NYSDEC surf clam monitoring effort.

Analysis of Historic Vegetative Zonation Changes Associated with Breach and Overwash Events: (Summer 1998-Present)

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/breaching 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. The analysis is nearly complete.



Water Quality Modeling

Breach impacts including salinity, temperature, circulation and bay residence time are being evaluated with the MIKE21 model. The 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, based on the results of the analysis.

Restoration of Shellfish in the Great South Bay

The Town of Brookhaven is conducting this study with partial cost sharing from the USACE. This demonstration project entails modification of the bay bottom substrates by broadcasting locally caught and processed bivalve shells. The purpose of the project is to determine whether this technique would increase clam set and production in Great South Bay, as was observed in studies conducted in New Jersey, Delaware Bay, and Long Island Sound.

Analysis of Breach and Overwash Sediment Transport: Summary of Known Impacts Physical and Biological: (Present)

Based upon the existing literature, a summary report or White Paper was developed which discusses the reported impacts on barrier island physical and biological systems. This White Paper will serve as a hypothesis for the scheduled water quality modeling effort. The Draft is currently under review by the USACE.

Aerial Photographic Analysis/Vegetative Mapping, Fire Island Inlet to Montauk Point (1996 Present)

Color infrared aerial photographs (July 1996) were obtained for the purpose of performing GIS vegetative mapping along the Atlantic coast from Fire Island Inlet to Montauk Point (approximately 83 miles). ArcView GIS software (Environmental Systems Research Institute) was used to digitize the species vegetative stand lines and match the boundary edges of wetland and upland transitional areas. Work also entailed field verification (1997-1998) of the various cover types. Seventy (70) draft maps were produced at a scale of 1" = 200' in 1998, and are currently under final review by the USACE.

West of Shinnecock Offshore Borrow Site Biological Assessment (Winter 1999-2000)

The USACE has begun characterizing the macrobenthic communities associated with the West of Shinnecock and Fire Island Interim Plan (FIIP) proposed borrow locations 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, lobster, squid and finfish). Some of the major issues raised at the FIIP interagency meetings and by the NYSDEC concern the potential for finding significant surf clam, lobster or finfish populations, and squid eggs attached to the substrates within the borrow areas.



Development of a Habitat Suitability Index (HSI) Model for Piping Plover (*Charadrius melodus*) on Long Island (1996 - 2000)

This is an interagency cooperative effort being funded by the USACE. A piping plover HSI model does not currently exist. Development of this HSI model is a crucial step in the completion of the Habitat Evaluation Procedure analysis concurrently being conducted and described below. The USACE New York District in cooperation with USFWS Long Island Field Office and the USGS Biological Research Division (BRD) is designing, constructing, verifying and applying the 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.

Data collection techniques were coordinated with plover researchers, and the HSI model will be reviewed by the Piping Plover Recovery Team. Data has been collected during the 1997 and 1998 field seasons to establish the significance of variables, associated values and their relative importance in refining the early draft of the HSI model. Beach insects and amphipods have been collected at Westhampton Beach (Pikes breach closure) through use of sticky sticks inserted into the beach substrates. Additional sampling has been conducted at Jones Beach in Nassau County, Cedar Beach in Babylon, and Old Inlet on the Fire Island National Seashore (FIIS), incorporating a combination of pitfall traps and core sampling, in addition to the sticky stick procedure. The Ecological Services division of USFWS in Islip has provided technical oversight of the local collection and species identification efforts. Two reports have been completed to date; Draft conceptual habitat suitability model for piping plover and Sampling and data collection protocol needed to determine food habits of piping plovers on Fire Island National Seashore .

Shorebird Habitat Evaluation Procedures (HEP) Analysis (1997 - 2000)

The HEP analysis will provide an indication of the quality and quantity of shorebird habitat within the Reformulation Study area. HEP is based on habitat values derived from a set of field measurable variables that are important to the target species. Using the least tern and experimental piping plover HSI models, the USACE New York District will evaluate the existing habitats at proposed beach nourishment sites for direct and indirect effects associated with placement activities. USACE will examine areas that are currently utilized by shorebirds and contrast these with areas that could be expected to support shorebirds but currently do not. Thus, this HEP analysis will help to quantify the site-specific habitat qualities that are preferred by beach-nesting shorebirds. Additionally, the HEP will assist with analysis of the project Alternatives, and will guide future mitigation, if warranted. The pre-field activities conducted to date include the formulation of a HEP study team, delineating the study boundaries, preliminary assessment of the cover types and review of aerial photographs.



South Shore Embayment Study (1997 - Present)

This study will examine the impacts of past USACE projects on the ecosystems, habitats and water quality of the back bay areas along the entire south shore of Long Island. These impacts may include the loss of wetlands and associated habitats, the alteration of tidal patterns and the degradation of water quality. Adverse impacts were likely associated with the Federal navigation projects and the indirect usage and development related to them.

The study area encompasses the south shore embayments (approximately 155 square miles) located between the Long Island mainland and the barrier island chain. A reconnaissance report was completed in June 1997 and the feasibility phase is scheduled for completion in June 2003. NYSDEC and NYSDOS have indicated support for this study and willingness to enter into a cost-sharing agreement for the Feasibility Study.

Montauk Point Study (1993 -Currently on Hold)

USACE has already conducted a preliminary reconnaissance (February 1993) for the study area which includes the historic lighthouse, approximately 3000 feet to the north, 1000 feet to the south and 200 feet offshore into the Atlantic Ocean. The purpose of the study is to determine the feasibility of providing erosion control improvements to protect the most critically eroding area of Montauk Point. Via correspondence to the New York District in 1995, NYSDEC had indicated support for continuing the study and the potential for some State cost-share funding for the project. The details have not been worked out yet; hence, the study is currently on hold.

Studies with Non-USACE Funding:

Beach Invertebrate Study (1998-1999)

In preparation of her Masters thesis at Marine Science Research Center (MSRC) under Dr. Robert Cerrato, Ms. Jackie Kluft has studied invertebrates collected from the beach environments corresponding to the FIIP study area. According to Dr. Cerrato, her thesis will contain an extensive species list, life history information, and results of a supplemental off-road vehicle impacts analysis. Some correlation may be drawn between this study and shorebird use of the study area, although that issue was not specifically addressed in the thesis.

Fox Use of the Fire Island National Seashore (FIIS) (Currently on hold)

Dr. Allen O'Connell of the University of Maine had begun efforts to track fox use and predation on the FIIS, similar to a study conducted at Cape Cod National Seashore. However, the current ban on beach vehicular use has postponed this effort until the capability of using of radio-collar transmitters and remote tracking with Global Positioning System (GPS) units is achieved.



Deer Tick Bird Survey at the FIIS Lighthouse Tract (1986 - Present)

This is a continuation of prior studies conducted at FIIS and several National Parks in the northeast. Dr. Paul Buckley of the USGS/BRD is currently coordinating this effort. Wildlife enclosures have been erected and mist nets have been set up to catch wild birds at the Fire Island Lighthouse tract. Birds are identified to species, aged, sexed, banded with USFWS bands, and checked for nymphal stage ticks. If found, the ticks are removed and preserved in ethanol for laboratory analysis to determine whether they carry the causal factor for Lyme disease, the bacterial spirochete *Borrelia burgdorferi*. Although the study objective was to determine the vector potential of wild birds, this study will yield valuable species use data for the Barrier Island.

Herpetological Study of the FIIS and other Barrier Island parks (February 1999 - 2001)

Dr. Robert Cook of the Cape Cod National Seashore has scheduled to commence this field survey of reptile and amphibian use of the FIIS this winter.

Estuarine Water Quality Analysis (1998 - Present)

The National Park Service (NPS) (Jim Ebert of FIIS, Dr. Norm Farris and Jennifer Beman of Cape Cod National Seashore) has begun water quality sampling of ten (10) stations within the backbay waters of the Reformulation study area. Water quality parameters include total suspended solids (TSS), Chlorophyll a, salinity, pH and others. Sampling stations are located at:

- Smith Point Bridge
- Mouth of Carmans River
- Old Inlet
- Bellport Beach
- Patchogue River
- Heckscher State Park
- Bay Shore Marina
- Cherry Grove
- Ocean Beach

Surface Water Quality Monitoring (1976 - Present)

For the past 20 years, the Suffolk County Department of Health Services (SCDHS) has routinely collected water samples for coliform and nutrient analysis in the backbay environment of Great South Bay, Mecox Bay, Shinnecock Bay and Lake Montauk. More recently, the SCDHS water quality analyses included an evaluation for the brown tide organism (*Aureococcus anophagefferens*).

Shinnecock Bay Finfish Study (1986 - Present)

Southampton College has been collecting finfish samples from Shinnecock Bay twice per week from June through November for the past thirteen years. Sampling is conducted using a high rise otter trawl, gill nets and beach seines. The study is being coordinated by Dr. Howard Reisman.

US Environmental Protection Agency water quality monitoring (1970 - Present)



The USEPA has conducted routine water quality monitoring since the early 1970s of both public and private bathing beaches located along the Atlantic coastline from Breezy Point to Shinnecock Inlet. Water samples are analyzed for both total and fecal coliform levels. The USEPA analysis results are sent to the Suffolk County Department of Health Services (SCDHS) to supplement the County database. In addition, duplicate water samples are collected and delivered to the NYSDEC for state analysis in support of the shellfish monitoring program.

Proposed Continuation and Additional Studies

A number of proposed study plans are presented in this section. Some of these represent a continuation of studies that are currently underway, as presented in the previous listing, as well as new studies that were identified as a result of the data gap analysis, and are deemed necessary for the evaluation of potential *primary* impacts associated with the Reformulation Study (as discussed in the introduction). Other studies have been recommended by various agencies to fulfill permit requirements. The studies listed below are presented in a generic manner, providing the level of detail necessary to allow judgments to be made upon their efficacy. Further details will be developed after preliminary coordination with the ETMG.

The NPS identified several research needs for their FIIS Science Advisory Board in June 1998. Although many of these studies in their entirety did not meet the USACE evaluation criteria, certain aspects of these studies may warrant additional consideration by the USACE for their ability to support an impact assessment of the various storm damage reduction alternatives. These are mentioned in the applicable summaries of proposed studies that follow.

Mapping the back-bay Sub-Aquatic Vegetation (SAV) beds in close proximity to the inlets and historic breach locations and historic analysis of tidal marsh development.

This would be a continuation of the current USACE study, which is examining the historic vegetative changes associated with breach and overwash events. The objectives of this study would be as follows:

- 1) To validate the assumption that tidal marsh development is dependent upon the delivery of sediment to the back bay environment by breaches;
- 2) To determine the net gain or loss of wetlands and SAV beds due to new inlet openings;
- 3) To identify the type, distribution and relative health of SAVs (eelgrass and seaweeds) in relation to inlet locations versus protected backbay areas; and
- 4) To determine the relative importance of SAV beds to finfish and macrobenthic productivity.



The NYSDOS has been conducting a wetlands trends analysis for the backbay marshes. The status and scope of this project is unclear at this time. Future work on this effort should be coordinated with the State to avoid duplication of efforts.

Establish a multiple-year-monitoring program for beach insects and invertebrates.

This would be an extension of the work recently completed by Ms. Kluft, and currently ongoing for the HEP and HSI studies on other portions of the study area. This study would provide valuable site-specific information regarding the types of macro-and meio- invertebrates potentially impacted by the various project alternatives, the changes in community structure and rates of recruitment following disturbance. This would also provide baseline data on insects using the beach and strand line areas. Coupled with documented shorebird use of the area, this study may also reveal critical linkages between species abundance, seasonal use, and dependency by wildlife species at certain life cycle stages.

Conduct a survey of the backbay habitat encompassing the Pikes Beach closure area.

Closure of the Pikes breach was a considerable effort and set the stage for new state and Federal policy regarding barrier breaches. Although changes to the upland ecology and shorebird use of the affected area have been fairly well documented, little is known about the resultant changes to the backbay benthic community. This information would be very valuable in qualifying and quantifying the impacts of another potential breach. Utilizing an acoustical profiling technique, such as RoxAnn, a survey of the backbay would be conducted to record bathymetry, identify sediment types, the density and distribution of shellfish, the macrobenthic invertebrates, and re-establishment of SAVs into the areas disturbed by the breach and or closure activities.

Conduct an Offshore Fisheries and Benthic Invertebrates Survey (March 1999-2000)

This fisheries field sampling program has been requested by NYSDEC to verify the biological conditions of the West of Shinnecock borrow site in support of the State's permit evaluation and issuance of a Water Quality Certificate. The proposal includes borrow area sampling over a twelve consecutive month period, with special attention being given to the identification of squid eggs during the May/June sampling events. Monthly samples of finfish will be collected at the borrow pit associated with the West of Shinnecock project and an adjacent reference site. Samples will be collected utilizing a semi-balloon otter trawl. A mid-water trawl will also be conducted during a month of peak finfish occurrence (May/June), to provide a species comparison between bottom trawls and mid-water catches.

Fish would be identified, enumerated, weighed, and measured. Subsamples of specific species (e.g., winter flounder, bluefish, tautog, weakfish, summer flounder, striped bass, black sea bass, scup) would be retained for aging (scales, otoliths) and stomach content analysis. If collected, sturgeon and American eels will also be enumerated, weighed, measured, scales removed for aging, and then returned immediately to the ocean to avoid mortality.



The proposal also includes provisions for surf clam sampling, utilizing a modified commercial surf clam dredge. Additionally, the existing Spring and Fall macrobenthic invertebrate sampling will be continued at the same borrow stations as the prior studies, plus several in the adjacent reference area, in an effort to build upon the pre-existing database and to enable eventual data trend analysis.

Conduct Surf Clam Surveys on a Site-Specific Basis for the Proposed Borrow Areas

Proposed borrow sites within the Reformulation Project area will be evaluated for the presence and density of surf clams. While the ongoing macrobenthic study (Work Order 10 described earlier) will provide some insight as to potential settling of surf clams in the project area, it will not adequately address the density of adult harvestable clams. Where possible, this effort would be piggy-backed onto the ongoing NYSDEC surf clam survey.

Conduct an ecological inventory of the Montauk headlands from the high beach out to any proposed offshore borrow site locations.

As presented earlier in the Identified Data Gaps, the ecological resources of the beach, intertidal and subtidal zones associated with the rocky coastline of the Montauk headlands have been poorly documented. The ecological importance of this area can only be assumed based upon the anecdotal accounts of local wildlife and bird watching enthusiasts and NMFS fisheries catch data that are not specific to this area. Such an ecological study may include a survey of: beach vegetation; the benthic invertebrates associated with the beach, intertidal, and subtidal areas; finfish; shorebird, waterfowl, and pelagic sea bird use; marine mammal and sea turtle use. Field sampling will be conducted to verify the anecdotal accounts of both floral and faunal species use of the project area, and will be limited to those areas which might either be directly or indirectly affected by a USACE project.

Conduct an ecological inventory of the coastal ponds (Mecox, Sagaponic and Georgica) that may potentially be impacted by the Reformulation Project

All existing data (GIS mapping, bird surveys and other raw data) collected by NYSDEC, the Town of Southampton, and the Town of East Hampton would be compiled and additional sampling would be conducted to fill in the data gaps. The initial effort would entail a survey of wetlands (both fresh and intertidal marsh communities), submerged aquatic vegetation, and sampling for water quality, benthics and finfish. Incidental wildlife observations would also be noted.

An investigation of the hydrologic inflow sources, point source discharges, nutrient loadings, etc., would be conducted to define the baseline conditions and to facilitate future water quality analyses and impact assessments. As part of the hydrologic design of any drainage outlet for these ponds, a hydrologic inflow and routing model must be developed. Since water quality concerns are an important planning consideration, the hydrologic modeling program selected will have the capability to evaluate water quality parameters. Data would be collected in a form that can accommodate development or calibration of such a model.



HUMAN ENVIRONMENT DATA GAPS AND STUDY NEEDS

Data Gaps

The human environment within the study area is generally well documented; however, the data must be compiled into a format which will be facilitate the assessment of potential impacts. As such, the description of data gaps and study needs is often related to simply compiling this information into the project database or GIS.

Land Use: This information must be compiled to allow a comprehensive description of the existing conditions along the Atlantic Ocean coast and along the shoreline of the bays behind the barrier islands. The latter is extremely important because of the potential of storm damage to structures and changes in shoreline configuration that affect how humans live in the area. Suffolk County has developed GIS-based land use maps; however, these maps do not incorporate the entire study area.

Bulkheading: The interface between the human environment and the natural environment of flora, fauna and water quality is often defined by the type of structure, if any, separating the land from the water. The length of bulkheading, as well as the number of docks and piers, has been increasing over the years. A historical accounting of the changes in this interface may be able to be correlated with changes in water quality and changes in the extent and type of natural resources in the bays. In turn, this information will allow better predictions of future changes.

Transportation: A key part of human development and its location is modes of transportation available to facilitate the development along the bay shore and the barrier islands. Certain of the proposed alternatives could have an effect on the need for transportation in various areas. While much of this information has been compiled for the Fire Island area, additional information is needed for the areas east of Fire Island.

Hazardous Materials: A concern with flooding is the potential for release of hazardous materials. The location of known hazardous waste sites and known generators of hazardous wastes should be compiled to determine if known Superfund sites or hazardous waste generators could be affected by flooding. If it is determined the mainland may have potential impacts due to construction of the project, a Preliminary HRTW assessment would be conducted.

Infrastructure: On Long Island, the supply of drinking water is limited and the treatment and disposal of wastewater varies from locale to locale. Recent information has shown that groundwater intrusion from the mainland is introducing more freshwater into the bays along with more herbicides from golf courses, wineries, small farms, and other source



points. The groundwater resources that are the drinking water supply need to be identified through a literature search. The available data should be sufficient for this project.

Bulkheading: As part of the storm damage and benefit assessment, the existing bulkheads in the study area have been inventoried and a database is being developed.

Recently Completed Studies

Water Quality: A literature survey for all bay and ocean water quality studies is on-going. Study completion was in January 1999. In addition, baymen were interviewed to determine if they have seen changes in water quality in recent years. The interviews are a qualitative analysis of water quality over a period of several decades by people who are working on the bay waters every day. This study was finalized in June 1999.

Recreation Usage: As part of the benefit assessment, a recreation use and value survey was conducted in the summer of 1998. Attendance data has also been requested from the municipalities and park agencies within the project area.

Proposed Continuation and Additional Studies

Land Use: Compile additional information from the Towns of Southampton and East Hampton and the Villages of Westhampton Beach, Quogue, Southampton, East Hampton:

- Comprehensive master plan/land use plan;
- Zoning ordinance;
- Beach usage information; and
- Land use surveys of these towns and villages.

Bulkheading: The main elements of the historical documentation of bulkheading are aerial photographs. Historic photos will be used to document the length of bulkheading over time, the number of in-water structures and the locations of these structures.

Transportation: The work involves contacting the public transportation authorities, private operators of both land and water transportation companies, and traffic counts of major roadways. The loci of transportation modes are areas of greatest population density, and the areas that can sustain the greatest damage during flooding. As such, they are the areas that generate the greatest demand for protection. These areas need to be identified, and the usage quantified. Parking is often the key factor of usage, especially on the barrier islands and beach areas. Surveys of available parking



and parking usage need to be conducted. The survey of available parking facilities can be conducted at any time, but parking usage is at its peak during the summer. The parking surveys should be conducted during the summer of 1999, to identify if the level of parking availability could limit access to recreational beaches.

Hazardous Materials: A survey of known hazardous waste sites and known generators of hazardous wastes will be based primarily on government records that are required under SARA and the private companies that compile these data. Each of these sites should be mapped, and their locations compared with the expected extent of flooding under the different alternatives being evaluated. The likelihood of the uncontrolled release of these materials will be assessed.

Air Quality: The potential for new industries and transportation centers entering the areas and the fate of existing facilities needs to be assessed based on a review of existing zoning and interviews with planning directors of the various towns. The New York Metropolitan Transportation Council (NYMTC) has developed and will soon release its forecast of vehicle miles traveled (VMT) to the year 2015. All of these data need to be collected and interviews conducted to determine the likely air quality conditions. Then, based on the alternatives, and the potential to alter beach usage or transportation patterns, resulting incremental increases in traffic assessed.

Noise: Noise measurements to assess baseline conditions need to be taken. Sensitive receptors will be selected, and measurements taken during times of high noise and quiet. Some information exists in Environmental Impact Statements prepared for other projects, but a comprehensive data set does not exist. This information is necessary to set the baseline noise conditions.

Infrastructure: The type of wastewater treatment needs to be mapped and defined.



LIST OF PERSONS CONTACTED DURING DATA COLLECTION EFFORT

SENTING	INDUAL	PHONE NUMBER
Town of Babylon	Richard Groh	516-422-7640
Town of Brookhaven	Jeffrey Kassner	516-451-6455
Town of Easthampton	Larry Penny	516-324-0496
Town of Islip	Dr. Stuart Buckner	
Town of Southampton	Martin Shea	516-287-5710
USEPA, Monitoring Operations Section	Randy Braun	732-321-6692
USFWS, Long Island Field Office	Steve Papa, Steve Mars, Christie Johnson Hughes	516-581-2941
USFWS, LI Wildlife Refuge Complex	Robert Parris	516-286-0485
USFWS, Northeast Coastal Programs Office	Andrew McLaughlin	401-364-9124
NYSDEC, Natural Resources	Charles Hamilton	516-444-0271
	Lou Chiarella, Matt Sclafani	516-444-0295
	Frank Phillips	516-444-0305
	Mark Lowry	516-444-0311
NYSDEC, Marine Resources	Dave Fallon,	516-444-0464
	Fred Muschacke	516-444-0465
	Byron Young	516-444-0436
	William Southard	516-444-0422
NYSDEC, Regulatory Affairs	Ray Cowen	516-444-0345
	John Pavacic	516-444-0365
NYSDEC, Albany	William Daley	518-457-5620
Suffolk County Cooperative Extension Marine Program	Christopher Smith	516-727-3910
	Christopher Pickerell	516-852-8660
NYSDOS	Fred Anders	518-473-2477
	Tom Hart	518-473-2465
New York Sea Grant Extension Program	Jay Tanski	516-632-8730
USGS/BRD	Dr. James Allen	617-223-5058
Suffolk County Department of Health Services	Dr. Robert Nuzzi	516-852-2077
Marine Sciences Research Center at Stony Brook	Dr. Elizabeth Cosper	516-563-8899
	Dr. Robert Cerrato	516-632-8666
Mid-Atlantic Fisheries Management Council	Thomas Hoff	302-674-2331
Atlantic States Marine Fisheries Commission	John Field	202-289-6400
NOAA National Ocean Service/ORCA	David Nelson	301-713-3000 x 185
Southampton College	Sandy Shumway	516-287-8407
	Keith Serafy	516-287-8408
	Bruce Ringers	516-287-8393



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	Regulation 200-2-2: Environmental Quality, Procedures for Implementing NEPA	March 1988	ACE 1988-0012	AKRF
	Regulation 200-2-2: Environmental Quality, Procedures for Implementing the National Environmental Policy Act	March 1996	ACE 1996-0013	AKRF
	U.S. Waterway Data	1994	ACE 1994-0089	AKRF
U.S. Army Corps of Engineers, Engineering and Design	Risk-Based Analysis for Flood Damage Reduction Studies (EM 1110-2-1619)	08/01/96	ACE 1996-0051	AKRF
U.S. Army Corps of Engineers, New York District	Atlantic Coast of New York, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Final Feasibility Report with Final Environmental Impact Statement, Storm Damage Reduction Project	03/98	ACE 1998-0044	AKRF
	Environmental Scoping Document, Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Storm Damage Reduction Reformulation Study	July 1997	ACE 1997-0011	AKRF
	Environmental Scoping Document, Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, NY - Annotated Bibliography and Index to Abstracts and Additional Available References.	circa 1995	ACE 1995-0025	AKRF

Author	Title	Date	Reference	Location
U.S. Army Corps of Engineers, New York District				
	Final Environmental Assessment, Interim Plan for Storm Damage Protection Project, Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Moriches to Shinnecock Reach (with FONSI)	December 1994	ACE 1994-0008	AKRF
	Final Environmental Assessment, Moriches Inlet Navigation Project, Sand Stockpiling Modification, Cupsogue County Park, Suffolk County, New York	August 1996	ACE 1996-0076	AKRF
	Final Environmental Impact Statement for Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project, Volume I: Final Environmental Impact Statement	September 1977	ACE 1977-0073	AKRF
	Final Environmental Impact Statement for Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project, Volume II: Appendices	September 1977	ACE 1977-0074	AKRF
	Final Environmental Impact Statement, Atlantic Coast of Long Island, Jones Inlet to East Rockaway Inlet, Long Beach Island, New York, Storm Damage Reduction Project	February 1995	ACE 1995-0048	AKRF
	Fire Island Inlet to Montauk Point Reformulation: Borrow Sites Macroinvertebrate Community Characterization	October 1996	ACE 1996-0024	AKRF
	Fire Island Inlet to Montauk Point, Long Island, New York, Beach Erosion Control and Hurricane Protection Project, Supplement NO. 2 to General Design Memorandum No. 1, Moriches to Shinnecock Reach	July 1980	ACE 1980-0065	AKRF
	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 1 - Main Report with Preliminary Assessment of Environmental Impacts	June 1996	ACE 1996-0004	AKRF
	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 II - Technical Appendices	June 1996	ACE 1996-0006	AKRF
	Fire Island Inlet to Montauk Point, Long Island, New York, Reach 2: West of Shinnecock Inlet, An Evaluation of an Interim Plan for Storm Damage Protection, Volume 1 - Main Report	June 1997	ACE 1997-0001	AKRF
	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	July 1995	ACE 1995-0002	AKRF

Author	Title	Date	Reference	Location
U.S. 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 Interim Plan for Storm Damage Protection Technical Support Document for an Interim Project with Preliminary Assessment of Environmental Impacts	June 1996	ACE 1996-0140	AKRF
	Fire Island to Montauk Point, Long Island, New York, Breach Contingency Plan, Executive Summary and Environmental Assessment	January 1996	ACE 1996-0005	AKRF
	General Design Memorandum Shinnecock Inlet Project, Long Island, New York, Reformulation Study and Environmental Impact Statement, Final Report	June 1987	ACE 1987-0075	AKRF
	Moriches Inlet, Long Island, New York, Reformulation Study and General Design Memorandum: Moriches Inlet	May 1982	ACE 1982-0080	AKRF
	Reconnaissance Report, Montauk Point, New York	February 1993	ACE 1993-0082	AKRF
	Section 905 (b) A(WRDA 86) Analysis South Shore of Long Island, New York (Fact Sheet for South Shore Embayment)	1997	ACE 1997-0045	AKRF
	Shallow Draft Navigation Study for Lake Montauk Harbor, Long Island, New York, Reconnaissance Study	May 1995	ACE 1995-0066	AKRF
	Topographic CAD Drawings with structural and landscape details	unknown	ACE 0000-0088	AKRF
	West of Shinnecock Inlet Interim Economic Analysis (Draft)	December 1997	ACE 1997-0014	AKRF
U.S. Census Bureau				
	Census Data	1990	OTH 1990-0083	AKRF

U.S. Congress

Author	Title	Date	Reference	Location
U.S. Congress	National Environmental Policy Act (Selected Excerpts)	August 9, 1975	OTH 1975-0059	AKRF
U.S. Department of Commerce	Tide Tables 1998, East Coast of North and South America	1998	OTH 1998-0132	AKRF
U.S. Department of the Interior, Fish and Wildlife Service	Significant Habitats and Habitat Complexes of the New York Bight Watershed	November 1997	OTH 1997-0086	AKRF
U.S. Department of the Interior, Fish and Wildlife Service, Long Island Field Office	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	02/20/98	OTH 1998-0043	AKRF
	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 - Draft Fish and Wildlife Coordination Act Section 2(b) Report	May 1997	OTH 1997-0026	AKRF
U.S. Department of the Interior, Fish and 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	February 1981	OTH 1981-0077	AKRF
	Fish and Wildlife Resource Studies for the Fire Island Inlet to Montauk Point, New York, Beach Erosion Control and Hurricane Protection Project Reformulation Study: Esuarine Resource Component	May 1983	OTH 1983-0067	AKRF
U.S. Department of the Interior, National Park Service	An Introduction to Selected Laws Important for Resource Management in the National Park Service	August 1994	OTH 1994-0110	AKRF

Author	Title	Date	Reference	Location
U.S. Department of the Interior, National Park Service	Environmental Inventory of the Fire Island National Seashore and the William Floyd Estate, Suffolk County, New York	January 1975	OTH 1975-0062	AKRF
	Final Environmental Statement, General Management Plan, Fire Island National Seashore, New York	November 17,	OTH 1977-0064	AKRF
	Fire Island 1998 Tide Tables	1998	OTH 1998-0117	AKRF
	Fire Island National Seashore 1998 Strategic Plan	September 1997	OTH 1997-0107	AKRF
	Fire Island National Seashore Federal Zoning Regulations	August 1991	OTH 1991-0109	AKRF
	Fire Island National Seashore Off-Road Vehicle Regulations	1987	OTH 1987-0118	AKRF
	Fire Island National Seashore Transportation Study	August 1977	OTH 1977-0113	AKRF
	Fire Island National Seashore, New York; Federal Zoning Regulations; Final Rule	August 29, 1991	OTH 1991-0105	AKRF
	General Management Plan: Fire Island National Seashore, New York	March 9, 1978	OTH 1978-0063	AKRF
	Legislative History of Fire Island National Seashore	1984	OTH 1984-0106	AKRF
	National Park Service Strategic Plan 1997	1997	OTH 1997-0111	AKRF

Author	Title	Date	Reference	Location
U.S. Department of the Interior, National Park Service				
	Transmittal of The Wilderness Management Plan, The Eastern Wilderness Act, The Wilderness Act, NPS Management Policies, The Fire Island National Seashore Resources Management Plan, and Legislative History of Fire Island National Seashore	April 1998	OTH 1998-0071	AKRF
U.S. Department of the Interior, Office of the Secretary				
	Response to the U.S. Army Corps of Engineers; Notice of Intent to Prepare a Draft Environmental Impact Statement on the proposed Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Fire Island Inlet to Moriches Inlet Interim Plan	02/20/98	OTH 1998-0042	AKRF
URS Consultants, Inc./Moffat & Nichol Engineers				
	Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Economic Base Study and Field Sampling Plan, For the Fire Island Inlet to Montauk Point Reformulation Study	12/23/97	URS 1997-0049	AKRF
	Fee Proposal Work Order 7: Atlantic Coast of Long Island, Fire Island Inlet to Montauk Point, New York, Storm Damage Reduction Reformulation Study, Sediment Transport Analysis and Water Quality Modeling	02/26/98	URS 1998-0041	AKRF
	Fire Island Inlet to Montauk Point, Long Island, New York, Storm Damage Reduction Reformulation Study, Reach Delineation	12/30/97	URS 1997-0052	AKRF
USGS				
	Elevation Grids	mid-1990s	OTH 1990-0084	AKRF
Village of Ocean Beach				
	Preparation of Flood Mitigation Plan, Preliminary Draft	April 1998	OTH 1998-0122	AKRF
	Zoning Ordinance	1997 revised	OTH 1997-0120	AKRF
Village of Saltaire				

Author	Title	Date	Reference	Location
Village of Saltaire				
	History of the Incorporated Village of Saltaire	1952	OTH 1952-0124	AKRF
	Village Zoning Ordinance	1954 revised	OTH 1954-0123	AKRF
Water Resources Division of Coastal Research				
	Water Resources Scoping Report	August 1992	OTH 1992-0112	AKRF