US Army Corps
of Engineers

WILMINGTON DISTRICT
SOUTH ATLANTIC DIVISION

# DRAFT
# EVALUATION REPORT
# AND
# ENVIRONMENTAL ASSESSMENT

## MOREHEAD CITY HARBOR
## SECTION 933

## CARTERET COUNTY, NORTH CAROLINA

May 2003

# SYLLABUS

The removal of 6,300,000 cubic yards of maintenance material from Brandt Island Upland Disposal Area as well as the maintenance dredging at Morehead City Harbor has created an opportunity for beneficial use of sand for the Carteret County beaches. The beach communities of Pine Knoll Shores, Indian Beach, and Salter Path are experiencing severe storm damage and erosion problems, particularly as a result of Hurricane Fran in September 1996 and Hurricane Floyd in September 1999. During the period from 1996 through 1999, Hurricanes Bertha, Bonnie, Dennis, and Irene have also affected the area. The storm damage and associated erosion from six named storms has resulted in considerable damage to homes and loss of the natural protective berm and dune system since 1996. The erosion of the berm and dune system has also increased and continues to increase the storm damage susceptibility of existing structures and infrastructure. The placement of sand from Brandt Island and Morehead City Harbor on these beaches would reduce the potential for erosion and storm damages.

This report presents two areas of beach placement to take place in conjunction with the Winter 2003/2004 Morehead City Harbor maintenance dredging and Brandt Island pumpout activities. The base disposal area is 100% fully funded by the Federal government and covers approximately 32,000 feet of Atlantic Beach and Fort Macon. If the Section 933 Project is implemented, the Base Disposal Plan will be modified from its 150-ft berm width to a 30-ft berm width; this is referred to as the Base Disposal Plan under the Section 933 project. This base disposal area under the Section 933 project will receive 1,834,000 cubic yards of sand. The area nourished with Federal/Sponsor cost sharing under the authority of Section 933 includes approximately 38,000 feet of shoreline along Pine Knoll Shores, Indian Beach, and Salter Path. The Section 933 project area will receive approximately 4,466,000 cubic yards of sand to construct a 30-ft berm width to an elevation of 7 feet above NGVD.

For the 38,000 feet of Pine Knoll Shores, Indian Beach, and Salter Path, where evaluation is required under Section 933, potential storm damage reduction benefits were analyzed. Expected annual hurricane and storm damages are reduced by 62 percent with the Section 933 project. Evaluating the Section 933 project over a twenty-year period of analysis, the total expected annual benefits (including incidental recreation) are estimated to be $10,655,000, whereas the equivalent expected annual increase in cost for placement of material along the Section 933 project area is $2,178,000. Thus, the net benefits would be $8,477,000 and benefit-cost ratio for the Section 933 project area is 4.9.

Based on the findings in this report, Carteret County is eligible for approximately 60.5% Federal and 39.5% non-Federal sponsor cost sharing for the added cost of depositing dredged navigation material on the beaches of Pine Knoll Shores, Indian Beach, and Salter Path, under authority of Section 933 of PL 99-662. The slight reduction in the Federal share of the cost sharing from the potential 65/35 is due to deficiencies in public beach access and parking requirements in the Section 933 project area.

The added cost of placing this quantity of material on the beach rather than in the base disposal plan area is estimated to be $16,354,000, of which $9,894,000 would be paid by the Federal Government and $6,460,000 contributed by non-Federal interest.

# EVALUATION REPORT AND ENVIRONMENTAL ASSESSMENT

# MOREHEAD CITY HARBOR SECTION 933 CARTERET COUNTY, NORTH CAROLINA

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# MOREHEAD CITY HARBOR SECTION 933
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## SECTION I - INTRODUCTION

The purpose of this study is to investigate the beneficial placement of dredged maintenance material from the authorized pump out of Brandt Island confined dike disposal area, and the maintenance dredging of the Morehead City Harbor navigation project, both of which are scheduled for the Winter of 2003-2004. This study analyzes the deposition of this dredged material along a portion of Bogue Banks beaches beyond the Corps' Base Disposal Plan, referred to as the "Section 933 Study Area" (Figure 1).

The Section 933 Study Area must be assessed for hurricane and storm damage reduction needs. This study also develops a plan of protection for this area based on the economic, engineering, and environmental feasibility, as well as the requests of the local sponsor.

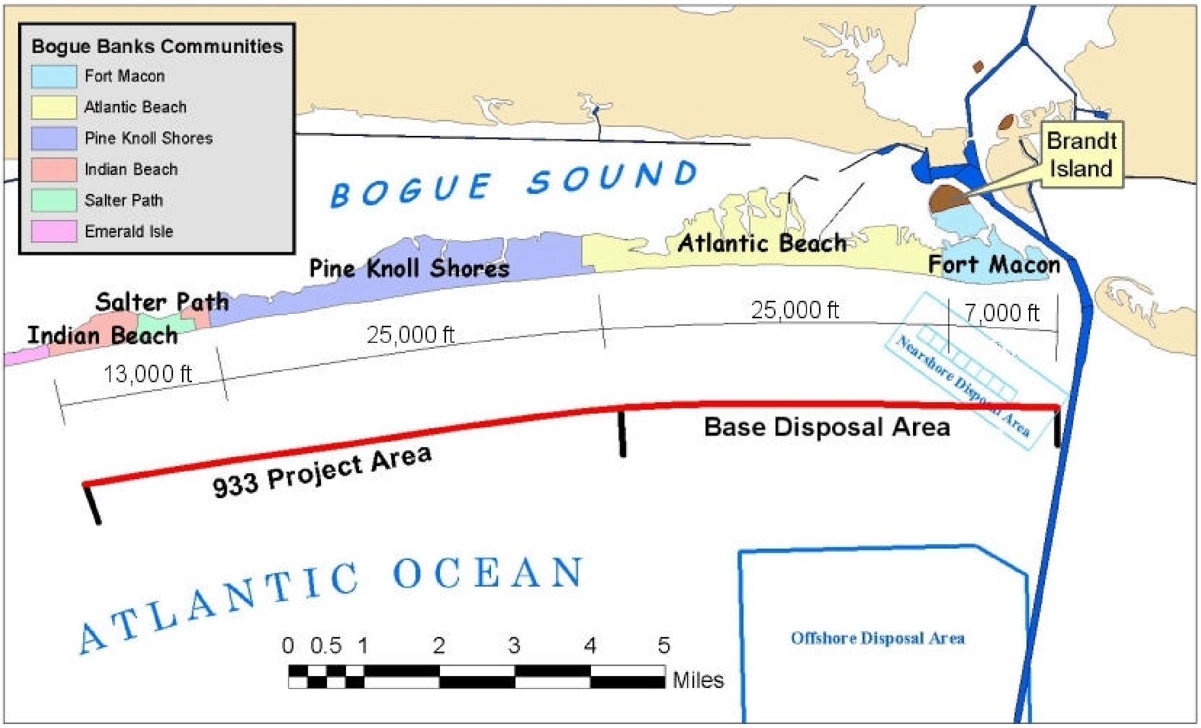


**Figure 1. Morehead City Harbor Section 933 Study Area and Base Disposal Plan Area**

Carteret County beaches are located on the central North Carolina Coast (Figure 2). The section of beachfront requested to be investigated for the beneficial placement of dredged material for hurricane and storm damage reduction needs includes the resort communities of Pine Knoll Shores, Indian Beach, and Salter Path. This 7.2-mile-long shoreline reach is eroding due to hurricane and storm action. A minimal berm exists along most of the Study Area, resulting in the dune system being frequently inundated during moderate energy events. Numerous structures in this area are highly vulnerable to damage by storm action due to the eroded dune system and loss of natural protection.

Based on analyses conducted during this study, the beneficial placement of dredged material for hurricane and storm damage reduction along the 7.2 miles of Pine Knoll Shores, Indian Beach and Salter Path was determined to be economically justified using a uniform 30-ft berm design width. The sponsor had requested the distribution of the dredged material to be placed in a uniform 30-ft berm design width stretching from Fort Macon to the Indian Beach/Emerald Isle border. Only those areas beyond the Base Disposal Plan are required to be studied and justified as part of the Section 933 project.

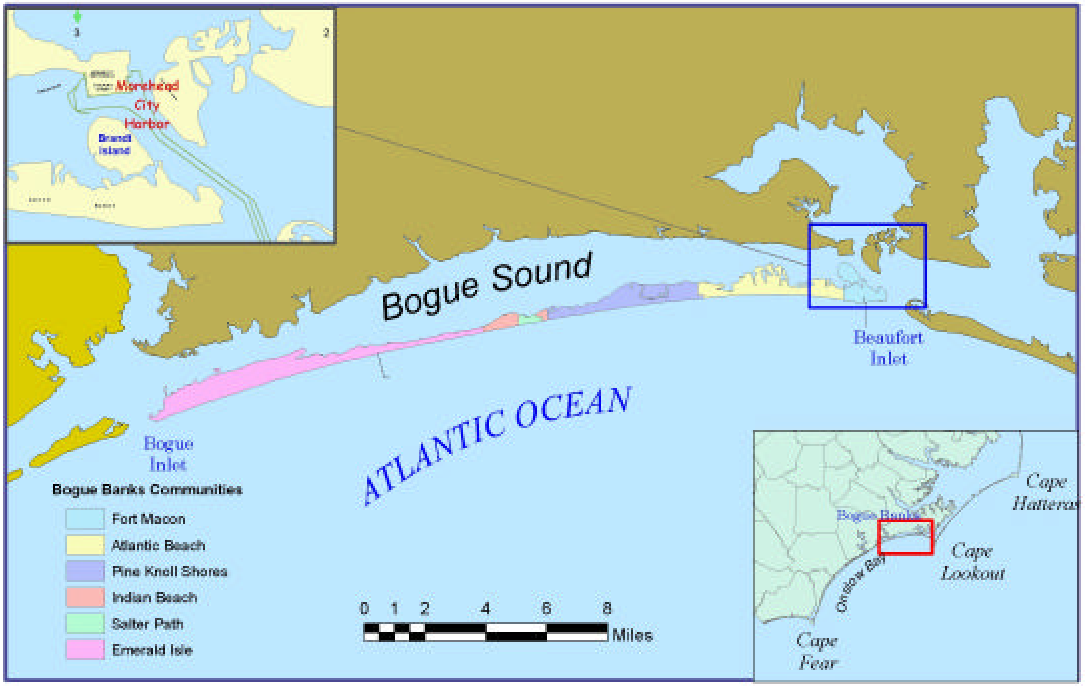


**Figure 2. Morehead City Harbor Section 933 Location Map**

## NON-FEDERAL SPONSOR

In a letter dated February 22, 2001, (see Appendix A, Exhibit 1) the State of North Carolina stated that they supported the interest of Carteret County in a study for a potential Section 933 Project for use of dredge maintenance material from the authorized pump out of the Brandt Island disposal area and dredging of Morehead City Harbor navigation channels, scheduled for 2003-2004, onto Bogue Banks beaches. This letter was produced on behalf of Carteret County that had passed a resolution on January 22, 2001 requesting a Section 933 Project to place this material onto the beaches of the Towns of Pine Knoll Shores and Indian Beach, and the Village of Salter Path (see Appendix A, Exhibit 2).

In their January 6, 2003, letter to the Wilmington District, Carteret County stated their commitment to acting as the cost-sharing sponsor for this Section 933 project (see Appendix A, Exhibit 3).

# STUDY AUTHORITY

This study was conducted under the authority of Section 145 of the Water Resources Development Act of 1976, P.L. 94-587, as amended by Section 933 of the Water Resources Development Act of 1986, P.L. 99-662, and other laws, 33 U.S.C. § 426j. Projects carried out under this authority are commonly referred to as “Section 933 projects.” The primary study emphasis was directed toward hurricane and storm damage reduction measures at Pine Knoll Shores, Indian Beach and Salter Path. The guidance for this study authority is:

**ER1105-2-100, Section II, E-14(h), 22 April 2000:**

> “Placement of Dredged Material on Beaches for Hurricane and Storm Damage Reduction. When placement of dredged material (beach quality sand) on a beach is the least costly acceptable means for disposal, then such placement is considered integral to the navigation project and cost shared accordingly. In cases where placement of dredged material on a beach is more costly than the least costly alternative, the Corps may participate in the additional placement costs when: (1) requested by the State; (2) the Secretary of the Army considers it in the public interest; and (3) the added cost of disposal is justified by hurricane and storm damage reduction benefits.
>
> When all local cooperation requirements are met the Corps may cost share the additional 65 percent (Section 933, WRDA 1986, as amended). In cases where the additional costs for placement of the dredged material is not justified, the Corps may still perform the work if the State requests it, and the State or other sponsor contributes 100 percent of the added cost. If the State requests, the Corps may enter into an agreement with a political subdivision of the State to place the sand on its beaches, with the subdivision responsible for the additional costs. The Corps should consider and accommodate to the degree reasonable and practicable a State's or subdivision's schedule for providing its cost share. Each placement event should be supported by a separate decision document. Subsequent decision reports may be supplements to the original Section 933 decision document.”

## SCOPE OF STUDY

This report presents the results of studies conducted to address the needs for the placement of dredged material for hurricane and storm damage reduction for Carteret County beaches. The study area is shown on Figure 1. Study emphasis was placed on hurricane and storm damage reduction measures for the 7.2-mile-long Study Area as requested by the local sponsor. This area includes the communities of Pine Knoll Shores, Indian Beach and Salter Path. This report is submitted in compliance with Section 933 of WRDA 1986, as amended and Engineer Regulation 1105-2-100 quoted in the "Study Authority" section of this document.

The congressionally authorized Feasibility Study of Bogue Banks (Atlantic Beach, Pine Knoll Shores, Indian Beach, Salter Path and Emerald Isle) will investigate the long term shore protection needs for those beach communities and will be conducted as a separate study and reported later. Carteret County is the non-federal sponsor for this study.

## PRIOR STUDIES

There have been several prior studies in the study area and adjacent waters by the Wilmington District. These studies, listed below, include three shoreline studies, two navigation studies and a shoreline mitigation study.

<u>House Document No.555, 87th Congress, "Fort Macon - Atlantic Beach and Vicinity, North Carolina,</u>" dated 1961. This report presents the results of an investigation of beach erosion along the Fort Macon - Atlantic Beach shoreline by the Wilmington District.

<u>House Document No. 93-121, "National Shoreline Study,</u>" dated 1970. This report, approved by Congress in 1970, presents the results of an investigation of the nations' shorelines as part of a comprehensive study to address shoreline conditions including shoreline ownership, property values, and shoreline changes (eroding, stable, or accreting).

<u>Wilmington District report, "Beaufort Inlet to Bogue Inlet, North Carolina</u>," dated 1965. This report presents the results of an investigation of beach erosion along the Bogue Banks shoreline by the Wilmington District.

<u>House Document No. 92-170/92/1, "Morehead City Harbor, North Carolina,</u>" dated 1970. This report presents the results of an investigation to deepen the project to 40-feet Mean Low Water (MLW).

<u>Report of the Chief of Engineers, "Morehead City Harbor, North Carolina</u>," dated 1991. This report presents the results of an investigation to deepen the project to 45-feet MLW.

Wilmington District Section 111 Feasibility Report, "Morehead City Harbor (Pine Knoll Shores), North Carolina," dated 2001. This report presents the results of an investigation of shoreline mitigation for the Morehead City Harbor Navigation Project.

## EXISTING FEDERAL PROJECTS

There are no active Federal hurricane and storm damage reduction projects in the study area. There is an active navigation project. The Morehead City Harbor navigation project presently consists of a 47-foot deep (MLW) by 450-foot wide ocean entrance channel through the ocean bar of Beaufort Inlet, which connects with channels and inner harbor which is generally 45 feet deep at MLW (East Leg) and 35 feet deep (West Leg and Northwest Leg). The current project is generally referred to as the 45-foot draft navigation project. A map of the Morehead City Harbor project is shown on Figure 3 and Figure 1 in the EA. Note that the entrance channel is composed of three reaches; namely, Range B (inner channel), the Cutoff, and Range A (ocean bar channel). The primary commodities passing through Morehead City Harbor are fertilizer products, rubber, and wood chips, which are handled by facilities provided by the North Carolina State Port Authority. Lesser amounts of petroleum products, machinery, and paper also pass through the State Port.

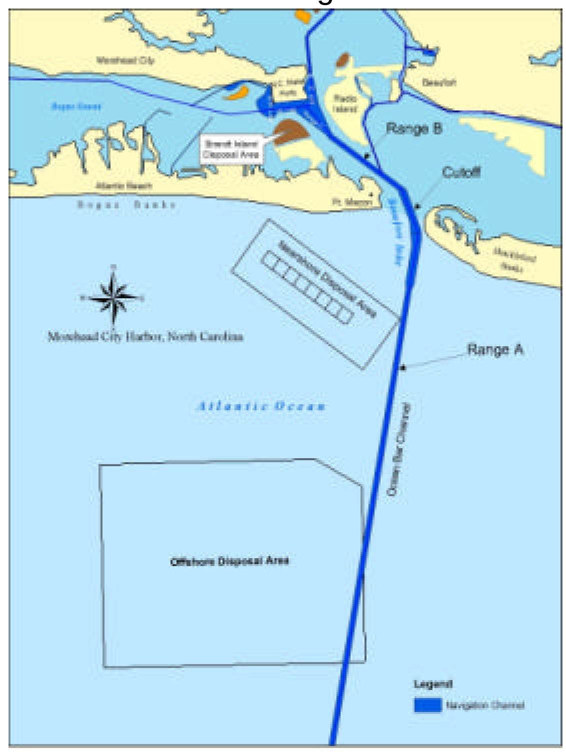


**Figure 3. Morehead City Harbor**

Historically, the Cutoff and Range A have been maintained by hopper dredge with the dredged material deposited in an offshore dredged material disposal site (ODMDS) located west of the seaward end of the bar channel. During the 1996 maintenance cycle for the bar channel, the disposal location was modified to include an option for near shore placement west of the bar channel in an area centered on the 30-foot MLW depth contour. Subsequent maintenance operations conducted in 1997 and 1999 required that all ocean bar channel material be placed in a near shore disposal site centered on the 25-foot MLW contour west of the channel.

However, operational constraints associated with the operation of hopper dredges has not allowed all of the maintenance material to be placed in the near shore site. The constraints associated with a hopper dredge operation include the inability of the dredge to deposit the material in shallow depths during unfavorable weather and wave conditions and the restricted dredging window (i.e. the time period in which hopper dredges are allowed to operate) imposed on hopper dredge operations due to their propensity to interfere with sea turtles. The dredging window for hopper dredges extends from January through March.

Maintenance of Range B and inner harbor has been performed by pipeline dredge with disposal on Brandt Island, a confined dredged material disposal site located immediately across the harbor from the State Port facility. Due to the limited capacity of this site, and the absence of other suitable upland disposal site in the area, Brandt Island was identified as a temporary holding area for the inner harbor dredged material during the formulation of the 40-foot project in 1976 and the 45-foot project in 1994. In this capacity, maintenance material is to be temporarily stored on Brandt Island for a period of 8 to 10 years after which the material is transferred to a beach disposal site located along the eastern end of Bogue Banks. Previous beach disposal sites have covered sections of both Fort Macon State Park and the Town of Atlantic Beach. Transfer of material from Brandt Island to the beach was accomplished in 1986 and 1994.

## FEDERAL STANDARD - BASE DISPOSAL PLAN

Should present plans for sharing sand by Bogue Banks beaches not materialize due to funding problems or other unforeseen reasons, up to 6.3 million cubic yards dredged maintenance material from the inner and outer harbor, as well as the pump out of Brandt Island would be distributed according to the base disposal plan as determined by the Federal Standard (see Appendix B). The base disposal plan represents the least cost alternative for the government, which is engineeringly feasible and environmentally acceptable.

Under the base disposal plan, the outer harbor would be maintained by hopper dredge and the resultant 1.5 million cubic yards of dredged material would be placed in the previously approved near-shore disposal area or the offshore dredged material disposal site (ODMDS) if inclement weather will not allow nearshore placement. The pumpout of Brandt Island and the maintenance dredging of the inner harbor by pipeline dredge would be placed using a design berm width of 150-feet. Up to 4.8 million cubic yards (about 4.0 million from Brandt Island and about 0.8 million from the inner harbor) of beach quality sand may be placed along approximately 32,000 feet of shoreline from Fort Macon State Park to the Atlantic Beach/Pine Knoll Shores border (Figure 1). If the North Carolina State Port Authority does not fund its share of approximately 1.2 million cubic yards of the Brandt Island material, this amount could be reduced to 3.6 million cubic yards.

## HISTORICAL BEACH DISPOSAL OF MOREHEAD CITY HARBOR DREDGED MATERIALS

Generally, routine maintenance dredging occurs every two years for Morehead City Inner Harbor and every year for the Outer Harbor. Pump outs of Brandt Island are scheduled every 8-10 years, depending on disposal capacity within the existing confined disposal area. Material removed from the Morehead

City Harbor project, from either Brandt Island or direct transfer onto beaches from maintenance activities, has been deposited on the shoreline of Bogue Banks on four separate occasions (Figure 4).

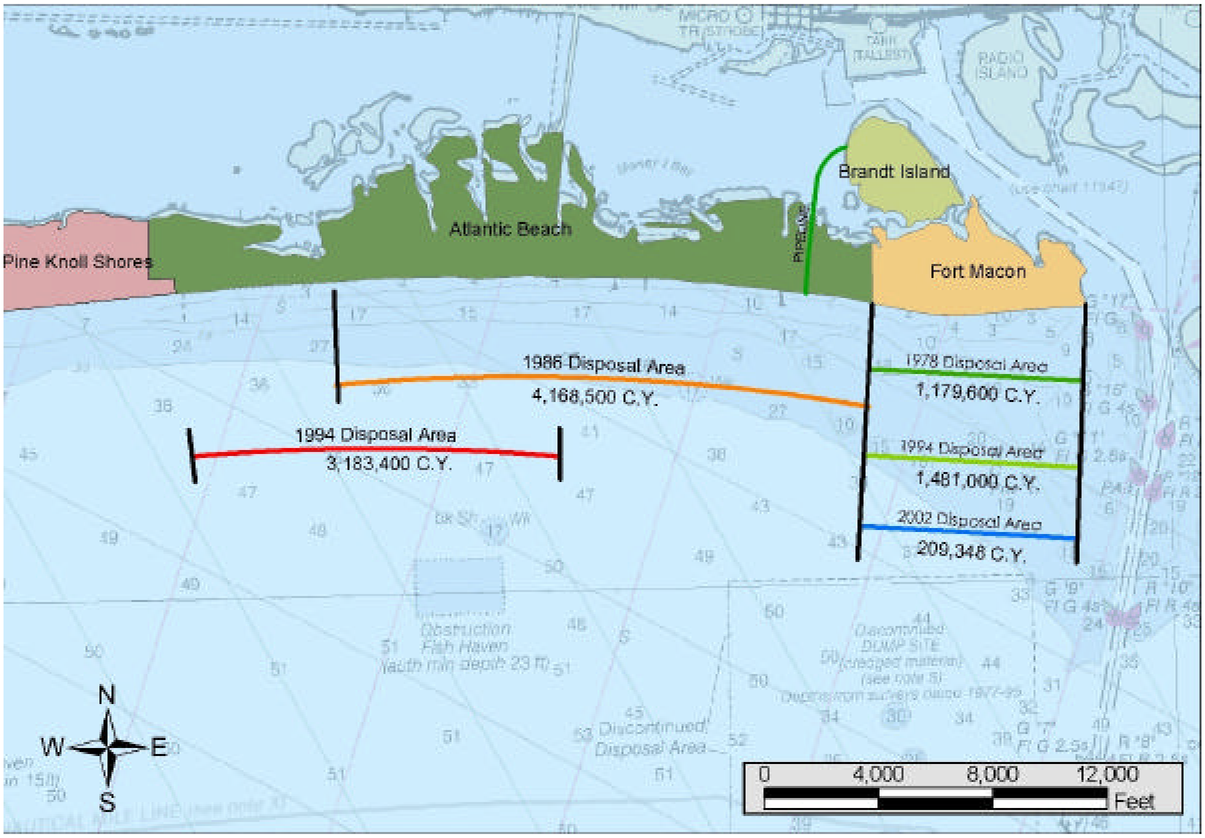


**Figure 4. Historic Beach Disposal Operations**

In 1978, a total of 1,179,600 CY of material removed for the deepening of the inner harbor and Range B was deposited along the Fort Macon State Park shoreline. In 1986, a total of 4,168,600 CY of dredged material was placed on Atlantic Beach between Corps of Engineers baseline stations 100+00 and 290+00. Of this total, 3,912,900 CY were from Brandt Island, and 255,700 CY of channel and basin maintenance material was transferred directly to the beach disposal site. In 1994 a total of 4,664,400 CY of material was placed on Fort Macon and Atlantic Beach with 3,183,400 CY being deposited between baseline stations 210+00 and 318+00 and the remaining 1,481,000 placed on the shoreline of Fort Macon State Park. Of the total 4,664,000 placed on the beach, 465,700 CY was maintenance material from the inner harbor, 1,725,000 CY was from new work construction, and 2,473,700 CY was from the Brandt Island disposal area. And finally, during the Spring of 2002, a direct transfer of 209,348 CY of maintenance material from the inner harbor was placed on the shoreline of Fort Macon between Corps of Engineers baseline stations 0+00 and 39+00 while the dike on Brandt Island was being reworked and was unavailable for accepting disposal material. The total amount of material available during any given pump out varies depending on the amount of material in Brandt Island and the annual maintenance needs of the inner harbor. There is no foreseeable new work dredging in the immediate future.

## LOCALLY FUNDED RENOURISHMENT

This project proposes to place approximately 4.57 million cubic yards of sand over 16.8 miles of Pine Knoll Shores, Indian Beach, Salter Path, and Emerald Isle shoreline. The source of the sand is an ocean borrow site. The project will be completed in three phases over a three-year period. The first phase has been completed with the nourishment of 6.8 miles of beach in Pine Knoll Shores and Indian Beach with approximately 1.7 million cubic yards of sand, which has been taken into account for the pre-Section 933 project conditions. The second phase is expected to place 1.8 million cubic yards of sand on 5.9 miles of Emerald Isle beginning January 13, 2003. And the final phase, if implemented would place 1.0 million cubic yards of sand on 3.5 miles of Emerald Isle in the winter of 2003/2004.

## STUDY PARTICIPANTS AND COORDINATION

This Section 933 study will be coordinated with various Federal, State, and local agencies and the public having concerns about the beneficial placement of dredged material for hurricane and storm damage reduction and the environmental impacts of proposed improvements. The Environmental Assessment (EA) will be circulated for review and comment along with this Evaluation Report. Comments received during the public review of the EA will be addressed in the Finding of No Significant Impact. Required coordination will be conducted with all appropriate agencies.

## SECTION 933 PROJECT REQUIREMENTS

A Section 933 Project, as described under " Study Authority", allows for the placement of navigation maintenance dredged materials onto beaches other than those that are determined to be part of the Base Disposal Plan. However, a Section 933 Project is subject to the availability of adequate Federal funding as well as the following conditions being met (ER 1165-2-130, *Federal Participation in Shore Protection,* and ER 1105-2-100, *Planning Guidance Notebook*).

a) The State must request that the dredged material be placed on the beach (this may be on the behalf of a political subdivision of the State);

b) The added cost of placing the material on the Section 933 project beaches over the Base Disposal Plan must be justified by the benefits it produces;
c) At least 50 percent of the additional costs must be covered by storm damage reduction benefits;
d) The beach must be open to the public and provide reasonable public access that has been defined as access points approximately every **one-half mile or less**. In addition, sufficient public parking, located within a reasonable walking distance of the access points should be provided. Parking should be sufficient to accommodate the lesser of peak hour demand or the beach capacity for the project area.
e) The placement of the dredged material must satisfy all applicable environmental statutes and regulations;
f) The non-Federal sponsor must pay **35 percent** of the added cost of disposal above the cost of the Base Disposal Plan; and
g) The non-Federal sponsor must provide, without cost to the Federal Government, all lands, easements, rights-of-way, and relocations needed to accomplish the work.

If all of these conditions are not met, the material could still be placed on the proposed beach areas outside of the Base Disposal Plan providing:

a) The State requests that the dredged material be placed on the beach (this may be on behalf of a political subdivision of the State);
b) Protection of the beach is in the public interest, regardless of benefits produced;
c) The placement satisfies all applicable environmental statutes and regulations;
d) The non-Federal-sponsor pays 100 percent of the added cost of disposal above the Base Disposal Plan; and
e) The non-Federal-sponsor provides without cost to the Federal Government, all lands, easements, rights-of-way, and relocation.

## AREAS OF CONCERN

The following issues are considered areas of particular concern regarding the proposed project.

- In response to the January 15, 2002, scoping letter, the public and review agencies expressed the following major concerns: fishery resources and habitats, rare butterfly habitat, short- and long-term impacts of the proposed activity, endangered/threatened species, cultural resources, sediment contamination, and other natural resources.

# PUBLIC BEACH ACCESS AND PARKING

The Army Corps of Engineers has several requirements that must be met in order to fully cost share in a Section 933 project (see "Section 933 Project Requirements" section on the preceding pages). The Corps' Wilmington District, additionally, has developed more specific public access and parking requirements for participation in Section 933 projects within the District's boundaries of North Carolina (see Appendix E).

The Wilmington District, using aerial photography and traffic surveys from the July 4th holiday, conducted an analysis to determine the peak hour demand for the area. The data was used to determine that the communities currently have adequate parking to meet the Corps' requirements for peak hour demand (see Appendix E).

The additional Section 933 requirements have been addressed by the local sponsor and documented in their Public Transportation and Parking/Access Plan for the proposed project area (see Appendix E – Exhibit 1). The document identifies the number of (8) and location of current public beach access sites and parking spaces (301) available, and outlines the sponsor's plans for future public beach access sites and parking. Additionally, the document addresses the installation of a public transportation system to assist visitors in accessing areas of the beach that have public access, but no public parking.

The sponsor's plan as currently proposed is acceptable to the Corps. Any changes to this plan or any new issues that arise will need to be resolved prior to the signing of the Project Cooperation Agreement.

When the plan is implemented, the sponsor will be eligible for full Federal cost sharing for the majority of the project area. The only exception currently identified includes the westernmost 1900 feet of Indian Beach (between Station 700+00 and Station 681+00) that does not meet the Corps' criteria, and would require 100% non-Federal funding to nourish. The local Sponsor has indicated that they do not intend to pursue this option at this time.

The sponsor will be eligible for cost sharing of 65.0% Federal and 35.0% non-Federal sponsor for the Section 933 project. These values are based on the sponsor's beach access and transportation plan and will be subject to change if more, less, or different access sites are decided upon prior to signing of the Project Cooperation Agreement. Once all access and/or parking sites are obtained, and prior to signing the PCA, the Corps will obtain specific measurements using GIS and or survey data of these sites to make a final determination on project cost sharing.

The local sponsor has developed the Public Transportation and Parking/Access Plan to identify how they will fulfill their commitment to meet the Corps' Section 933 requirements. The adequacy of public access will be revisited before the signing of a Project Cooperation Agreement. At that time, the Corps will verify that all plans have been implemented and that they meet all Section 933 requirements as outlined in this report.

If additional access points and parking are deemed necessary, the Wilmington District and local sponsor will work together on the local sponsor's plan to provide these. Should the local sponsor be required to obtain additional public access areas, these areas should be acquired as easements for the term of years identified in the Project Cooperation Agreement for which the local sponsor is responsible for providing public access for the project. The sponsor will be responsible for ensuring that the Section 933 requirements are met throughout the life of the project. Beach access and parking requirements are presented in Appendix E.

# SECTION II - PROBLEM IDENTIFICATION

The purpose of this report section is to identify problems, needs and opportunities in the study area in accordance with the study authority. This report section includes the following: (1) description of the study area; (2) an analysis of public concerns, which presents the concerns of local interests, Federal agencies, and others having interests in the study; (3) a statement of the National Objective, which outlines the criteria for Federal participation in water resources developments; (4) an assessment of Federal interest, which identifies concerns in the study area which the Federal government can address under this objective; and (5) specification of Problems, Needs, and Opportunities.

## STUDY AREA

Carteret County is located on the central North Carolina coast. Bogue Banks is a 25.4 miles long south-facing barrier island located on the low-energy limb of the Cape Lookout foreland within Carteret County. It is oriented in an approximate east to west direction between Beaufort and Bogue Inlets, located on the east and west terminuses of the island, respectively. The island is bound to the north by Bogue Sound, a relatively shallow water body through which the Atlantic Intracoastal Waterway passes (Figure 2).

Fort Macon State Park occupies the eastern end of the island. Political subdivisions on the rest of the island include, from east to west: the Town of Atlantic Beach, the Town of Pine Knoll Shores, an unincorporated area known as Salter Path, Town of Indian Beach, and the Town of Emerald Isle. The width of the upland portions of the island (the landmass above mean high water) varies from a minimum of approximately 800 feet to a maximum of over 4,000 feet. The narrowest part of the island, which ranges in width from 800 feet to 1,000 feet, is located along the easternmost 2.8 miles of Emerald Isle. The widest part of the island, which measures over 4,000 feet, is located on the westernmost 5.1 miles of the island, also within the corporate limits of Emerald Isle.

A maritime forest area is located on the sound side of Bogue Banks between the east portion of Indian Beach through Pine Knoll Shores. This reach of the island includes the Theodore Roosevelt Natural Area, which is the only portion of Bogue Banks included in the Coastal Barrier Resources System. In general, the island has been developed in such a manner as to preserve as much of the natural vegetation from the ocean to the sound as possible.

Hurricanes, extratropical events and progressive erosion have always occurred in the study area. Increasing development in Carteret County over the last several years has raised the potential for damages considerably. Development in the study area consists of single family houses, multi-unit apartment and condominium buildings, hotels, motels, and commercial buildings of various sorts, all covering a wide range of values and susceptibility to storm damages. Long-term erosion rates and elevations also vary over the study area.

Because of substantial variations in every factor that will affect storm damages, it is impossible to select any small areas or reaches that could be considered representative of the study area as a whole.

From 1990 to 2000, the population of Carteret County grew about 13% (i.e., 1990 population was 52,407 and 2000 population was 59,383). About 40 percent of the residents live in one of the county's municipalities. With its overwhelming economic emphasis on tourism, retail sales in Carteret County comprise the most important source of jobs and income for the county's economy. In 1993, total farm income for Carteret County was over 18 million dollars, with corn, soybeans, and tobacco the leading commodities. In 1995, the manufacturing sector employed about 10 percent of Carteret County workers.

The North Carolina Office of State Budget and Management estimates Carteret County's 1994 employment at 25,000, with about 35 percent in trade and 21 percent in Government employment. In 1997, per capita income in Carteret County was estimated at $21,624, somewhat higher than the North Carolina per capita income of $20,217.

The 1990's were a decade of rapid growth for the Carteret County beaches. The populations of the towns and Carteret County since 1990 are shown below. The total permanent population for the three principal towns in 2000 is estimated at 3,400. However, peak daily population in the summer can swell to more than 160,000 for the entire county.

**TABLE 1**

**POPULATION STATISTICS**
**CARTERET COUNTY, NORTH CAROLINA**

| Town/County | 1990 Population | 2000 Population |
|---|---|---|
| Atlantic Beach | 720 | 789 |
| Pine Knoll Shores | 1,360 | 1,524 |
| Indian Beach | 153 | 95 |
| Morehead City | 6,046 | 7,691 |
| Carteret County | 52,407 | 59,383 |

Carteret County population projections for 2000 – 2020 are shown below.

**TABLE 2**

**POPULATION PROJECTIONS
CARTERET COUNTY, NORTH CAROLINA**

| County | 2005 Population | 2010 Population | 2020 Population |
|---|---|---|---|
| Carteret | 65,633 | 69,358 | 76,341 |

Source: Office of State Planning, State of North Carolina.

In the summer months, a large portion of the homes along Bogue Banks are available as summer rentals to vacationers. Almost 2 million people, including those residing in the Research Triangle area of North Carolina, live within a two-hour drive of these beaches. During the summer months, the population of Carteret County is estimated to exceed 160,000 people. In the off-season months, it drops to 59,000, which includes about 789 permanent residents in Atlantic Beach (2000), 1,524 in Pine Knoll Shores, 95 in Indian Beach and 7,691 in Morehead City.

## PUBLIC CONCERNS

Local interests have expressed a need for hurricane and storm damage reduction measures for the 7.2-mile-long shoreline reach, which includes the communities of Pine Knoll Shores, Indian Beach, and Salter Path. In addition, agencies and individuals with interests related to environmental quality have expressed concerns that any plan of improvement be implemented in a manner, which avoids or minimizes environmental impacts. Public concerns are summarized below; detailed discussion of these concerns will be presented in subsequent report sections.

### HURRICANE AND STORM DAMAGE REDUCTION

The concerns of local interests, as expressed by their elected representatives, are reflected in the Carteret County resolution and the State's request for a Section 933 evaluation, which is the basis for this study (see Appendix A, Exhibit 2). Hurricane and storm damage have been persistent public concerns in the communities of Pine Knoll Shores, Indian Beach and Salter Path. All three of these areas of Bogue Banks are faced with moderate erosion problems and there is a high potential for hurricane and storm damage to structures in these areas where the protective berm and dune system has been weakened or lost due to recent storm action and long term erosion.

### ENVIRONMENTAL QUALITY CONCERNS

In response to the January 15, 2002 scoping letter, the public and review agencies expressed the following major concerns: fishery resources and habitats, rare butterfly habitat, short-and long-term impacts of the proposed activity, endangered/threatened species, cultural resources, sediment contamination, and other natural resources. Specific concerns will be addressed in the Final Report.

### CONSISTENCY WITH STATE COASTAL MANAGEMENT PROGRAM

As will be discussed in subsequent report sections, the plan of improvement recommended is considered to be consistent with the State's Coastal Management Program.

## THE FEDERAL OBJECTIVE

The Federal Objective in water resources planning is to contribute to the National Economic Development in a manner consistent with protection of the nation's environment. If hurricane and storm damage reduction measures at Pine Knoll Shores, Indian Beach, and Salter Path are economically feasible (benefits exceed costs) and environmentally acceptable, construction of a Federal project for this purpose utilizing the beneficial use of dredged material from the Morehead City Harbor navigation project would contribute to this objective.

## FEDERAL INTEREST

In accord with the Federal Objective any plan of improvement to be recommended for Federal implementation must produce benefits that exceed costs. The area must also be open and accessible to the general public on an equal basis. Therefore, detailed studies were directed toward those areas within the 7.2-mile-long reach of shoreline that includes the communities of Pine Knoll Shores, Indian Beach and Salter Path, which will be referred to as the "Section 933 Project Area" (Figure 1). The technically feasible solutions identified in this study consisted of beach berm construction utilizing maintenance dredged material from the Morehead City Harbor navigation project to reduce hurricane and storm damage along the Section 933 project area. These measures will be discussed in detail in the subsequent report section on "Plan Formulation".

# PROBLEMS, NEEDS, AND OPPORTUNITIES

The primary public concerns identified in the study area are the loss of land and potential loss of structures due to progressive beach erosion and potential damages to structures due to hurricane and storm action. These concerns are discussed below, and protective solutions are identified. These solutions will be discussed in detail in subsequent report sections.

## LONG-TERM EROSION

"Long-term erosion" as used in this report section refers to long-term shore processes. These processes can be documented based on shoreline history, and projected to estimate future conditions. Erosion in this sense differs from erosion during storms, which, although devastating to development, is generally of a temporary nature. Following storms, the coastline tends to reshape itself into its former configuration, as sand displaced from the beach is returned by wave action. The beach shape then conforms to the prevailing wave climate and littoral processes.

However, land losses due to progressive erosion are essentially permanent, as documented by the shoreline history along the Section 933 project area. Analyses of coastal processes conducted during this study indicate that historical erosion trends along the Section 933 project area can be expected to continue if no action is taken to stabilize erosion-prone areas. Past and projected future shoreline positions for the Section 933 project area are discussed below.

**Past Shoreline Positions, Section 933 Project Area.** Shoreline changes for beach segments from Fort Macon through Indian Beach are shown in Table 3. Figure 5 displays the "representative" reaches identified in Table 3. As shown, the peak erosion has occurred along the Pine Knoll Shores shorelines. Erosion has resulted in the loss of much of the protective berm and results in the dune system and structures located just upland of the shoreline being frequently threatened. Many of the seaward most buildings are highly vulnerable to damages by storm wave action due to the loss of the natural protective berm and dune system. Also, the width and quality of the beach available for recreation have diminished.

## Table 3

## Shoreline Changes – Project Base Year 2004

| | | Erosion Rates Change (+ Accretion - Erosion) | Future Shoreline Positions Linear Distance (ft) (+ Accretion - Erosion) | |
|---|---|---|---|---|
| REPRESENTATIVE REACH | LENGTH (ft) | RATE (ft/yr) | 10-yrs 2014 | 20-yrs 2024 |
| FM-R1 | 3020 | -1.8 | -18 | -36 |
| FM-R2 | 4016 | -2.1 | -21 | -42 |
| AB-R1 | 6063 | -2.2 | -22 | -44 |
| AB-R2 | 7053 | -0.1 | -1 | -3 |
| AB-R3 | 6019 | +0.9 | +9 | +18 |
| AB-R4 | 5998 | -0.3 | -3 | -6 |
| PKS-R1 | 7037 | -2.0 | -20 | -40 |
| PKS-R2 | 7008 | -3.9 | -39 | -78 |
| PKS-R3 | 7020 | -3.6 | -36 | -72 |
| PKS-R4 | 6006 | -2.8 | -28 | -55 |
| IB-R1 | 4994 | -0.8 | -8 | -15 |
| IB-R2 | 6011 | +0.3 | +3 | +7 |

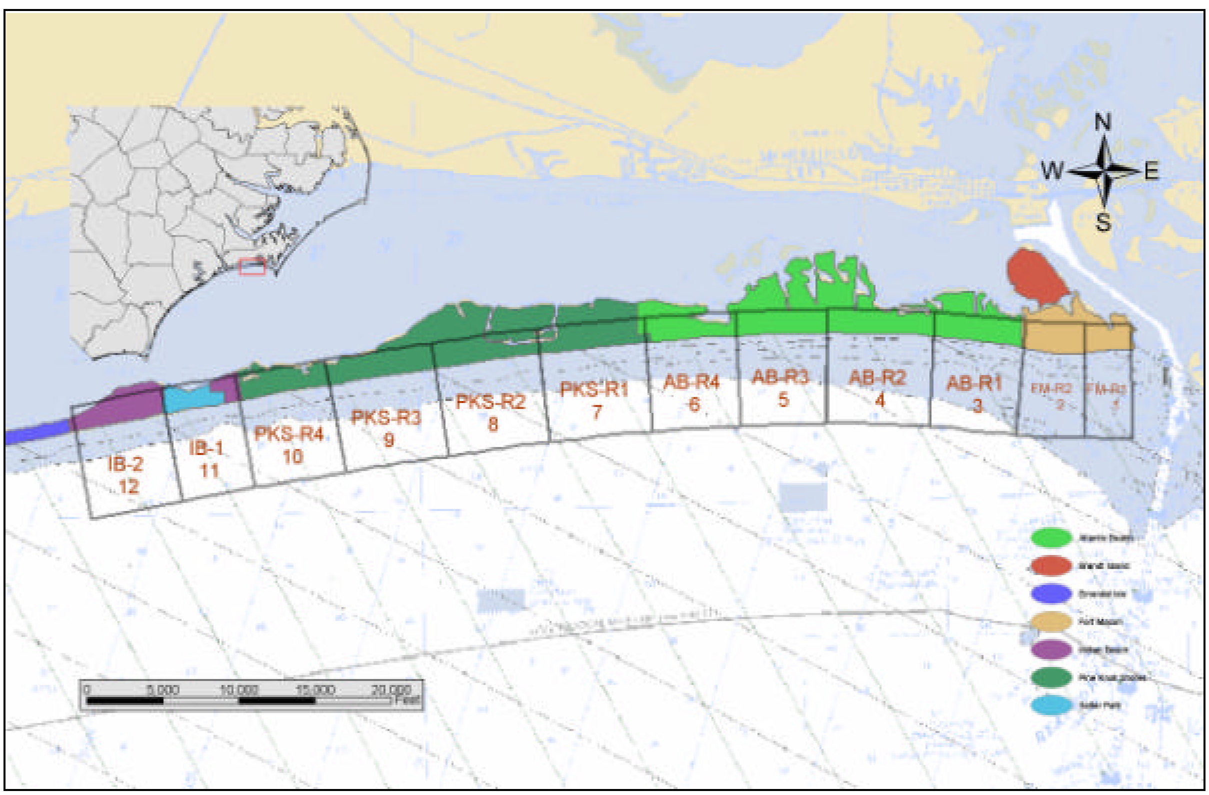


**Figure 5. Representative Reach Layout**

**Estimated Future Shoreline Conditions, Section 933 Project Area.** The discussion below presents an estimate of the future shoreline. Again, emphasis is placed on the 7.2-mile-long reach along the shorelines of Pine Knoll Shores, Indian Beach and Salter Path, which is the Section 933 Project Area. This estimated future without-project condition will form the basis for evaluating potential economic benefits for hurricane and storm damage reduction and developing dredged material placement plans to address these needs. For purposes of this discussion, it is assumed that no Federal project will be constructed before 2004. The year 2004 is referred to as the "base year" in subsequent report sections. (It should be noted that a Federal project could be implemented before or after 2004; however, this base year is assumed for purposes of economic analysis.)

Table 3 shows the estimated shoreline positions 10 and 20 years from the base year (2004). These projections were developed based on historic rates of erosion and shoreline adjustments, and do not take into account any erosion-control measures that might be undertaken during the periods of analysis.

By the year 2024, progressive long-term erosion is expected to threaten many structures along the Section 933 project area. The period of analysis for the Section 933 project has been selected to be 20 years. This is based on a 10-year physical life for the Section 933 project and doubling this time period for the period of analysis of the project.

The future shoreline positions discussed above are based on continuation of uniform historic rates of shoreline change. However, considering the value of property along the Section 933 project area (Pine Knoll Shores, Indian Beach, and Salter Path) relative to the cost of erosion control measures, it is likely that local interests will undertake temporary measures to protect against progressive erosion.

At present, the three towns bulldoze the beaches to create artificial dunes in the areas where erosion is most acute. Also, property owners have placed a small beachfill project along their property and have sandbagged for temporary protection. These projects have to be approved by the NC Division of Coastal Management. For beach communities that are actively pursuing a beach nourishment project, these local projects provide temporary protection until the long-term project is constructed. At the present level of activity, these measures are not sufficient to prevent erosion from proceeding landward, as shown in table 3. Therefore, unless more effective beach erosion control measures are undertaken, erosion is expected to progress landward.

Thus, the "most likely future" scenario along the Section 933 project area is that erosion control measures by local and state interests are not expected to provide significant protection against the erosion and flooding associated with hurricane and storm events.

## HISTORICAL HURRICANE AND STORM DAMAGE

"Hurricane and storm damages," as used in this report, refer to flooding by wave overwash during hurricanes and extratropical events, as well as short-term erosion, which occurs during these events. When the island is under hurricane and storm attack, the full force of the waves is felt along the immediate ocean shoreline; as the waves break and spill over the ocean edge of the island, development in upland areas is subject to the force of the waves. As noted in the discussion of "beach erosion" problems above, erosion is threatening much of the dune system along the shoreline within the Section 933 project area. These segments of the island could be overtopped by a category 2-storm event. With the smaller storms, such as a category 1-storm event, the principal damages would be associated with the battering and loosening of the pilings, which support beachfront structures, and the loss of decks and other structures. With the larger storms, such as Hurricane Donna in 1960, entire structures can be swept away. Past hurricanes and extratropical events and their damage potential are discussed below.

**Past Hurricanes and Extratropical events.** Devastating hurricanes and extratropical events periodically strike the study area. Storms occur in cycles with the recent years being fairly active. The following list is intended to present some of the worst storms that have been experienced in the study area. Hurricane season runs from 1 June through 30 November; while the northeaster season extends from 15 October to 10 April. Dollar estimates of the extent of the damages were not available for every storm and sometimes the available estimate covered a wider area than the scope of this study. Where any damage figures are given for storms in previous decades, it should be kept in mind that the damages would of course be far worse if a similar storm occurred today due to the surge in development during recent years.

During the years 1954 and 1955, three extremely severe and devastating storms struck the North Carolina coast. These hurricanes are important because similar storms do have the potential to occur in the study area. Hurricane Hazel, which pounded the coast from 5 to 18 October 1954, was the most destructive storm to strike North Carolina in 50 years. Every fishing pier along 170 miles of coast was destroyed. Between the North Carolina-South Carolina State line and Cape Fear, grass covered dunes, some 20 feet high, and a line of beach houses behind the dunes simply disappeared. Nineteen people were killed and 200 were injured. Damages throughout the State were estimated at $125,309,000, of which $31,190,300 occurred in the coastal and tidal areas. Hurricane Connie caused tremendous beach erosion between 3 and 14 August 1955. The damage throughout the State was thought to be about $50,000,000, but before damages could be fully assessed, Hurricane Diane followed, and between 7 and 21 August, caused about $40,000,000 more in damages.

**Recent Hurricane History - Bertha, Fran, Bonnie, Dennis, Floyd, Irene**

**12 July 1996** - Hurricane Bertha. The center moved over the North Carolina coast near Wilmington on 12 July with sustained winds of approximately 105 mph and gusts reported as high as 144 mph at Topsail Beach. The category 2 hurricane was an early season Cape Verde Hurricane. Damages were estimated to exceed $60 million for homes and structures and over $10 million for agriculture. Corn, tobacco, and other crops received severe damage from the storm. Rainfall totals of over 5 inches were common in eastern North Carolina.

**6 September 1996** - Hurricane Fran. The center moved over the Cape Fear area around 0030 on 6 September and was moving northward near 15 knots. When it made landfall, Hurricane Fran was a category three hurricane resulting in significant storm surge flooding on the North Carolina coast and widespread wind damage over North Carolina. At landfall, the minimum central pressure was estimated at 954 mb and the maximum sustained surface winds were estimated at 100 knots. Twenty-one died in North Carolina alone. Rainfall totals exceeding six inches were common near the path of Fran. Extensive flooding spread well inland from the Carolinas. Storm surge on the North Carolina coast destroyed or seriously damaged numerous beachfront houses. Widespread wind damage to trees and roofs, as well as downed power lines, occurred as Fran moved inland over North Carolina. Extensive flooding was responsible for additional damage in the Carolinas. Nearly a half-million tourists and residents were ordered to evacuate the coast in North and South Carolina. Press reports from Reuters News Service stated that 4.5 million people in the Carolinas and Virginia were left without power. The Property Claim Services Division of the American Insurance Services Group reported that Fran caused an estimated $1.6 billion dollars in insured property damage to the United States. This estimate includes $1.275 billion in North Carolina, $20 million in South Carolina, $175 million in Virginia, $50 million in Maryland, $20 million in West Virginia, $40 million in Pennsylvania and $20 million in Ohio. A conservative ratio between total damage and insured property damage, compared to past landfalling hurricanes, is two to one. Therefore, the total U.S. damage estimate is $3.2 billion.

**26 August 1998** - Hurricane Bonnie. The center drifted along the coast, with the western part of the eye moving across extreme southeast Brunswick County and over eastern New Hanover County. The center officially came onshore a short distance northeast of Wilmington during the late evening of the 26th and early morning of the 27th. Bonnie then moved slowly over extreme eastern North Carolina, emerging off the Outer Banks near Kitty Hawk early on the 28th. After being downgraded to a tropical storm while over land, Bonnie re-strengthened into a hurricane with 75-mph winds as it moved back into the Atlantic. Early estimates of storm tides are as follows. Brunswick coast: 7 to 9 feet above normal, 2 feet of overwash at Bald Head and eastern end of other islands. New Hanover and Pender County coasts: 9 to 10 feet above normal, 2 to 3 feet overwash at the north end of Carolina Beach. There was less overwash on the south end of Topsail Island.

**30 August 1999** - Hurricane Dennis. The hurricane lashed the Carolina coast on the 30th and part of the 31st with sustained tropical storm force winds, gusts to hurricane force, large waves, and high surf. The hurricane turned northeast away from the coast on the morning of the 30th and began to accelerate later that day while moving to the east-northeast. Dennis stalled about 150 miles east of Cape Hatteras on the morning of the 31st and then began to drift westward and weaken. During the first couple of days of September, Dennis continued to weaken and was downgraded to a tropical storm as it drifted slowly to the southwest along the lower Outer Banks. The storm turned to the northwest on the 4th and made landfall over the Outer Banks between Cape Lookout and Ocracoke as a tropical storm. NC 12 was washed out north of Buxton.

**16 September 1999** - Hurricane Floyd. The center made landfall near Cape Fear North Carolina as a category two hurricane around 0230 EDT September 16. The hurricane moved over the eastern part of the state and accelerated north-northeast up the coast, weakening to a tropical storm before moving into New England and losing its tropical characteristics early on the 17th. Floyd is responsible for massive inland flooding over portions of the eastern United States, particularly in North Carolina. The death toll from Floyd was 51 and makes this the deadliest United States tropical cyclone since Agnes of 1972. Many ocean front homes were heavily damaged.

**18 October 1999** - Hurricane Irene. The center passed just east of the Outer Banks early on the 18th. After passing the Outer Banks, Irene rapidly intensified and reached a peak intensity of 105 mph on the 18th. Irene continued northeast and was absorbed by an extra-tropical low on the 19th.

**Hurricane and Storm Damage Potential.** The Section 933 project area is heavily developed and the potential for hurricane-wave damage is more likely given the weakened dune system in this area. Unlike long-term erosion, which can be predicted, to some extent, based on past trends and observed shore processes, damages from hurricane-wave attack can occur in any year, and can be predicted only as a mathematical probability. Based on these probabilities, average annual damages were computed for hurricane and storm events, and will be discussed in Section III of this report, "Economic Benefits".

## CONDITIONS IF NO FEDERAL ACTION IS TAKEN

Development at Pine Knoll Shores, Indian Beach, and Salter Path is expected to continue, with or without any Federal projects. However, if no Federal action is taken this development will continue to be threatened by hurricanes and storm damage and long-term erosion. Basic assumptions are as follows:

(1) Most development is expected to still be in place by year 2004, the year in which it is assumed that a Section 933 project could be implemented along the Section 933 project area. Local interests are expected to take

short-term actions (bulldozing and sandbagging) to protect their property, however erosion will eventually threaten their structures.

(2) Local measures are not considered likely to provide significant protection against hurricane and storm damage, including wave overwash and flooding.

(3) The Corps of Engineers will continue to pursue the Federal Standard in navigation maintenance dredged material disposal for Morehead City Harbor, which is the most cost effective disposal plan that is environmentally acceptable and consistent with sound engineering practices.

## SUMMARY OF PROBLEMS, NEEDS, AND OPPORTUNITIES

The principal water-resources problems identified along the Section 933 project area are progressive beach erosion, due to long-term shore processes, and the threat of hurricane and storm overwash. The need for action to address these problems is particularly acute along the Section 933 project area including the resort communities of Pine Knoll Shores, Indian Beach, and Salter Path.

# SECTION III - ECONOMIC BENEFITS

The purpose of this analysis is to estimate the potential economic benefits that could be realized with the reduction of preventable damages due to beach erosion and hurricane and storm action in the Section 933 project area. As discussed previously, the Section 933 project area includes the 7.2-mile-long reach of shoreline, which includes the communities of Pine Knoll Shores, Indian Beach, and Salter Path. This is the area along Bogue Banks beaches where potential benefits are of significant magnitude to merit detailed study of a Section 933 project. Reduction of these damages, along with benefits for enhanced recreational use of the area, constitutes the economic justification for the plans of improvement that will be discussed in subsequent report sections.

## METHODOLOGY AND ASSUMPTIONS

The analysis of potential economic benefits, which follows is based on the assumption that no effective action will be taken to reduce hurricane and storm damages along the Section 933 project area. However, efforts by local and state interests will include bulldozing and sandbagging.

The interest rate for the analysis is 5-7/8 percent and a 20-year Period of analysis is used. October 2002 price levels are applied. The "base year" used for the economic analysis is 2004.

The structural database used for this analysis was compiled by field surveying every structure on the oceanfront and second-row in the Study Area, which includes the communities of Fort Macon, Atlantic Beach, Pine Knoll Shores, Indian Beach and Salter Path. Each structure was assigned a reasonable estimate of its depreciated replacement value. Factors such as age, condition, quality of materials, and type and quality of construction enter into this value determination. Tax values were used for the sake of comparison, since the Carteret County tax appraisers also strive to measure replacement value less depreciation.

Estimates of values of contents of commercial structures in the Study Area are based on interviews with business owners and insurance agents familiar with the Carteret County oceanfront, as well as empirical data collected for past studies. Each type of business has a unique content factor applied to its structural value. Motels comprise most of the commercial base and 50 percent of the structural value was used for their content value. For estimating the value of household contents of residential structures in the area, 40 percent of the structural value is used. This is based on site-specific responses from Carteret County officials, insurance agents, realtors, and homeowners familiar with the residential development along this section of oceanfront.

This analysis includes 842 structures that occupy the Study Area and Base Disposal Plan Area. Of this total, there are 470 structures in Atlantic Beach, 258 structures in Pine Knoll Shores, 69 structures in Indian Beach, 44 structures in Salter Path, and 1 structure in Fort Macon State Park. Altogether, they represent a total structural value of about $377 million as shown in table 4.

TABLE 4
Structural Inventory by Town

| **Town** | **Number** | **Oceanfront Structure Value** | **Second Row Structure Value** | **Total Structure Value** |
|---|---|---|---|---|
| Fort Macon | 1 | $160,000 | $0 | $160,000 |
| Atlantic Beach | 470 | $105,959,000 | $31,768,000 | $137,727,000 |
| Pine Knoll Shores | 258 | $119,791,000 | $27,688,000 | $147,479,000 |
| Indian Beach (Salter Path) | 113 | $77,258,000 | $14,039,000 | $91,297,000 |
| TOTAL | 842 | $303,168,000 | $73,495,000 | $376,663,000 |

## BENEFITS FOR
## HURRICANE AND STORM DAMAGE REDUCTION

Expected annual hurricane and storm damages for these areas were computed using Wilmington District computer programs (see Appendix D). The level of storm damage reduction for this beach fill configuration is determined by simulating hundreds of 20-year life cycles. This is accomplished through the use of the model, GRANDUC, which incorporates risk and uncertainty principles into the analysis. Through a random selection process, a particular 20-year simulation may include several severe storms or perhaps none. All of the 20-year life cycle simulations are run for the existing conditions, then again for a particular plan. Then, the average storm damage reduction potential afforded by a particular design configuration is computed. These damages are then estimated at an expected annual amount. Expected annual hurricane and storm damages for the Section 933 Project Study Area were estimated at $14,543,000 as shown in table 5. The expected annual damage figure includes damages to structures and contents associated with inundation, wave impacts, and storm induced erosion.

TABLE 5
Expected Annual Hurricane and Storm
Benefits for the Section 933 Study Area

| TOWN | Expected Annual H&S Damages Existing | BD Plan | 933 Plan | Expected Annual H&S Benefits 933 Plan |
|---|---|---|---|---|
| Pine Knoll Shores | $12,008,057 | $12,008,057 | $4,750,681 | $7,257,376 |
| Indian Beach | $2,534,965 | $2,534,965 | $842,311 | $1,692,654 |
| TOTAL | $14,543,022 | $14,543,022 | $5,592,991 | $8,950,031 |

## BENEFITS FOR EMERGENCY COSTS AND OTHER DAMAGE REDUCTION

Emergency costs prevented refer to expected annual expenditures that residents and local and state governments are experiencing under the without project condition that a Federal project would preclude. Other damages prevented include storm damages that are not covered under the National Flood Insurance Program, but represent financial impacts on public and private storm victims that a Federal project could prevent. The categories for this benefit include: (1) bulldozing; (2) sandbagging; (3) emergency costs incurred by the North Carolina Department of Transportation (NCDOT); (4) damages to public property (water and electric utility distribution systems and access walkways); (5) damages to private property such as walkways, driveways, and cleanup costs; and post-storm recovery expenses and storm related expenses such as police patrolling, inspections, and permits. Expected annual emergency costs and other damages for the towns of Pine Knoll Shores, Indian Beach, and Salter Path are estimated at $140,000. The Section 933 Project would reduce this amount to an estimated $18,000. Therefore, the expected annual emergency costs reduction benefits for the Study Area amount to $122,000.

## BENEFITS FOR RECREATION

As discussed previously, local interests are expected to bulldoze sand after storm events and place sandbags along the shoreline fronting their structures in an attempt to protect their structures for as long as possible. The local beach nourishment project has provided some additional relief to the beach area. However, the recreational beach that remains by 2004 is expected to be narrow at high tides. Potential recreation benefits for the Study Area were computed by estimating the unit day value of the recreational experience available with and without a Federal project. The term "unit day value" represents the economic value that is assigned to a day of recreational experience (see Appendix D).

A unit day value of $3.96 was assigned for the "without project" condition (see Appendix D). The unit day value will be higher if a Section 933 project is implemented to restore and stabilize the beach strand. With the improved beach width and public access that would accompany a Section 933 project, a unit day value increase of $5.32 for Pine Knoll Shores and $5.11 for Indian Beach and Salter Path is considered more appropriate. This increase of $1.36 for Pine Knoll Shores and $1.15 for Indian Beach and Salter Path per unit day multiplied by estimated annual visitation represents the potential economic benefits for a restored and stabilized beach along the Study Area. Estimated visitation is discussed as follows.

Beach use along the Section 933 project area is estimated at a daily peak of 17,200 persons, based on data from the Towns of Pine Knoll Shores, Indian

Beach, and the Village of Salter Path and the Carteret County Tourist Bureau. This total represents an annual visitation of 776,000 for the Section 933 project area. Therefore, recreational benefits for the Section 933 project area are estimated at an expected annual amount of $1,009,000 (555,000 visitor days x $1.36 increase in unit day value for Pine Knoll Shores plus 221,000 visitor days X $1.15 increase in unit day value for Indian Beach and Salter Path).

## SUMMARY OF ECONOMIC BENEFITS

The total expected annual benefits for shore protection along the 7.2-mile-long Section 933 project area that includes the resort towns of Pine Knoll Shores, Indian Beach, and Salter Path, are summarized in table 6. As shown, economic benefits include three categories: (1) Hurricane and Storm Damage Reduction Benefits - Potential benefits in this category are based on damages due to long-term beach erosion and short-term storm erosion and wave overwash during hurricanes and northeasters; (2) Emergency Costs and Other Damage Reduction - Potential benefits in this category are based on storm related expenditures that are not covered by the National Flood Insurance Program; (3) Recreation - Potential benefits in this category are based on increases in the value of the recreation experience for beachgoers with implementation of a Federal project within the Study Area; (4) Benefits During Construction – Those benefits that accrue to the project as it is being constructed.

**TABLE 6**

**EXPECTED ANNUAL BENEFITS**
**FOR THE SECTION 933 PROJECT AREA**
(Pine Knoll Shores, Indian Beach, and Salter Path)

| **Benefit Category** | |
|---|---|
| Hurricane and Storm Damage Reduction | $8,950,000 |
| Emergency Costs and Other Damages Reduction | 122,000 |
| Recreation | 1,009,000 |
| Benefits During Construction | 574,000 |
| TOTAL | $10,655,000 |

As shown in Table 6, total expected annual benefits for the Section 933 project area are estimated at $10,655,000. In accord with the National Objective stated previously, the expected annual cost of any Federal improvement recommended must be less than the expected annual benefits. In addition, any plan of improvement to be recommended must be shown to be environmentally acceptable. Environmental resources in the Study Area are discussed in the following report sections.

# SECTION IV - ENVIRONMENTAL CONSIDERATIONS IN PROJECT PLANNING

The purposes of this report section are (1) to identify significant environmental resources which might be affected by a Section 933 project along the Section 933 project area; and (2) to identify criteria which should be followed in planning and designing a project to minimize impacts on those resources. Significant, or potentially significant, resources are discussed as follows.

## SIGNIFICANT RESOURCES

Generally, the upland areas in the Section 933 project area (i.e., Towns of Pine Knoll Shores and Indian Beach (including Salter Path)) have limited natural values, due to the intensity of development. However, the estuaries, inlets, beaches, and shallow ocean bottom surrounding the Section 933 project area has significant values, as discussed below.

### BIOLOGICAL RESOURCES

Marine waters in the vicinity of the beach disposal sites and maintenance dredging of the Morehead City Harbor outer navigation channels, provide habitat for a variety of ocean fish and are important commercial and recreational fishing grounds. Kingfish, spot, bluefish, weakfish, spotted sea trout, flounder, red drum, king mackerel, and Spanish mackerel are actively fished for from boats, the surf, and local piers. Off shore marine waters serve as habitat for the spawning of many estuarine dependent species. These species, according to the National Marine Fisheries Service, "compose approximately 75 percent of commercially and recreationally important catch of fish and invertebrates in North Carolina". The surf zone serves as a nursery area for Florida pompano and juvenile gulf kingfish during the summer. Nearshore waters also accumulate juvenile, ocean spawning, and estuarine dependent fish and invertebrates in the late winter and early spring prior to their transport through Beaufort Inlet and Bogue Inlet to the Bogue Sound estuary.

Although developed areas in the Study Area have limited habitat value, portions of the barrier island beaches (i.e., the inlet shorelines) within the Study Area are important nesting areas. During Migratory periods, piping plover, Wilson's plover, semipalmated plover (*Charadrius semipalmatus*), red knot (*Calidris canutus*), sandwich tern (*Sterna sandvicensis)* Foster's tern (*Sterna forsteri*), Royal tern (*Sterna maxima*), least tern, gull-billed tern (*Sterna nilotica*), common tern, black tern (*Chlidonias niger*), Caspian tern (*Sterna caspia*), herons, egrets, marbled godwit (*Limosa fedoa*), laughing gull (*Larus atricilla*) and cormorant are commonly found in and around the inlets. Overwintering bird species include piping plover, brown pelican, cormorants, Foster's tern, Royal tern, dunlin, and various gull species. Potential project areas were surveyed during this study to determine potential use of these areas by the species mentioned above and the results are presented in the attached Environmental Assessment.

A natural dune system is present along the Study Area, however, this dune system is being severely eroded. These dunes are vegetated primarily with grasses, sea oats, and salt meadow hay, which provide habitat for some wildlife species including birds and small mammals. Dunes serve an important function as a barrier to storm tides, protecting barrier island development. Dune vegetation such as sea oats is important as a dune builder and helps to protect against erosion. It is expected that the recommended plan will result in reestablishing and protecting the dune system along the project area.

More detailed descriptions of the landforms and fish and wildlife resources of the study area are presented in the attached Environmental Assessment.

**ENDANGERED AND THREATENED SPECIES**

Coordination with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service has been conducted to identify endangered and threatened species (as well as Federal Species of Concern) that might be present in the vicinity of the Study Area. Species that are currently Federally listed as endangered or threatened (as well as Federal Species of Concern), which may or do occur in the Study Area, and which may be subject to impacts from beach disposal are listed in Table 7.

**TABLE 7**

**THREATENED AND ENDANGERED SPECIES (INCLUDING FEDERAL SPECIES OF CONCERN) POTENTIALLY PRESENT IN CARTERET COUNTY, NORTH CAROLINA**

| Species Common Names | Scientific Name | Federal Status |
|---|---|---|
| *Vertebrates* | | |
| American alligator | *Alligator mississippiensis* | T(S/A) |
| Eastern cougar | *Felis concolor couguar* | Endangered* |
| Green sea turtle | *Chelonia mydas* | Threatened 1 |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Right whale | *Eubaleana glacialis* | Endangered |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Sperm whale | *Physeter macrocephalus* | Endangered |
| Finback whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Kemp's ridley sea turtle | *Lepidochelys kempii* | Endangered |
| Leatherback sea turtle | *Dermochelys coriacea* | Endangered |
| Loggerhead sea turtle | *Caretta caretta* | Threatened |
| West Indian Manatee | *Trichechus manatus* | Endangered |

| | | |
|---|---|---|
| Piping Plover | *Charadrius melodus* | Threatened |
| Roseate tern | *Sterna dougallii* | Endangered |
| Shortnose sturgeon | *Acipenser brevirostrum* | Endangered |
| Smalltooth sawfish | *Pristis pectinata* | Endangered |
| *Invertebrates* | | |
| a skipper (butterfly) | *Atrytonopsis sp1* | FSC |
| Arogos skipper | *Atrytone arogos* | FSC |

| **Species Common Names** | **Scientific Name** | **Federal Status** |
|---|---|---|
| *Vascular Plants* | | |
| Rough-leaved loosestrife | *Lysimachia asperulaefolia* | Endangered |
| Seabeach amaranth | *Amaranthus pumilus* | Threatened |

[1]Green turtles are listed as threatened, except for breeding populations in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

**KEY:**

Status Definition

Endangered - A taxon "in danger of extinction throughout all or a significant portion of its range."

Threatened - A taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

T(S/A) - Threatened due to similarity of appearance (e.g., American alligator )--a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation.

Species with 1 asterisk behind them indicate historic record:

* Historic record - the species was last observed in the county more than 50 years ago.

Potential project-related impacts have been addressed for each of these species and are presented in the attached Environmental Assessment. It has been determined that the project, as currently proposed, may affect the, piping plover, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, shortnose sturgeon, and sea-beach amaranth. Methods to minimize impacts to these species are found in the attached EA.

## WATER QUALITY

Morehead City Harbor is located at the confluence of the Newport River and Bogue Sound. All tidal waters within Morehead City Harbor are classified as SC and SA. Coastal waters offshore of the project area are classified SB by the State of North Carolina (NCDEM 1989). Class SA waters are defined as suitable for shellfishing for market purposes and any other usage specified by the “SB” and “SC” classification. Best usage of class SB waters includes swimming, primary recreation, and all Class SC uses including fishing, secondary recreation, fish and wildlife propagation, and other uses requiring lower water quality (NCDEM 1991). The waters in the vicinity of Morehead City Harbor are prohibited shellfish areas.

## CULTURAL RESOURCES

The Morehead City Harbor Section 933 study has been reviewed pursuant to Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) and the Abandoned Shipwreck Act (43 USC 2101 et seq.). This review has included consultation with the North Carolina State Historic Preservation Officer and staff of the NC Division of Archives and History Underwater Archaeology Unit and indicates that six archaeological sites have been recorded along the Bogue Banks beaches. Some of these sites consist of transient wreckage that has washed ashore from ships lost nearby in offshore waters. The sites and their last known locations are (NAD83 datum, UTM Zone 18):

0001BBB Iron Steamer Pier Wreck Site (3840366N, 0332561E)
Believed to be the Civil War blockade-runner *Pevensey*, an iron-hull side-wheel steamer, lost June 9, 1864. The wreck is located approximately 100 yards offshore on the east side of the pier lying almost parallel to the beach. Portions of a paddle wheel are visible during low tide.

0002BBB Gun Emplacement Site (3838105N, 0317035E)
Granite stones located in the surf zone adjacent to the 6200 block of Ocean Drive at Emerald Isle, believed to be from a World War II coastal shore battery exposed by beach erosion.

0003BBB Salter Path Site
Ship timbers 14” square, approximately 42 feet and 18 feet long with 1.25” diameter iron fasteners located roughly 1200 feet east of the beach access road near Squatters Campground.

0004BBB Cupola Site (3839081N, 0322515E)
Portions of a ship hull approximately 30’ long and 14’ wide fastened with iron pins, yellow pine planking on oak frames. This site is located in the surf zone near 18$^{th}$ Street, Emerald Isle. (Tag Numbers 134, 135)

0005BBB Emerald Isle Pier Wreck (3838758N, 0320674E)
Ship timber 40’ long, 12” x 18” square, iron fasteners and one attached frame. This site is located near Emerald Isle Fishing Pier. (Tag Numbers 155, 156)

0006BBB Ocean Reef Site (3838806N, 0320892E)
Ship wreckage covering an area of approximately 100’ by 35’ near the Ocean Reef Condos (marked by a warning sign on the beach). This site consists of extensive debris with iron fasteners.

**AESTHETIC RESOURCES**

The Carteret County beach communities of Pine Knoll Shores, Indian Beach, and Salter Path that are located in the Section 933 project area, provide a vacation area for millions of visitors each year. The beaches within the Section 933 project area are used extensively for recreation. This includes sunbathing, swimming, surf fishing, jogging, bird watching and sightseeing. Public access with parking or public transportation will be available along the Section 933 project area as outlined in Appendix E – Exhibit 1.

## ENVIRONMENTAL CRITERIA AND CONSTRAINTS

No environmental constraints were identified which would preclude implementation of a Section 933 project at Pine Knoll Shores, Indian Beach, and Salter Path. However, any plan of improvement should be designed and implemented, to the extent practicable, to avoid impacts on the threatened species known to occur along the Section 933 project area (see Table 7).

Generally, any plan of improvement should be designed to avoid adverse impacts on water quality and biological resources. Also, the timing of project construction should be adjusted as practicable to avoid periods of high biological productivity. Methods to minimize impacts to these periods of high biological productivity are found in the attached EA.

As noted above, the aesthetic qualities of the beach strand at Pine Knoll Shores, Indian Beach, and Salter Path will probably continue to be degraded as erosion encroaches on development. Therefore, there is an opportunity to enhance this aspect of the island's aesthetic quality by restoration of the beachfront.

# SECTION V - PLAN FORMULATION

This report section describes the procedures by which the Recommended Plan of improvement was developed and ultimately selected. The Recommended Plan, which may also be referred to as the Section 933 Project, includes approximately 7.2 miles of beachfront, and is the maximum project area that has been identified within the Study Area. The non-Federal sponsor prefers a project that covers the maximum project area.

## PLAN FORMULATION RATIONALE

A Section 933 project would consist of a beach berm project to control erosion and reduce wave overwash during storms. Beneficial use of dredged material for a Section 933 project for hurricane and storm damage reduction is limited to the volume of dredge maintenance material required to be removed from the navigation project due to channel shoaling and is also limited to operation and maintenance funds available for maintaining the project. Furthermore since dredged volumes are tied to the navigation project, the typical plan optimization (identification of the NED Plan based on maximum net average annual benefits) is not required. Therefore only one plan need be evaluated to determine economic feasibility.

## ALTERNATIVE PLANS

As explained above, only one plan need be evaluated in determining economic feasibility. The Recommended Plan, therefore, was the only plan considered in great detail. Although the Recommended Plan was the only plan analyzed in detail, there were several plans initially assessed which would have provided protection for a number of different combinations of areas within the Study Area and the Base Disposal Plan Area. These plans were used as tools to assist in the initial determination of the one plan to evaluate in more detail. The recommended project area was evaluated since: (1) this area has had consistent development and erosion has weakened the protective dune; (2) there are no significant environmental constraints associated with these reaches; and (3) The non-Federal sponsor prefers a project that covers the maximum project area.

# SECTION 933 RECOMMENDED PLAN

The Recommended Plan would consist of constructing a sand berm along the oceanfront at an elevation of 7 feet above NGVD, which mimics the natural berm elevation in the Study Area. The design berm ties into the existing dune system at + 7 ft NGVD, extends 30-ft seaward, and transitions at a 1V:25H slope to the Mean Tide Level (MTL). The offshore portion of the profile then parallels the preplacement profile slope out to closure depth.

The construction profile will greatly differ from the design profile. Since it is not economically feasible to groom the offshore portion of the profile to mimic design profile conditions, it is common construction practice to place an equivalent volume of material in the upper part of the profile as shown in Figure 6. Natural wave conditions will restore the profile shape to equilibrium conditions, resulting in the design profile berm width. The increase in berm width during construction varies according to profile conditions. The average construction berm width for the project increased to 107 ft as compared to the 30-ft design berm width. Average volumetric requirements for the recommended plan were approximately 90 cubic yards per foot.

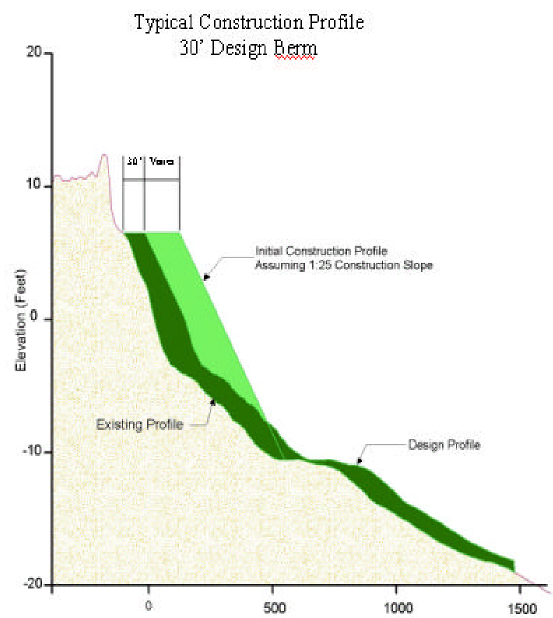


**Figure 6. Design and Construction Profile Conditions.**

It should be noted that existing dune conditions in the Project Area typically exceeded 15 ft NGVD. Such conditions exceed typical dune systems commonly incorporated into storm damage reduction projects. Therefore, dunes were not considered as an alternative. The 30-foot design berm width along the entire study area (7.2 miles) is expected to provide increased protection against long-term erosion.

The Recommended Plan includes a transition zone at the west end of the main fill. Since the fill will cause the shoreline to protrude seaward, the west end of the fill will erode rapidly unless measures are taken to terminate the fill with a gradual transition. The transition zone at the west end of the fill is 1,000 feet long. The transition fill will taper into the existing system. The east end of the main fill will tie into the base disposal main fill.

The Recommended Plan would be constructed by hydraulic dredges (pipeline and hopper with pump out capability) using the navigation project areas shown on Figure 3. The material would be pumped from the navigation project areas to the beach and shaped by earth moving equipment. The beachfill would be constructed at an elevation of +7-feet NGVD, the elevation of the existing beach berm along the project reaches. A benefits and costs discussions for the Recommended Plan follows.

## BENEFITS AND COSTS FOR THE RECOMMENDED PLAN

Benefits for the Recommended Plan as well as the Base Disposal Plan, the disposal plan that would be used in the without project condition as determined by the Federal Standard, are shown below in Table 8.

**TABLE 8**

**EXPECTED ANNUAL BENEFITS FOR RECOMMENDED PLAN**
(Based on 5-7/8 percent interest rate, 20-year Period of analysis)
(October 2002 price levels)

| **Benefit Category** | |
|---|---|
| Hurricane and Storm Damage Reduction | $8,950,000 |
| Emergency | $ 122,000 |
| Recreation | $ 1,009,000 |
| Benefits During Construction | $ 574,000 |
| Expected Annual Total Benefits | $10,655,000 |

### BENEFITS FOREGONE

Benefits foregone were evaluated for those reaches that are located within the Base Disposal Plan (Atlantic Beach and Fort Macon) that would not receive the entire dredge disposal due to the proposed Section 933 project. There are no benefits foregone related to emergency costs or recreation, only hurricane and storm damage reduction. The total expected annual benefits forgone are estimated at $705,000. This amount is added to the cost side of the Section 933 Project to account for the lower level of protection that the Base Disposal Plan would have offered Atlantic Beach and Fort Macon.

## COSTS FOR RECOMMENDED PLAN

First costs for the Recommended Plan and the Base Disposal Plan are shown in Table 9. The costs between the two plans vary proportionately to the volume of the fill and the distance the fill is located from the navigation project areas. Expected annual costs of the recommended Section 933 Project are shown in table 10 and presented in Appendix H.

**TABLE 9**
**FIRST COST SUMMARY**

| Description | Sand Placement Location | Costs |
|---|---|---|
| **TOTAL SECTION 933 PROJECT + MODIFIED DISPOSAL PLAN:** | | |
| Mobilization & Demobilization | | $2,850,000 |
| Pumpout Brandt Island & Inner Harbor | Fort Macon & Atlantic Beach | $3,929,074 |
| Pumpout Brandt Island, Inner Harbor, & Entrance Channel | AB, PKS, & IB | $24,428,234 |
| Embankment Replacement | | $1,750,000 |
| Beach Tilling | | $137,600 |
| Planning Engineering & Design | | $375,000 |
| Construction Management | | $100,000 |
| SUBTOTAL before Contingencies | | **$33,569,908** |
| Contingencies (10%) | | $3,357,093 |
| **TOTAL Section 933 Project + Modified Disposal Plan** | | **$36,927,000** |
| **BASE DISPOSAL PLAN:** | | |
| Mobilization & Demobilization | | $1,750,000 |
| Pumpout Brandt Island & Inner Harbor | Atlantic Beach and Fort Macon | $10,752,000 |
| Mobilization & Demobilization | | $250,000 |
| Dredge Entrance Channel | Near Shore Disposal Area | $3,900,000 |
| Embankment Replacement | | $1,750,000 |
| Beach Tilling | | $130,400 |
| Planning Engineering & Design | | $120,000 |
| Construction Management | | $50,000 |
| SUBTOTAL before Contingencies | | **$18,702,400** |
| Contingencies (10%) | | $1,870,600 |
| **TOTAL Base Disposal Plan** | | **$20,573,000** |
| **SECTION 933 PROJECT COSTS** | | **$16,354,000** |

Note: The percentage of the Section 933 Project costs ($16,354,000) to the total Section 933 Project plus the Modified Disposal Plan ($36,927,000) is 44.3 percent.

**TABLE 10**

**EXPECTED ANNUAL COSTS FOR RECOMMENDED PLAN**
(Based on 5-7/8 percent interest rate, 20-year Period of analysis)
(October 2002 price levels)

| **Total Project Summary** | **Total 933 Project** | **Base Disposal Plan** | **Difference to be Justified** |
|---|---|---|---|
| **Total Initial Construction:** | $36,927,000 | $20,573,000 | $16,354,000 |
| Interest During Construction | $708,000 | $0 | $708,000 |
| **Total Investment Cost** | $37,644,000 | $20,573,000 | $17,062,000 |
| | | | |
| **Expected Annual Cost:** | | | |
| I&A-20 years | | | $1,473,000 |
| Annual Benefits Forgone | | | $705,000 |
| **Total Expected Annual Cost** | | | $2,178,000 |

**SUMMARY OF BENEFITS AND COSTS, SECTION 933 PLANS**

Table 11 summarizes benefits and costs for the Recommended Plan. As shown in this table, the Recommended Plan would produce benefits greater than costs. This plan would provide effective protection for long-term shore erosion.

## TABLE 11

### EXPECTED ANNUAL BENEFITS AND COSTS OF THE RECOMMENDED PLAN

| | |
|---|---|
| Expected Annual Total Benefits | $10,655,000 |
| Expected Annual Total Costs | $2,178,000 |
| Benefit-to-Cost Ratio | 4.9 |

## RATIONALE FOR DESIGNATION OF RECOMMENDED PLAN AND PLAN SELECTION

The Recommended Plan would control progressive erosion and minimize permanent land losses. The plan would reduce damages to structures caused by short-term, storm-induced erosion. The plan is considered to be environmentally acceptable. As discussed previously, the National Objective for Federal water resources projects is to contribute to the National Economic Development.

# SECTION VI - RECOMMENDED PLAN OF IMPROVEMENT

The purpose of this report section is to centralize information concerning the Recommended Plan of Improvement for the Section 933 Project. The Recommended Plan is discussed in terms of (1) Plan Features, (2) Construction, (3) Plan Accomplishments, (4) Plan Impacts, (5) Public Views and (6) Plan Implementation.

## PLAN FEATURES

The Recommended Plan of Improvement includes a 30-ft wide berm placed at 7-ft NGVD. Project dimensions are shown on Figure 7. The project will extend along the reaches shown on Figure 1. The total length of the main fill will be approximately 38,000 feet, which includes the 1,000-foot transition zone on the west end of the main fill.

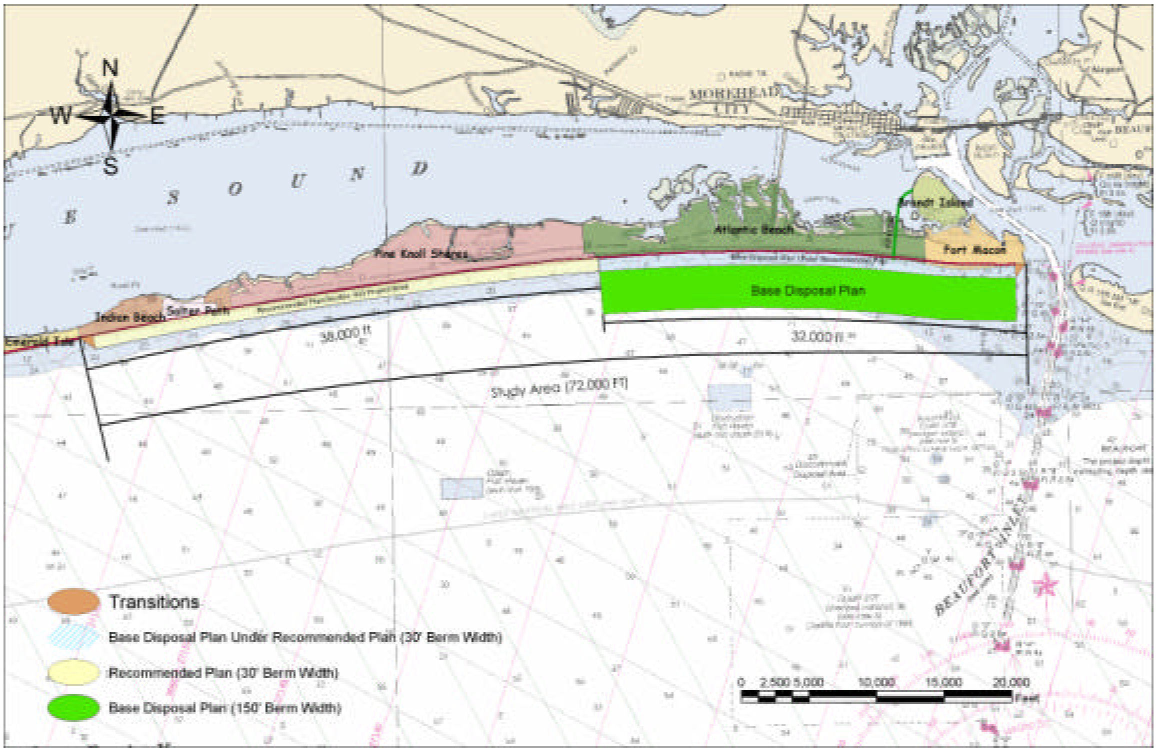


**Figure 7. MHC Section 933 Recommended and Base Disposal Plans**

## PROJECT CONSTRUCTION AND OPERATION

Project construction will make use of approximately 4,466,000 cubic yards of sand for the Recommended Plan. The material will be pumped to the beach by pipeline dredge and/or hopper dredge with pump out capability and shaped on the beach by earth moving equipment. Initial construction will take up to 16 months to complete.

### NAVIGATION PROJECT AREAS AND FILL MATERIAL

Navigation project areas to be dredged and the material to be used for beachfill are located as shown on Figure 3. Based on grain size analysis of samples taken in these areas from the previous placements of material from Brandt Island and Morehead City Harbor maintenance onto Bogue Banks, it is reasonably confident that the navigation project areas contain good quality beach sand, which will be verified prior to placement on the beaches (see Appendix G for additional details on the geotechnical analysis).

Brandt Island, the inner harbor and the entrance channel will be the major sources of sand for the construction of the Section 933 project. The volume of material remaining on the beach immediately following placement will be reworked (sorted) by wave action into a distribution of material sizes from the berm crest seaward to closure depth that will closely mimic the native material distribution. This sorting process will take several months to occur and will result in the removal of the remaining excess material from the design template. Generally, the material removed by this sorting action will be the finer fraction of the sandy material, which will be transported to offshore depths greater than 27 feet below NGVD.

**OPERATION AND MAINTENANCE**

There are no operation and maintenance requirements associated with the Section 933 project. All benefits to the Section 933 Project will accrue without operation and maintenance.

## GEOTECHNICAL PROCESS

Morehead City Harbor dredge material has traditionally been placed in Brandt Island or on the beach at Atlantic Beach and Fort Macon. The material in Brandt Island was sampled and grain size tests were performed in the mid-1980's prior to the initial pump out in 1986. The quality of the material was determined to be suitable for beach disposal. Brandt Island was pumped out again in 1994 with the material being disposed of on the beach.

The subsurface investigation will include drilling the shoals in Morehead City Harbor and taking beach grab samples, and grain size testing the material collected from these samples. Twenty-one, 10-foot vibracore borings in the Harbor area and the connecting channels with the worst shoals were drilled on March 26, 2003. The borings were performed with the snagboat *SNELL* using a 3 7/8 inch diameter Alpine vibracore drill machine. The tubes were sampled for representative material and at a minimum of one sample for every two feet of recovered length. Each tube is expected to have approximately 3 soil samples for a total of approximately 60 samples. No borings will be performed on Brandt Island as part of this project. It is assumed that the material in Brandt Island is the same as the inner Harbor material tested for this project, since the Inner Harbor material from previous dredging is stored in Brandt Island. Grab samples will be collected from twenty-five profile lines perpendicular to Fort Macon, Atlantic Beach, Pine Knoll Shores, Indian Beach, Emerald Isle, and Bogue Inlet Area for a total of 150 samples. These samples will be tested for grain size, silt content, shell content in accordance with ASTM D 422 using a minimum of 12 sieves. Samples will be classified in accordance with the Unified Soils Classification system.

All the samples collected from the Harbor Shoal material and the beach grab samples will be analyzed to determine the material suitability for beach placement. Based on material removed from the Inner Harbor and Brandt Island in the past, it is expected that the material designated for beach placement as part of this project will be suitable.

## REAL ESTATE REQUIREMENTS

Real estate requirements for the Recommended Plan of Improvement include lands, easements, rights-of-way and relocations, and disposal/borrow areas, which are referred to as LERRD's. Existing easements are in places that were acquired by the sponsor for a local, non-federally funded project. The easements incorporated the standard language in the Government Perpetual Storm Damage Reduction Easement. It is anticipated that all work will be completed within the limits of the existing easements and/or seaward of these easements. In order for Real Estate to be certified for this project, the project sponsor will be required to supply CESAS-RE with a map and copies of their existing easements. Per discussion with The North Carolina Department of Administration, the State of North Carolina does not require a permit to place sands below the mean high water line. However, the Local Sponsor will need to furnish the State of North Carolina Department of Administration with a letter of intent to place sand below the Mean High Water Line.

Other things that are to be considered are access to the beach during construction, additional pipeline routes, and temporary work area easements. Access to the beach will be by public access points that are located along the beach area. A previously acquired perpetual pipeline easement will be used for the placement of the pipeline. Should additional pipeline routes be identified, the project sponsor will be responsible for acquisition. Additional details of the Real Estate Requirements are discussed in Appendix F.

## PLAN ACCOMPLISHMENTS

The Recommended Plan reduces expected annual damages to structures due to hurricane-wave action and storm induced erosion. As shown in Table 5, existing expected annual damages for hurricane and storm damage are estimated at $14,543,000 without a Section 933 project in place in the Study Area. With the Recommended Plan in place expected annual hurricane and storm damages are reduced to about $5,593,000. Thus, as stated above, the Recommended Plan would reduce hurricane and storm damages by an expected annual amount of $8,950,000 for the 7.2-mile-long Section 933 project area, or about 62 percent.

Although the plan will substantially reduce damages due to hurricane-wave overwash, it should be noted that the Recommended Plan of Improvement provides for storm protection only in terms of protecting development from the action of ocean storm surge and wave action.

### BENEFITS

Total expected annual benefits for the Recommended Plan are estimated at $10,655,000 based on October 2002 price levels. An itemized listing of expected annual benefits was presented in Table 6. If the plan is to be recommended for implementation, expected annual costs must be less than this amount. Project costs are discussed below.

**PROJECT COSTS**

Determination of the economic costs of the Recommended Plan consists of two basic steps. First, project first costs are computed. First costs include expenditures for project design and construction and related costs of supervision and administration. First costs also include the lands, easements, and rights of way for project construction.

Second, interest during construction is added to the project first cost. Interest during construction is computed from the start of PED through the construction period. The project first cost plus interest during construction represents the total investment required to place the project into operation.

These costs consist of interest and amortization of the investment. The expected annual costs provide a basis for comparing project costs to project benefits. A summary of the computations involved in each of these two steps is presented below.

**Project First Costs** - The total first cost of construction for the Recommended Plan is estimated at $16,354,000, based on October 2002 price levels. An itemized listing of first costs is presented in Table 9.

**Interest During Construction** - Interest during construction, computed over PED and the construction period, is established at $708,000 for the Section 933 Project Area. The total investment required to place the project into operation would be $17,062,000 for the Section 933 Project Area.

**Expected Annual Costs** - Expected annual costs include interest and amortization of the investment over an assumed project life of 20 years. As shown in Table 10, expected annual costs for the Selected Plan of Improvement are estimated at $2,178,000 for the Section 933 Project Area.

**Benefit-Cost Ratio** - The Recommended Plan produces expected annual benefits estimated at $10,655,000 for the Section 933 Project Area. Expected annual costs for the Recommended Plan are estimated at $2,178,000 for the Section 933 Project Area. Thus benefits divided by costs results in a benefit-cost ratio of 4.9 for the Section 933 Project Area. Since project benefits exceed costs, the Recommended Plan is considered economically feasible.

## ENVIRONMENTAL IMPACTS

The Recommended Plan of Improvement is considered to be environmentally acceptable, although some environmental impacts are anticipated. Significant resources likely to be affected by the Recommended Plan include biological resources, water quality, aesthetic values, and threatened species. The proposed action will not cause any significant impacts to the environment (see attached EA). No effect on cultural resources is anticipated. Anticipated impacts on each resource are discussed below.

## IMPACTS ON BIOLOGICAL RESOURCES

Biological resources will be affected by dredging of material from Brandt Island and the Morehead City Harbor navigation channels for project construction and by placement of this material on the beach. The sediments taken from Brandt Island and the Morehead City Harbor navigation channels is believed to be suitable for placement on the beaches of Bogue Banks. As indicated in the attached EA, Brandt Island has been previously pumped out in FY 1986 and FY 1994 and the resultant dredge material placed on the beaches of Bogue Banks. Expected impacts on biological resources due to dredging and fill placement are discussed on the following pages.

**Navigation Project Area Dredging** - No significant impact on biological resources is expected due to piping of dredged material from the navigation project areas (including Brandt Island) to the beachfill areas. The pipeline route will extend from the navigation project areas and Brandt Island to the beach and then will follow the shoreline.

There will be some loss of dune vegetation where the pipeline crosses the dune to the beach. Plants growing adjacent to the seaward side of the dunes will be buried by the discharge of dredged material. Dune vegetation disturbed by the pipeline crossing to the beach will be restored to pre-project grade and replanted following project completion.

Negative impacts associated with pipeline routes will be minor and temporary.

**Beachfill Construction** - The major impacts associated with this type of operation include:

A. Increased turbidity in the surf zone;

B. Effects on the benthic communities;

During disposal operations, there will be an increase in the turbidity of the surf zone in the immediate area of sand disposition. This increase may cause the temporary displacement of various species of sport fish, causing a negative impact to surf fishing in the area of deposition.

A considerable body of information is available on the effects of dredging on benthic communities and specific environmental consequences of beach disposal. However, there are some uncertainties on the degree of impacts on certain resources over the long term. A more detailed discussion is found within the Environmental Assessment.

**ENDANGERED AND THREATENED SPECIES**

As noted previously, species which could be present in the project area during the proposed action are the finback whale, humpback whale, right whale, sei whale, sperm whale, West Indian manatee, piping plover, roseate tern, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, shortnose sturgeon, and sea-beach amaranth. Some of these species may be affected by construction of the Recommended Plan of Improvement. The greatest potential for impacts to the endangered and threatened sea turtle species found within the project area is for beach disposal from 1 May to 15 November of any year, and hopper dredging from April 1 to December 31. Potential project impacts to these species are discussed below and more detailed information is found in the Environmental Assessment.

**Loggerhead, Kemp's Ridley, and Green Sea Turtles -** All of these turtles are known to nest in North Carolina and could nest in the project area. For this reason, they may be affected by the project construction.

In order to minimize impacts on nesting sea turtles, beach disposal sand should match natural sand as closely as possible. Before any dredged maintenance material is pumped from Brandt Island and/or Morehead City Harbor maintenance, onto Bogue Banks beaches, we will assure that the material is suitable for beach disposal. The type of material used for beachfill should not affect sea turtles. Also, beach tilling will be accomplished for the purpose of loosening the sand fill set, which hardens and makes nesting by sea turtles difficult.

Sea turtle monitoring and nest relocation will be required during construction if disposal occurs during the sea turtle nesting season (1 May to 15 November). Sea turtles also occur in the entrance channel proposed for dredging and may be affected (by take) since hopper dredges may be used for maintenance dredging and pump out for beach disposal along the Project Area. To minimize takes by a hopper dredge, work will be restricted from 1 January to 31 March.

As noted above, a monitoring and nest relocation program will be implemented when beach disposal occurs during the nesting season. However, even with this program in place, the possibility of accidental egg loss during nest relocation exists. Therefore, it has been determined that the project may adversely affect the loggerhead, Kemp’s ridley, and green sea turtles.

During the period of sea turtle nesting and hatching (1 May through 15 November), all lighting associated with project construction shall be minimized to the maximum extent practicable while maintaining compliance with all safety requirements. Reduced wattage and special fixtures or screens to reduce illumination of adjacent beach and near shore waters shall be used if practical.

Lighting on offshore equipment shall also be minimized to the maximum extent practicable while meeting Coast Guard requirements. Shielded low pressure sodium vapor lights are highly recommended for all lights on the beach or on offshore equipment.

**Piping Plover** - Because beach disposal may temporarily impact foraging habitat and disrupt nesting that may be attempted along the eroded beach front, it has been determined that the project may affect the piping plover.

**Marine Mammals** - Marine mammals occur in offshore sites proposed for dredging. It is expected that these species can be detected by use of observers and avoided, therefore a no effect determination is proposed.

**Seabeach Amaranth** - While beach disposal will restore much of the habitat lost to erosion, disposal on a portion of the beaches in the growing season during project construction may slow population recovery over the short term. Therefore, the project may affect seabeach amaranth.

## IMPACTS ON WATER QUALITY

The proposed project will result in elevated turbidity and suspended solids compared to the existing non-storm conditions of the surf zone in the immediate area of beachfill. Due to the low percentage of silt and clay in Brandt Island and the Morehead City Harbor navigation channels (averaging less than 10 percent), this impact is not expected to be greater than the natural increases in turbidity and suspended material during storm events. Discharge of sediment that is predominantly sand would be required for beach disposal. Such discharge would occur within the 3-mile limit and therefore would be subject to regulation under Section 404(b)(1) of the Clean Water Act of 1977, as amended and will require a Section 401 (P.L. 95-217) State of North Carolina Water Quality Certificate.

It is expected that dredged disposal on the beach would result in turbidity and suspended solids concentrations that are elevated over normal background levels in the navigation project areas during dredge excavation and in the surf zone in the immediate area of beach disposal operation. No other water quality parameters are anticipated to be impacted significantly during dredge channel maintenance, pumpout of Brandt Island, and beach disposal.

The degree of water quality impacts associated with navigation maintenance dredging activities and beach disposal has been evaluated during this study and presented in the attached Environmental Assessment. Investigations indicated that suitable material would be used for beach disposal; therefore water quality impacts would not be significant.

## IMPACTS ON AESTHETIC RESOURCES

Aesthetic impacts of project construction are expected to be both positive and negative. The aesthetics of the beach would temporarily be degraded during beach disposal due to the presence of heavy equipment and pipeline on the beach and elevated turbidity in the surf zone. Noise and exhaust created by the operation of the dredge and other equipment will result in minor increases in noise and air pollution. However, upon completion of the project, the aesthetics and recreational use of the beach should be enhanced due to the wider beach.

## IMPACTS ON CULTURAL RESOURCES

The Wilmington District, in consultation with the NC Division of Archives and History Underwater Archaeology Unit, have considered both the potential impact of the project and the nature of the known resources, and have determined that the information does not support a recommendation for an archaeological survey of the entire beach area. However, it is possible during the course of construction that vessel remains will be encountered. Therefore, the Underwater Archaeology Unit has requested that Wilmington District personnel, contractors, and others be aware that the possibility exists that this work may unearth a beached shipwreck. In the event that such occurs, work should move to another area and the Underwater Archaeology Unit should be contacted immediately at telephone number (910) 458-9042. A staff member will be sent to assess the wreckage and, if practical, undertake appropriate documentation.

## CUMULATIVE IMPACTS

A cumulative analysis of the impacts of existing, proposed and potential projects involving beach disposal, is shown in Attachment E found in the Environmental Assessment. General impacts of beach disposal on other North Carolina beaches are considered to be similar to those described herein. The degree of cumulative impact would increase proportionally with the total length of beach impacted. This analysis quantifies these impacts in terms of the percent of North Carolina beaches affected on an annual and total basis by sand disposal for maintenance of Federal navigation channels, and existing, proposed or potential beach disposal projects. Cumulative impacts of the proposed action appear negligible.

### SUMMARY OF ENVIRONMENTAL IMPACTS

Adverse environmental impacts associated with the proposed action include (1) Destruction and displacement of intertidal and benthic fauna during construction; (2) temporary increases in turbidity and suspended solids during construction and disposal operations; and (3) it has been determined that the project, as currently proposed, may affect the piping plover, green sea turtle, loggerhead sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and seabeach amaranth. A program of monitoring and nest relocation will be implemented to mitigate adverse impacts on the sea turtles when fill placement overlaps the sea turtle nesting season. Additionally, the Corps will continue to monitor seabeach amaranth during the growing season (1 July to September 30).

## MITIGATION REQUIREMENTS

The term "mitigation requirements," as used herein refers to actions necessary to reduce or compensate for adverse environmental impacts of the project. Overall environmental impacts are expected to be minor, due to the scope, location, and timing of project activities. However, project construction may occur during the nesting season of the loggerhead sea turtle, green sea turtle, and Kemp's ridley sea turtle (1 May through 15 November). A beach monitoring and nest relocation program will be implemented to mitigate impacts on these species as discussed in the Environmental Assessment.

## PUBLIC VIEWS

The Recommended Plan is considered acceptable to local interests. Required coordination related to the environmental permits and entitlements necessary for project construction is discussed in detail in the attached Environmental Assessment. Local views and the views of the State of North Carolina are summarized below. Additional views will be received during public and agency coordination of the Evaluation Report and Environmental Assessment.

### VIEWS OF THE LOCAL SPONSOR

The Recommended Plan of Improvement is considered to be acceptable to, and supported by, the local sponsor, Carteret County (see Appendix A, Exhibit 3.)

### VIEWS OF THE STATE OF NORTH CAROLINA

The State of North Carolina, Department of Environment and Natural Resources, Division of Water Resources, supports the Recommended Plan of Improvement.

## SUMMARY OF PLAN EFFECTS

Table 12 provides a summary of project effects. Effects are evaluated in the following categories: (1) National Economic Development (NED), which reflects the plan's economic justification; (2) Environmental Quality, which evaluates the plan's environmental acceptability; (3) Regional Economic Development; and (4) Other Social Effects, including health and safety.

Effects in these four categories encompass significant effects on the human environment as required by the National Environmental Policy Act of 1969, as amended. They also encompass social well being as required by Section 122 of the Flood Control Act of 1970. For purposes of comparison, the effects of the Selected Plan are evaluated against the "without project" or "no action" condition.

**TABLE 12**

**SUMMARY OF PLAN EFFECTS OF SECTION 933 PROJECT AREA**

| | RECOMMENDED PLAN | "NO ACTION" |
|---|---|---|
| 1. NATIONAL ECONOMIC DEVELOPMENT | | |
| Beneficial Contribution | | |
| Expected Annual Benefits: | | |
| Hurricane Storm Damage Reduction | $8,950,000 | None |
| Emergency Costs and Other Damage Reduction | $ 122,000 | None |
| Recreation | $ 1,009,000 | None |
| Benefits During Construction | $ 574,000 | None |
| Total Expected Annual Benefits | $10,655,000 | |
| Adverse Contributions | | |
| Expected Annual Costs: | | |
| Interest & Amortization | $ 1,473,000 | Continuation of hurricane and storm damages along with damages due to progressive beach erosion. |
| Annual Benefits Foregone | $ 705,000 | |
| Total Exp. Annual Costs 933 Project Area | $ 2,178,000 | |

2. ENVIRONMENTAL QUALITY

| | | |
|---|---|---|
| Beneficial Contribution | None | None |
| Adverse Contribution | | |
| a. Water Quality and Aquatic Resources | *Increased turbidity during construction | None |
| b. Vegetation and Wetlands | *Minimal impact | None |
| c. Wildlife Habitat | *Destruction and displacement of intertidal and benthic fauna during construction; effect will be temporary, but will recur over life of project. | None |
| d. Aesthetic Value | *Minimal impact | Continued loss of aesthetic values of oceanfront as erosion intrudes upon development. |
| e. Air and Noise Pollution | *Increased air and noise pollution during construction | None |
| f. Threatened and Endangered | *Possible adverse impacts on loggerhead sea turtle, green sea turtle, Kemps ridley sea turtle, and leatherback sea turtle. When fill placement occurs during the sea turtle nesting season, a nest monitoring and relocation program will be implemented. | None |
| g. Cultural Resources | None | None |

**TABLE 12** (continued)

**SUMMARY OF PLAN EFFECTS OF SECTION 933 PROJECT AREA**

| | RECOMMENDED PLAN | "NO ACTION" |
|---|---|---|
| 3. REGIONAL ECONOMIC DEVELOPMENT | | |
| Beneficial Contribution | | |
| Increased Income and Employment | *Minimal portion of project cost returned to local economy | None |
| Adverse Contributions | | |
| Increased Income and Employment | None | *Potential loss of tourism income due to beach erosion |
| 4. OTHER SOCIAL EFFECTS | | |
| Beneficial Contributions | | |
| Enhancement of community social well being, health and safety | *Reduction of hurricane and storm hazard along with shoreline stabilization is expected to have favorable impact on social well being and safety; net effect not quantified | None |
| Adverse Contributions | | |
| Enhancement of community social well being, health and safety | *Minor and temporary inconvenience due to construction activities | *Continued threat of erosion along with hurricane and storm damages |

*Effect specified in Section 122 of PL 91-611

# PROJECT SCHEDULE

The schedule for the Section 933 Project through initial construction is shown below. This schedule assumes expeditious review and approval of the project through all steps, including ASA(CW) approval and funding. Actual project implementation would follow as shown on the proposed schedule.

| Date | Milestone |
|---|---|
| February 10, 2003 | Initiate Plans and Specs |
| March 31, 2003 | CESAW provides report to CESAD and HQUSACE for review and approval |
| April 30, 2003 | HQUSACE approves Section 933 Report |
| May 9, 2003 | CESAW sends PCA, Financial Plan, Letters of Support from Carteret County and State of North Carolina to HQUSACE |
| May 9, 2003 | HQUSACE provides Report to ASA(CW) 6-weeks before submitting the PCA for approval |
| June 2, 2003 | HQUSACE approves PCA Package |
| June 16, 2003 | HQUSACE provides PCA to ASA(CW) for approval |
| June 30, 2003 | ASA(CW) approves PCA |
| July 7, 2003 | Carteret County and CESAW sign PCA |
| July 14, 2003 | Carteret County provides cash contribution |
| July 14, 2003 | Carteret County and State of North Carolina provide all Lands, Easements, Rights-of-Way, Etc (Including evidence of legal authority to grant Right-of-Entry) and CESASRE certifies Real Estate for Project |
| July 25, 2003 | Complete Plans and Specs |
| August 1, 2003 | CESAW sends out Solicitation for Bids - "Advertise" |
| September 4, 2003 | Bids are Opened by CESAW |
| September 26, 2003 | Contract Award |
| October 31, 2003 | CESAW gives "Notice to Proceed" |
| November 15, 2003 | Begin Dredging |
| April 30, 2005 | Complete Dredging |

# DIVISION OF PLAN RESPONSIBILITIES

Federal policy concerning cost sharing for water resources projects requires that project costs be allocated to the various purposes served by the project; these costs are then apportioned between the Federal Government and the non-Federal sponsor according to percentages specified in Federal guidelines. As shown in Table 13, all project costs are allocated to the purposes of "Section 933 - Beneficial Use of Dredged Material for Hurricane and Storm Damage Reduction." Under current Federal policy, costs allocated to this category are shared with the Federal Government paying 65 percent and the non-Federal sponsor paying 35 percent for project construction. Private-use shores are cost shared at 100 percent by the non-Federal sponsor. Based on the findings in this report (see Appendix E), Carteret County is eligible for 65.0% Federal and 35.0% non-Federal sponsor cost sharing for the added cost of depositing dredged navigation material on the requested sections of the beaches of Pine Knoll Shores, Indian Beach, and Salter Path, under authority of Section 933 of PL 99-662.

## TABLE 13

## COST ALLOCATION AND APPORTIONMENT

### PROJECT CONSTRUCTION

SECTION 933 PROJECT AREA

| Project | Project | Apportionment (%) | | Apportionment ($) | |
|---|---|---|---|---|---|
| Purpose | First Cost | Non-Federal | Federal | Non-Federal | Federal |
| Section 933 | $16,354,000 | 35.0% | 65.0% | $5,724,000 | $10,630,000 |

As shown above, the non-Federal and Federal shares of initial project construction are estimated at $5,724,000 and $10,630,000 respectively for the Section 933 project.

# SECTION VII - CONCLUSIONS AND RECOMMENDATIONS

## CONCLUSIONS

I have given consideration to all significant aspects in the overall public interest, including engineering feasibility and economic, social, and environmental effects. The Recommended Plan of Improvement described in this report provides an economical feasible solution for the beneficial use of dredged material for hurricane and storm damage reduction for the Section 933 project area, which includes Pine Knoll Shores, Indian Beach, and Salter Path.

## RECOMMENDATIONS

This study has addressed the beneficial use of dredged material from the Morehead City Harbor navigation project to meet the needs for hurricane and storm damage protection for the 7.2-mile shoreline reach which includes the communities of Pine Knoll Shores, Indian Beach, and Salter Path in Carteret County, as requested by the non-Federal sponsor, Carteret County and also as requested by the State of North Carolina.

I recommend that the Recommended Plan of Improvement described herein as the "Section 933 Project," and selected herein for the purposes of beneficial use of dredged material from the Morehead City Harbor navigation project for hurricane and storm damage reduction for the Pine Knoll Shores, Indian Beach, and Salter Path Project Area, be approved for implementation as a Federal Section 933 project, with such modifications as in the discretion of the Chief of Engineers may be advisable; at a first cost presently estimated at $16,354,000, and an expected annual costs presently estimated at $2,178,000. When compared to expected annual benefits of $10,655,00, the Recommended Plan yields a benefit-to-cost ratio of 4.9. The recommended plan consists of a 7-foot NGVD, 30-foot wide, beach berm with a main fill length of 38,000 feet including a transition length of 1,000 feet at the west end of the project. The east end of the Project will tie in to the Base Disposal Area along the Atlantic Beach shoreline. Recommendations of this plan is made, provided that, except as otherwise provided in these recommendations, the exact amount of non-Federal contributions shall be determined by the Chief of Engineers prior to project implementation in accordance with the following requirements to which non-Federal interests must agree prior to implementation.

a. Contribute 35 percent of total project costs for public shorelines and 100 percent for private shorelines.

b. Provide all lands, easements, and rights-of-way, and suitable borrow and dredged or excavated material disposal areas that the Government determines the Non-Federal sponsor must provide for the construction of the Project, and shall perform or ensure performance of all relocations that the Government determines to be necessary for the construction of the Project.

c. Do not use Federal funds to meet the non-Federal sponsors share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized;

d. Assure continued conditions of public ownership and use of the shore upon which the amount of Federal participation is based during the life of the Project, in accordance with existing law and based on shore ownership and use existing at the time of construction;

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

f. Be responsible for monitoring the nesting of sea turtles within the Project limits when construction occurs during the 1 May to 15 November nesting season;

g. Assure that dredged material placed under this Project is not removed or the configuration altered or the material is placed on privately owned land, nor shall the Non-Federal sponsor allow any third party to do so;

h. Hold and save the Government free from all damages arising from the construction, 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 Government or its contractors;

i. 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 at 32 Code of Federal Regulations (CFR) Section 33.20;

j. 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 construction, 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;

k. 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, operation, or maintenance of the project;

l. 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;

m. 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, 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;

n. 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 plan;.

o. Provide costs of that portion of total historic preservation mitigation and data recovery costs attributable to the Project that are in excess of 1 percent of the total amount authorized to be appropriated for the Project; and

p. Recognize and support the requirements of 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.

The local sponsor has indicated that they have available the necessary funds to provide the non-Federal share of project costs. I am confident that the local sponsor will provide their share.

The recommendations contained herein reflect the information available at this time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works operation and maintenance program nor the perspective of higher review levels within the Executive Branch.

Ben F. Wood II, P.E.
Deputy District Engineer,
Programs and Project Management

Charles R. Alexander
Colonel, U.S. Army
District Engineer

US Army Corps
of Engineers

WILMINGTON DISTRICT
SOUTH ATLANTIC DIVISION

# ENVIRONMENTAL ASSESSMENT

## MOREHEAD CITY HARBOR SECTION 933
## CARTERET COUNTY, NORTH CAROLINA

May 2003

**ENVIRONMENTAL ASSESSMENT**
**MOREHEAD CITY HARBOR SECTION 933**
**CARTERET COUNTY, NORTH CAROLINA**

The responsible lead agency is the U. S. Army Engineer District, Wilmington.

**ABSTRACT**: The maintenance dredging of Morehead City Harbor and the pumpout of the Brandt Island Upland Diked Disposal Area has created an opportunity under Section 933 for the beneficial use of sand for the Bogue Banks beaches. The beach communities of Atlantic Beach, Pine Knoll Shores, and Indian Beach (which includes Salter Path), and Fort Macon State Park are located on Bogue Banks and are experiencing severe storm damage and erosion problems. During the period from 1996 through 1999, Hurricanes Bertha, Fran, Bonnie, Dennis, Floyd, and Irene have affected this area. The storm damage and associated erosion from these six named storms have resulted in considerable damage to homes and loss of land since 1996. The severe erosion has also increased and continues to increase the storm damage susceptibility of existing structures and infrastructure. Two different dredged material placement areas are discussed within this document. The least-cost disposal or base disposal plan would place dredged maintenance material taken from the existing Morehead City Inner Harbor navigation channels and the pumpout of Brandt Island from Fort Macon State Park to Atlantic Beach, a distance of about 32,000 feet or 6 miles. The base disposal plan has been previously addressed in environmental documents circulated for public and environmental agency review. The proposed Section 933 project would place dredged maintenance material an additional 38,000 feet or 7 miles from Pine Knoll Shores to Indian Beach, if the requirements of Section 933 are satisfied. The placement of beach quality sand from the maintenance dredging of Morehead City Harbor and the pumpout of Brandt Island on these Bogue Banks beaches may reduce the erosion and storm damage potential. The Section 933 project would be a one-time placement of maintenance material on Bogue Banks and re-nourishment or future maintenance is not provided under this authority. The proposed project is being undertaken under the authority of Section 933 of the Water Resources Development Act of 1986 (Public Law 99-662), as amended.

SEND YOUR COMMENTS TO THE DISTRICT ENGINEER AT THE ADDRESS BELOW:

For further information concerning this statement, please contact: Mr. Hugh Heine, CESAW-TS-PE, Environmental Resources Section, at the address below, by telephone at (910) 251-4070, or by e-mail at hugh.heine@usace.army.mil.

DISTRICT ENGINEER
U.S. Army Engineer District, Wilmington
Post Office Box 1890
Wilmington, NC 28402

**ENVIRONMENTAL ASSESSMENT**
**MOREHEAD CITY HARBOR SECTION 933**
**CARTERET COUNTY, NORTH CAROLINA**

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## Attachments



## List of Figures

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**ENVIRONMENTAL ASSESSMENT**
**MOREHEAD CITY HARBOR SECTION 933**
**CARTERET COUNTY, NORTH CAROLINA**
**May 2003**

## 1.00 PURPOSE AND NEED FOR ACTION

**1.01 <u>Introduction and Location</u>.** Morehead City Harbor is a deep-draft, federal navigation project located in the town of Morehead City, North Carolina, approximately 2.5 miles from the Atlantic Ocean through Beaufort Inlet (Figure 1). Morehead City Harbor is divided into two main parts: the outer harbor, which is made up of Range A (including extension and widener) and the Cutoff; and the inner harbor, which is made up of Ranges B and C, Northeast Leg, West Leg, East Leg (including extension), and Turning Basin (including extension).

On average, the Morehead City Harbor inner harbor navigation channels are maintained every two years by hydraulic pipeline with dredged material being placed either in the Brandt Island Upland Diked Disposal Area (hereafter referred to as Brandt Island) or the beaches on Bogue Banks. The Morehead City outer harbor navigation channels are usually maintained annually by hopper dredge and the resultant material is placed either in the United States Environmental Protection Agency (USEPA) designated Morehead City Ocean Dredged Material Disposal Site (ODMDS) or the previously approved nearshore area. The frequency of maintenance dredging in Morehead City Harbor is subject to the availability of funds.

Approval was obtained for deepening of the inner harbor navigation channels (including Range B and the Cutoff) from the existing 40 feet (plus 2 feet overdepth) to 45 feet (plus 2 feet overdepth) mean low water (mlw). Range A (Ocean Bar Channel) was also approved to be deepened from an existing depth of 42 feet (plus 2 feet overdepth) to 47 feet (plus 2 feet overdepth) mlw to account for wave action. Regularly scheduled maintenance dredging, deepening of the navigation channels and pumpout of Brandt Island were completed in Fiscal Year (FY) 1994.

Brandt Island is a 96-acre island, which has been used as a disposal area since about 1955. Brandt Island is owned and used as a sand-recycling site by the North Carolina State Ports Authority (NCSPA) and dedicated for the purpose of dredged material disposal. Brandt Island has a present capacity of about 3 million cubic yards, which can be increased by about 1 million cubic yards by reworking the dikes every four to five years. Every 8 to 10 years maintenance material is pumped out of Brandt Island and placed on the ocean beaches of Bogue Banks. In FY 1986 and FY 1994 approximately 3.9 million and 2.5 million cubic yards of dredged material were pumped out of Brandt Island and placed on Bogue Banks from Fort Macon State Park to Atlantic Beach, respectively.

**1.02 Locally Funded Beach Nourishment Project.** In April 2001, Coastal Science & Engineering, LLC and Stroud Engineering, PA, prepared a Final Environmental Impact Statement (FEIS) for the Bogue Banks Beach Restoration Plan, for the NC Department of Environment and Natural Resources, Division of Coastal Management (NCDCM), which was submitted by Carteret County, the Town of Pine Knoll Shores, the Town of Indian Beach (including Salter Path), and the Town of Emerald Isle (CSE 2001). This FEIS was prepared in accordance with North Carolina environmental permitting regulations in the coastal zone and was also provided to U.S. Army Corps of Engineers, Wilmington District (USACE), Regulatory Division, for federal review of permit application ID 20000362.

In October 2001, representatives from Carteret County, Pine Knoll Shores, Indian Beach, and Emerald Isle received the required Federal and State authorizations to place up to 6.7 million cubic yards of material dredged from offshore borrow areas on 16.8 miles of Bogue Banks from the Atlantic Beach/Pine Knoll Shores town limit to Shipwreck Lane in Emerald Isle, approximately 1.0 mile east of Bogue Inlet. The project was divided into three different phases. The first phase was constructed from November 2001 to April 2002, and extended from Pine Knoll Shores to Indian Beach town limits (including the community of Salter Path). Approximately 1.73 million cubic yards of dredged material was placed on 7.4 miles (39,202 feet) of beach. The second phase was constructed from November 2002 to April 2003 and extended from Indian Beach/Emerald Isle Town Limit to Pinta Drive (Milepost 18) in Emerald Isle. About 1.84 million cubic yards of dredged material was placed on 5.9-miles (31,111 feet) of beach. Phase 3 may be constructed in November 2003, and completed in April 2004, and includes a 3.5-mile (18,593 feet) stretch of beach from Pinta Drive (Milepost 18) to Shipwreck Lane in Emerald Isle. The amount of material used in this phase is estimated at approximately 1.0 million cubic yards. Note, Phase 3 may be delayed until the NCDCM and U.S. Army Corps of Engineers, Wilmington District, Regulatory Division issues the required permits for the proposed Bogue Inlet Channel Relocation Project. If these permits are obtained, the approximately 1,000,000 cubic yards of material would be excavated from Bogue Inlet and placed from Pinta Drive (Milepost 18) to Shipwreck Lane in Emerald Isle. If the proposed Bogue Inlet Channel Relocation Project is not authorized, then the approximately 1,000,000 cubic yards of material would be dredged from the previously authorized offshore borrow areas.

At this time, a revised total of approximately 4.57 million cubic yards of material may be placed within the 16.8-mile project area (Personnel Communication, Greg “Rudi” Rudolph, Shore Protection Manager, Carteret County, April 10, 2003).

The purpose of the locally funded project was to restore the existing recreation beach and its associated habitats in the chronic erosion areas of Bogue Banks, to preserve property values, and the tax base of Carteret County.

**1.03 Proposed Action and Authority.** Historically, dredged material has been considered a waste material. Prior to the National Environmental Policy Act (NEPA) of 1969 and the Federal Water Pollution Control Act of 1972, its treatment often consisted of unconfined disposal into waters and wetlands adjacent to navigation channels. More recently, it has been deposited within diked disposal islands or transported to an ODMDS located offshore. However, dredged material is now recognized as a valuable resource that can be beneficially used in various ways depending upon its physical and chemical characteristics and its location. Sand is especially valuable for beach replenishment. Consequently, it is no longer an acceptable practice to remove sand from the active littoral system by ocean disposal when other cost-efficient and environmentally acceptable options are available. The North Carolina Coastal Management Program now requires that clean, beach-quality sand dredged from navigation channels in the coastal area not be removed permanently from the active nearshore, beach, or inlet shoal system, unless no practicable alternative exists (NC Administrative Code T15A: 07M.1102). Beach-quality dredged material is defined as having no more than 10 percent fine sediment (silt/clay fraction with grain size passing a #200 sieve). This policy is not without controversy since intertidal macroinvertebrate populations, shorebirds, and nesting sea turtles utilize beach habitat and can be subject to adverse impacts from placement of dredged material during warmer months of the year.

Beach-quality sand dredged during maintenance of Morehead City Harbor and the pumpout of Brandt Island will be made available for placement on area beaches, to the extent feasible. Planning for the placement of this sand is being coordinated through Carteret County, the towns of Atlantic Beach, Pine Knoll Shores and Indian Beach (including Salter Path), and Fort Macon State Park. These communities have expressed interest in acquiring as much sand as possible from the proposed action and are currently working with Federal and State governments to obtain funding assistance for sand placement, through the authority of Section 933 of the Water Resources Development Act of 1986, as amended.

Placement of sand on the Bogue Banks beaches under Section 933 is designed to begin at the toe of the existing dune (elevation + 7.0 ft NGVD) and extend to the mean high water mark seaward by means of a low berm (Figure 6 of the main report).

Potential design and *maximum* measurements and quantities are shown below in Table 1-1. Note that it is not possible for all beaches to simultaneously receive the maximum measurements shown because the available sand quantity will be limited and is not expected to exceed 6.3 million cubic yards. For one beach to

Table 1-1 Potential Design, Maximum Measurements, and Quantities, Morehead City Section 933

| Location | Shoreline Length (Feet) | Average Sediment Disposal Rate (CY per linear ft) | | Design Berm Width (Feet) | | Maximum Construction Width (Feet) | | Potential Placement Volume (CY) | |
|---|---|---|---|---|---|---|---|---|---|
| | | 933 | Base | 933 | Base | 933 | Base | 933 | Base |
| Fort Macon | 7,000 | 88 | 200 | 30 | 150 | 215 | 426 | 618,322 | 1,020,342 |
| Atlantic Beach | 25,000 | 49 | 163 | 30 | 150 | 205 | 402 | 1,215,394 | 3,779,658 |
| Pine Knoll Shores | 25,000 | 124 | - | 30 | - | 254 | - | 3,102,175 | - |
| Indian Beach (Includes Salter Path) | 13,000 | 105 | - | 30 | - | 221 | - | 1,364,109 | - |
| **Totals** | **70,000** | | | | | | | **6,300,000** | **4,800,000** |

*Beachfill Construction Widths are measured as the distance from the existing dune tie-in at +7 feet NGVD to Mean High Water (+2.21 feet NGVD)*
*Shoreline lengths are total shoreline lengths for each community and include transition areas and other areas not nourished due to fishing piers and offsets from terminal groin.*

receive the maximum measurement shown, another beach would have to receive less than its possible maximum. These maximums are presented in order to depict potential environmental impacts on beach-dwelling fauna, which would result from construction of the widest beach.

As indicated in Table 1-1, the estimated maximum amount of maintenance material that may be pumped to the Bogue Bank beaches could be up to 6.3 million cubic yards (i.e., about 4 million from Brandt Island, about 0.8 million from the inner harbor, and about 1.5 million from the outer harbor).

Should present plans for sharing sand by Bogue Banks beaches not materialize due to funding problems or other unforeseen reasons, dredged maintenance material from the inner and the outer harbor, as well as the pump out of Brandt Island would be distributed according to the base disposal plan. The base disposal plan represents the least cost alternative for the government, which is engineeringly feasible and environmentally acceptable.

Under this base disposal plan, the outer harbor would be maintained by hopper dredge and the resultant 1.5 million cubic yards of excavated material would be placed in the previously approved nearshore area, or in the ODMDS if sea conditions are too rough neashore. The pumpout of Brandt Island and the maintenance dredging of inner harbor by pipeline dredge would be placed from Fort Macon State Park to Atlantic Beach. Up to 4.8 million cubic yards (i.e., about 4.0 million from Brandt Island and about 0.8 million from the inner harbor) of beach quality sand may be placed along 32,000 feet of shoreline from Fort Macon State Park to Atlantic Beach.

Under either the 933 or base plan, the beachfill impacts are measured as the distance from the existing dune tie-in at +7 feet NGVD to Mean High Water (+2.21 feet NGVD). After a period of sorting, the beachfill slope will flatten as indicated in Figure 6 of the main report. Because of the sorting process, the proposed construction berm width will be 2 to 3 times as wide as the design berm widths indicated in Table 1-1.

The time requirement to place the large volume of sand on Bogue Banks is estimated up to 16 months. However, beach disposal is normally restricted to a 5 1/2-month cold-weather period (16 November - April 30) to avoid impacts to nesting sea turtles. Construction confined to this short interval could require over 2.5 years for completion, and up to 3 extra equipment mobilization/demobilization (mob/demob) cycles. Continuous rather than intermittent construction could, therefore, save up to about $2.25 million ($0.75 million per mob/demob). Both pipeline and hopper dredges will be used for the proposed action. Continuous construction is proposed on a year-around basis for the pipeline dredge only, but would occur in a sequential manner with progress estimated at about 4-5,000 feet of beach per month. With this plan, the pipeline dredge would begin pumping sand from Brandt Island and/or the inner harbor channels to Fort Macon State Park on 16 November 2003, and proceed to Atlantic Beach, Pine Knoll Shores, and Indian Beach (including Salter Path). The placement on Fort Macon State Park, Atlantic Beach, and a portion of Pine Knoll Shores beaches should be complete by May 1 when sea turtle nesting begins. The remainder of Pine Knoll Shores and a portion of Indian

Beach (if not completed by the hopper dredge(s)) may be the primary recipient of beach sand during the turtle season.

The hopper dredge(s) would start maintaining the Morehead City outer harbor channels and pump the material ashore to Indian Beach and/or Pine Knoll Shores. The hopper dredge(s) would work only from 1 January to 31 March of any year, when turtles are not likely to be present.

The proposed project is being undertaken under the authority of Section 933 of the Water Resources Development Act of 1986 (Public Law 99-662), as amended. Section 933 authorizes 65 percent federal and 35 percent non-federal sharing of the extra costs of depositing dredged material from federal navigation improvements and maintenance on beaches. Sand placed through the use of this authority must provide benefits at least equal to the cost of placement, but future nourishment of the beach is not a project requirement; i.e., the beach does not become a federal shore protection project with a continuing maintenance obligation.

For additional design information, see Section 1 of the Evaluation Report.

**1.04 Purpose and Need for the Proposed Action.** The purpose of the 933 project is to utilize beach quality sand dredged from the adjacent Federal navigation channels and from Brandt Island in order to stabilize eroding beaches on Bogue Banks.

**1.05 Environmental Issues Within the Project Area.** The potential impacts associated with the proposed action within the project area are primarily from the excavation of material from Brandt Island and the existing navigation channels in Morehead City Harbor and the placement of beach quality material on Bogue Banks. Impacts to threatened and endangered species; entrainment; essential fish habitat; hardbottoms; nearshore ocean birds; marine, terrestrial, cultural, and socioeconomic resources; are described in Sections 4.0 and 5.0 of the EA.

Impacts of the proposed action on the environment will be minimized or are considered minor for the following reasons:

1. Dredging and placement activities will comply with the South Atlantic dredging protocol for threatened and endangered species (see Section 5.08). The hopper dredge will use turtle deflecting dragheads and all dredged material will be screened using inflow screens. Full (100 percent) observer coverage will also be required to check the inflow screens and serve as whale and manatee observers. If work takes place from 1 May to 15 November, USACE will monitor the construction area and relocate any sea turtle nests. During the period of sea turtle nesting and hatching (1 May through 15 November), all lighting associated with project construction shall be minimized to the maximum extent practicable while maintaining compliance with all safety requirements. Reduced wattage and special fixtures or screens to reduce illumination of adjacent beach and near shore waters shall be used if practical. Lighting on offshore equipment shall also be minimized to the maximum extent practical while meeting Coast Guard requirements. Shielded low-pressure sodium vapor lights are

highly recommended for all lights on the beach or on offshore equipment.

2. Pipeline or hopper dredges operating in Morehead City Harbor navigation channels or Brandt Island would pump such a small amount of water in proportion to the surrounding water volume of the estuary and ocean that any entrainment impacts for the proposed action are expected to be insignificant (see Section 5.04).

3. The proposed action is not expected to cause any significant adverse impacts to Essential Fish Habitat (EFH) or EFH species (see Section 5.05).

4. Based on the fact that Brandt Island had been previously pumped out in FY 1986 and FY 1994 and that only maintenance material will be dredged from the existing navigation channels in Morehead City Harbor (i.e., no deepening or widening is proposed), there was no indications of any hard bottoms or cultural resources within the navigation channels, Brandt Island, or within the placement area on Bogue Banks. Additionally, no artificial reefs managed by the NC Division of Marine Fisheries would be adversely affected (see Sections 5.05).

5. The placement of beach-compatible sand from Brandt Island and the navigation channels of Morehead City Harbor on the beaches of Bogue Banks is a beneficial use of this sediment and would improve the esthetic qualities of affected beaches and reduce economic threats posed by erosion. These benefits to society would offset temporary reductions in intertidal macrofaunal populations, related temporary reductions in local shorebird habitat and short- term concerns regarding the safety of nesting sea turtles and their hatchlings when sand placement occurs in summer. Upon project completion, the replenished beaches should offer additional nesting habitat for sea turtles and Seabeach amaranth (see Section 5.08 and Attachment D).

6. There may be some loss of vegetation where the pipeline crosses the dune to the beach. Plants growing adjacent to the seaward side of the dunes may be buried by the discharge of dredged material. Dune vegetation disturbed by the pipeline crossing to the beach will be restored to pre-project grade and replanted following project completion. Planting stocks shall consist of sea oats and American beachgrass. The vegetative cover shall extend from the landward to the seaward toe of the dune. American beachgrass will be the predominant plant with sea oats as a supplemental plant. Planting would be accomplished during the season best suited for the particular plant.

7. Within Morehead City Harbor, some of the navigational channels are closed to shellfish harvesting. By Memorandum dated January 31, 2002, from the North Carolina Department of Environment and Natural Resources, Division of Environmental Health, Shellfish Sanitation and Recreational Water Quality Section (see Attachment B), if maintenance material is excavated from closed shellfishing areas between May 1 and October 31 and placed on Bogue Banks a swimming advisory will be posted and a press release made. The Wilmington District will notify the Shellfish Sanitation and

Recreational Water Quality Section prior to dredging from a closed shellfishing area with placement on a recreational swimming area.

**1.06 Proposed Schedule.** Subject to funding requirements, work may commence in FY 2004. Pipeline dredging of the inner harbor and the pumpout of Brandt Island and placement activities may be scheduled for 16 November to 30 April. Hopper dredging of the outer harbor would work only from 1 January to March 31. However, the proposed action may extend past the beach disposal window of 16 November to 30 April (see Section 1.02). Should pipeline dredging become necessary outside of this optimum dredging period (16 November to 30 April):

1. The Wilmington District would be responsible to monitor and relocate any turtle nests found within the construction limits from 1 May to November 15.

2. The Wilmington District would be responsible to monitor for the presence of Seabeach amaranth (*Amaranthus pumilis*) found within the construction limits from 1 July to 30 September.

**1.07 Partners.** The North Carolina Division of Water Resources and Carteret County (including the Towns of Atlantic Beach, Pine Knoll Shores, and Indian Beach (including Salter Path) and Fort Macon State Park) are the non-federal sponsor of this project. The proposed action has been planned with the non-federal sponsors and the North Carolina State Port Authority.

**1.08 Relationship of Plan to Environmental Protection Statutes and Other Environmental Requirements.** The relationship of the proposed Section 933 project to environmental protection statutes and other environmental requirements is presented in table 1-2. Compliance with all applicable Federal, State, and local policies has been examined.

**TABLE 1-2. RELATIONSHIP OF PROPOSED ACTION TO ENVIRONMENTAL REQUIREMENTS.**

| Federal Laws and Policies | Proposed Action |
|---|---|
| Abandoned Shipwreck Act of 1987 | Full Compliance |
| Clean Water Act of 1977, as amended | Full Compliance |
| Clean Air Act, as amended | Full Compliance |
| Coastal Zone Management Act of 1972, as amended | Full Compliance |
| Coastal Barrier Resources Act of 1982 | Full Compliance |
| Endangered Species Act of 1973, as amended | Full Compliance |
| Estuary Protection Act of 1968 | Full Compliance |
| Federal Water Project Recreation Act of 1968, as amended | N/A |
| Fish and Wildlife Coordination Act of 1934, as amended | Full Compliance |
| Fishery Conservation and Management Act of 1976 | Full Compliance |
| Hazardous and Toxic Materials Issues | Full Compliance |
| Land and Water Conservation Act of 1964, as amended | Full Compliance |
| Magnuson-Stevens Fishery Conservation and Management Act of 1996, as amended | Full Compliance |
| Marine Protection, Research, and Sanctuaries Act of 1972, as amended | Full Compliance |
| Marine Mammal Protection Act of 1972, as amended | Full Compliance |
| Migratory Bird Treaty Act of 1918, as amended | Full Compliance |
| National Historic Preservation Act of 1966, as amended | Full Compliance |
| National Environmental Policy Act of 1969, as amended | Full Compliance |
| River and Harbor Act of 1970, Public Law 91-611, Section 122 | Full Compliance |
| Submerged Lands Act of 1953, as amended | Full Compliance |
| Water Resources Development Act of 1986 Section 906 | Full Compliance |
| Watershed Protection and Flood Prevention Act of 1954, as amended | Full Compliance |
| Wild and Scenic Rivers Act of 1968, as amended | Not Applicable |
| **Executive Orders (EO), Memoranda, etc.** | |
| EO 11988, Flood Plain Management | Full Compliance |
| EO 11990, Protection of Wetlands | Full Compliance |
| EO 11593, Protection and Enhancement of the Cultural Environment | Full Compliance |
| EO 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations | Full Compliance |
| EO 13045 (Protection of Children from Environmental Health Risks) | Full Compliance |
| EO 13186 (Protection of Migratory Birds) | Full Compliance |
| CEQ Guidance on Prime and Unique Farmlands | Full Compliance |
| **State Law and Local Policies** | |
| Coastal Area Management Act (CAMA) of 1974 | Full Compliance |
| Carteret County Land Use Plan | Full Compliance |
| Atlantic Beach Land Use Plan | Full Compliance |
| Pine Knoll Shores Land Use Plan | Full Compliance |

Note: Full compliance is defined as having met all the requirements of the statute, Executive Order, or other environmental requirement for the current stage of project planning.

## 2.00 INCORPORATION BY REFERENCE

The least cost disposal plan (hereafter referred to as the base disposal plan) consists of the placement of dredged maintenance material from Morehead City Harbor (only the inner harbor channels) and the pumpout of Brandt Island on Bogue Banks, from Fort Macon State Park to Atlantic Beach, a distance of about 6 miles (or 32,000 feet). Additionally, maintenance material dredged from the outer harbor channel would be placed in the previously approved nearshore area, or placed in the ODMDS if sea conditions are too rough for nearshore placement. This base disposal plan and the placement of dredged maintenance material from outer harbor channel have been previously addressed in environmental documents circulated for public and environmental agency review. Incorporated by reference, these documents explain the environmental acceptability of the dredging and disposal methods. Additionally, the base disposal plan is the same as the one described in the Preliminary Assessment (PA) of the Dredged Material Management Plan (DMMP) for Morehead City Harbor, North Carolina dated 25 September 1997. The PA was written in accordance with EC 1165-2-200 (Implementation of Guidance). The following documents are being incorporated into this environmental assessment (EA) by reference:

a. US Army Corps of Engineers, Wilmington District. Feasibility Report and Environmental Assessment, Morehead City Harbor Improvement, Morehead City, North Carolina. June 1990 and revised December 1990.

b. US Army Corps of Engineers, Wilmington District. Environmental Assessment and Finding of No Significant Impact, Design Memorandum, Morehead City Harbor Improvement, Morehead City, North Carolina, Project Modifications. March 1992.

c. US Army Corps of Engineers, Wilmington District. Environmental Assessment and Finding of No Significant Impact, Disposal of Dredged Material on the Ocean Beach of Bogue Banks from the Combined Maintenance Dredging and Deepening of Morehead City Harbor Inner Harbor Navigation Channels and Pumpout of Brandt Island Upland Diked Disposal Site, Carteret County, North Carolina. January 1993a.

d. US Army Corps of Engineers, Wilmington District. Finding of No Significant Impact, Disposal of Dredged Material on the Ocean Beach of Bogue Banks from the Combined Maintenance Dredging and Deepening of Morehead City Harbor Inner Harbor Navigation Channels, Bulkhead Channel, U.S. Navy LST Ramp, and Pumpout of Brandt Island Upland Diked Disposal Site, Carteret County, North Carolina. April 1993b.

e. US Army Corps of Engineers, Wilmington District. Environmental Assessment, Designation and Use of a Placement Area for Underwater Nearshore Berm, Morehead City Harbor Project, Morehead City, North Carolina. August 1994a.

f. US Army Corps of Engineers, Wilmington District. Finding of No Significant Impact, Designation and Use of a Placement Area for Underwater Nearshore Berm, Morehead City Harbor Project, Morehead City, North Carolina. December 1994b.

Copies of the NC Division of Environmental Management Section 401 Water Quality Certificate (dated April 13, 1993), NC Division of Coastal Management Consistency for Federal Activities (dated April 22, 1993), and the USFWS's Revised Biological Opinion (dated April 19, 1993) are found in Attachment B for the FY 1994 placement of dredged material from the deepening and maintenance of Morehead City Harbor and the pumpout of Brandt Island (see Section 2.0, items c and d, above).

Aspects of the proposed Section 933 project, which are different from the base disposal plan, are as follows:

1. Depositing material excavated from Brandt Island and/or Morehead City Harbor Navigation project (both the inner and outer harbor channels) on Bogue Banks from Pine Knoll Shores to Indian Beach (including Salter Path). Up to 6.3 million cubic yards of dredged maintenance material may be available (i.e., about 4 million cubic yards from Brandt Island and the remainder coming from the Morehead City Harbor navigation channels).

2. The disposal area on Bogue Banks beaches would be extended from Pine Knoll Shores to Indian Beach (including Salter Path), a distance of approximately 7 miles or 38,000 feet.

Accordingly, this report assesses primarily the environmental effects for the new aspects of the proposed work and summarizes the impacts of work elements previously addressed.

## 3.00 ALTERNATIVES

Alternatives for the proposed action were evaluated and are discussed in this section. These include the recommended plan (i.e., proposed action), the base disposal plan, and the no-action plan.

**3.01 Recommended Plan - Proposed Action.** The proposed project would involve the following items:

a. The placement of up to 6.3 million cubic yards of dredged maintenance material on Bogue Banks, from the pumpout of Brandt Island and/or the maintenance dredging of the Morehead City Harbor navigation channels.

b. The proposed plan would extend the placement area an additional 7 miles. The maintenance material placed on Bogue Banks could extend up to 13 miles, from Fort Macon State Park to Indian Beach (including Salter Path). As requested by the NC Division of Parks and Recreation in their e-mail dated October 8, 2002 (Attachment B), material will be placed along the entire beach including the shoreline between the bathhouse jetty and the western boundary of the park.

c. A pipeline dredge would be used to pump out Brandt Island and the inner harbor. Hopper or ocean certified pipeline dredges would be used to maintain the outer harbor and pump the material to Bogue Banks.

d. Pumpout of Brandt Island. A pipeline dredge will excavate a 500-foot long, 200-foot wide, and 15-foot deep access channel from the inner harbor channels to Brandt Island. This same access channel was used during the FY 1986 and FY 1994 pumpout events. Material dredged from the access channel as well as Brandt Island will be pumped to the beaches of Bogue Banks. The pipeline from Brandt Island to Bogue Banks will be located within the existing pipeline easement that runs from Brandt Island to the Seaspray Condominiums in Atlantic Beach and goes underneath NC Highway 58 (east of the Triple S pier). Upon completion of the pumpout operation, all shore pipes and other equipment will be removed and the easement areas will be cleaned up and restored to pre-project conditions. Additionally, the pipeline dredge would be removed from Brandt Island and the dike would be repaired where it intersects the access channel.

For additional design information, see Section 1 of the Evaluation Report.

**3.02 <u>Base Disposal Plan</u>.** The base disposal plan that has been previously authorized (see Section 2.0, items c and d, above) and consists of the following:

Placement of a **maximum** of 4.8 million cubic yards of dredged maintenance material from Morehead City Harbor inner harbor navigation channels and the pump out of Brandt Island on Bogue Banks, from Fort Macon State Park to Atlantic Beach, a distance of about 6 miles. Approximately 1.5 million cubic yards of dredged maintenance material would be placed from the outer harbor to the ODMDS and/or the previously approved nearshore area.

The base disposal plan described above is the same as the one described in the Preliminary Assessment (PA) of the Dredged Material Management Plan (DMMP) for Morehead City Harbor, North Carolina dated 25 September 1997. The PA was written in accordance with EC 1165-2-200 (Implementation of Guidance).
For additional design information, see Section 1 of the Evaluation Report.

**3.03 <u>No Action</u>.** The no action alternative for the proposed 933 project is the base disposal plan. If the 933 project is not constructed, about 4.8 million cubic yards of dredge material from Morehead City Harbor inner harbor navigation channels and the pump out of Brandt Island would be placed on Bogue Banks from Fort Macon State Park to Atlantic Beach, a distance of about 6 miles. Additionally, approximately 1.5 million cubic yards of dredged maintenance material taken from the Morehead City Harbor outer channels would be deposited either in the ODMDS or the previously approved nearshore area.

For additional design information, see Section 1 of the Evaluation Report.

## 4.00 AFFECTED ENVIRONMENT

This portion of the EA deals with the affected environment within the Bogue Banks project area.

### 4.01 Geology and Sediment Characteristics.

**4.01.1 Background** The following information (in italics) was taken from Appendix D, Geotechnical Appendix, Feasibility Report and Environmental Assessment, Morehead City Harbor Improvement, Morehead City, North Carolina, dated June 1990 and revised December 1990 (USACE 1990):

*The project area is located in the lower Atlantic Coastal Plain Physiographic Province, along the central coast of North Carolina. More specifically, the channel passes through Beaufort Inlet between the barrier islands of Shackleford Banks and Bogue Banks and continues inland to the mainland at Morehead City and Beaufort North Carolina. The channel is flanked by shoals of the ebb-tidal delta seaward of the inlet and by those of the flood-tidal delta landward along Back Sound on the east. Further inland, the channel is flanked by Bogue Sound on the west. The Newport River empties into Morehead City harbor at the head of the channel, i.e., the northern most end of the harbor. The project site encompasses depositional environments that include nearshore littoral settings, an active coastal inlet, barrier islands, and a shallow, back barrier lagoonal complex of sounds and channels. The prominent geographical feature of the region is Cape Lookout, which is composed of a lobate sand body ranging up to 90 feet in thickness and covering an area of approximate 100 square miles. The western edge of the Cape Lookout shoal lies immediately east of the entrance channel. Shackleford Banks is a Holocene age barrier island that is underlain by extensive deposits of inlet filled sediments along its entire length. Historically, an inlet or inlets have opened and closed along the full length of the island, while displaying an overall westward lateral movement to the present-day Beaufort Inlet location. Back Sound, landward of Shackleford Banks, is underlain by stacked sequences of flood-tidal delta deposits, which stratigraphically compliment the inlet-fill sequences under the island. Holocene age shoreface deposits underlie Bogue Banks, to the west of the channel. The barrier sands of the island are prograding seaward over these deposits at present. Bogue Sound, landward of this island, is underlain by back-barrier lagoonal sequence of sediments having a greater abundance of clays than Back Sound to the east. The entire sequence of barrier/back-barrier sediments in the area represents several transgressive/regressive ocean events that occurred during Pleistocene and Holocene time.*

*Sediments within the Morehead City Harbor channels range from Pliocene to Holocene in age. The Pliocene sediments are from the Yorktown formation and are only found in limited areas (i.e., the turning basin and possibly along portions of Ranges B and C).*

*The top of the Yorktown sediments range between –45 and –50 mean sea level (MSL) in the inner harbor area and to about –65 feet MSL at Beaufort Inlet. These sediments consist of bluish to greenish-gray, clayey sands and interbedded clay and sandy clay, all of which have abundant fossil debris. Generally the Yorktown is more indurated than the overlying sediments. The Pleistocene sediments are from the Core Creek Sand. Within the inlet, these sediments are at approximately –50 to –54 feet MSL. Beneath Bogue Banks and Shackleford Banks, the Pleistocene varies from –45 feet MSL to –55 feet MSL, respectively. In the landward direction, the top of the Core Creek Sand rises along the dip such that it is only 15 to 20 feet below MSL. Pleistone deposits from Beaufort sand form a ridge along the mainland at the rear of Back and Bogue Sounds, as part of the Core Creek Plain (Pamlico Plain of Stephenson, 1912). This plain is a shallow, seaward dipping surface, which lies east and south of the Suffolk Scarp. In general, the Pleistocene sediments in the project area are representative of back-barrier and nearshore or shoreface deposits consisting of interbedded clays, silts, and fine sands, and poorly graded fine to medium sands and shelly sands, respectively. Holocene sediments are undifferentiated. They are the uppermost sediments at the site. Within the inner harbor, they consist of some reworked clays and silts but are predominately very fine to fine sands that are derived from Bogue and Back Sounds and the Newport River. Coarser sediments are concentrated in the channels. Holocene deposits are derived from the ongoing reworking of older sediments along the nearshore seabed and the Cape Lookout sand body. Deposits in each of the stratigraphic units are interbedded vertically and interfinger horizontally (facies changes) as the environments of deposition changed across the project area.*

*Forty Vibracore borings were completed in 1972 between the ocean bar at the entrance to the channel and the head of the harbor. All borings penetrated to a minimum depth of – 45 feet mean low water (MLW), except No. 33, which stopped at – 44.2 MLW. Review of the boring logs indicates that the depth between – 40 and – 47 MLW has a variety of sediments to be dredged, ranging from clays to coarse sands and some pea gravel. No rock occurs in the areas to be dredged. In general clayey sands, fat clay and some lean clays occur as a discontinuous layer between – 42 and – 48 MLW across most of the project reach. These clayey sediments are commonly interbedded with sands and have shell fragments. The sands above the clayey zone contain amounts of shell and clay.*

### 4.01.2 Sediment Characteristics

**a. Inner Harbor Sediment Characteristics**. As indicated in Section 1.01, deepening of Morehead City Harbor and pump out of Brandt Island was completed in FY 1994. To determine suitability of harbor sediments for beach disposal, subsurface investigations were taken of the bottom sediments.

The locations of vibracore sediment borings in the inner harbor navigation channels (4 vibracores taken in 1990 in the turning basin area to be expanded, and 12 vibracores taken in 1992 in various channels) were shown on Figure 3 in the EA/FONSI for the Disposal of Dredged Material and the Pumpout of Brandt (USACE 1993b). The sediment logs from the 1992 vibracore samples were included in Appendix A of the aforementioned EA. Vibracore sediment borings taken in the inner harbor navigation channels extended below a depth of 47 feet below mlw. Sediment samples from the vibracore borings were analyzed for grain-size distributions and percent fines down to a depth of 47 feet below mlw. Percent fines were defined as that portion of the sample with grain sizes less than the 200 mesh sieve (0.075 mm).

The distribution of material removed for the expansion of the turning basin is contained in Table 4-1 below.

**TABLE 4-1** Distribution of material removed for the expansion of the turning basin.

| Classification | Description | Percent |
|---|---|---|
| SP | Poorly Graded Sand | 76.5 |
| SM | Silty Sand | 7.2 |
| SC | Clayey Sand | 0.0 |
| SP/SM | Poorly Graded Silty Sand | 5.3 |
| SP/MH | Poorly Graded Sand with Clay Layers | 4.2 |
| MH | Silty Clay with Shell | 6.8 |

The size characteristics of the SP, SM, SC, SP/SM, and SP/MH material were combined based on the percent of material in the area resulting in a phi mean of 2.13 (.23 mm) and a phi standard deviation of 1.17. The native material on Atlantic Beach had a composite phi mean of 2.52 (.18 mm) and a phi standard deviation of 0.77. Thus, the turning basin material was slightly coarser and more widely distributed than the native beach sand. The percent of material in the turning basin smaller than the 200-mesh sieve was estimated to be about 12 percent. This material has already been removed when the new work was completed in FY 1994. Due to the strong currents in the basin, the fines of the maintenance material for the proposed project should be much less than 10 percent.

A standard used for determining beach quality of dredged material is the overfill factor. The overfill factor is the number of yards of dredged material (yards) that must be placed on the beach in order to equal to one inplace yard of native beach material. The overfill factor for the turning basin material was 1.08 which indicated the material was highly suited for placement on the beach.

The composite characteristics of the material removed from the inner harbor (excluding the expanded turning basin area), and a portion of Range B, were determined through a weighing process that was based on the volume of the various types of material to be removed during construction and is indicated in Table 4-2 below.

**TABLE 4-2** Distribution of the material removed from the inner harbor, and a portion of Range B.

| Classification | Description | Percent |
|---|---|---|
| SP | Poorly Graded Sand | 78.5 |
| SM | Silty Sand | 9.9 |
| SC | Clayey Sand | 11.6 |

The composite phi mean for the material from the rest of the inner harbor, and Range B was 1.65 (.32 mm) with a phi standard deviation of 1.59. The overfill factor for this material was 1.10, which also indicated that this material was highly suited for disposal on the beach. The percent fines were estimated to be approximately 6 percent, and should be similar to the maintenance material for the proposed project. Disposal of this material on the beach would only result in temporary turbidity.

The compatibility analysis of the sediments from Morehead City Harbor inner harbor navigation channels and the native beach material indicated that the sand from the channels was suitable for disposal on the beach. Overall, the combined volume of material to be removed from the turning basin and the other inner harbor areas for the proposed project should contain less than 10 percent fines. To verify the compatibility analysis and percent fines, additional sediment samples will be collected as indicated in Appendix G.

**b. Brandt Island Upland Dike Disposal Site Sediment Characteristics.** Dredged material temporarily stockpiled in the Brandt Island upland diked disposal site consists predominately of fine- to medium-grain sand with some silty material from maintenance of the inner harbor navigation channels. Therefore, the additional sediment samples collected as indicated in the previous paragraph should adequately characterize the material in Brandt Island.

**c. Outer Harbor Sediment Characteristics.** Based on sediment samples taken in 1979 and 1980, the material dredged from the Morehead City Ocean Bar Channel (Range A) was classified as medium sand. Average grain size in the outer harbor ranged from 0.15 mm on the west side of the ocean bar channel to about 0.21 mm on the east side of the channel. Additional information on sediment grain size data for the Morehead City Harbor Ocean Bar Channel can be found in Appendix D - Geotechnical Analysis, Design Memorandum, Morehead City Harbor Improvement, Morehead City, North Carolina, Project Modifications, March 1992, (USACE 1992). To verify this, additional sediment samples will be collected as indicated in Appendix G.

## 4.02 Water Quality

Water Quality Classification. Morehead City Harbor is located at the confluence of the Newport River and Bogue Sound. All tidal waters within Morehead City Harbor are classified as SC and SA. Coastal waters offshore of the project area are classified SB by the State of North Carolina. Class SA waters are defined as suitable for shellfishing for market purposes and any other usage specified by the “SB” and “SC” classification. Best usage of class SB waters includes swimming, primary recreation, and all Class SC uses including fishing, secondary recreation, fish and wildlife propagation, and other uses requiring lower water quality (NCDENR 2002). The waters in the vicinity of Morehead City Harbor are prohibited shellfish areas.

The turbidity water quality standard for all tidal salt waters is the basic standard applicable to SC waters: turbidity due to a discharge cannot exceed 25 NTU; if the background turbidity exceeds 25 NTU, the discharge cannot cause any increase in turbidity in the receiving waters outside of the surf zone.

**4.03 Air Quality**

The Wilmington Regional Office of the North Carolina Department of Environment and Natural Resources has air quality jurisdiction for the project area. The ambient air quality for Carteret County has been determined to be in compliance with the National Ambient Air Quality Standards, and this county is designated as an attainment area (Personal Communication, 11 March 02, Brad Newland, Engineer, NC Division of Air Quality).

**4.04 Marine Resources.**

Nekton. Nekton collectively refers to aquatic organisms capable of controlling their location through active movement rather than depending upon water currents or gravity for passive movement. Nekton of the nearshore Atlantic Ocean along Bogue Banks, North Carolina can be grouped into three categories: estuarine dependent species; permanent resident species; and seasonal migrant species. The most abundant nekton of these waters are the estuarine dependent species which inhabit the estuary as larvae and the ocean as juveniles or adults. This group includes species which spawn offshore, such as the Atlantic croaker (*Micropogon undulatus*), spot (*Leiostomus xanthurus*), Atlantic menhaden (*Brevoortia tyrannus*), star drum (*Stellifer lanceolatus*), southern kingfish (*Menticirrhus americanus*), flounders (*Paralichthys* spp.), mullets (*Mugil* spp.), anchovies (*Anchoa* spp.), blue crab (*Callinectes sapidus*), and penaeid shrimp (*Penaeus* spp.), as well as species which spawn in the estuary, such as red drum (*Sciaenops ocellatus*) and weakfish (*Cynoscion regalis*). Species which are permanent residents of the nearshore marine waters include the black sea bass (*Centropristis striata*), longspine porgy (*Stenotomus caprinus*), Atlantic bumper (*Chloroscombrus chrysurus*), inshore lizardfish (*Synodus foetens*), and searobins (*Prionotus* spp.). Common warm water migrant species include the bluefish (*Pomatomus saltatrix*), Spanish mackerel (*Scomberomorus maculatus*), king mackerel (*Scomberomorus cavalla*), cobia (*Rachycentron canadum*), Florida pompano (*Trachinotus carolinus*), and spiny dogfish (*Squalus acanthias*).

The State of North Carolina, Department of Environment and Natural Resources, Division of Marine Fisheries Artificial Reef Program manages six reefs that are located off Bogue Banks. They are AR 315, AR 320, AR 330, AR 340, AR 342, and AR 345. The locations of the closest sites are shown in Figure 2. None are in proximity to the proposed work.

The surf zone along the area beaches provides important fishery habitat. Surf zone fisheries are typically diverse, and 52 species have been identified from North Carolina (Ross 1996, Ross and Lancaster, 1996). Some species may be dependent upon surf zone habitat. Recent studies indicate that juveniles of certain species may have high site fidelity and extended residence time in the surf zone suggesting its function as a nursery area (Ross and Lancaster, 1996). Two species in particular, the Florida pompano and gulf kingfish (*Menticirrhus littoralis*) seem to use the surf zone exclusively as a juvenile nursery area.

Beaufort Inlet passes approximately 142,000,000 $m^3$ of water on spring tides (Jarret, 1976) and 132,000,000 $m^3$ during neap tides (Logan, 1995). Thus, Beaufort Inlet is an important passageway for the larvae of many species of commercially or ecologically important fish. Spawning grounds for many marine fishes are believed to occur on the continental shelf with immigration to estuaries during the juvenile stage. The shelter provided by the marsh and creek systems within the sound serves as nursery habitat where young fish undergo rapid growth before returning to the offshore environment.

Transport from offshore shelves to estuarine nursery habitats occurs in three stages: offshore spawning grounds to nearshore, nearshore to the locality of an inlet or estuary mouth, and from the mouth into the estuary (Boehlert and Mundy, 1988). Hettler et al. (1997) documented, through analysis of larvae otoliths, that a large number of young *B. tyrannus* larvae averaging 55 days post hatch arrived in mid-March on the date of maximum observed daily concentration (160 larvae per 100 $m^3$). For all species recorded in this study, abundance varied as much as an order of magnitude from night to night. The methods these larvae use to traverse large distances over the open ocean and find inlets are uncertain. Various studies have hypothesized such mechanisms as passive wind and depth-varying current dispersal and active horizontal swimming transport. However, little is known regarding larval distribution in the nearshore area. During the winters of 1992-1993 and 1993-1994, Hettler and Hare (1998b) conducted an experiment at Beaufort Inlet, North Carolina in order to further understand the estuarine ingress of offshore spawning species. A complex lateral structure in estuarine circulation, independent of the inlet opening size, was found in regards to larval concentration with significant interactions among inlet side, distance offshore, and date of ichthyoplankton tows. Length of species caught varied by cruise, inlet side, and distance offshore. The differences in larval concentration offshore and inshore and the species differences in length suggest species-specific rates controlling the net number of larvae entering the nearshore from offshore, the net number of larvae entering the inlet mouth from nearshore, and the larval mortality in the nearshore zone. Results from this study suggest two bottlenecks for offshore-spawning fishes with estuarine juveniles: the transport of larvae into the nearshore zone and the transport of larvae into the estuary from the nearshore zone (Hettler and Hare, 1998b).

Egg and larval transport from offshore spawning grounds to the inshore environment of Beaufort Inlet has been studied by Hettler and Hare (1998) in seven estuarine dependent species, including Atlantic menhaden (*Brevoortia tyrannus*), spot

(*Leiostomus xanthurus*), Atlantic croaker (*Micropogonias undulatus*), pinfish (*Lagodon rhomboides*), summer flounder (*Paralichthys dentatus*), southern flounder (*P. lethostigma*) and Gulf flounder *(P. albigutta*). Research conducted by the National Marine Fisheries Service (NMFS) Beaufort Laboratory through June 2002, collected a total of 120 species of larval fish fauna off the Beaufort Inlet and adjacent waters. According to Hettler and Hare (1998), average weekly concentration (number per 100 $m^3$) for all of the above estuarine dependent species, with the exception of Gulf flounder, was calculated during the October 1994 to April 1995 immigration season. Concentrations were 22.9, 4.8, 25.7, 12.4, 0.3, and 0.8 larvae/100$m^3$ respectively (Hettler, 1998a.). According to the spring tide flow calculated by Jarret (1976) and calculated daily larval concentration, approximately 32.5, 6.8, 36.5, 17.6, 0.43, and 1.1 million larvae pass through the inlet during a single spring tide for each respective species. Concentrations for all species combined (see Attachment C) entering the inlet during a single tidal prism range from 0.5 to 5 larvae $m^{-3}$. Therefore, daily calculated larval concentration for all species within the tidal prism ranges between 66 to 710 million (Personal Communication, Larry Settle, Fishery Biologist, NMFS, 27 June 2002).

The State of North Carolina defines Primary Nursery Areas (PNAs) as tidal saltwaters that provide essential habitat for the early development of commercially important fish and shellfish. It is in these estuarine areas that many fish species undergo initial post-larval development. The North Carolina Marine Fisheries Commission designates PNAs. Neither Morehead City Harbor nor the beaches of Bogue Banks are located within a designated PNA (15 NC Administrative Code 3B .1405).

Marine mammals also occur in North Carolina's coastal waters. The federally endangered North Atlantic right whale (*Eubaleana glacialis*) and humpback whale *(Megaptera novaeangliae*) are spring and fall migrants off the coast; and the North Atlantic right whale often occurs in shallow water. A number of other whale and dolphin species normally inhabit deeper waters offshore, while the bottlenose dolphin (*Tursiops truncatus*) and the harbor porpoise (*Phocoena phocoena*) utilize nearshore waters. The bottlenose dolphin is common in the project area. The federally endangered manatee (*Trichechus manatus*) is a rare visitor in the project area.

Three species of sea turtles are known to nest on the beaches of North Carolina. These include the Federally-endangered Kemp's ridley sea turtle (*Lepidochelys kempii*) and the federally threatened green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtles. These are discussed in Sections 4.08 and 5.08.

Benthos. Aquatic organisms that live in close association with the bottom, or substrate, of a body of water, are collectively called the benthos. Benthic communities of the project area exhibit a wide range of organism composition and density, and community structure may vary considerably depending on substrate type and salinity regime. Benthic surveys of three nearshore ocean sites located off Virginia Beach were conducted for the USDOI Minerals Management Service in 1996 and 1997 by Cutter and Diaz (1998). They collected a total of 119 taxa from 13 Smith-MacIntrye grabs collected in 1996. Half of the top 14 taxa (occurrence and abundance) were polychaetes. The remainder included representatives from the amphipods, decapods, bivalves, nemerteans, tanaids, echinoderms, and chordates. They found the overall community composition to be typical for sandy shallow continental shelf habitats and with similar species composition for similar depths and sediment types reported by Day et al. (1971) for North Carolina. Benthic resources in the proposed navigation and access channels are expected to also be similar to those found during these studies. Day et al (1971) defines the nearshore ocean in a project area as the “turbulent zone”. The turbulent zone includes ocean waters from below low tide to a depth of about -60 feet.

The most abundant species (total number > 50) collected by Day (1971) in waters within the turbulent zone near Cape Lookout North Carolina are shown in Table 4-1. Polychaete species are highly represented. Abundant species also include, pelecypods, decapods, amphipods, echinoderms, and cephalochordates.

**Table 4-3** Abundant benthic species within the turbulent zone near Cape Lookout, North Carolina. (Day, 1971)

| **Group and Species** | **Depth** | | | |
|---|---|---|---|---|
| | 3 Meters | 5 Meters | 10 Meters | 20 Meters |
| Archiannelida | | | | |
| *Polygordius* sp. | X | X | X | X |
| Polychaeta | | | | |
| *Palaenous heteroseta* | | X | X | X |
| Pseudeurythoe ambigua | X | X | | |
| *Exogone dispar* | | | *X* | *X* |
| *Goniadides n.sp* | | | *X* | *X* |
| *Magelona papillicornis* | *X* | *X* | *X* | |
| *Ophelia denticulata* | | *X* | *X* | *X* |
| *Macroclymene zonalis* | | | | |
| Amphipoda | | | | |
| *Platyischnopus n.sp* | *X* | *X* | *X* | |
| *Maera sp.1* | | *X* | *X* | *X* |
| Decapoda | | | | |
| *Dissodactylus mellitae* | *X* | *X* | *X* | |
| Pelecypoda | | | | |
| *Spisula ravenelli* | *X* | *X* | *X* | *X* |
| Gastropoda | | | | |
| *Olivella adelae* | *X* | | *X* | *X* |
| *O. mutica* | *X* | *X* | *X* | |
| Echinoidea | | | | |
| *Mellita quinquiesperforata* | *X* | *X* | *X* | *X* |
| Cephalochordata | | | | |
| *Branchiostoma caribbaeum* | | *X* | *X* | *X* |

Hardbottoms. Of special concern in the offshore area are hardbottoms, which are localized areas, not covered by unconsolidated sediments and where the ocean floor is hard rock. Hardbottoms are also called "live bottoms" because they support a rich diversity of invertebrates such as corals, anemones, and sponges, which are refuges for fish and other marine life. They provide valuable habitat for reef fish such as black sea bass, red porgy, and groupers. Hardbottoms are also attractive to pelagic species such as king mackerel, amberjack, and cobia. Along the North Carolina coast, hardbottoms are most abundant in southern portion of the state. Review of data provided by the Southeast Monitoring and Assessment Program (SEAMAP) identified one area of hardbottom off Pine Knoll Shores, about 2 miles south of the project area as shown on Figure 2.

Intertidal Macrofauna. Intertidal portions of ocean beaches are inhabited by a number of invertebrate species, which are ecologically important. These include mole crabs (*Emerita talpoida*) and coquina clams (*Donax* spp.), as well as various species of polychaete worms and amphipods. Mole crabs and coquinas represent the largest component of the total macrofaunal biomass of North Carolina intertidal beaches, and they are consumed in large numbers by important fish species such as flounders, pompanos, mullets, and kingfish (Reilly and Bellis, 1978). Beach intertidal macrofauna are also a seasonally important food source for numerous shorebird species.

### 4.05 Essential Fish Habitat.

The 1996 Congressional amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (PL 94-265) set forth new requirements for the National Marine Fisheries Service (NMFS), regional fishery management councils (FMC), and other federal agencies to identify and protect important marine and anadromous fish habitat. These amendments established procedures for the identification of Essential Fish Habitat (EFH) and a requirement for interagency coordination to further the conservation of Federally managed fisheries. Table 4-4 lists the federally managed fish species of North Carolina for which Fishery Management Plans have been developed by the South Atlantic Fishery Management Council (SAFMC), Mid-Atlantic Fishery Management Council (MAFMC), and National Marine Fisheries Service (NMFS). In addition, this table shows EFH by fish lifestage and ecosystem type for those species that have designated EFH. Table 4-5 shows the categories of EFH and Habitat Areas of Particular Concern (HAPC) for managed species which were identified in the Fishery Management Plan Amendments affecting the South Atlantic area. The fish species and habitats shown in these tables require special consideration to promote their viability and sustainability. The potential impacts of the proposed action on these fish and habitats are discussed in Section 5.05 of this report.

| Table 4-4. Essential Fish Habitat (EFH) Species for Coastal North Carolina.[1] | | | | | | |
|---|---|---|---|---|---|---|
| MANAGEMENT PLAN AGENCY[2] | MANAGEMENT PLAN SPECIES GROUP | COMMON NAME OF SPECIES | SCIENTIFIC NAME OF SPECIES | EFH for LIFE STAGES BY ECOSYSTEM[3] | | GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN (HAPC) (North Carolina Locations Only) |
| | | | | Marine | Estuarine | |
| SAFMC | Calico Scallop | Calico scallop | *Argopecten gibbus* | A | | |
| SAFMC | Coastal Migratory Pelagics | Cobia | *Rachycentron canadum* | E L P J A | L P J A | Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom |
| SAFMC | Coastal Migratory Pelagics | Dolphin | *Coryphaena hippurus* | L P J A | | Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom |
| SAFMC | Coastal Migratory Pelagics | King mackerel | *Scomberomorus cavalla* | J A | | Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom |
| SAFMC | Coastal Migratory Pelagics | Spanish mackerel | *Scomberomorus maculatus* | L J A | J | Capes Fear, Lookout, & Hatteras sandy shoals; The Point; Ten Fathom Ledge; Big Rock; Bogue Sound; New River; hardbottom |
| SAFMC | Coral & Coral Reef | Corals | 100s of species | Florida only | | Big Rock; Ten Fathom Ledge; The Point |
| SAFMC | Golden Crab | Golden crab | *Chaceon fenneri* | A | | |
| SAFMC | Red Drum | Red drum | *Sciaenops ocellatus* | E L A | P J S A | tidal inlets, state nursery, spawning sites, SAV |
| SAFMC | Shrimp | Brown shrimp | *Farfantepenaeus aztecus* | E L A | P J S | tidal inlets, state nursery, overwintering habitats |
| SAFMC | Shrimp | Pink shrimp | *Farfantepenaeus duorarum* | E L A | P J S | tidal inlets, state nursery, overwintering habitats |
| SAFMC | Shrimp | Rock shrimp | *Sicyonia brevirostris* | A | | |
| SAFMC | Shrimp | Royal red shrimp | *Pleoticus robustus* | A | | |
| SAFMC | Shrimp | White shrimp | *Lilopenaeus setiferus* | E L A | P J S | tidal inlets, state nursery, overwintering habitats |
| SAFMC | Snapper Grouper | Blackfin snapper | *Lutjanus buccanella* | J A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Blueline tilefish | *Caulolatilus microps* | E A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Golden tilefish | *Lopholatilus chamaeleonticeps* | A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Gray snapper | *Lutjanus griseus* | L A | P J A | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Greater amberjack | *Seriola dumerili* | J A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Jewfish | *Epinephelus itajara* | Florida only | Florida only | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Mutton snapper | *Lutjanus analis* | Florida only | Florida only | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Red porgy | *Pagrus pagrus* | | | |
| SAFMC | Snapper Grouper | Red snapper | *Lutjanus campechanus* | L P J A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Scamp | *Mycteroperca phenax* | A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Silk snapper | *Lutjanus vivanus* | J A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Snowy grouper | *Epinephelus niveatus* | E L A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Speckled hind | *Epinephelus drummondhayi* | A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Vermillion snapper | *Rhomboplites aurorubens* | J A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Warsaw grouper | *Epinephelus nigritus* | E A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | White grunt | *Haemulon plumieri* | E L A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Wreckfish | *Polyprion americanus* | A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Snapper Grouper | Yellowedge grouper | *Epinephelus flavolimbatus* | E L A | | hardbottom, SAV, oyster/shell, inlets, state nursery, The Point, Ten Fathom Ledge, Big Rock, Hoyt Hills |
| SAFMC | Spiny Lobster | Spiny Lobster | *Panulirus argus* | L J A | L J A | Spiny lobster EFH and HAPC located only in Florida |
| MAFMC | Atlantic Mackerel, Squid, Butterfish | Atlantic butterfish | *Peprilus triacanthus* | | | |
| MAFMC | Atlantic Mackerel, Squid, Butterfish | Atlantic mackerel | *Scomber scombrus* | | | |
| MAFMC | Atlantic Mackerel, Squid, Butterfish | Long finned squid | *Loligo pealei* | | | |
| MAFMC | Atlantic Mackerel, Squid, Butterfish | Short finned squid | *Illex illecebrosus* | | | |
| MAFMC | Atlantic Surfclam & Ocean Quahog | Ocean quahog | *Artica islandica* | | | |
| MAFMC | Atlantic Surfclam & Ocean Quahog | Surfclam | *Spisula solidissima* | | | |
| MAFMC | Bluefish | Bluefish | *Pomatomus saltatrix* | L J A | J A | |
| MAFMC | Spiny Dogfish | Spiny dogfish | *Squalus acanthias* | J A | | |
| MAFMC | Summer Flounder, Scup, Black Sea Bass | Black sea bass | *Centropristis striata* | | | |
| MAFMC | Summer Flounder, Scup, Black Sea Bass | Scup | *Stenotomus chrysops* | | | |
| MAFMC | Summer Flounder, Scup, Black Sea Bass | Summer flounder | *Paralichthys dentatus* | L J A | L J A | SAV for larvae and juveniles |
| NMFS | Billfish | Blue marlin | *Makaira nigricans* | E L J A | | |
| NMFS | Billfish | Longbill spearfish | *Tetrapturus pfluegeri* | J A | | |
| NMFS | Billfish | Sailfish | *Istiophorus platypterus* | E L J A | | |
| NMFS | Billfish | White marlin | *Tetrapturus albidus* | J A | | |

**Table 4-4 (Continued). Essential Fish Habitat (EFH) Species for Coastal North Carolina.[1]**

| MANAGEMENT PLAN AGENCY[3] | MANAGEMENT PLAN SPECIES GROUP | COMMON NAME OF SPECIES | SCIENTIFIC NAME OF SPECIES | EFH for LIFE STAGES BY ECOSYSTEM[2] Marine | Estuarine | GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN (HAPC) (North Carolina Locations Only) |
|---|---|---|---|---|---|---|
| NMFS | Sharks | Atlantic angel shark | *Squatina dumerili* | | | |
| NMFS | Sharks | Atlantic sharpnose shark | *Rhizoprionodon terraenovae* | J A | J | |
| NMFS | Sharks | Basking shark | *Cetorhinos maximus* | | | |
| NMFS | Sharks | Big nose shark | *Carcharhinus altimus* | J | | |
| NMFS | Sharks | Bigeye sand tiger shark | *Odontaspis noronhai* | | | |
| NMFS | Sharks | Bigeye sixgill shark | *Hexanchus vitulus* | | | |
| NMFS | Sharks | Bigeye thresher shark | *Alopias superciliosus* | E L P J S A | | |
| NMFS | Sharks | Blacknose shark | *Carcharhinus acronotus* | J A | | |
| NMFS | Sharks | Blacktip shark | *Carcharhinus limbatus* | J A | | |
| NMFS | Sharks | Blue shark | *Prionace glauca* | J S A | | |
| NMFS | Sharks | Bonnethead | *Sphyrna tiburo* | J A | J A | |
| NMFS | Sharks | Bull shark | *Carcharhinus leucas* | J | J | |
| NMFS | Sharks | Carribean reef shark | *Carcharhinus perezi* | Florida only | | |
| NMFS | Sharks | Carribean sharpnose shark | *Rhizoprionodon porosus* | | | |
| NMFS | Sharks | Dusky shark | *Carcharhinus obscurus* | A | J A | |
| NMFS | Sharks | Finetooth shark | *Carcharhinus isodon* | E L P J S A | | |
| NMFS | Sharks | Galapagos shark | *Carcharhinus galapagensis* | | | |
| NMFS | Sharks | Great hammerhead | *Sphyrna mokarran* | J A | | |
| NMFS | Sharks | Lemon shark | *Negaprion brevirostris* | J A | J A | |
| NMFS | Sharks | Longfin mako shark | *Isurus paucus* | E L P J S A | | |
| NMFS | Sharks | Narrowtooth shark | *Carcharhinus brachyurus* | | | |
| NMFS | Sharks | Night shark | *Carcharhinus signatus* | J A | | |
| NMFS | Sharks | Nurse shark | *Ginglymostoma cirratum* | J A | | |
| NMFS | Sharks | Oceanic whitetip shark | *Carcharhinus longimanus* | J S A | | |
| NMFS | Sharks | Porbeagle shark | *Lamna nasus* | | | |
| NMFS | Sharks | Sand tiger shark | *Odontaspis taurus* | J A | | |
| NMFS | Sharks | Sandbar shark | *Carcharhinus plumbeus* | J A | J A | Pamlico Sound adjacent to Hatteras and Ocracoke Islands and offshore |
| NMFS | Sharks | Scalloped hammerhead | *Sphyrna lewini* | J A | | |
| NMFS | Sharks | Sharpnose sevengill shark | *Heptranchias perlo* | | | |
| NMFS | Sharks | Shortfin mako shark | *Isurus oxyrinchus* | E L P J S A | | |
| NMFS | Sharks | Silky shark | *Carcharhinus falciformis* | J | | |
| NMFS | Sharks | Sixgill shark | *Hexanchus griseus* | | | |
| NMFS | Sharks | Smalltail shark | *Carcharhinus porosus* | | | |
| NMFS | Sharks | Smooth hamerhead | *Sphyrna zygaena* | | | |
| NMFS | Sharks | Spinner shark | *Carcharhinus brevipinna* | J A | | |
| NMFS | Sharks | Thresher shark, common | *Alopias vulpinus* | | | |
| NMFS | Sharks | Tiger shark | *Galeocerdo cuvieri* | J S A | | |
| NMFS | Sharks | Whale shark | *Rhincodon typus* | | | |
| NMFS | Sharks | White shark | *Carcharodon carcharias* | J | | |
| NMFS | Swordfish | Swordfish | *Xiphias gladius* | E L J S A | | |
| NMFS | Tuna | Albacore | *Thunnus alalunga* | A | | |
| NMFS | Tuna | Atlantic bigeye tuna | *Thunnus obesus* | J A | | |
| NMFS | Tuna | Atlantic Yellowfin tuna | *Thunnus albacares* | E L J S A | | |
| NMFS | Tuna | Skipjack tuna | *Katsuwonus pelamis* | E L J S A | | |
| NMFS | Tuna | Western Atlantic bluefin tuna | *Thunnus thynnus* | E L J S A | | |

Note: **1.**These Essential Fish Habitat species were compiled from **Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies**. February 1999 (Revised 10/2001) (Appendices 2, 3, 6, 7, and 8).
Although 49 species are listed in Appendix 3 under National Marine Fisheries Service management, only 35 of these species have EFH listed in Appendix 8.

**2**. Organizations responsible for Fishery Management Plans include: **SAFMC** = South Atlantic Fishery Management Council; **MAFMC** = Mid-Atlantic Fishery Management Council; **NMFS** = National Marine Fisheries Service.

**3**. Life stages include: E = Eggs, L = Larvae, P = PostLarvae, J = Juveniles, S = SubAdults, A = Adults

Table 4-5. Categories of Essential Fish Habitat and Habitat Areas of Particular Concern identified in Fishery Management Plan Amendments affecting the South Atlantic Area.[1, 2]

| ESSENTIAL FISH HABITAT | GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN |
|---|---|
| **Estuarine Areas** | **Area - Wide** |
| Estuarine Emergent Wetlands | Council-designated Artificial Reef Special Management Zones |
| Estuarine Scrub / Shrub Mangroves | Hermatypic (reef-forming) Coral Habitat & Reefs |
| Submerged Aquatic Vegetation (SAV) | Hard Bottoms |
| Oyster Reefs & Shell Banks | Hoyt Hills |
| Intertidal Flats | *Sargassum* Habitat |
| Palustrine Emergent & Forested Wetlands | State-designated Areas of Importance of Managed Species |
| Aquatic Beds | Submerged Aquatic Vegetation |
| Estuarine Water Column[2] | |
| Seagrass | |
| Creeks | |
| Mud Bottom | |
| **Marine Areas** | **North Carolina** |
| Live / Hard Bottoms | Big Rock |
| Coral & Coral Reefs | Bogue Sound |
| Artificial / Manmade Reefs | Pamlico Sound at Hatteras / Ocracoke Islands |
| *Sargassum* | Capes Fear, Lookout, & Hatteras (sandy shoals) |
| Water Column[2] | New River |
| | The Ten Fathom Ledge |
| | The Point |

[1]Essential Fish Habitat areas are identified in Fishery Management Plan Amendments for the South Atlantic and Mid-Atlantic Fishery Management Councils. Geographically Defined Habitat Areas of Particular Concern are identified in Fishery Management Plan Amendments affecting the South Atlantic Area. Information in this table was derived from Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies. February 1999 (Revised 10/2001) (Appendices 4 and 5).

[2]EFH for species managed under NMFS Billfish and Highly Migratory Species generally falls within the marine and estuarine water column habitats designated by the Fishery Management Councils.

### 4.06 Terrestrial Resources

**Beach and Dune.** When compared to most of North Carolina's upland communities, the beach and dune community in Bogue Banks could be considered depauperate in both plants and animals. The environment on the beach is severe because of constant exposure to salt spray, shifting sands, wind, and sterile soils with low water retention capacity. Beach vegetation known from the area includes beach spurge (*Euphorbia polygonifolia*), sea rocket (*Cakile edentula*) and pennywort (*Hydrocotyle bonariensis*). The dunes are more heavily vegetated with American beach grass (*Ammophila breviligulata*), panic grass (*Panicum amarum*) sea oats (*Uniola paniculata*), broom straw (*Andropogon virginicus*) and salt meadow hay (*Spartina patens*) being commonly observed.

There will be some loss of dune vegetation where the pipeline crosses the dune to the beach. Plants growing adjacent to the seaward side of the dunes will be buried by the discharge of dredged material. Dune vegetation disturbed by the pipeline crossing to the beach will be restored to pre-project grade and replanted following project completion. Planting stocks shall consist of sea oats and American beachgrass. The vegetative cover shall extend from the landward to the seaward toe of the dune. American beachgrass will be the predominant plant with sea oats as a supplemental plant. Planting would be accomplished during the season best suited for the particular plant.

Important invertebrates of the beach/dune community include the mole crab (*Emerita talpoida*), coquina clams (*Donax variabilus*), and ghost crabs (*Ocypode quadrata*). These can represent a significant food resource for the shorebirds and fishes of the area.

The inlet shorelines on both Bogue Banks (including Brandt Island) and Hammocks Beach State Park have consistently supported bird-nesting habitat. Black skimmers, least terns (*Sterna antillarum*), and Wilson's plovers (*Charadrius wilsonia*) are nesting on bare sandy flats adjacent to the inlet (Personnel Communication, David Allen, NC Wildlife Resources Commission). Historically, piping plovers (*Charadrius melodus*), common terns (*Sterna hirundo*), willet (*Catoptrophorus semipalmatus*), and American oystercatcher also have nested in these areas. During Migratory periods, piping plover, Wilson's plover, semipalmated plover (*Charadrius semipalmatus*), red knot (*Calidris canutus*), sandwich tern (*Sterna sandvicensis*, Foster's tern (*Sterna forsteri*), Royal tern (*Sterna maxima*), least tern, gull-billed tern (*Sterna nilotica*), common tern, black tern (*Chlidonias niger*), Caspian tern (*Sterna caspia*), herons, egrets, marbled godwit (*Limosa fedoa*), laughing gull (*Larus atricilla*) and cormorant are commonly found in and around the inlets. Overwintering bird species include piping plover, brown pelican, cormorants, Foster's tern, Royal tern, dunlin, and various gull species (Fussell 1985).

In the herbaceous dune areas, marsh hawks, kestrels, and other bird of prey forage. Other birds occurring in this area are mourning doves, swallows, fish crows, starlings, meadowlarks, redwinged blackbirds, boat tailed grackles, and savannah sparrows.

Mammals occurring here are opossums, cottontails, gray foxes, raccoons, feral house cats, shrews, moles, voles, and house mice.

Colonially nesting waterbirds (gulls, terns, and wading birds) are an important part of the project area ecosystem and add a vital element to the overall aesthetic appeal of the area for the many tourists that visit it each year. These species formerly nested primarily on the barrier islands of the region but have had most of these nesting sites usurped by development or recreational activities. With the loss of their traditional nesting areas, these species have retreated to the relatively undisturbed dredged material disposal islands, which border the navigation channels in the area. These islands often offer ideal nesting areas as they are close to food sources, well removed from human activities, and are isolated from mammalian egg and nestling predators.

Species of colonial waterbirds have been documented to nest on the disposal islands in Bogue Sound or inlets of the project area are shown on Table 4-6. Data was taken from the USFWS Draft Coordination Act Report Bogue Banks Shore Protection Study (USFWS 2002). Other species also use the islands for loafing or roosting during migratory periods or the winter months.

**Table 4-6**: Colonial waterbirds that have been documented to nest on the disposal islands in Bogue Sound or inlets in Carteret County NC (USFWS 2002):

least (little) tern (*Sterna albifrons*)
Forster's tern (*Sterna forsteri*)
common tern (*Sterna hirundo*)
gull-billed tern (*Gelochelidon nilotica*)
black skimmer (*Rynchops niger*)
glossy ibis (*Plegadis falcinellus*)
great egret (*Casmerodius albus*)
snowy egret (*Egretta thula*)
cattle egret (*Bubulcus ibis*)
tricolored heron (*Hydranassa tricolor*)
green heron (*Butorides striatus*)
little blue heron (*Egrette caerulea*)
black-crowned night-heron (*Nycticorax nycticorax*)
Great blue heron (*Plegadis falcinellus*)

Migratory shorebirds birds may also use the project area for foraging and roosting habitat (Personal Communication, Dave Allen, NC Wildlife Resources Commission, August 2002).

The Natural Heritage Program is currently conducting a status survey under contract with the US Fish and Wildlife Service of a rare butterfly that is known only from Bogue Banks and adjoining islands. This species, *Atrytonopsis* new species 1, is associated with the Dune Grass natural community and its larvae are believed to feed solely on seaside little bluestem (*Schizachryium littorale*), a common to dominant member of that community. Most of the known populations occur in naturally vegetated dune fields located behind the primary beaches along the ocean. Populations are also known from dredge disposal islands that support seaside little bluestem, including Brandt Island. A recent year round study in Brunswick County, NC, documents in detail shorebird use there (USACE 2002).

**4.07 <u>Wetlands and Flood Plains</u>.**

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions (33 C.F.R. § 328.3). Wetlands possess three essential characteristics: hydrophytic vegetation, hydric soils, and wetland hydrology. No wetlands are found within the project area.

The 100-year flood plain is established by the Federal Emergency Management Agency (FEMA) and is identified on Federal Insurance Rate Maps. Base flood elevations for flood zones and velocity zones are also identified by FEMA, as are designated floodways. All the beach disposal areas are within the 100-year floodplain.

**4.08 <u>Threatened and Endangered Species</u>.**

Updated lists of threatened and endangered (T&E) species for the project area were obtained from NMFS (Southeast Regional Office, St. Petersburg, FL) and the U.S. Fish and Wildlife Service (USFWS) (Field Office, Raleigh, NC). These were combined to develop the composite list shown in Table 7 (found in the Evaluation Report), which includes T&E species that could be present in the area based upon their historical occurrence or potential geographic range. However, the actual occurrence of a species in the area depends upon the availability of suitable habitat, the season of the year relative to a species' temperature tolerance, migratory habits, and other factors. The likelihood of occurrence and potential project impacts regarding T&E species are summarized in Section 5.08.

**4.09 <u>Cultural Resources</u>**

The Morehead City Section 933 study has been reviewed pursuant to Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) and the Abandoned Shipwreck Act (43 USC 2101 et seq.). This review has included consultation with the North Carolina State Historic Preservation Officer and staff of the NC Division of Archives and History Underwater Archaeology Unit. This review indicates that six archaeological sites have been recorded along the Bogue Banks beaches. Some of these sites consist of transient wreckage that has washed ashore from ships lost nearby in offshore waters. The sites and their last known locations are found in Section IV – Environmental Considerations in Project Planning of the Evaluation Report.

## 4.10 Esthetic and Recreational Resources

The towns of Atlantic Beach, Pine Knoll Shores, and Indian Beach (including Salter Path) are urbanized beach communities characterized by paved streets, parking lots, hotels, single-family dwellings, and condominiums. The esthetic values of these beach communities are evidenced by the popularity of the area for family orientated use and tourism. The total environment of barrier islands, oceans, estuaries, and inlets attract many residents and visitors to the area to enjoy the total esthetic experience created by the sights, sounds, winds, and ocean sprays. Four ocean fishing piers are located in the study area and are considered important recreational facilities. Also in the fall, recreational surf fishing is extensive.

## 4.11 Recreational and Commercial Fishing

Commercial and recreational fishing are important industries along Bogue Banks. In Carteret County there are several major centers of fishing activity, recreational and commercial fishing centers at Morehead City and Beaufort. The project area is heavily used by all fishing interests including; surf and pier fishermen, charter boats, and commercial gill-netters and trawlers. Important commercial species include menhaden, thread herring, croaker, and summer flounder. Total commercial landings utilizing Beaufort Inlet during 1996-2001 was about 415 million pounds (Personal Communication, Ms. Lees Sabo, NC Division of Marine Fisheries, June, 10, 2002).

The beaches of Bogue Banks are used by off road vehicles (ORV'S) and surf fishermen. These two interests constitute the major user groups of the project area and contribute to the local economy. The use of ORV'S on the beach is generally restricted to the months of October-April; however numerous public beach access points are available for foot travel year round. The Triple S, Oceania, Sportsman, and Sheraton piers are located in the Town of Atlantic Beach, which is within the proposed project limits. These ocean piers, private recreational vessels, charter boats, and head boats that use the nearshore waters also contribute to the local economy.

## 4.12 Socio-Economic Resources

Carteret County is located on the lower coastal plain of eastern North Carolina. The county seat of Beaufort lies 150 miles east of Raleigh and 90 miles north of Wilmington, North Carolina. The principal industries are tourism, construction, services, sport and commercial fisheries. The county is also home to a growing retirement population attracted to the area by a mild climate and beautiful natural surroundings. Tourism is generated by the 65 miles of south-facing beaches, Fort Macon State Park, NC Aquarium, NC Maritime Museum, and Cape Lookout National Seashore. Large numbers of vacation homes, motels, restaurants, and shopping centers have been developed to serve the local, retirement, and tourist populations.

Base Socioeconomic Conditions. From 1990 to 2000, the population of Carteret County grew at a rate of 13 percent (i.e., 1990 population was 52,407 and 2000 population was 59,383). About 40 percent of the residents live in one of the county's municipalities. With its overwhelming economic emphasis on tourism, retail sales in Carteret County comprise the most important source of jobs and income for the county's economy. In 1993, total farm income for Carteret County was over 18 million dollars, with corn, soybeans, and tobacco the leading commodities. In 1995, the manufacturing sector employed about 10 percent of Carteret County workers.

The North Carolina Office of State Budget and Management estimates Carteret County's 1994 employment at 25,000, with about 35 percent in trade and 21 percent in government employment. In 1997, per capita income in Carteret County was estimated at $21,624, somewhat higher than the North Carolina per capita income of $20,217.

The 1990's were a decade of rapid growth for the Carteret County beaches. Table 4-7 shows the populations of the towns and Carteret County since 1990. The total permanent population for the three principal towns in 2000 is estimated at 3,400. However, peak daily population in the summer can swell to more than 160,000 for the entire county.

**TABLE 4-7**
Population Statistics
Carteret County, North Carolina

| Town/County | 1990 Population | 2000 Population |
|---|---|---|
| Atlantic Beach | 720 | 789 |
| Pine Knoll Shores | 1,360 | 1,524 |
| Indian Beach | 153 | 95 |
| Morehead City | 6,046 | 7,691 |
| Carteret County | 52,407 | 59,383 |

**Projected Population:** Carteret County population projections for 2000 – 2020 are shown in Table 4-8.

**TABLE 4-8**
Population Projections
Carteret County, North Carolina

| County | 2005 Population | 2010 Population | 2020 Population |
|---|---|---|---|
| Carteret | 65,633 | 69,358 | 76,341 |

Source: Office of State Planning, State of North Carolina.

## 4.13 <u>Other Significant Resources (Section 122, P. L. 91-611)</u>

Section 122 of P. L. 91-611 identifies other significant resources which must be considered during project development. These resources, and their occurrence in the study area, are described below.

a. <u>Noise and water pollution</u>: Noise is a prominent feature in the study area due to the sound of the breakers. These sounds are tranquil and add to the pleasure experienced by visitors. Water quality is discussed in Section 4.02 and in the Section 404(b)(1) (P. L. 95-217) evaluation included with this document as Attachment A.

b. <u>Man-made and natural resources, esthetic values, community cohesion, and the availability of public facilities and services</u>: The Triple S, Oceania, Sportsman, and Sheraton piers are located in the Town of Atlantic Beach, which is within the proposed project area. Aesthetic values are discussed in Section 4.10.

c. <u>Employment, tax, and property value</u>: The study area is a major resort area in Carteret County. Property values contribute to the tax base. The tax base of the first row of oceanfront properties found in Atlantic Beach, Pine Knoll Shores, and Indian Beach (includes Salter Path) are 38 percent, 43 percent, and 62 percent, respectively (Personnel Communication, Greg Rudolph, Shore Protection Manager, Carteret County, July 8, 2002).

d. <u>Displacement of people, businesses, and farms</u>: No people, homes, or businesses will be displaced by the proposed action. There will be no utility relocations and there are no existing federal projects within the project area. There are no farms in the project area, which would be affected by the proposed action.

e. <u>Community and regional growth</u>: Project area beaches have undergone rapid population growth in recent decades. This is expected to continue with or without the proposed project.

# 5.00 ENVIRONMENTAL IMPACTS

This section describes the probable consequences (impacts and effects) of the work within the Bogue Banks project area on significant environmental resources.

## 5.01 <u>Geology and Sediments</u>

Removal of dredged sediments from the existing navigation channels and Brandt Island is not expected to produce any significant adverse geologic impacts. Sediments of the nearshore ocean are continually subject to movement facilitated by strong currents. Redistribution of sediments is, therefore, a natural and continuous phenomenon.

## 5.02 Water Quality

Dredging in the existing navigation channels and Brandt Island would involve mechanical disturbance of the bottom substrate and subsequently redeposition of suspended sediment and turbidity during dredging. Factors that are known to influence sediment spread and turbidities are grain size, water currents and depths. Monitoring studies done on the impacts of offshore dredging indicates that sediments suspended during offshore are generally localized and rapidly dissipate when dredging ceases (Naqvi and Pullen. 1982, Bowen and Marsh.1988, and Van Dolah et al. 1992).

During placement of the maintenance material along Bogue Banks beaches, there will be elevated turbidity and suspended solids in the immediate area when compared to the existing non-storm conditions of the nearshore zone. Significant increases in turbidity are not expected to occur outside the immediate construction area (turbidity increases of 25 Nephelometric Turbidity Units (NTU's) or less are not considered significant). Turbid waters (increased turbidity relative to background levels but not necessarily above 25 NTU's) may hug the nearshore and be transported with waves either northeast or southwest depending on wind and current conditions. Turbidity levels are expected to return to background levels in the nearshore zone upon cessation of dredging and placement activities.

Beach disposal of 3.9 million cubic yards of material dredged from Brandt Island during the summer of 1986 produced turbidities as high as 250 NTU's in the Atlantic Ocean in the vicinity of the discharge pipe or within the construction zone. However, turbidities decreased rapidly with distance from the pipe or outside of the construction/mixing zone. The applicable standard for a Section 401 Water Quality Certificate is that "that the activity (i.e., beach disposal of dredge maintenance material) be conducted in such a manner as to prevent significant increase in turbidity **outside the area of construction** (emphasis added by the writer)...". Turbidities outside of the construction or mixing zone would not exceed the state standard of 25 NTU's in all saltwater classes.

The proposed maintenance dredging of the Morehead City navigation channels and the pumpout of Brandt Island will not impact ground water resources in the study area.

A Section 401 (P.L. 92-500) Water Quality Certificate is being requested from the NC Division of Water Quality since the discharge of dredged material will be into waters of the United States. The impacts associated with the discharge of fill material into waters of the United States are discussed in the Section 404(b)(1) (P.L. 95-217) evaluation (Attachment A).

Within Morehead City Harbor, some of the navigational channels are closed to shellfish harvesting. By Memorandum dated January 31, 2002, from the North Carolina Department of Environment and Natural Resources, Division of Environmental Health, Shellfish Sanitation and Recreational Water Quality Section (see Attachment B), if maintenance material is excavated from these closed shellfishing areas between May 1 and October 31 and placed on Bogue Banks a swimming advisory will be posted and a press release made. The U.S. Army Corps of Engineers, Wilmington District, will notify the Shellfish Sanitation and Recreational Water Quality Section prior to dredging from a closed shellfishing area with placement on a recreational swimming area.

**5.03 Air Quality**

Temporary increases in exhaust emissions from construction equipment are expected during the construction period. The project is in compliance with Section 176 (c) of the Clean Air Act, as amended (CAA). The air quality in Carteret County, North Carolina, is designated as an attainment area. The State of North Carolina does have a State Implementation Plan ("SIP") approved or promulgated under Section 110 of the CAA. However, a conformity determination is not required because Carteret County has been designated by the State of North Carolina as an attainment area, and the direct and indirect emissions from the project fall below the prescribed deminimus levels (58 Fed. Reg. 93.153(c)(1)) and; therefore, no conformity determination would be required.

The project is located within the jurisdiction for air quality of the Wilmington Regional Office of the NCDENR. The ambient air quality for Carteret County has been determined to be in compliance with the National Ambient Air Quality Standards. This project is not anticipated to create any adverse effect on the air quality of this attainment area.

**5.04 Marine Resources.**

Impacts on Nekton. Most free-swimming animals, including fish, shellfish, marine mammals, sea turtles, nearshore ocean birds, and cephalopod mollusks, are not expected to experience any significant direct effects from the proposed action. However, dredging and the placement activities may result in minor and/or temporary impacts.

Dredging and Placement Impacts. Hopper dredges do not pose a significant threat to most nekton because their mobility can enable them to avoid or escape from a dredge's suction-velocity field, which extends over only a small area in the vicinity of the operating draghead. Hopper dredges pose a particular threat to sea turtles and whales and are addressed in that regard in Section 5.08.

Placement of dredged maintenance material on the Bogue Banks beaches may affect fishery resources through increases in turbidity and sedimentation, which, in turn, may create, localized stressful habitat conditions and may result in temporary displacement of fish and other biota. However, since less than 200 feet of beach would be affected each day (i.e., about a mile of beach per month would be impacted), mobile biota, including juvenile and adult fish, should be able to relocate outside the more stressful conditions of the proposed action. Cumulative effects of the proposed action would not be potentially harmful to fishes of the surf zone, since the daily disposal area is less than 200 feet. The unknowns concerning the occurrence, distribution, and life history aspects of fishes in the nearshore area and their sensitivity to the proposed action were monitored for the Wilmington Harbor project and found not to be significant.

Entrainment Impacts. Larvae and early juvenile stages of many species pose a greater concern that adults because their powers of mobility are either absent or poorly developed, leaving them subject to transport by tides and currents. This physical limitation makes them potentially more susceptible to entrainment by an operating pipeline and/or hopper dredges. Organisms close to the pipeline cutterhead or the hopper dredge draghead may be captured by the effects of its suction and may be entrained in the flow of dredged sediment and water. As a worst-case, it may be assumed that entrained animals experience 100 percent mortality, although some small number may survive. Susceptibility to this effect depends upon avoidance reactions of the organism, the efficiency of its swimming ability, its proximity to the draghead, the pumping rate of the dredge, and possibly other factors. Behavioral characteristics of different species in response to factors such as salinity, current, and diurnal phase (daylight versus darkness) are also believed to affect their concentrations in particular locations or strata of the water column. Any organisms present near the existing channel bottom would be closer to the pipeline dredge cutterhead or hopper dredge draghead and, therefore, subject to higher risk of entrainment.

The biological effect of hydraulic entrainment has been a subject of concern for more than a decade, and numerous studies have been conducted nationwide to assess its impact on early life stages of marine resources, including larval oysters (Carriker et al., 1986), post-larval brown shrimp (Van Dolah et al., 1994), striped bass eggs and larvae (Burton et al., 1992), juvenile salmonid fishes (Buell, 1992), and Dungeness crabs (Armstrong et al., 1982). These studies indicate that the primary organisms subject to entrainment by hydraulic dredges are bottom-oriented fishes and shellfishes. The significance of entrainment impact depends upon the species present; the number of organisms entrained; the relationship of the number entrained to local, regional, and total population numbers; and the natural mortality rate for the various life stages of a species. Assessment of the significance of entrainment is difficult, but most studies indicate that the significance of impact is low. Reasons for low levels of impact include: (1) the very small volumes of water pumped by dredges relative to the total amount of water in the vicinity, thereby impacting only a small proportion of organisms, (2) the extremely large numbers of larvae produced by most estuarine-dependent species, and (3) the extremely high natural mortality rate for early life stages of many fish species. Since natural larval mortalities may approach 99 percent (Dew and Hecht, 1994; Cushing, 1988), entrainment by a hydraulic dredge should not pose a significant additional risk in most circumstances. Neither direct quantification studies nor modeling efforts have demonstrated population level impacts due to larval entrainment by hydraulic dredges (memo of August 8, 1995 from Douglas Clarke, PhD., Coastal Ecology Branch, Waterways Experiment Station, USACE, Vicksburg).

A hopper dredge operating within the outer harbor would pump an even smaller amount of water than a hydraulic dredge in proportion to the surrounding water volume. Therefore, entrainment impacts of dredging are expected to be insignificant.

For Beaufort Inlet specifically, concentrations for all species combined (according to Attachment C) entering the Inlet during a single tidal prism range from 0.5 to 5 larvae $m^{-3}$. The largest hydraulic dredge likely to work in Beaufort Inlet would have a discharge pipe about 30 inches in diameter and would be capable of transporting about 30,582.2 $m^3$ of sand per day if operated 24 hours (24 hours per day, 7 days per week operation is not normal). The sediment would be pumped as a slurry containing about 15 percent sand and about 85 percent water by volume. The volume of water discharged would, thus, be about 173,299.1 $m^3$ per day, or about 2.0 $m^3$ per second. Considering the amount of water moving thorough Beaufort Inlet, most of the simulated scenarios in Attachment C indicate the percent entrainment mortality to be less than 0.06 to 0.07 percent per day. Therefore, the dredging conducted, as part of the proposed action is not expected to create significant impacts on these life forms.

Impacts on Benthos. Removal of benthos and benthic habitat within the existing navigation channels by pipeline and/or hopper dredging has been previously addressed in earlier environmental documents (see Section 2.0). Removal of benthos and benthic habitat by channel dredging represents a temporary resource loss since the channel bottom will become a new area of benthic habitat and will be recolonized by benthic organisms. However, physical conditions will be different from those of the previously undredged adjacent area because the existing channel will be subject to turbulence created by passing ships and to periodic disturbance from maintenance dredging that is expected to occur on a 1 to 2-year cycle. Therefore, the new benthic community, which develops, may be different in terms of species diversity, biomass, or other characteristics. The ecological significance of temporary benthic losses is not well-understood but is considered minor since the affected area is very small relative to the amount of benthic habitat present on the ocean bottom, the time span of loss is likely a period of months, and benthic populations in the vicinity are in a state of flux due to the continual sedimentation and shoaling which creates the need for maintenance dredging.

Temporary loss of the benthic habitat and benthic organisms will also occur within the access channel from Morehead City inner harbor to Brandt Island which must be established to allow a 30-inch dredge to remove the sand present. Minimum dimensions for the access channel will need to be about 400 feet long, about 200 feet of bottom width, and about 15 feet of depth. This same access channel was used during the FY 1986 and FY 1994 pumpout events. Allowing for side slopes of 1V:5H in the sandy substrate, the affected bottom area is estimated at less than 5 acres for the required entrance channel. Essentially total loss of benthos will occur during dredging, but recovery will begin immediately and is expected to be completed over a period of months. After dredging is complete, the access channel to Brandt Island will be plugged at the island perimeter, and the bottom of the access channel will remain undisturbed by dredging until the next sand removal episode, which is expected to be at intervals of about 8 to 10 years. During the intervening years, the benthic community is expected to fully reestablish.

Impacts on Hardbottoms. Hardbottoms have been documented in the nearshore areas off Carteret County (Figure 2). However, surveys in the vicinity of the placement areas have not indicated any hardbottoms within the project area. Therefore, the proposed action will have no direct or indirect effect on hardbottoms.

Impacts on Macrofauna. Beach disposal of dredged material may have negative impacts on intertidal macrofauna through direct burial, increased turbidity in the surf zone, or changes in the sand grain size or beach profile. Some previous disposal operations have resulted in nearly complete localized mortality of intertidal macrofauna (Reilly and Bellis, 1978) while others involving disposal of coarse sand have caused only temporary shifts in population distribution that are believed to represent only minor impacts (Hayden and Dolan, 1974).

Temporary impacts on intertidal macrofauna in the immediate vicinity of the project are expected as a result of discharges of maintenance material on the beach. Any reduction in the numbers and/or biomass of intertidal macrofauna present immediately after beach disposal may have localized limiting effects on surf-feeding fishes and shorebirds due to a reduced food supply. In such instances, these animals may be temporarily displaced to other locations.

Reilly and Bellis (1978) stated, "Beach nourishment virtually destroys existing intertidal macrofauna; however, recovery is rapid once the pumping operation ceases. In most cases, recovery should occur within one or two seasons following the project completion." Similar findings were reached by Van Dolah (1992) in a study of the impacts of a beach nourishment project in South Carolina. A study by Dolan et al. (1992) of the effects of beach fill activities on mole crabs at the Pea Island National Wildlife Refuge, Dare County, North Carolina, indicates that while nourishment has a dramatic impact on mole crabs in the area where beachfill is placed, mole crabs returned to the beach areas that were nourished soon after pumping stopped.

While beach disposal may produce negative effects on intertidal macrofauna, these are localized in the vicinity of the disposal operation. Beach disposal conducted as a component of the proposed action could occur year-round during construction, but would be expected to move along the beach at a relatively slow rate (i.e., about a mile per month or less than 200 feet per day). This rate of progress is slow enough that surf-feeding fishes and shorebirds may move to other areas that are not affected by the disposal operation. Also, this rate of progress would mean that only a few consecutive miles of beach would be affected during any season of the year. As the dredging operation passes by a given section of beach, that area is soon available for recolonization by invertebrates.

In a 1999 Environmental Report on the use of federal offshore sand resources for beach and coastal restoration, US Department of Interior, Minerals Management Service provided the following assessment of potential impacts to beach fauna from beach disposal.

Because benthic organisms living in beach habitats are adapted to living in high energy environments, they are able to quickly recover to original levels following beach nourishment events; sometimes in as little as three months (Van Dolah et al. 1994; Levison and Van Dolah 1996). This is again attributed to the fact that intertidal organisms are living in high energy habitats where disturbances are more common. Because of a lower diversity of species compared to other intertidal and shallow subtidal habitats (Hackney et al. 1996), the vast majority of beach habitats are recolonized by the same species that existed before nourishment (Van Dolah et al. 1992; Nelson 1985; Levison and Van Dolah 1996; Hackney et al. 1996).

While the proposed beach disposal will adversely impact intertidal macrofauna, these effects will be localized, short-term, and reversible.

Project construction is expected to run from about November 2003 through March 2004 and will run through the overwintering period and recruitment of intertidal organisms on the beach. Beach disposal will be completed prior to the onshore recruitment of most intertidal organisms. Recruitment of coquina clams on the beach at Fort Macon begins in March (Reilly and Bellis, 1983). Any loss of intertidal organisms would be temporary, as repopulation would be expected to begin as soon as the disposal operation ends. Intertidal organisms are expected to recover upon completion of project construction from recolonization of the beach by organisms from adjacent areas and offshore.

## 5.05 Essential Fish Habitat.

The Fishery Management Plan Amendments of the South Atlantic Fishery Management Council identify over 30 categories of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC), which are listed in Tables 5-1. While all of these habitat categories occur in waters of the southeastern United States, only a few occur in the immediate project vicinity and/or the project impact zone. Those absent include estuarine scrub/shrub mangroves which require a more tropical environment and several areas that are geographically removed from the project area including: Hoyt Hills located in the Blake Plateau area in water 450-600 meters deep, the Point located off Cape Hatteras near the 200-meter contour, and sandy shoals off Cape Hatteras and Cape Fear. In addition, there are no Council-designated Artificial Reef Special Management Zones, Estuarine Emergent Wetlands, Palustrine Emergent & Forested Wetlands, Intertidal Flats, Oyster Reefs & Shell Banks, Aquatic Beds, Wetlands, Creeks, Seagrass Beds, or Submerged Aquatic Vegetation in the potential project impact area, although some of these habitat types may occur in the vicinity of Morehead City, particularly in and around Bogue Sound. Impacts on habitat categories potentially present in the project vicinity are discussed below.

Table 5-1. Categories of Essential Fish Habitat and Habitat Areas of Particular Concern in the Project Vicinity and Potential Impacts.

| ESSENTIAL FISH HABITAT | Potential Presence | | Potential Impacts | |
|---|---|---|---|---|
| **Estuarine Areas** | **In / Near Project Vicinity** | **Project Impact Area** | **Dredge Plant Operation** | **Sediment Disposal Activities** |
| Estuarine Emergent Wetlands | yes | no | no | no |
| Estuarine Scrub / Shrub Mangroves | no | no | no | no |
| Submerged Aquatic Vegetation (SAV) | yes | no | no | no |
| Oyster Reefs & Shell Banks | yes | no | no | no |
| Intertidal Flats | yes | no | no | no |
| Palustrine Emergent & Forested Wetlands | no | no | no | no |
| Aquatic Beds | no | no | no | no |
| Estuarine Water Column | yes | yes | insignificant | insignificant |
| Seagrass | yes | no | no | no |
| Creeks | yes | no | no | no |
| Mud Bottom | yes | no | no | no |
| **Marine Areas** | | | | |
| Live / Hard Bottoms | nearshore ocean | no | no | no |
| Coral & Coral Reefs | offshore | no | no | no |
| Artificial / Manmade Reefs | 2 miles offshore | no | no | no |
| *Sargassum* | offshore | no | no | no |
| Water Column | yes | yes | insignificant | insignificant |
| **GEOGRAPHICALLY DEFINED HABITAT AREAS OF PARTICULAR CONCERN** | | | | |
| **Area - Wide** | | | | |
| Council-designated Artificial Reef Special Management Zones | no | no | no | no |
| Hermatypic (reef-forming) Coral Habitat & Reefs | offshore | no | no | no |
| Hard Bottoms | nearshore ocean | no | no | no |
| Hoyt Hills | distant offshore | no | no | no |
| *Sargassum* Habitat | offshore | no | no | no |
| State-designated Areas of Importance of Managed Species (PNAs) | yes | no | no | no |
| Submerged Aquatic Vegetation (SAV) | yes | no | no | no |
| **North Carolina** | | | | |
| Big Rock | distant offshore | no | no | no |
| Bogue Sound | yes | no | no | no |
| Pamlico Sound at Hatteras / Ocracoke Islands | no | no | no | no |
| Cape Fear sandy shoals | distant offshore | no | no | no |
| Cape Hatteras sandy shoals | distant offshore | no | no | no |
| Cape Lookout sandy shoals | >10 miles southeast | no | no | no |
| New River | no | no | no | no |
| The Ten Fathom Ledge | distant offshore | no | no | no |
| The Point | distant offshore | no | no | no |

Essential Fish Habitat areas are identified in Fishery Management Plan Amendments for the South Atlantic and Mid-Atlantic Fishery Management Councils. Geographically Defined Habitat Areas of Particular Concern are identified in Fishery Management Plan Amendments affecting the South Atlantic Area. Areas listed in this table were derived from Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies. February 1999 (Revised 10/2001) (Appendices 4 and 5).

Impacts on Big Rock and Ten-Fathom Ledge located off Cape Lookout. This site is located about 18 miles east of the project area and would not be affected by the proposed action.

Impacts to New River. The New River is located about 30 miles from the proposed project and would not be affected.

Impacts on Bogue Sound. All work will be located within the existing Morehead City Harbor navigational channels, Brandt Island, and the Bogue Banks beaches. No dredged maintenance material will be excavated or placed in Bogue Sound. Therefore the proposed action will not affect Bogue Sound.

Impacts on Sargassum. *Sargassum* is a pelagic brown algae which occurs in large floating mats on the continental shelf, in the Sargasso Sea, and in the Gulf Stream. It is a major source of productivity in a nutrient-poor part of the ocean. Masses of *Sargassum* provide extremely valuable habitat for a diverse assemblage of animal life, including juvenile sea turtles, sea birds, and over 100 species of fish. Unregulated commercial harvest of *Sargassum* for fertilizer and livestock feed has prompted concerns over the potential loss of this important resource. While smaller clumps of this seaweed may float into the project area, it typically occurs much further offshore. In any case, since it occurs in the upper few feet of the water column, it is not subject to impacts from dredging or placement activities associated with the proposed action.

Impacts on Reef-forming Corals. Hermatypic, or reef-forming, corals consist of anemone-like polyps occurring in colonies united by calcium encrustations. Reef-forming corals are characterized by the presence of symbiotic, unicellular algae called zooxanthellae, which impart a greenish or brown color. Since these corals derive a very large percentage of their energy from these algae, they require strong sunlight and are, therefore, generally found in depths of less than 150 feet. They require warm water temperatures (68 to 82 F) and generally occur between $30^0$N and $30^0$S latitudes. Off the east coast of the United States, this northern limit roughly coincides with northern Florida. Although they occur off the North Carolina coast, they are not known from the immediate project vicinity, and they should not be affected by the proposed action.

Impacts on Artificial Reefs. The NCDMF lists six artificial reefs in the project vicinity. They are AR 315, AR 320, AR 330, AR 340, AR 342, and AR 345. The locations of these sites are shown in Figure 2.

Dredging and placement of material on Bogue Banks will not be done in close proximity to any of these artificial reefs, so no adverse impacts would occur. The closest artificial reef (AR 315) is about 2 miles offshore of Atlantic Beach and an average water depth of 49 feet. Turbidity plumes may be produced by placement of the dredged material on Bogue Banks in the nearshore area as fine sediments are washed away by littoral processes. If such plumes are still detectable as far offshore as the NC Artificial Reef Project (NCARP) reefs, their effects should be minor, temporary, and should quickly dissipate. The proposed action will not significantly impact any NCARP reefs.

Impacts on Hardbottoms. All maintenance dredging will be located within the existing channels of Morehead City Harbor and Brandt Island. There are no hardbottoms within these areas. Review of data provided by the Southeast Monitoring and Assessment Program (SEAMAP) identified one area of hardbottom off Pine Knoll Shores, about 2 miles south of the project area as shown on Figure 2. While beach disposal will cause turbidity, this effect should be minor and temporary and not affect the hardbottom 2 miles off Pine Knoll Shores.

Impacts on State-designated Areas Important for Managed Species. Primary Nursery Areas (PNAs) are designated by the NC Marine Fisheries Commission and are defined by the State of North Carolina as tidal saltwaters, which provide essential habitat for the early development of commercially important fish and shellfish (15 NC Administrative Code 3B .1405). Many fish species undergo initial post-larval development in these areas. This project will not impact PNAs because they are not present in the project impact area.

Impacts on the Marine Water Column. The potential water quality impacts of dredging and disposal are addressed in Section 5.02. Dredging and disposal operations conducted during project construction may create impacts in the marine water column in the immediate vicinity of the activity potentially affecting the nearshore area. These impacts may include minor and short-term suspended sediment plumes and related turbidity, as well as the release of soluble trace constituents from the sediment. During dredging, turbidity increases outside the dredging area should be less than 25 NTUs and are, therefore, considered insignificant. Overall water quality impacts of the proposed action are expected to be short-term and minor. Living marine resources dependent upon good water quality are not expected to experience significant adverse impacts due to water quality changes.

Scientific data are very limited with regard to the effects of placement of dredged material on Bogue Banks on fishery resources. These effects may be similar, on a smaller scale, to the effects of storms; storm effects may include increased turbidity and sediment load in the water column and, in some cases, changes in fish community structure (Hackney et al., 1996).

Placement of dredged material on Bogue Banks may affect fishery resources and EFH through increases in turbidity and sedimentation that, in turn, may create localized stressful habitat conditions and may result in temporary displacement of fish and other biota. However, less than 200 feet of beach per day would be impacted, mobile biota, including juvenile and adult fish, should be able to relocate outside the more stressful conditions of the proposed action.

Impacts on Cape Lookout Sandy Shoals. The sandy shoals off Cape Lookout are located over 10 miles southeast of the entrance to Morehead City Harbor. No effects on these shoals are anticipated.

Impacts on Mud Bottoms. The proposed action involves the dredging and placement of beach quality sand. Mud bottoms are not appropriate for this purpose and will not be within the areas affected by this action.

Impacts of Larval Entrainment. See Section 5.04, Entrainment Impacts.

Impacts on other Habitat Areas of Particular Concern (HAPC). Tidal inlets comprise HAPC for several important species, including the planktonic larvae of brown shrimp, white shrimp, pink shrimp, as well as the eggs and larvae of red drum. These species are sometimes present in Beaufort Inlet, which is the location of the entrance channel to Morehead City Harbor. Therefore, channel dredging will likely impact the early life stages of these species through entrainment by suction dredging. While individual mortality is the result, population level impacts are considered to be insignificant, as is explained in Section 5.04, Entrainment Impacts.

The surf zone represents HAPC for adult bluefish and red drum that feed extensively in this portion of the ocean. Disposal operations along the beach can result in increased turbidity and mortality of intertidal macrofauna that serves as food organisms for these and other species. Therefore, feeding activities of these species may be interrupted in the immediate area of beach sand placement. However, these mobile species are expected to temporarily relocate to other areas as the work proceeds along the beach. Once the placement operation has passed, physical conditions in the impact zone quickly recover and biological recovery soon follow. Surf-feeding fish can then resume their normal activities in these areas. Therefore, these impacts are considered temporary and minor.

Impact Summary for Essential Fish Habitat. The proposed action is not expected to cause any significant adverse impacts to Essential Fish Habitat of EFH species. Impacts are expected to be minor on an individual and cumulative effects basis. Therefore, mitigation is not required.

## 5.06 Terrestrial Resources

The proposed action is not expected to adversely impact any wildlife or vegetation found along the beach or the dune areas. There will be some loss of dune vegetation where the pipeline crosses the dune to the beach. Plants growing adjacent to the seaward side of the dunes will be buried by the discharge of dredged material. Dune vegetation disturbed by the pipeline crossing to the beach will be restored to pre-project grade and replanted following project completion. Planting stocks shall consist of sea oats and American beachgrass. The vegetative cover shall extend from the landward to the seaward toe of the dune. American beachgrass will be the predominant plant with sea oats as a supplemental plant. Planting would be accomplished during the season best suited for the particular plant.

Migratory shorebirds may use the project area for foraging and roosting habitat, but would not be adversely affected by the proposed action. A recent year round study in

Brunswick County, NC documents in detail shorebird use there (USACE 2002). This report indicated that beach nourishment had no measurable impact to bird use during the first year of monitoring. The results of the second year of monitoring are due in the spring of 2003.

Migratory birds may also use Brandt Island for foraging, nesting, and roosting habitat. The pumpout of Brandt Island may start on November 16, 2003 and work may continue for up to 16 months to complete the removal of about 4.0 million cubic yards of dredged material. The hydraulic pipeline dredge and other heavy equipment (i.e., bulldozers, backhoes, front end loaders, etc) would be working in and on Brandt Island during the nesting season for migratory birds. However, this activity would not significantly impact nesting migratory birds for the following reasons:

1. The 96-acre Brandt Island is not isolated from Bogue Banks. A small and shallow 50-foot wide tidal creek separates Brandt Island from Bogue Banks. Raccoons and other predators (i.e., cats, dogs, etc.) can easily reach the island and destroy nests.

2. No work will take place outside of the existing dike alignment of Brandt Island, which means that the remaining upland portions of Brandt Island will not be disturbed.

To the maximum extent practicable, we will work with the NC Natural Heritage Program and the USFWS to reduce impacts to the rare butterfly, *Atrytonopsis* new species 1.

### 5.07 Wetlands and Flood Plains

No wetlands will be impacted by the proposed action. This sand placement on the beach is an alteration of the floodplain in that the zone of tidal flooding is displaced seaward. This is consistent with the purpose of the project, which is to offset erosion. This activity cannot be accomplished outside the floodplain. Impacts to floodplains will be temporary and insignificant.

### 5.08 Threatened and Endangered Species

A biological assessment evaluating the potential impacts of the proposed action on endangered and threatened species has been prepared and is being coordinated with the USFWS (jurisdiction over the Florida manatee, nesting sea turtles, and seabeach amaranth) and NMFS (jurisdiction over other protected marine and aquatic species which may occur in the project vicinity) pursuant to Section 7 of the Endangered Species Act of 1973 (PL 93-205), as amended. The biological assessment resulted in a determination that the project, as currently proposed, may affect the piping plover, seabeach amaranth, green sea turtle, loggerhead sea turtle, and Kemp's ridley sea turtle. The biological assessment appears in Attachment D, and discusses the relationship of the proposed action to these species. Project plans have been refined to minimize potential effects, to the extent feasible. Interagency coordination for endangered and threatened species will be completed prior to the initiation of the proposed action.

Disposal of sand will be conducted between November 16 and April 30 to the degree practicable, in order to minimize potential impacts on nesting sea turtles. However, if disposal is conducted during May 1 through November 15, impacts will be reduced through the implementation of a standard beach monitoring and turtle nest relocation program. Also, after placement of dredged material, any affected beach will be monitored for hardness and areas exceeding 500 CPUs will be tilled in order to make them more suitable for sea turtle nesting. Thus, any adverse impacts on sea turtles should be minor. In addition, the portion of beach that receives sand should provide improved nesting habitat for sea turtles as compared to the currently eroded condition of these areas.

If disposal on the beaches occurs year round during construction, the Wilmington District will be responsible for monitoring seabeach amaranth from 1 July to September 30 of any year.

To the maximum extent practicable, we will work with the NC Natural Heritage Program and the USFWS to reduce impacts to the rare butterfly, *Atrytonopsis* new species 1.

### 5.09 Cultural Resources

The US Army Corps of Engineers, Wilmington District, in consultation with the NC Division of Archives and History Underwater Archaeology Unit, have considered both the potential impact of the project and the nature of the known resources, and have determined that the information does not support a recommendation for an archaeological survey of the entire beach area. However, it is possible during the course of construction that vessel remains will be encountered. Therefore, the Underwater Archaeology Unit has requested that Wilmington District personnel, contractors, and others be aware that the possibility exists that this work may unearth a beached shipwreck. In the event that such occurs, work should move to another area and the Underwater Archaeology Unit should be contacted immediately at telephone number (910) 458-9042. A staff member will be sent to assess the wreckage and, if practical, undertake appropriate documentation.

### 5.10 Aesthetic and Recreational Resources

Expansion of the beach area would improve recreational quality for beach users. Recreation benefits for the proposed project would result from increased quality of the recreation experience. The aesthetic quality of Fort Macon State Park, Atlantic Beach, Pine Knoll Shores, and Indian Beach (including Salter Path) Beaches would be impacted by the noise and visual intrusion of the dredge and associated pipes and equipment during construction and maintenance of the project; however, the presence of such equipment will be temporary.

Four ocean piers are within the construction area. The Triple S, Oceania, Sportsman, and Sheraton piers are located in the Town of Atlantic Beach. A minimum of 500-foot long, no-pumping zone on both sides of each pier will be established. This means that no dredge maintenance material will be placed a minimum of 500-feet on either side of the four piers. No dredged maintenance material will be placed under or immediately adjacent these piers and therefore the area available for fishing would not be reduced. Disposal during the fishing season may also impact the recreational catch. During past projects at Wrightsville Beach, Carolina Beach, and Kure Beach, no special provisions were made during placement of beach-fill around the piers and no major objections were raised during the process. The Section 933 project is similar to the Wrightsville, Carolina Beach, and Kure Beach projects. Any turbidity that may occur during placement will be dissipated during several tidal cycles and should have no significant long-term impact on fishing from either the four piers or the surf zone. These impacts are not expected to significantly reduce public use at any of the affected piers.

### 5.11 Recreational and Commercial Fishing

During project construction there will be an increase in the turbidity of the surf zone in the immediate area of sand deposition. Most of the fine material in the beachfill is expected to be washed seaward into the surf zone during construction and maintenance. This increase in fine material may cause the temporary displacement of various species of fish, causing a negative impact to surf and pier fishing and beach seining in the area of deposition. A study done by the NMFS on the effects of beach nourishment on nearshore macrofauna concluded that beach nourishment projects using offshore dredged material have no harmful effects provided that the sediments are similar to those where they are placed (Saloman and Naughton 1984). The material that would be used for beachfill is similar in composition to the native beach material.

Beach disposal will proceed up or down the beach progressing at slow rate of about 1 mile a month. Fishing activities (such as surf or seine fishing from the beach strand) will be precluded from the immediate vicinity of the discharge during construction and maintenance. Portions of the project area that have been recently completed and those awaiting disposal would be accessible for fishing. The immediate construction area is small relative to nearby available fishing areas that could be accessed by numerous beach access points located throughout the project area. Pipelines along the beach that cross established vehicle access points would be ramped as practical to facilitate continued use.

Four ocean piers in the project area are within the proposed disposal area. The proposed project would not move the shoreline under these piers seaward, since no dredge maintenance material will be placed a minimum of 500-feet on either side of the four ocean piers (Section 1.02).

Commercial trawlers would not be able to operate in construction areas and any areas occupied by pipelines during construction. Dredging is proposed to occur from about November 2003, through early spring 2005, and progress is estimated at about 1 mile of beach per month. No permanent placement of equipment is proposed. Only a limited area of open-ocean would be occupied by equipment (i.e., hopper and pipeline dredges) in relation to available fishing areas.

**5.12 Socio-Economic Resources.**

No adverse impacts are anticipated, but benefits are significant as indicated in Section III of the main report.

**5.13 Other Significant Resources (Section 122, P.L. 91-611).**

a. Air, noise, and water pollution: Air pollution will be created by construction equipment; however, the pollution produced is no worse than that from any other large piece of machinery and should be readily dispersed. Noise from construction equipment is slightly out of character for some of the project area; however, construction sounds will be readily attenuated by background sounds from wind and surf. Water quality impacts are discussed in Section 4.02 and in the Section 404(b)(1) (P.L. 95-217) evaluation included with this document as Attachment A.

b. Man-made and natural resources, aesthetic values, community cohesion, and the availability of public facilities and services: The proposed project may require the extension of dune crossover structures along the beach. Existing DOT storm drainage pipes will have to be extended to the shoreward crest of the newly constructed berm. Dredging in the Morehead City Harbor navigation channels or the Brandt Island pumpout are not expected to cause significant interference with commercial and recreational boat traffic. The mobility of a hopper dredge will preclude any interference with regular commercial ship traffic as a result of travel to and from the navigation channels. Should a hydraulic pipeline dredge be used, the pipeline from the navigation channels or Brandt Island to the disposal beach will be submerged until it reaches nearshore waters or within the pipeline corridor on Atlantic Beach. The pipeline would be marked to let commercial and recreational boaters know of its presence along the bottom. Work barges and other appurtenances associated with a pipeline dredge operating in open water would be moored so as to minimize interference with boat traffic in the area.

Impacts to aesthetic values are discussed in Section 5.10. Impacts to natural resources are discussed in Sections 5.02, 5.04, 5.05, and 5.06. Impacts to cultural resources are discussed in Section 5.09. Hurricane protection and beach erosion control will benefit numerous roads, business, and residences. The proposed project will have beneficial effects on community cohesion and will protect many public facilities and services (i.e. roads and utilities) from storm events.

c. Employment, tax, and property value: No adverse effects on employment, tax, and property value are expected as a result of implementation of the Section 933 plan alternative. Some temporary jobs may be available during construction. Any ocean front homes that are currently taxed at a reduced rate due to high erosion could return to full taxation with the project in place.

d. Displacement of people, businesses, and farms: There are improvements that will be affected by the proposed project. The proposed action does not include the acquisition of any residential or commercial properties. There will be no utility relocations and there are no existing federal projects within the acquisition area. No businesses or farms will be displaced by the proposed action.

e. Community and regional growth: An increase in the growth rate of affected beach communities is not expected as a result of the proposed action. The presence of a beachfill project on the beach will enhance the quality of the recreational experience for both residents and tourists. Tourism is an industry vital to the region's economy. Existing beachfront real property and that which occurs as growth continues will be protected.

**5.14 Cumulative Impacts.** A cumulative analysis of the impacts of existing, proposed and potential projects involving the placement of sand material on the beach on significant coastal shoreline resources is found in Attachment E.

Relatively small portions of North Carolina beaches are presently affected by the placement of sand, about 15 percent. With the proposed action the impact area would not increase since all areas proposed for fill have previously has sand deposition. On a statewide scale the existing and approved disposal sites are well distributed in northern central and southern parts of the state with undeveloped protected beaches (i.e., National/Federal and State Parks and Estuarine Reserves) in between. It is unlikely that cumulative impacts from space crowded perturbation are occurring or will occur due to the construction of this project. The analysis suggests that the potential impact area from the proposed and existing actions is small relative to the area of available similar habitat on a vicinity and statewide basis. These areas are expected to recover food resources, which should continue to be available. It is expected that the risk that the direct and cumulative impacts of the proposed action and other existing similar activities, would reach a threshold with high potential for population level impacts on important commercial fish stocks and birds is low.

**5.15 Mitigation.** Project impacts will be minimized by avoidance of significant resources such as hardbottoms and significant cultural resources. If work takes place from 1 May to November 15, the Wilmington District will monitor the construction area and relocate any sea turtle nests.

The 933 project is not expected to result in significant cumulative impacts and monitoring is not proposed as a component of this project. Several of the incrementally larger beach projects including Wilmington Harbor, Bogue Banks (local nourishment project, see Section 1.2) and Dare County Beaches have significant monitoring components that will address beach impact on northern, central and southern North Carolina Beaches. This project is a one-time event and is located within the larger Bogue Banks project (local beach nourishment project).

To the maximum extent practicable and during the warmer summer months, we will try to reduce direct impacts to intertidal macrofauna by relocation to undisturbed portions of the beach.

No compensatory mitigation is proposed for this project.

## 6.00 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

**6.01 Water Quality.** A Section 404(b)(1) evaluation and a Section 401 Water Quality Certificate under the Clean Water Act of 1977 (PL 95-217), as amended, are required for specific aspects of the proposed action. The Section 404(b)(1) evaluation is included in Attachment A. The Wilmington District is applying for a Section 401 Water Quality Certificate from the NC Division of Water Quality. Work will not proceed until the certificate is received.

**6.02 Essential Fish Habitat.** Potential project impacts on Essential Fish Habitat species and their habitats have been evaluated. It has been determined that the proposed action will not have a significant adverse effect on these resources. We consider these impacts to be minimal on an individual and cumulative affects basis. Because those impacts are minor, mitigation is not being proposed. Compliance obligations related to Essential Fish Habitat provisions of the 1996 Congressional amendments to the Magnuson-Stevens Fishery Conservation and Management Act (PL 94-265) will be fulfilled prior to initiation of the proposed action.

**6.03 Threatened and Endangered Species.** A biological assessment evaluating the potential impacts of the proposed action on endangered and threatened species has been prepared (Attachment D) and is being coordinated with the USFWS (jurisdiction over the Florida manatee, nesting sea turtles, and seabeach amaranth) and NMFS (jurisdiction over other protected marine and aquatic species which may occur in the project vicinity) pursuant to Section 7 of the Endangered Species Act of 1973 (PL 93-205), as amended. Compliance obligations under Section 7 will be satisfied prior to implementation of the proposed action.

**6.04 Executive Order 11988 (Flood Plain Management).** Dredged maintenance material will be placed in the flood plain. The proposed action is not anticipated to induce development of the floodplain, or to otherwise adversely affect any floodplain, since the existing oceanfront property is already developed. The proposed action is in compliance with the requirements of Executive Order 11988.

**6.05 Executive Order 11990 (Protection of Wetlands).** The work will not require filling any wetlands. The proposed work will not produce any significant hydrologic or salinity changes affecting any wetlands. The proposed action is in compliance with Executive Order 11990.

**6.06 Executive Order 11593 (Protection and Enhancement of the Cultural Environment).** Significant impacts to known archaeological or historic resources are not anticipated due to the proposed work. The Wilmington District, in consultation with the NC Division of Archives and History Underwater Archaeology Unit, have considered both the potential impact of the project and the nature of the known resources, and have determined that the information does not support a recommendation for an archaeological survey of the entire beach area. However, it is possible during the course of construction that vessel remains will be encountered. Therefore, the Underwater Archaeology Unit has requested that Wilmington District personnel, contractors, and others be aware that the possibility exists that this work may unearth a beached shipwreck. In the event that such occurs, work should move to another area and the Underwater Archaeology Unit should be contacted immediately at telephone number (910) 458-9042. A staff member will be sent to assess the wreckage and, if practical, undertake appropriate documentation. The proposed action is in compliance with Executive Order 11593.

**6.07 Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low Income Communities and Low Income Populations).** The Proposed Action would not impact minority communities or low-income populations because no minority communities or low-income populations reside in the project area.

**6.08 Executive Order 13045 (Protection of Children from Environmental Health Risks).** This order mandates Federal agencies identify and assess environmental health and safety risks that may disproportionately affect children as a result of the implementation of federal policies, programs, activities, and standards (63 Federal Register 19883-19888). The Proposed Action would not impact schools or housing areas. The beaches at Bogue Banks are considered a gathering place for children. However, the actual beach construction zone would be fenced off and monitored by the contractor. No unauthorized individuals will be allowed within the work zone. Therefore, there would be no short- or long-term impacts on the health and safety of children.

**6.09 Executive Order 13186 (Protection of Migratory Birds).** This Executive Order mandates agencies to protect and conserve migratory birds and their habitats. The proposed action will not have a measurable negative affect on migratory bird populations. In fact the proposed action would restore and increase the riparian habitat along Bogue Banks beaches for migratory birds.

Migratory birds may also use Brandt Island for foraging, nesting, and roosting habitat. The pumpout of Brandt Island may start on November 16, 2003, and work may continue for up to 16 months to complete the removal of about 4.0 million cubic yards of dredged material. The hydraulic pipeline dredge and other heavy equipment (i.e., bulldozers, backhoes, front end loaders, etc) would be working in and on Brandt Island during the nesting season for migratory birds. However, this activity would not significantly impact nesting migratory birds for the following reasons:

1. The 96-acre Brandt Island is not isolated from Bogue Banks. A small and shallow 50-foot wide tidal creek separates Brandt Island from Bogue Banks. Raccoons and other predators (i.e., cats, dogs, etc.) can reach the island and destroy nests.

2. No work will take place outside of the existing dike alignment of Brandt Island, which means that the remaining upland portions of Brandt Island will not be disturbed.

## 6.10 North Carolina Coastal Management Program

The project will take place in the designated coastal zone of the State of North Carolina. Pursuant to the federal Coastal Zone Management Act (CZMA) of 1972, as amended (P.L. 92-583), federal activities are required to be consistent to the maximum extent practicable with the federally approved coastal management program of the state in which their activities would be occurring.

The disposal of dredged material on the ocean beach of Bogue Banks is consistent with the North Carolina Coastal Management Program. State concurrence with placement of maintenance dredged material from maintenance dredging of the inner harbor navigation channels on Bogue Banks was obtained on January 11, 1984. State concurrence with construction of improvements to the Morehead City Harbor project (including deepening of the inner harbor navigation channels with direct disposal of dredged material in the Brandt Island upland diked disposal site) was obtained on December 14, 1990. State concurrence with the disposal of dredged material on Pine Knoll Shores from dredging of the AIWW was received on August 18, 1989. State concurrence with disposal of dredged material on the ocean beach of Bogue Banks from the dredging of an access channel and the pumpout of Brandt Island was obtained on December 10, 1985, as amended on March 21, 1986, to allow discharge of dredged material associated with construction of an access plug into Brandt Island.

The disposal of dredged material along the beach strand of Bogue Banks is consistent with land classifications and policy statements found in the Town of Atlantic Beach 1988 Local Land Use Plan update, and the Town of Pine Knoll Shores Land Use Plan update, dated July 24, 1987. The towns of Atlantic Beach and Pine Knoll Shores will be responsible for surveying the first line of stable natural vegetation along the beach strand within their jurisdiction. This line is used to establish the building setback line along the ocean beach pursuant to 15 North Carolina Administrative Code 7H .0305.

By letter dated April 22, 1993 (copy found in Attachment B), the NC Division of Coastal Management determined that the base disposal plan (i.e., placement of maintenance material taken form Morehead City Harbor channels and the pumpout of Brandt Island on Bogue Banks from Fort Macon State Park to Atlantic Beach, a distance of about 6 miles), was consistent with the approved Coastal Management Program of the State of North Carolina and the local land use plans for the project area. If the 933 project is not funded or constructed, the no-action or base disposal plan will be implemented in FY 2004. The base disposal plan is the placement of a **maximum** of 4.8 million cubic yards of dredged maintenance material from Morehead City Harbor inner harbor navigation channels and the pump out of Brandt Island on Bogue Banks, from Fort Macon State Park to Atlantic Beach, a distance of about 6 miles. Approximately 1.5 million cubic yards of dredged maintenance material would be placed from the outer harbor to the ODMDS and/or the previously approved nearshore area.

Based upon the information presented within this EA, the proposed 933 project (i.e., the placement of maintenance dredge material from Morehead City Harbor navigation channels and the pumpout of Brandt Island from Pine Knoll Shores to Indian Beach, an additional distance of about 7 miles) is consistent with the North Carolina Coastal Management Program, the land use plan for Carteret County, towns of Atlantic Beach, and Pine Knoll Shores. This determination is being provided to the state for its review and concurrence.

### 6.10.1 Areas of Environmental Concern (AECs)

The proposed action would take place in areas designated under the NC Coastal Management Program as AECs (15A NCAC 7H .0100). Specifically, the activities will occur in three AECs, Estuarine Waters, Ocean Hazard, and Public Trust Area. The following determination has been made regarding the consistency of the proposed action with the State's management objective for the AECs that may be affected:

Estuarine Waters. Estuarine Waters are the state's oceans, sounds, tidal rivers and their tributaries, which stretch across coastal North Carolina and link to the other parts of the estuarine system: public trust areas, coastal wetlands and coastal shorelines. For regulatory purposes, the inland, or upstream, boundary of estuarine waters is the same line used to separate the jurisdictions of the Division of Marine Fisheries and the Wildlife Resources Commission. However, many of the fish and shellfish that spend part of their lives in estuaries move between the "official" estuarine and inland waters.

The proposed project would not adversely impact estuarine waters, since all dredging will take place within the existing Morehead City inner harbor channels and Brandt Island. On average, maintenance of these inner harbor channels take place every two years and Brandt Island was previously pumped out in FY 86 and FY 94.

Ocean Hazard. The Ocean Hazard System is made up of oceanfront lands and the inlets that connect the ocean to the sounds. The Coastal Resources Commission has designated three-ocean hazard AECs.

1. The Ocean Erodible AEC covers North Carolina's beaches and any other oceanfront lands that are subject to long-term erosion and significant shoreline changes. The seaward boundary of this AEC is the mean low water line. The landward limit of the AEC is measured from the first line of stable natural vegetation and is determined by adding: a distance equal to 60 times the long-term, average annual erosion rate for that stretch of shoreline to the distance of erosion expected during a major storm. The width of the AEC varies from about 145 feet to more than 700 feet.

2. The High Hazard Flood AEC covers land subject to flooding, high waves and heavy water currents during a major storm. These are the lands identified as coastal flood with velocity hazard, or "V zones," on flood insurance rate maps prepared by the Federal Insurance Administration. "V zones" are determined by an engineering analysis of expected flood levels during a storm, expected wave and current patterns, and the existing topography of the land. The high hazard flood AEC often overlaps with the ocean erodible and inlet hazard AECs.

3. Unvegetated Beach Area AEC where no stable natural vegetation is present may be designated as an unvegetated beach area on either a permanent or temporary basis.

The proposed action would not adversely affect oceanfront lands and inlets on Bogue Banks. In fact, the placement of beach quality sand from the maintenance dredging of Morehead City Harbor and Brandt Island on these beaches may reduce the erosion and storm damage potential.

Public Trust Areas. These areas include waters of the Atlantic Ocean and the lands there under from the mean high water mark to the 3-mile limit of state jurisdiction. Acceptable uses include those that are consistent with protection of the public rights for navigation and recreation, as well as conservation and management to safeguard and perpetuate the biological, economic, and esthetic value of these areas. The activities that comprise the proposed action are not intended to adversely impact the public' rights for navigation and recreation, and are consistent with conservation of the biological, physical, and esthetic values of public trust areas.

### 6.10.2 Other State Policies

The following state policies found in the NC Coastal Management Program document are also applicable to the proposed action in terms of beach placement of sand.

Shoreline Erosion Response Policies. NC Administrative Code 7M - Section .0200 addresses beach restoration projects as feasible alternatives to the loss or massive relocation of oceanfront development when public beaches and public or private properties are threatened by erosion; when beach restoration, renourishment, or sand disposal projects are determined to be socially and economically feasible and cause no significant adverse environmental impacts; and the project is consistent with state policies for shoreline erosion response and state use standards for Ocean Hazard and Public Trust Areas AECs.

Policies on Beneficial Use of Materials from the Excavation or Maintenance of Navigation Channels. NC Administrative Code 7M - Section .1101 states that it is the policy of the state that material resulting from the excavation or maintenance of navigation channels be used in a beneficial way wherever practicable. Policy statement .1102 (a) indicates that "clean, beach quality material dredged from navigation channels within the active nearshore, beach, or inlet shoal systems must not be removed permanently from the active nearshore, beach, or inlet shoal system unless no practicable alternative exists.  Preferably, this dredged material will be disposed of on the ocean beach or shallow active nearshore area where environmentally acceptable and compatible with other uses of the beach."

Components of the proposed action are consistent with these policies of the NC Coastal Management Program.

#### 6.10.3 Local Land Use Plans.

This project is consistent with the policies addressed in the local Land Use Plans for Carteret County and the Towns of Atlantic Beach and Pine Knoll Shores.

### 6.11 Coastal Barrier Resources Act

The Coastal Barrier Resources Act (CBRA) of 1982 (PL 97-348) and the Coastal Barrier Improvement Act of 1990 (PL 101-591) restrict federal expenditures in those areas comprising the Coastal Barrier Resources System (CBRS).  Designated maps showing all sites included in the system in North Carolina show Fort Macon State Park Unit (NC-04P), Roosevelt Natural Area Unit (NC-05P), and Hammocks Beach Unit (NC-06P) to be within the Coastal Barrier Resource System and protected under the Coastal Barrier Improvement Act of 1990.  The Fort Macon State Park Unit (NC-04P) is excluded from CBRA since it is located within a state park.  The Roosevelt Natural Area Unit (NC-05P) extends only to NC Highway 58 and not to any adjacent beaches.  The Hammocks Beach Unit (NC-06P) is located west of the study area and would not be affected by the recommended plan.  Therefore, the proposed action is in compliance with CBRA.

### 6.12 Hazardous and Toxic Waste (HTW)

The USACE standard tiered approach for analyzing the potential for encountering contaminated sediments in the navigational channels and Brandt Island were used to assess these areas for HTW.  According to this analysis, before any chemical or physical testing of sediments is conducted, a reason to believe that the sediments may be contaminated must be established.  The sources of the sediments in the selected areas (i.e., Brandt Island and the existing navigation channels) are generally sand derived from sediment transport and deposition by ocean currents that are not conducive to settling of contaminants.  The probability of the sites being contaminated by pollutants is also low since the sediment in existing navigational channels and placement areas have not been used as an industrial site, dump, or contaminant disposal area.

### 6.13 Prime and Unique Agriculture Land

According to the Soil Survey of Carteret County, North Carolina, no prime or unique agriculture lands designated by the Natural Resource Conservation Service are found within the project area.

## 6.14 Environmental Commitments

The following environmental commitments are being proposed for the project:

1. A sea turtle nest-monitoring program will be implemented during construction if dredging and disposal occur during sea turtle nesting season on the beach between May 1 and November 15. If work takes place from 1 May to 15 November, the Wilmington District will be responsible for monitoring the construction area and relocate any sea turtle nests. During the period of sea turtle nesting and hatching (1 May through 15 November), all lighting associated with project construction shall be minimized to the maximum extent practicable while maintaining compliance with all safety requirements. Reduced wattage and special fixtures or screens to reduce illumination of adjacent beach and near shore waters shall be used if practical. Lighting on offshore equipment shall also be minimized to the maximum extent practical while meeting Coast Guard requirements. Shielded low-pressure sodium vapor lights are highly recommended for all lights on the beach or on offshore equipment.

2. If escarpments occur on the beach after construction, the escarpment will be graded prior to the sea turtle nesting season during any given year in order to permit sea turtle nesting on the beach.

3. Should a hydraulic pipeline dredge be used offshore, the pipeline from the navigation channels to the disposal beach will be submerged until it reaches nearshore waters. The pipeline would be marked to let commercial and recreational boaters know of its presence along the bottom. Work barges and other appurtenances associated with a pipeline dredge operating in open water would be moored so as to minimize interference with boat traffic in the area.

4. Surveys of the project area for seabeach amaranth will be conducted prior to any disposal operation (construction) from 1 July to September 30.

5. There will be some loss of dune vegetation where the pipeline crosses the dune to the beach. Plants growing adjacent to the seaward side of the dunes will be buried by the discharge of dredged material. Dune vegetation disturbed by the pipeline crossing to the beach will be restored to pre-project grade and replanted following project completion. Planting stocks shall consist of sea oats and American beachgrass. The vegetative cover shall extend from the landward to the seaward toe of the dune. American beachgrass will be the predominant plant with sea oats as a supplemental plant. Planting would be accomplished during the season best suited for the particular plant.

6. Within Morehead City Harbor, some of the navigational channels are closed to shellfish harvesting. By Memorandum dated January 31, 2002, from the North Carolina Department of Environment and Natural Resources, Division of Environmental Health, Shellfish Sanitation and Recreational Water Quality Section (see Attachment B), if maintenance material is excavated from these closed shellfishing areas between May 1

and October 31 and placed on Bogue Banks a swimming advisory will be posted and a press release made. The Wilmington District will notify the Shellfish Sanitation and Recreational Water Quality Section prior to dredging from a closed shellfishing area with placement on a recreational swimming area.

## 7.00 PUBLIC AND AGENCY COORDINATION

### 7.01 Scoping

On January 15, 2002, a scoping letter was sent to agencies, interest groups, and the public to request identification of significant resources and issues of concern (see Attachment B). The purpose of the scoping letter was to solicit comments from various private, local, state, and federal agencies on this proposal to ensure that the development of a recommended plan considers the concerns of other agencies and the public. In response to the scoping letter, the public and review agencies expressed the following major concerns: fishery resources and habitats, rare butterfly habitat, short- and long-term impacts of the proposed activity, endangered/threatened species, cultural resources, sediment contamination, and other natural resources. All concerns were considered and have been addressed in the recommended plan.

Letters were received or individuals were contacted from the agencies listed below.

US Fish and Wildlife Service
National Marine Fisheries Service
USDA, Natural Resources Conservation Service
North Carolina Department of Administration
North Carolina Department of Environment and Natural Resources
  Division of Parks and Recreation
  Division of Water Quality
  Division of Marine Fisheries
  Division of Environment Health
  Division of Coastal Management
Mr. T. B. Doe, III

### 7.02 Coordination of this Document

This EA is being provided to a standard list of federal, state, and local agencies; elected officials; environmental groups; and known interested individuals for review and comment. After a 30-day review period, all input received will be considered in planned preparation of the Finding of No Significant Impact (FONSI).

We invite your comments and suggestions regarding the proposed action. In accordance with Council on Environmental Quality regulations (40 CFR 1500-1508) for implementing the National Environmental Policy Act (NEPA), your comments should be as specific as possible and should be made with recognition that NEPA documents must focus on the issues that are truly significant to the proposed action rather than amassing needless detail. The NEPA process is intended to help public officials make decisions based upon an understanding of environmental consequences. The NEPA process directs that federal activities be conducted so as to attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences. As individual resources and stakeholder interests increasingly compete for priority, public officials are challenged to make management decisions that reflect a balance of the overall public interest. Please respond with a focus on essential issues that will be useful in guiding our decisions and actions as the proposed action proceeds.

### 7.03 Recipients of this Assessment

#### Representatives

Honorable Walter B. Jones, Jr.
Honorable Elizabeth Dole
Honorable John Edwards
Honorable Patrick J. Ballantine
Honorable Charles E. Johnson

#### Federal Agencies

U.S. Environmental Protection Agency, Office of Federal Activities
U.S. Environmental Protection Agency, Region IV
Forest Service, USDA
HUD, Atlanta Regional Office
Executive Director, Advisory Council on Historic Preservation
Environmental Conservation Office, Department of Commerce, NOAA
Center of Disease Control
Beaufort Marine Fisheries Center, National Marine Fisheries Service
Director, Office of Environmental Policy & Compliance, DOI
Raleigh Field Office, U.S. Fish and Wildlife Service
Commander, Fifth Coast Guard District
Federal Highway Administration
Office of the Solicitor, Energy and Resources, U.S. Department of the Interior
Director, Office of Environmental Compliance, Department of Energy
Superintendent, Cape Lookout National Seashore
Regional Director, National Park Service
Seymour Johnson AFB

## State Agencies

North Carolina State Clearinghouse
North Carolina Division of Coastal Management
CAMA Officer, Donna Turner, Town of Atlantic Beach
CAMA Officer, Chris Jones, Town of Pine Knoll Shores

## Local Government

CAMA Officer, Donna Turner, Town of Atlantic Beach
CAMA Officer, Chris Jones, Town of Pine Knoll Shores
Carteret County Board of Commissioners
Mayor, Town of Atlantic Beach
Mayor, Town of Pine Knoll Shores
Mayor, Town of Indian Beach
Carteret County Register of Deeds
Town Manager, Atlantic Beach
Town Manager, Pine Knoll Shores
Town Manager, Indian Beach
Carteret County Building Inspections, Larry Smith (Courthouse Square Beaufort)

## Independent Groups and Individuals

Conservation Council of North Carolina
Cape Fear Group Sierra Club
Sierra Club Legal Defense Fund
Defenders of Wildlife
National Parks and Conservation Association
National Audubon Society, Southeastern Regional Office
North Carolina Wildlife Commission
National Wildlife Federation
North Carolina Environmental Defense Fund
North Carolina Coastal Federation
North Carolina Fisheries Association
National Wildlife Refuge Association
Wilderness Society
Dr. Vince Bellis
Mr. Ray P. Brandi, Cape Fear Community College
Dr. Robert Dolan, University of Virginia, Charlottesville
Dr. Bill Cleary, University of North Carolina at Wilmington.
Dr. Mark Posey, University of North Carolina at Wilmington
Dr. Orrin Pilkey, Duke University

**Postmasters**

Atlantic Beach
Pine Knoll Shores
Indian Beach
Salter Path
Morehead City

**Newspapers**

Carteret County News-Times

**Libraries**

N.C. Collection, Wilson Library, UNC-Chapel Hill
N.C. Dept. of Environment, Health, and Natural Resources Library
Randall Library, UNC-Wilmington
State Library of North Carolina
Joyner Library, East Carolina University

## 8.0 POINT OF CONTACT

Written comments regarding this Environmental Assessment should be sent to Mr. Hugh Heine, CESAW-TS-PE, U.S. Army Engineer District, P.O. Box 1890, Wilmington, North Carolina 28402-1890. Questions may be directed to Mr. Heine by telephone (910) 251-4070 or e-mail address hugh.heine@usace.army.mil.

## 9.0 DRAFT FINDING OF NO SIGNIFICANT IMPACT

The proposed action is not expected to significantly affect the quality of the human environment. If this judgment is confirmed through coordination of this EA, an Environmental Impact Statement will not be required, and a Finding of No Significant Impact (FONSI) will be signed prior to the initiation of the proposed action. The signed FONSI will be available to the public.

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## ATTACHMENT A

## ENVIRONMENTAL ASSESSMENT
## MOREHEAD CITY HARBOR SECTION 933
## CARTERET COUNTY, NORTH CAROLINA
## EVALUATION OF SECTION 404(b)(1)
## (PUBLIC LAW 95-217) GUIDELINES
## 40 CFR 230

An evaluation of the placement of dredge and/or fill material into waters of the United States includes the standard form.

# MOREHEAD CITY HARBOR SECTION 933
# CARTERET COUNTY, NORTH CAROLINA

## Preliminary Evaluation of Section 404 (b) (1) Guidelines 40 CFR 230

**This evaluation covers the placement of all fill material into waters and wetlands of the United States required for construction of the Morehead City Harbor Section 933, Carteret County, North Carolina.**

**Section 404 Public Notice No. CESAW-TS-PE-03-16-0002**

| | | Preliminary 1/ | Final 2/ |
|---|---|---|---|
| 1. | Review of Compliance (230.10(a)-(d)) A review of the NEPA Document indicates that: | | |
| a. | The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose (if no, see section 2 and NEPA document); | YES ☐ NO☐ | YES☒ NO☐ |
| b. | The activity does not: 1) violate applicable State water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of federally listed endangered or threatened species or their habitat; and 3) violate requirements of any federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies); | YES☐ NO☐* | YES☒ NO☐ |
| c. | The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values (if no, see section 2); | YES☐ NO☐ | YES☒ NO☐ |
| d | Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see section 5). | YES☐ NO☐* | YES☒ NO☐ |

Proceed to Section 2

*, 1, 2/ See page 6.

2. Technical Evaluation Factors (Subparts C-F)

a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)

| Factor | **N/A** | **Not Significant** | **Significant** |
|---|---|---|---|
| (1) Substrate impacts. | | X | |
| (2) Suspended particulates/turbidity impacts | | X | |
| (3) Water column impacts. | | X | |
| (4) Alteration of current patterns and water circulation. | | X | |
| (5) Alteration of normal water fluctuations/hydroperiod. | | X | |
| (6) Alteration of salinity gradients. | NA | X | |

b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)

| Factor | **N/A** | **Not Significant** | **Significant** |
|---|---|---|---|
| (1) Effect on threatened/endangered species and their habitat. | | X | |
| (2) Effect on the aquatic food web. | | X | |
| (3) Effect on other wildlife (mammals birds, reptiles, and amphibians). | | X | |

c Special Aquatic Sites (Subpart E)

| Factor | **N/A** | **Not Significant** | **Significant** |
|---|---|---|---|
| (1) Sanctuaries and refuges. | NA | | |
| (2) Wetlands. | NA | | |
| (3) Mud flats. | NA | | |
| (4) Vegetated shallows. | NA | | |
| (5) Coral reefs. | NA | | |
| (6) Riffle and pool complexes. | NA | | |

d. Human Use Characteristics (Subpart F)

| Factor | **N/A** | **Not Significant** | **Significant** |
|---|---|---|---|
| (1) Effects on municipal and private water supplies. | NA | | |
| (2) Recreational and commercial fisheries impacts | | X | |
| (3) Effects on water-related recreation. | | X | |
| (4) Aesthetic impacts. | | X | |
| (5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves. | | X | |

Remarks: Where a check is placed under the significant category, preparer add explanation below.

Proceed to Section 3

*See page 6.

3. <u>Evaluation of Dredged or Fill Material (Subpart G) 3/</u>

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

| | |
|---|---|
| (1) Physical characteristics | ☒ |
| (2) Hydrography in relation to known or anticipated sources of contaminants | ☒ |
| (3) Results from previous testing of the material or similar material in the vicinity of the project | ☒ |
| (4) Known, significant sources of persistent pesticides from land runoff or percolation | ☐ |
| (5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances | ☐ |
| (6) Other public records of significant introduction of contaminants from industries, municipalities, or other sources | ☐ |
| (7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities | ☐ |
| (8) Other sources (specify). | ☐ |

List appropriate references.

Reference: <u>Environmental Assessment, Morehead City Harbor Section 933, Carteret County, North Carolina</u>, dated February 2003.

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to result in degradation of the disposal site.** YES ☒ NO☐ *

<u>Proceed to Section 4</u>

*, <u>3</u>/, see page 6.

4. Disposal Site Determinations (230.11(f)).

a. The following factors as appropriate, have been considered in evaluating the disposal site.

(1) Depth of water at disposal site. ☒

(2) Current velocity, direction, and variability at disposal site ☒

(3) Degree of turbulence. ☒

(4) Water column stratification ☒

(5) Discharge vessel speed and direction ☒

(6) Rate of discharge ☒

(7) Dredged material characteristics (constituents, amount and type of material, settling velocities). ☒

(8) Number of discharges per unit of time. ☒

(9) Other factors affecting rates and patterns of mixing (specify)

List appropriate references.

Reference: .Environmental Assessment, Morehead City Harbor Section 933, Carteret Count, NC.

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable. YES ☒ NO ☐*

5. Actions to Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77, to ensure minimal adverse effects of the proposed discharge. List actions taken. YES ☒ NO ☐*

See EA.

Return to section 1 for final stage of compliance review. See also note 3/, page 3.
*See page 6.

6. Factual Determinations (230.11).

A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:

| | | |
|---|---|---|
| a. Physical substrate at the disposal site (review sections 2a, 3, 4, and 5). | YES ☒ | NO ☐* |
| b. Water circulation, fluctuation, and salinity (review sections 2a, 3, 4, and 5). | YES ☒ | NO ☐* |
| c. Suspended particulates/turbidity (review sections 2a, 3, 4, and 5). | YES ☒ | NO ☐* |
| d Contaminant availability (review sections 2a, 3, and 4). | YES ☒ | NO ☐* |
| e. Aquatic ecosystem structure and function (review sections 2b and c, 3, and 5). | YES ☒ | NO ☐* |
| f. Disposal site (review sections 2, 4, and 5). | YES ☒ | NO ☐* |
| g. Cumulative impact on the aquatic ecosystem. | YES ☒ | NO ☐* |
| h. Secondary impacts on the aquatic ecosystem. | YES ☒ | NO ☐* |

7. Findings.

a. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines. . . . . . . . . . . . . . . . . . . . . . . . . . . ☒

b. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines with the inclusion of the following conditions:. . . . . . . . . . . . . . . . . . . . . . . . ☐

c. The proposed disposal site for discharge of dredged or fill material does not comply with the Section 404(b)(1) guidelines for the following reasons(s):

(1) There is a less damaging practicable alternative . . . . . . . . . . . . . . ☐

(2) The proposed discharge will result in significant degradation of the aquatic ecosystem . . . . . . . . . . . . . . . . . . . . ☐

*See page 6.

(3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem. . . . . . . . . . . . . . . . . . . ☐

8.

__________________________
Charles R. Alexander, Jr.
Colonel, U.S. Army
District Engineer

Date: ____________________

*A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

1/ Negative responses to three or more of the compliance criteria at this stage indicate that the proposed projects may not be evaluated using this "short form procedure." Care should be used in assessing pertinent portions of the technical information of items 2 a-d, before completing the final review of compliance.

2/ Negative response to one of the compliance criteria at this stage indicates that the proposed project does not comply with the guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form evaluation process is inappropriate."

3/ If the dredged or fill material cannot be excluded from individual testing, the "short-form" evaluation process is inappropriate.

# ATTACHMENT B
# ENVIRONMENTAL ASSESSMENT
# MOREHEAD CITY HARBOR SECTION 933
# CARTERET COUNTY, NORTH CAROLINA

## CORRESPONDENCE

United States Department of Agriculture
Natural Resources Conservation Service

4405 Bland Road, Suite 205, Raleigh, NC 27609
Phone No.: (919) 873-2134
Fax No.: (919) 873-2154

January 23, 2002

Mr. Hugh Heine
Environmental Resources Section
Dept of the Army
Wilmington District, COE
P. O. Box 1890
Wilmington, NC 28402-1890

Dear Mr. Heine:

Thank you for the opportunity to provide comments on Morehead City Harbor on Bogue Banks. Section 933, Carteret, County, North Carolina.

The Natural Resources Conservation Service does not have any comments at this time.

Sincerely,

Mary K. Combs
State Conservationist

Heine, Hugh SAW

| | |
|---|---|
| From: | T. B. Doe, III [Tom@TomDoe.com] |
| Sent: | Thursday, January 24, 2002 3:29 AM |
| To: | Hugh.Heine@USACE.Army.mil |
| Cc: | Town of Atlantic Beach Mayor & Commissioners |
| Subject: | Comments on 1/15/02 Letter from Thomas G. Corder, P. E. |

Re: Mr. Corder's letter detailing the upcoming transfer of spoils from Brandt Island to Bogue Banks.

As you know, this letter directs that comments be addressed to you. As an interested and involved citizen of Atlantic Beach, I requested and received a copy of his package from the Town. Following are a couple of comments on wording and facts.

1. The last sentence starting on the bottom of page one of Mr. Corder's letter suggests that the placement of spoils on the Beach "may reduce the erosion". The only way to reduce the erosion is through timely erosion control strategies and the elimination of man's actions which cause the erosion. Placement of sand on the Beach will replace sand lost through erosion not reduce the erosion. The erosion will continue as long as God's and Man's actions cause it.

2. There is a significant error on the map included with the letter. I've attached a scan of your map showing the error in red. One of the reasons I know the project ended at the point I've indicated in red is that on May 3, 1986, I attended an end of project celebration at the home where the dredge pipe and pumping ended. Check with your man, Howard Varnam, I believe he was also in attendance.

3. My final item is more of a comment and question. For a variety of reasons, which I'd be happy to discuss, I'm skeptical of the 3,182,400 figure for the number of yards placed on Atlantic Beach in 1993-94. If I had to guess I'd say in the area of 2,600,000. I suspect the difference went to the Park. Is your 3.1 million number based on before/after surveys or reported pumped yards?

Contact me back with any answers or questions.

Thanks,

[T. B. Doe, III]
T. B. Doe, III
Post Office Box 1229
Atlantic Beach, North Carolina 28512
252-726-8952
FAX: 603-710-0574 Tom@TomDoe.com

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Parks and Recreation

Michael F. Easley, Governor
William G. Ross, Jr., Secretary
Dr. Philip K. McKnelly, Director

February 4, 2002

Mr. Hugh Heine
Environmental Resources Section
Wilmington District, Corps of Engineers
PO Box 1890
Wilmington, NC 28402-1890

Dear Mr. Heine:

I am writing concerning the proposed Section 933 Project that would place material on beaches from Fort Macon State Park to Indian Beach. While Fort Macon does fall into the base bid, there are other factors that I would like you to consider when deciding the amount of material to be placed at the different locations.

Fort Macon's shoreline continues to have an accelerated rate of erosion. The Morehead City Harbor Section III Study indicates that the area located within 2.8 miles west of Beaufort Inlet has had a greater erosion than other areas along Bogue Banks. Fort Macon State Park fa11s within this 2.8 mile section. Since the last placement of materials (1994) on Fort Macon we have suffered severe erosion along our beach front. This erosion has affected the park in several ways:

1) We have lost nesting areas for birds
2) Sea Turtles have less beach to nest on
3) Attendance for the park during the summer months (June, July, August) is down over 100,000 visitors when you compare 2001 to 1994.

As the largest tourist attraction in Carteret County (1,261,986 visitors) we hope to be able to maintain a beach that our many patrons will be able to enjoy.

I hope you will consider placing the same amount of material in the next maintenance project as you did in 1994. If you have any questions, please feel free to contact me at 252-726-3775.

Sincerely,

Jody Merritt, Park Superintendent
PO Box 127
Atlantic Beach, NC 28512

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

February 13, 2002

Colonel James W. DeLony
District Engineer, Wilmington District U.S. Army Corps of Engineers
Post Office Box 1890
Wilmington, North Carolina 28402-1890

Attn: Hugh Heine, Environmental Resources Section

Dear Colonel DeLony:

The U.S. Fish and Wildlife Service (Service) has reviewed the request for scoping comments for a proposal to expand the beachfront dredge disposal area for maintenance dredging of the Morehead City Harbor navigation project. The U.S. Army Corps of Engineers (Corps) proposes to lengthen the authorized beach disposal area from 7 miles to 13 miles. Fort Macon, Atlantic Beach and Pine Knoll Shores are currently authorized to receive beach disposal, and this proposed action would add 6 miles of western Pine Knoll Shores and Indian Beach under Section 933 of the Water Resources Development Act of 1986 (Public Law 99-662). These comments are provided by the Service pursuant to, and in accordance with, provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Dredged material from the Morehead City Harbor and navigational channel is currently pumped to Brandt Island, a dredge disposal island in Bogue Sound near Atlantic Beach. This material is then periodically pumped to the beaches of Fort Macon, Atlantic Beach and part of Pine Knoll Shores. Several scientific studies have been conducted on the environmental impacts of these activities (e.g., Reilly and Bellis 1978, Reed and Wells 2000, Peterson et al. 2000).

The Towns of Pine Knoll Shores and Indian Beach are currently constructing an artificial beach project that involves mining sediment and shell material from the base of the shoreface and placing it on 7.2 miles of beach. The Section 933 dredge disposal expansion would cover the same beaches. The local project is not ecologically compatible with the native beach, and as a result the without project condition for the Section 933 project is degraded (Figures 1 and 2) and differs from previous data collected by the Corps for federal projects in this area. Therefore the Service recommends that the Corps thoroughly evaluate the without project conditions of the beaches in the proposed project area. The Environmental Assessment (EA) or Environmental Impact Statement (EIS) under preparation can then evaluate whether the dredge disposal of Brandt Island sediments would have a beneficial impact on the beach ecosystem by diluting the incompatible sediment currently being placed on the beach. Previous studies have determined that the beach ecosystem can be restored within months when ecologically compatible material is used as beach fill, while incompatible sediments may create a recovery time of years.

Shortening the recovery time of the local project could be considered an environmental benefit of the Section 933 project.

In the long-term, the frequency of dredge disposal on the beaches in Pine Knoll Shores and Indian Beach will be the key factor in evaluating the significance of the impacts of the Section 933 project. The environmental documentation should provide detailed technical assessments of the volumes pumped to Brandt Island on an annual basis and the timeframes to economically reach the volumes necessary to pump the material to the 13 miles of beaches. Existing sediment analyses of the dredged material should also be incorporated for comparison to the local project's and native sediment characteristics. A cumulative impacts assessment of the existing dredge disposal, local beach fill project, and extensive beach scraping (bulldozing) on the project area beaches should be included as well.

Finally, the environmental documentation should include a summary discussion of the results from the monitoring studies conducted on the nearshore disposal site previously used for dredge material from the navigation project. It is the Service's understanding that this material was not effectively transported to the beaches, but we are not aware of summary studies available to document this finding.

The project area contains nesting habitat for federally-listed sea turtles, potential foraging habitat for the threatened piping plover *(Charadrius melodus),* and habitat for the threatened seabeach amaranth *(Amaranthus pumilus).* A biological assessment should be prepared and submitted to the Service along with your determination on the effects of the proposed action on federally-listed species. Migratory shorebirds and colonial waterbirds use the project area beaches and potentially Brandt Island as foraging, loafing and nesting habitat. Many of these species are declining nationally and have been given priority status under several national and regional management plans. Brandt Island is also under study as habitat for a rare skipper that may be a new species. If the project proposes to disturb Brandt Island on a higher frequency, the Corps should evaluate the impact those actions will have on migratory birds and the unnamed skipper.

We appreciate the opportunity to comment on this proposal. Please contact Tracy Rice, of my staff, at (919) 856-4520, extension 12, if you have any questions or comments.

Sincerely,

Garland B. Pardue, Ph.D.
Ecological Services Supervisor

References

Peterson, C.H., D. H. M. Hickerson, and G. G. Johnson.  2000.  Short-term consequences of nourishment and bulldozing on the dominant large invertebrates of a sandy beach. *Journal of Coastal Research.* 16(2):368-378.

Reed, A.J., and J. T. Wells. 2000. Sediment distribution patters offshore of a renourished beach: Atlantic Beach and Fort Macon, North Carolina. *Journal of Coastal Research.* 16(1):88-98.

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. East Carolina University Institute for Coastal and Marine Resources, Technical Report No. 4., Greenville, North Carolina. 107 pp.

cc:
Gerald Miller, EPA (Atlanta)
Ron Sechler, NMFS (Beaufort)
Caroline Bellis, NC DCM (Raleigh)
Dave Allen, NC WRC (Trenton)
William Wescott, NC WRC (Washington)
Mike Street, NC DMF (Morehead City)
Joanne Steenhuis, NC DWQ (Wilmington)

FWS/R4:TMRice:TMR:2/13/02:919/856-4529 extension 12:\Rev. Sec 933Scoping.wpd

Figure 1. The local artificial beach construction project is placing ecologically incompatible material on the beach in Pine Knoll Shores near mile marker 5, as shown here in a 14" scarp of highly shelly, dark gray material. The scarp is resistant to mass wasting, incoming swash erosion and aeolian sediment transport. The native beige sand can be seen in the distance at the top of the photo. Photo taken February 8, 2002, by the U.S. Fish and Wildlife Service.

Figure 2. The local artificial beach construction project is placing ecologically incompatible material on the beach in Pine Knoll Shores near mile marker 6. Resorting of the beach fill by wave action has concentrated the shell material in large patches. The shells contain a high percentage of broken oyster and clam shells with sharp, immature (not smoothed by waves) edges. Photo taken February 8, 2002, by the U.S. Fish and Wildlife Service.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat Conservation Division
9721 Executive Center Drive North
St. Petersburg, Florida 33702

February 25, 2002

Mr. Thomas G. Corder, P. E.
Chief, Planning and Environmental Branch
Department of the Army, Corps of Engineers
P. O. Box 1890
Wilmington, North Carolina 28402-1890

Attention. Mr. Hugh Hiene

Dear Mr. Corder:

This responds to your January 15, 2002, letter requesting National Marine Fisheries Service (NMFS) comments on initiation of studies for the placement of dredged material taken from Morehead City Harbor on Bogue Banks beaches in Carteret County, North Carolina. The proposed work would be authorized under Section 933 of the Water Resources Development Act of 1986 (Public Law 99662), as amended.

Beach quality sand dredged from the upland disposal site on Brandt Island and maintenance material dredged from the Morehead City inner harbor is currently authorized for placement on Bogue Banks beaches from Fort Macon State Park to Pine Knoll Shores, a distance of about seven miles. The proposed Section 933 project would expand the sand borrow area to include any channel involved with the Morehead City Navigation Project. In addition, the disposal area on Bogue Banks would be extended from Pine Knoll Shores to Indian Beach, a distance of approximately six miles. Potentially, as much as seven million cubic yards of beach quality sand could be placed on 13 miles of beach at Bogue Banks. This is in addition to the ongoing beach nourishment project that was recently undertaken by Carteret County.

The nearshore placement site for the dredged material has been identified as Essential *fish Habitat (EFH) for adult red drum which occur in the water column and surf zone, and for larval and adult brown shrimp and white shrimp which occur on marine bottoms. These fishery resources and associated EFH are discussed in detail in' documents prepared by the South Atlantic Fishery Management Council (SAFMC). Species under jurisdiction of the Mid-Atlantic Fishery Management Council (MAFMC) also occur in the project area. These species and their associated EFH include larvae, juvenile, and adult summer flounder, which occur on marine bottoms and in the water column and surf zone, and juvenile and adult bluefish which occur in the water column and surf zone.

The nearshore and surf zone that would receive the dredged material also provides habitat for other commercially, recreationally, and ecologically important species including Florida pompano, southern kingfish, Atlantic croaker, spot, Atlantic menhaden, and striped mullet. Several of these species serve as prey for king mackerel, Spanish mackerel, and cobia, species that are managed by the SAFMC, and for highly migratory species (e.g., billfishes and sharks) that are managed by the NMFS. Detailed information on Federally managed fisheries and their EFH is provided in the 1998 amendments to the Fishery Management Plans for the South and Mid-Atlantic Regions and prepared by the SAFMC and the MAFMC, respectively. The amendments were prepared as required in accordance with the Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA) (P.L. 104-297).

The NMFS supports the beneficial use of dredged material when it can be accomplished without causing significant harm to living marine resources. Although previously authorized, the proposed dredging causes temporary disturbance to exiting bottoms and the water column. Of greatest concern, however, is the discharge of dredged material on approximately 13 miles of ocean beach. If the sediments placed there are not compatible with existing beach material, species such as mole crab and coquina clam, surf zone species that are important components in the aquatic food chain, could be adversely impacted through loss of habitat that supports feeding, cover, and other requisite needs. Although the recovery time associated with this disruption is estimated at between one and three years, repeated beach nourishment, or beach nourishment with incompatible sand, could result in long-term population reductions of these important food sources. In this regard, we refer you to issues raised in connection with the ongoing Carteret County beach nourishment project at Pine Knoll Shore and Indian Beach on Bogue Banks.

Sufficient information and data are not available to establish conclusions regarding the cumulative impacts of long-term disposal of dredged material on larvae and juvenile fish and invertebrates found in the surf zone. It is possible, however, that species such as red drum, summer flounder, and bluefish could be adversely impacted due to loss of food species and as a result of physical and physiological harm and behavioral modification associated with elevated turbidity and modification of bottom substrates.

Based on the preceding and in accordance with the EFH consultation requirement of the MSFCMA and the September 6, 2000, Findings agreement between our respective agencies, we recommend that an EFH Assessment be included in the Environmental Assessment. We further note that the Wilmington District is conducting environmental monitoring of work that is underway at Brunswick County beaches and that the Dare County Beaches Project will also be monitored. This monitoring will provide substantial information regarding the effects of beach nourishment on fishery resources. Consequently, it may be prudent to delay decision making on implementation of the proposed Section 933 project until the results of ongoing and planned studies are available and can be used in connection with the subject project.

Finally, in accordance with the Endangered Species Act of 1973, as amended, it is the responsibility of the appropriate Federal agency to review its activities and programs and identify any activity or program that may adversely affect endangered or threatened species and their habitat. Determinations involving species under NMFS jurisdiction should be reported to our Protected Resources Division at the letterhead address. If it is determined that the activities may adversely affect any species listed as endangered or threatened and under NMFS purview, then formal consultation must be initiated.

Please direct related comments or questions to the attention of Mr. Ron Sechler at our Beaufort Facility. He can be reached at 101 Pivers Island Road, Beaufort, North Carolina 28516-9722, or at (252) 728-5090.

Sincerely,

Andreas Mager, Jr.
Assistant Regional Administrator
Habitat Conservation Division

cc: FWS, Raleigh, NC
EPA, Athens, GA
NCDENR, Raleigh, NC
SAFMC, Charleston, SC

North Carolina
Department of Administration

Michael F. Easley, Governor
Gwynn T. Swinson, Secretary

March 6, 2002

Mr. Hugh Heine
Dept. of the Army/Corps of Engineers
P.O. Box 1890
Wilmington, NC 28402-1890

Dear Mr. Heine:

Re: SCH File # 02-E-0000-0342; Scoping Proposed Placement of Dredged Maintenance Material Taken from Morehead City Harbor on Bogue Banks Beaches in Carteret County

The above referenced project has been reviewed through the State Clearinghouse Intergovernmental Review Process. Attached to this letter are comments made by agencies reviewing this document.

Should you have any questions, please do not hesitate to call me at (919) 807-2425.

Sincerely,

Ms. Chrys Baggett
Environmental Policy Act Coordinator

Attachments

cc: Region P

NCDENR

North Carolina Department of Environment and Natural Resources

Michael F. Easley, Governor William G. Ross Jr., Secretary

MEMORANDUM

TO: Chrys Baggett State Clearinghouse

FROM: Melba McGee
Project Review Coordinator

RE: 02-0342 Scoping Morehead City Harbor Dredging Beach Disposal on Bogue Banks, Carteret County

DATE: March 4, 2002

The Department of Environment and Natural Resources has reviewed the proposed project. The attached comments are a result of this review. More specific comments will be provided during the environmental review process.

Thank you for the opportunity to respond. If during the preparation of the environmental document, additional information is needed, the applicant is encouraged to notify our respective divisions.

Attachments

NCDENR

North Carolina Department of Environment and Natural Resources
Division of Parks and Recreation

Michael F. Easley, Governor
William G. Ross, Jr., Secretary
Dr. Philip K. McKnelly, Director

February 21, 2002

MEMORANDUM

TO: Melba McGee

FROM: Stephen Hall

SUBJECT: Scoping - Morehead City Harbor Dredging Beach Disposal on Bogue Banks

REFERENCE: 02E-0342

The Natural Heritage Program is currently conducting a status survey under contract with the US Fish and Wildlife Service of a rare butterfly that is known only from Bogue Banks and adjoining islands. This species, *Atrytonopsis* new species 1, is associated with the Dune Grass natural community and its larvae are believed to feed solely on seaside little bluestem *(Schizachryium littorale*), a common to dominant member of that. community. Most of the known populations occur in naturally vegetated dune fields located behind the primary beaches along the ocean. Populations are also known from dredge spoil islands that support seaside little bluestem, including Brandt Island and Radio Island.

Both the butterfly and seaside little bluestem may be vulnerable to the effects of salt spray and overwash. The proposed project may therefore provide some protection where deposition of spoil along the Bogue Bank beaches reduces these types of impacts to areas still possessing secondary dunes, such as Fort Macon State Park. There will be virtually no benefit, however, where houses have been built all the way up to the primary dunes. Ideally, we would like to see this project coupled with incentives to preserve remaining undeveloped tracts of secondary dunes or to encourage property owners to move their houses well-back from the primary dunes.

Use of currently operated dredge spoil deposition areas should cause little, if any, harm to the butterfly. However, expansion of dredge storage and removal operations could cause impacts where dune grass vegetation has been allowed to develop. We would be particularly concerned about any expansion of the current deposition basin on Brandt Island eastward of its current limits, since a large population of the butterfly has been documented in that area. Any renewal of activity on disused dredge islands, including several in the mouth of the Newport River, should be preceded by a search for the butterfly and an evaluation of the potential impacts.

State of North Carolina
Department of Environment
and Natural Resources
Division of Marine Fisheries

Michael F. Easley, Governor
William G. Ross, Jr., Secretary
Preston P. Pate, Jr., Director

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES

MEMORANDUM

TO: Melba McGee, Environmental Coordinator
Office of Legislative and Intergovernmental Affairs

FROM: Mike Street

DATE: February 19, 2002

SUBJECT: Morehead City Harbor Dredging Beach Disposal on Bogue Banks Carteret County

Attached is the Division's reply for the above referenced project. If you have any questions, please do not hesitate to contact me.

MS/sw

Memorandum

To: Caroline Bellis and Melba McGee

From: James Patrick Monaghan, Jr.

Date: February 19, 2002

Subject: Morehead City Harbor Dredging Beach Disposal on Bogue Banks

The Division of Marine Fisheries looks forward to commenting on this project. We have the some of the same concerns for this beach nourishment project as we have for the present project initiated by Carteret County.

1. An adequate plan will need to be developed to monitor potential impacts to the fish and benthos in the areas to be nourished. This probably can be coordinated with the Carteret County monitoring plan.

2. Due to the probability of cumulative impacts we request that an EIS be prepared.

3. We recommend a "pumping window" of November 15 to April 15 to reduce impacts to marine resources and traditional fishing activities.

4. The EIS should also include QA/QC measures designed to assure compatible particle size of pumped material with "natural" beach material.

Thank you for the opportunity to comment of this proposed project.

State of North Carolina Reviewing Officer: Wilmington
NCDENR Department of Environment and Natural Resources Project Number:02e-0342 Due Date: 2/11/02

INTERGOVERNMENTAL REVIEW - PROJECT COMMENTS

After review of this project it has been determined that the DENR permit(s) and/or approvals indicated may need to be obtained in order for this project to comply with North Carolina Law. Questions regarding these permits should be addressed to the Regional Office indicated on the reverse of this form. All applications, information and guidelines relative to these plans and permits are available from the same Regional Office.

| | PERMITS | SPECIAL APPLICATION PROCEDURES or | Normal Process (Statutory Time |
|---|---|---|---|
| | Permit to construct & operate facilities, sewer system extensions & not discharging into state surface | Application 90 days before begin construction or contracts. On-site inspection. Post-application | 30 days (90 days) |
| 0 | NPDES-permit to discharge into permit to operate and construct discharging into state surface - | Application 180 days before begin activity. On-site conference usual. Additionally, obtain permit to facility-granted after NPDES. Reply time, 30 days of NPDES permit-whichever is later. - - - - | 90 -120 days (N/A) - - |
| 0 | Water Use Permit | Preapplication technical conference usually | 30 days (N/A) |
| | Well Construction Permit | Complete application must be received and permit installation of a well. | 7 days (15 days) |
| | Dredge and Fill Permit | Application copy must be served on each adjacent On-site inspection. Preapplication conference usual. to Fill from N.C. Department of Administration and | 55 days (90 days) |
| | Permit to construct & operate Air facilities and/or Emission Sources as (2Q.0100, 2Q.0300, 2H.0600) | N/A | 60 days |
| | Any open burning associated with must be in compliance with 15 A | N/A | 60 days (90 days) |
| 0 | Demolition or renovations of asbestos material must be in 15 A NCAC 2D.1110 (a) (1) which and removal prior to demolition. Control Group 919-733-0820. | | |
| | Complex Source Permit required 2D.0800 | | |
| x | The Sedimentation Pollution Control Act of 1973 must be properly addressed for any land control plan will be required if one or more acres to be disturbed. Plan filed with proper days before beginning activity. A fee of $40 for the first acre or any part of an acre. | | 20 days (30 days) |
| | The Sedimentation Pollution Control Act of 1973 must be addressed with respect to the referenced Local Ordinance | | 30 days |
| | Mining Permit | On-site inspection usual. Surety bond filed with type mine and number of acres of affected land. Any one acre must be permitted. The appropriate bond the permit can be issued. | 30 days (60 days) |
| | North Carolina Burning permit | On-site inspection by N.C. Division of Forest | 1 day (N/A) |
| O | Special Ground Clearance Burning in coastal N.C., with organic soils, | On-site inspection by N.C. Division of Forest acres of ground clearing activities are involved. at least ten days before actual burn is planned.' | 1 day (N/A) |
| 0 | Oil Refining Facilities | N/A | 90-120 days (N/A) |
| | Dam Safety Permit | If permit required, application 60 days before begin must hire N.C. qualified engineerto: prepare plans, construction is according to DENR approved plans, mosquito control program, and a 404 permit from An inspection of site is necessary to verify Hazard fee of $200.00 must accompany the application. An | 30 days (60 days) |

| | | | |
|---|---|---|---|
| | | based on a percentage or the total project cost will be required upon completion. | |

| | PERMITS | SPECIAL APPLICATION PROCEDURES or | Normal.Rroces (Statutory time |
|---|---|---|---|
| | Permit to drill exploratory oil or gas<br>' | File surety bond of $5,000 with DENR running to State<br>well opened by drill operator shall, upon<br>to DENR rules and regulations. ° | 10 days<br>(N/A) |
| | Geophysical Exploration Permit<br>. | Application filed with DENR at least 10 days prior to<br>by letter. No standard application form. | 10 days<br>(N/A) |
| 0 | State Lakes Construction Permit | Application fees based on structure size is charged.<br>& drawings of structure & proof of ownership of | 15- 20 days<br>(N/A) |
| | 401 Water Quality Certification | N/A | 55 days<br>(130 days) |
| O | CAMA Permit for MAJOR | $250.00 fee must accompany application | 60 days<br>(130 days) |
| | CAMA Permit for MINOR | $50.00 fee must accompany application | 22 days<br>(25 days) |
| | Several geodetic monuments are located in or near the project area. If any monument needs to be moved or<br>N.C. Geodetic Survey, Box 27687 Raleigh, N.C.27611 | | |
| | Abandonment of any wells, if required must be in accordance with Title 15A. Subchapter 2C.0100. | | |
| 0 | Notification of the proper regional office is requested if "orphan' underground storage tanks (LISTS) are discovered during any excavation operation. | | |
| o | Compliance with 15A NCAC 2H 1000 (Coastal Stormwater Rules) is required. | | 45 days<br>(N/A) |
| * | Other comments (attach additional pages as necessary, being certain to cite comment authority) | | |

DIVISION OF WATER QUALITY

Michael F. Easley, Governor
William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Gregory J. Thorpe, Ph.D.
Acting Director
Division of Water Quality

February 11, 2002

MEMORANDUM

TO: Melba McGee
Department of Environment and Natural Resources

FROM: J. Todd Kennedy
Division of Water Quality

SUBJECT: Review of Scoping Letter for Morehead Harbor Dredging and Bogue Banks Beach Nourishment, Carteret County, DENR #02E-0342

The Division of Water Quality (Division) has reviewed the referenced document. The U.S. Army Corps of Engineers proposes to place dredged material from Morehead City Harbor onto Bogue Banks beaches. Approximately 13 miles of beaches will be affected. The proposed project would be authorized by Section 933 of the Water Resources Development Act of 1986.

The Division submits the attached continents for consideration. Questions that should be addressed involve the effects of the project on endangered bird and sea turtle nesting, coquina and various crab populations, and juvenile finfish populations. Further, will the dredged material be tested for contaminants such as hydrocarbons and heavy metals?

I may be contacted at (919) 733-5083 ext. 555. Thank you for the opportunity to comment on this project.

Attachment
DWQ# 12995

Michael F. Easley Governor
William G. Ross, Jr., Secretary
Department of Environment and Natural Resources

Kerr T. Stevens
Division of Water Quality

February 7, 2002

MEMORANDUM

To: J. Todd Kennedy

Through: John Dorney

From: Lawrence Eaton

Subject: Scoping letter for Morehead Harbor Bogue Banks renourishment, Carteret County; DWQ # 12995, DENR # 02E-0342

The referenced scoping letter has been reviewed by this office. The Division of Water Quality (DWQ), 401/Wetlands Unit, is responsible for the issuance of the Section 401 Water Quality Certification for activities which impact waters of the state including wetlands. The proposed Morehead Harbor dredging and disposal of fill on Bogue Banks from Fort Fisher to Indian Beach will involve no fill, dredging or excavation in wetlands. As much as 7 million cubic yards of material will be dredged from waters around the NC State Port in Morehead City, surrounding spoil islands, the Beaufort Inlet channel and the Atlantic Intracoastal Waterway.

The scoping letter provides a general outline of the project and it is clear that renourishing the beaches on Bogue Banks would provide important economic benefits to the local economy. As the Corps proceeds with development of the EA for this project, there are a few items that they should address. Do any endangered species of birds nest on any of the islands that will be dredged to provide additional beach grade material? Will timing of the beach renourishment avoid disturbing any nesting sea turtles or their eggs? What procedures will be employed to verify that sediment dredged from the existing NC Port area does not contain elevated levels of hydrocarbons and heavy metals, common contaminants in boat basins. Does the Corps plan to monitor the recovery of Coquina, mole crab and ghost crab populations along the beach renourishment area? Recovery of coquina and mole crab populations tend to be faster if nourished sections of beach are alternated with unnourished sections that provide local larvae to more quickly recolonize nourished areas. Then the unnourished areas can be renourished and the beach fauna will recolonize from the previously nourished areas. Will the significant decline in invertebrate fauna along this 6 mile section of beach cause a large enough reduction in the available food supply to adversely affect the juvenile finfish (including gamefish) populations along this portion of coastline?

DWQ appreciates the opportunity to provide comments. The applicant is reminded that issuance of a 401 Water Quality Certification requires satisfaction of water quality concerns, to ensure that water quality standards are met and no wetland or stream uses are lost. Questions regarding the 401 Certification Program as it relates to this project should be directed to Cyndi Karoly at (919) 733-9721.

Cc: Mickey Sugg, COE, Wilmington
Deborah Sawyer, WaRO
Morehead Harbor/Bogue Banks

DEPARTMENT OF ENVIRONMENT AND
NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH

Project Number 02E-0342

Inter-Agency Project Review Response

Project Name 02e-0342 Type of Project COE Scoping

The applicant should be advised that plans and specifications or all water system improvements must be approved by the Division of Environmental Health prior to the award of a contract or the initiation of construction (as required by 15A NCAC 18C .0300et. seq.). For information, contact the Public Water Supply Section, (919) 733-2321.

This project will be classified as a non-community public water supply and must comply with state and federal drinking water monitoring requirements. For more information the applicant should contact the Public Water Supply Section, (919) 733-2321.

If this project is constructed as proposed, we will recommend closure of feet of adjacent waters to the harvest of shellfish. For information regarding the shellfish sanitation program, the applicant should contact the Shellfish Sanitation Section at (252) 726-6827.

**From the removal of sand the island will provide habitat**. (This statement handwritten in by agency).

The soil disposal area(s) proposed for this project may produce a mosquito breeding problem. For information concerning appropriate mosquito control measures, the applicant should contact the Public Health Pest Management Section at (252) 726-8970.

The applicant should be advised that prior to the removal or demolition of dilapidated structures, a extensive rodent control program may be necessary in order to prevent the migration of the rodents to adjacent areas. For information concerning rodent control, contact the local health department or the Public Health Pest Management Section at (919) 733-6407.

The applicant should be advised to contact the local health department regarding their requirements for septic tank installations (as required under 15A NCAC 18A. 1900 et. sep.). For information concerning septic tank and other on-site waste disposal methods contact the On-Site Wastewater Section at (919) 733-2895.

The applicant should be advised to contact the local health department regarding the sanitary facilities required for this project.

If existing water lines will be relocated during the construction, plans for the waterline relocation must be submitted to the Division of Environmental Health, Public Water Supply Section, Technical Services Branch, 1634 Mail Service Center, Raleigh, North Carolina 27699-1634, (919) 733-2321.

For Regional and Central Office comments, see the reverse side of this form.

NCDENR
NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

State of North Carolina
Department of Environment
and Natural Resources
Division of Environmental Health

James B. Hunt, Jr., Governor
Bill Holman, Secretary
Linda C. Sewall, Director

MEMORANDUM

TO: Jerry Perkins

FROM: Gina Brooks

SUBJECT: 02E-0342, US Army Corps of Engineers, Carteret County

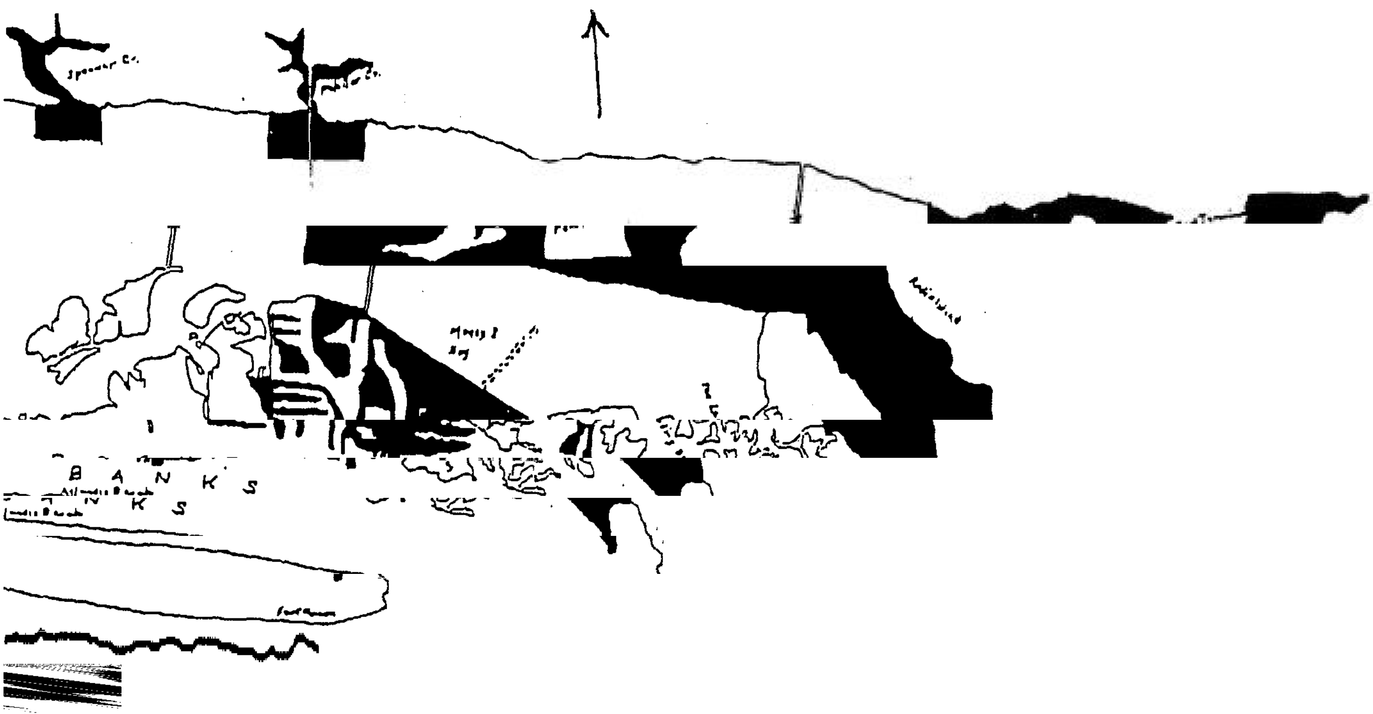
DATE: January 31, 2002

The subject project involves placement of sand on Bogue Banks beaches from two sources: the diked disposal area on Brandt Island and the Morehead City Harbor inner harbor and surrounding areas. The Shellfish Sanitation Section would have no comment regarding placement of dry sand from the Brandt Island disposal area; however, the Morehead City Harbor involves areas which are classified as closed and open to shellfish harvesting. See attached closure maps. If beach disposal occurs at any time between May 1 and October 31 and if sand from a closed shellfishing area is to be used, a swimming advisory will be posted and a press release will be made. The applicant is advised to notify the Shellfish Sanitation and Recreational Water Quality Section prior to dredging from a closed shellfishing area with dredge disposal to recreational swimming area.

If you have any questions regarding this matter, please contact me at (252)726-6827 or you may email me at gina.brooks@ncmail.net.

cc: Linda Sewall

PROHIBITED TERRITORY
Area E-3 (Map 31)



Revisions: 7/24/75,7/12/7/,4/17/80,1/24/84,10/11/84,6/18/87,3/16/[1]95,5/99 Technical Revision:;: <u>3/20/80, 2/19/92</u>
NO PERSON SHALL TAKE OR ATTEMPT TO TAKE ANY OYSTERS, CLAMS OR MUSSELS OR POSSESS, SELL, OR OFFER FOR SALE ANY OYSTERS, CLAMS OR MUSSELS TAKEN FROM TIME FOLLOWINC AREAS, AT ANY TIME

(31) <u>MOREHEAD CITY AREA</u>

(a) All the waters enclosed by a line beginning at a point on the shore at 34° 43' 08" N - $76^0$ 43' 28" W and thence in a straight line 475 yards to a point 34" 42' 53" N - 76° 43' 28" W, thence in a straight line 2350 yards to a point 34" 42' 43" N - $76^0$ 42' 04" W on northwestern end of spoil island; 'hence in a southeasterly direction following shoreline to a point located $34^0$ $41^1$58 " N - 760 40' 47" W on Fort Macon; thence in a straight line 750 yards to a point on Radio Island at 34" 42' 22" N - 76° 40'49" W; thence along shoreline in a northwesterly direction to east end of Newport River Bridge; thence West to the Morehead City mainland; thence south and west along shoreline back to the point of beginning.

(b) Spooners Creek Area - All the waters enclosed by a line beginning at a point on the shore at 34° 43$^{1}$31 " :V - 76$^{0}$1.8' 20" W; thence in a straight line 300 yards to a point at 34° 43'38 " N - 76$^{0}$ 48' 20" W; thence ire a straight line 550 yards to a point at 340 43' 38" N - 76° 48' 00" W; thence in a straight line 350 yards to a point at 34° 43' 3 l "N - 761481 00" W to include all of Spooners Creek,

(c) Peletier Creek Area - All those waters enclosed by a line beginning at a point on shore, 34° 43' 32" N -'16° 4707" W, thence in a southerly direction 375 yards to a point 34° 43' l S" N -76'47' 07" W, 2t north side of TC WW; thence in an easterly direction 900 yards to a point 34'43'18" N - 76° 462,8" W; thence in a northerly direction 300 yards to a point on shore 34° 43' 29" N - 76° 46'28$^{11}$ W; including all of Peletier Creek.

(d) Bogue Sound/Atlantic Beach Area - Beginning at a point on the west shore of Moonlight Hay at 34$^{0}$ 42' 42" N - 76° 44' 31" W; thence in a straight line to a point on the east side of the causeway at 34° 42'38" N - 76° 44' 11" W; thence in a straight line to a point near 8 % Marina at

(Description continued on back of sheet)

34° 4 2' 12" N - 76' 43'2 1" W. This will include all of Moonlight Bay, Causeway Canal, West Canal, Central Canal, East Canal, Money Island Slough, Anchorage Marina and 8 1/2 Marina.

(e) All those waters upstream from a point near the west end of Pond Drive on Atlantic Beach at 34" 42' 21" N - 76" 44' 46" W; thence in a straight line 200 yards in a westerly direction to a point on the shore at 34° 42' 21" N'- 76$^{1}$ 44$^{1}$54" W.

(f) <u>Fish-N- Lake Area</u> - All those waters upstream of a line beginning at a point on the north shore at 34° 42'24" N - 76° 44'27" W; thence in a straight line across the mouth of the canal to a point at 3q° 42'23" N - 76° 44'27" W; thence following the shoreline to a point at 34n 42' 21 " N - 76° 44'27" W; thence across the mouth of the canal and Fish-N-Lake to a point on the shoreline at 3~ ° 4.2'20" N - 76° 44'27" W; to include all waters in Fish-N-Lake.

(g) <u>Hoop Pole Creek</u> - All those waters in Hoop Pole Creek, upstream of a line beginning at a point on the west shore at 34° 42$^{1}$04" N - 76" 46' 05" W; thence to a point *on the* marsh island at 34° 42$^{1}$05" N - 76" 46$^{1}$05$^{11}$ W; thence following the shoreline of the marsh island to a point at 34° 42' 05" N - 76° 4.5$^{1}$33" W; thence to a point on the east shore at 34" 42$^{1}$06" N - 76" 45'33" W.

(h) All those waters upstream from a line *drawn* across the mouths *of the* Triple Ess Marina and McClamrock SIough.

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Coastal Management

Michael F. Easley, Govemor Donna D. Moffitt, Director William G. Ross Jr., Secretary

MEMORANDUM

TO: Melba McGee, NC Division of Policy and Development
FROM: Caroline Bellis, NC Division of Coastal Management
SUBJECT: Review of SCH#02-0342 DATE: 2/11/2002
A COPY OF ALL ACENCY COMMENTS RECEIVED IS REQUESTED
REVIEWER COMMENTS ARE ATTACHED
Review Comments:

This document is being reviewed for consistency with the NC Coastal Management Program pursuant to federal law and or NC Executive Order 15. Agency comments received by SCH are needed to develop the State's consistency position. Project Review Number (if different from above)
A consistency position will be developed based upon our review on or before .

A Consistency Determination documents, is, or_ may be required for this project pursuant to federal law and or NC Executive Order 15. Applicant should contact Caroline Bellis in Raleigh, phone (919) 733-2293, for information on proper document format and applicable state guidelines and land use plan policies.

Proposal is in draft form, a consistency response is inappropriate at this time. A Consistency Determination should be included in the final document.

A Consistency Determination Document (pursuant to federal law and/or NC Executive Order 15) is not
required.

A consistency response has already been issued.
Project Number Date Issued
Proposal involves < 20 Acres and or a structure < 60,000 Square Feet and no AECs or Land Use Plan problems.
Proposal is not in the Coastal Area and will have no significant impacts on any land or water use or natural resources of the Coastal Area.

A CAMA Permit is, or may be required for all or part of this project. Applicant should contact in , phone # , for information.

A CAMA Permit has already been issued, or is currently being reviewed under separate circulation. Permit Number Date Issued

Other (see attached).

State of North Carolina Consistency Position:

The proposal is consistent with the NC Coastal Management Program provided that all conditions are adhered to and that all state authorization and/or permit requirements are met prior to implementation of the project.

The proposal is inconsistent with the NC Coastal Management Program.
Other (see attached).

From: Heine, Hugh SAW
Sent: Tuesday, October 08, 2002 12:42 PM
To: McIntosh, Glenn SAW
Cc: Clay, Noel C SAW; McCormick, John W SAW; Wutkowski, Michael J SAW; Lackey, Ben SAW; Struthers, Caroline J SAW; Finch, Robert A SAW

Subject: FW: Dredge spoil at Fort Macon

FYI
-----Original Message----
From: jody merritt [mailto:jody.merritt@ncmail.net] Sent: Tuesday, October 08, 2002 11:53 AM
To: hugh.heine@usace.army.mil Subject: Dredge spoil at Fort Macon

Hugh-
When the next pumping occurs at Fort Macon State Park I would like to request that sand be place the full length of the park. If the the profile can be adjusted so that there is not such a large scarp wall that would be great. Thanks for your help.

Jody Merritt
Park Superintendent

**ATTACHMENT C**
**ENVIRONMENTAL ASSESSMENT**
**MOREHEAD CITY HARBOR SECTION 933**
**CARTERET COUNTY, NORTH CAROLINA**

# ASSESSMENT OF POTENTIAL LARVAL ENTRAINMENT MORTALITY DUE TO HYDRAULIC DREDGING OF BEAUFORT INLET

Assessment of potential larval entrainment mortality due to hydraulic dredging of Beaufort Inlet

Lawrence R. Settle
NOAA/NOS
National Centers for Coastal Ocean Science
Center for Coastal Fisheries and Habitat Research
101 Pivers Island Road
Beaufort, NC 28516

The larval fish distribution, abundance, seasonality, transport and ingress at Beaufort Inlet has been extensively studied, particularly during the fall-winter period coinciding with the permitted dredging window (see references below). The concentration of fish larvae (all species combined) typically ranges from 0.5 to 5 larvae $m^{-3}$. The concentration (i.e. abundance) of larvae varies both spatially and temporally over a range of scales. It is therefore important to recognize that not all larvae in the inlet would be vulnerable to entrainment. Larvae are not equally distributed in the inlet as the flow has considerable asymmetry. During flood the bulk of the transport is on the eastern side of the inlet and most larvae enter on that side. Ebb flows containing larvae that were not retained in the estuary are strongest on the west side of the inlet. In addition, many larvae exhibit a vertical migration strategy that facilitates tidal stream transport. That is, larvae are up in the water column during flood and descend to near the bottom during ebb. Such behavior helps to prevent larvae from being flushed back out the inlet.

One can estimate the potential larval entrainment mortality due to hydraulic dredging of Beaufort Inlet using a simple mathematical model that incorporates the following:

**C** = concentration of larvae
= 0.5 to 5.0 larvae $m^{-3}$

**M** = proportion of larvae dying by natural causes every six hours
= 0.0125 (i.e. 5 % $d^{-1}$) to 0.025 (i.e. 10 % $d^{-1}$)

**V** = volume of water entrained by dredge (24 h operation)
= 173,299 $m^3 d^{-1}$ (USACE)

$\mathbf{P_s}$ = spring tidal prism
= 1.42 E8 $m^3$ (Jarrett, 1976)

$\mathbf{P_n}$ = neap tidal prism
= 1.32 E8 $m^3$ (Logan, 1995)

$\mathbf{P_b}$ = proportion of larvae in the bottom of the water column
= 0.1 to 1.0

$\mathbf{P_c}$ = proportion of larvae in the navigation channel
= 0.1 to 1.0

$\mathbf{P_r}$ = proportion of larvae retained inside to estuary during ebb phase
= 0.1 to 1.0

$\mathbf{E_s}$ = proportion of daily spring tidal volume entrained by dredge
= $V / 2\ P_s\ d^{-1}$
= 0.0006

$\mathbf{E_n}$ = proportion of daily neap tidal volume entrained by dredge
= $V / 2\ P_n\ d^{-1}$
= 0.0007

$\mathbf{L_s}$ = initial number of larvae within a spring tidal prism
= $C * P_s$

$\mathbf{L_n}$ = initial number of larvae within a neap tidal prism
= $C * P_n$

$\mathbf{K_{sf}}$ = number of larvae entrained during a single spring tide flood phase
= $(L_s - (L_s * M * 2)) * P_b * P_c * E_s$

$\mathbf{K_{se}}$ = number of larvae entrained during a single spring tide ebb phase
= $(L_s - (L_s * M * 2) - K_{sf}) * P_b * P_c * P_r * E_s$

$\mathbf{K_{nf}}$ = number of larvae entrained during neap tide flood phase
=$(L_n - (L_n * M * 2)) * P_b * P_c * E_n$

$\mathbf{K_{ne}}$ = number of larvae entrained during neap tide ebb phase
= $(L_n - (L_n * M * 2)- K_{nf}) * P_b * P_c * P_r * E_n$

$\mathbf{K_s}$ = absolute larval entrainment mortality $d^{-1}$ during spring tide
= $(K_{sf} + K_{se}) * 2$

$\mathbf{Z_s}$ = percent larval entrainment mortality $d^{-1}$ during spring tide
= $(K_s/L_s*2)*100$

$\mathbf{K_n}$ = absolute larval entrainment mortality $d^{-1}$ during neap tide
= $(K_{nf} + K_{ne}) * 2$

$\mathbf{Z_n}$ = percent larval entrainment mortality $d^{-1}$ during neap tide
= $(K_n/L_n*2)*100$

Mortality due to entrainment was simulated 10,100 times for each level of natural mortality (i.e. 5% $d^{-1}$ and 10% $d^{-1}$) during both spring and neap tidal conditions by systematically varying **C**, $\mathbf{P_b}$, $\mathbf{P_c}$, and $\mathbf{P_c}$ over the ranges outlined above using SAS Version 8.2 (SAS Institute Inc., Cary, NC). The results depicting the distribution of outcomes are shown below and include the minimum, maximum and mean impact levels as well as the 10%, 25%, 50% (median), 75% and 90% quantiles.

| | Natural mortality 10 % $d^{-1}$ | | | | Natural mortality 5 % $d^{-1}$ | | | |
|---|---|---|---|---|---|---|---|---|
| | $\mathbf{K_s}$ No. | $\mathbf{Z_s}$ % | $\mathbf{K_n}$ No. | $\mathbf{Z_n}$ % | $\mathbf{K_s}$ No. | $\mathbf{Z_s}$ % | $\mathbf{K_n}$ No. | $\mathbf{Z_n}$ % |
| min | 914 | 0.0006 | 991 | 0.0008 | 925 | 0.0007 | 1004 | 0.0008 |
| max | 1660902 | 0.1170 | 1801169 | 0.1365 | 1682195 | 0.1185 | 1824261 | 0.1382 |
| mean | 246426 | 0.0316 | 267246 | 0.0316 | 249585 | 0.0320 | 270672 | 0.0373 |
| 10 % | 16282 | 0.0036 | 17658 | 0.0042 | 16490 | 0.0037 | 17884 | 0.0043 |
| 25 % | 48845 | 0.0070 | 52973 | 0.0082 | 49471 | 0.0071 | 53651 | 0.0083 |
| 50 % | 132906 | 0.0239 | 144136 | 0.0278 | 134610 | 0.0242 | 145984 | 0.0282 |
| 75 % | 376763 | 0.0579 | 408595 | 0.0676 | 381594 | 0.0587 | 413833 | 0.0684 |
| 90 % | 657882 | 0.0632 | 713472 | 0.0737 | 666316 | 0.0640 | 722619 | 0.0746 |

What is quite apparent is that both $\mathbf{Z_s}$ and $\mathbf{Z_n}$ (i.e. the percentage of the daily flux of larvae entrained) are very low regardless of larval concentration and the distribution of larvae within the channel. Under the worst-case scenario where the dredge operates 24 h $d^{-1}$, all larvae are in the navigation channel, on the bottom, and with poor retention in the estuary following flood stage, the maximum percentage entrained barely exceeds 0.1 % $d^{-1}$. Most of the simulated scenarios (see the 90 % quantiles) indicate the percent entrainment mortality to be less than 0.06 to 0.07 % $d^{-1}$ with over half falling below 0.03 % $d^{-1}$ (see 50 % quantile). The actual number of larvae entrained however, can range from as few as 914 up to over 1.8 million depending on the initial concentration of larvae within the tidal prism.

This simple analysis of the potential entrainment impacts to larvae could be further refined by stochastically varying the spatial and temporal concentration of larvae and their positions within the water column, but, based on the results presented here, such effort is not required to achieve a useful first approximation of the level of impact to the resource. Because the estimated entrainment mortality, even under the worst-case scenario, is minimal (0.1 % $d^{-1}$), it seems reasonable to conclude that while any larvae that are entrained will certainly be killed, it is likely that the impact at the population-level would be insignificant.

References for larval fish distribution, abundance, seasonality, transport and ingress at Beaufort Inlet, North Carolina.

Blanton, J.O., J. Amft, R.A. Luettich, Jr., J.L. Hench and J.H. Churchill. 1999. Tidal and subtidal fluctuations in temperature, salinity and pressure for the winter 1996 larval ingress experiment - Beaufort Inlet, NC. Fish. Oceanogr. 8(Suppl. 2):134-152.

Burke, J.S., J.M. Miller and D.E. Hoss. 1991. Immigration and settlement pattern of *Paralichthys dentatus* and *P. lethostigma* in an estuarine nursery ground, North Carolina, U.S.A. Netherlands J. Sea Res. 27:393-405.

Churchill, J.H., J.O. Blanton, J.L. Hench, R.A. Luettich, Jr. and F.E. Werner. 1999. Flood tide circulation near Beaufort Inlet, North Carolina: implications for larval recruitment. Estuaries 22:1057-1070.

Churchill, J.H., R.B. Forward, R.A. Luettich, Jr., J.L. Hench, W.F. Hettler, Jr., L.B. Crowder and J.O. Blanton. 1999. Circulation and larval fish transport within a tidally dominated estuary. Fish. Oceanogr. 8(Suppl. 2):173-189.

Flores-Coto, C. And S.M. Warlen. 1993. Spawning time, growth, and recruitment of larval spot *Leiostomus xanthurus* into a North Carolina estuary. Fish. Bull. 91:8-22.

Forward, R.B. Jr., K.A Reinsel, D.S. Petrs, R.A. Tankersley, J.H. Churchill, L.B. Crowder, W.F. Hettler, Jr., S.M. Warlen and M.D. Greene. 1999. Transport of fish larvae through a tidal inlet. Fish. Oceanogr. 8(Suppl. 2):153-172.

Hare, J.A., J.A. Quinlan, F.E. Werner, B.O. Blanton, J.J. Govoni, R.B. Forward, L.R. Settle and D.E. Hoss. 1999. Larval transport during winter in the SABRE study area: results of a coupled vertical larval behavior-three-dimensional circulation model. Fish. Oceanogr. 8(Suppl. 2):57-76.

Hettler, W.F., Jr. and D.L. Barker. 1993. Distribution and abundance of larval fishes at two North Carolina inlets. Estuar. Coast. and Shelf Sci. 37:161-179.

Hettler, W.F., Jr. and A.J. Chester. 1990. Temporal distribution of ichthyoplankton near Beaufort Inlet, North Carolina. Mar. Ecol. Prog. Ser. 68:157-168.

Hettler, W.F., Jr. and J.A. Hare. 1998. Abundance and size of larval fishes outside the entrance to Beaufort Inlet, North Carolina. Estuaries 21:476-499.

Hettler, W.F., Jr., D.S. Peters, D.R. Colby and E.H. Laban. 1997. Daily variability in abundance of larval fishes inside Beaufort Inlet. Fish. Bull. 95:477-493.

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# ATTACHMENT D
# BIOLOGICAL ASSESSMENT
# ENDANGERED SPECIES

**Environmental Assessment, Morehead City Harbor Section 933,**
**Carteret County, North Carolina**

**May 2003**

ATTACHMENT D
BIOLOGICAL ASSESSMENT
ENDANGERED SPECIES

Environmental Assessment, Morehead City Harbor Section 933,
Carteret County, North Carolina

## 1.00 PROPOSED PROJECT

The proposed project is the same as described in detail in the environmental assessment, which precedes the appendices.

## 2.00 PRIOR COORDINATION

Potential impacts on listed species have also been addressed previously for the project area. In July 2001, Coastal Science & Engineering, LLC, prepared a Biological Assessment (BA) for the Bogue Banks Beach Restoration Plan, for the U.S. Army Corps of Engineers Regulatory Permit ID 20000362, which was submitted by Carteret County, the Town of Pine Knoll Shores, the Town of Indian Beach, and the Town of Emerald Isle (CSE 2001). Portions of Section 4.0 entitled “ASSESSMENT OF IMPACTS TO LISTED SPECIES” have been taken from this existing BA.

## 3.0 SPECIES CONSIDERED UNDER THIS ASSESSMENT

Updated lists of endangered and threatened (E&T) species for the project area were obtained from NMFS (Southeast Regional Office, St. Petersburg, FL) and the USFWS (Field Office, Raleigh, NC). These were combined to develop the following composite list, which includes E&T species that could be present in the area based upon their geographic range. However, the actual occurrence of a species in the area would depend upon the availability of suitable habitat, the season of the year relative to a species' temperature tolerance and migratory habits, and other factors.

Threatened and Endangered Species Potentially Present in Carteret County, NC.

| Species Common Names | Scientific Name | Federal Status |
|---|---|---|
| *Vertebrates* | | |
| American alligator | *Alligator mississippiensis* | T(S/A) |
| Bachman's sparrow | *Aimophila aestivalis* | FSC |
| Black rail | *Laterallus jamaicensis* | FSC |
| Bogue Banks endemic skipper | *Atrytonopsis sp1* | FSC |
| Carolina gopher frog | *Rana capito capito* | FSC |
| Eastern painted bunting | *Passerina ciris ciris* | FSC* |
| Eastern cougar | *Felis concolor couguar* | Endangered* |

| Species Common Names (continued) | Scientific Name | Federal Status |
|---|---|---|
| *Vertebrates* | | |
| Green sea turtle | *Chelonia mydas* | Threatened |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Henslow's sparrow | *Ammodramus henslowii* | FSC |
| North Atlantic Right whale | *Eubaleana glacialis* | Endangered |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Sperm whale | *Physeter macrocephalus* | Endangered |
| Finback whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Kemp's ridley sea turtle | *Lepidochelys kempii* | Endangered |
| Leatherback sea turtle | *Dermochelys coriacea* | Endangered |
| Loggerhead sea turtle | *Caretta caretta* | Threatened |
| West Indian Manatee | *Trichechus manatus* | Endangered |
| Mimic glass lizard | *Ophisaurus mimicus* | FSC |
| Northern diamondback terrapin | *Malaclemys terrapin terrapin* | FSC |
| Piping Plover | *Charadrius melodus* | Threatened |
| Red-cockaded woodpecker | *Picoides borealis* | Endangered |
| Roseate tern | *Sterna dougallii* | Endangered |
| Shortnose sturgeon | *Acipenser brevirostrum* | Endangered |
| Smalltooth sawfish | *Pristis pectinata* | Endangered |
| Southern hognose snake | *Heterodon simus* | FSC* |
| *Invertebrates* | | |
| a skipper (butterfly) | *Atrytonopsis sp1* | FSC |
| Arogos skipper | *Atrytone arogos arogos* | FSC |
| Carter's noctuid moth | *Spartiniphaga carterae* | FSC |
| Croatan crayfish | *Procambarus plumimanus* | FSC |
| Venus flytrap cutworm moth | *Hemipachnobia subporphyrea subporphyrea* | FSC |
| *Vascular Plants* | | |
| Carolina asphodel | *Tofieldia glabra* | FSC |
| Carolina goldenrod | *Solidago pulchra* | FSC |
| Chapman's sedge | *Carex chapmanii* | FSC |
| Dune bluecurls | *Trichostema sp. 1* | FSC |
| Loose watermilfoil | *Myriophyllum laxum* | FSC |
| Pondspice | *Litsea aestivalis* | FSC |
| Rough-leaved loosestrife | *Lysimachia asperulaefolia* | Endangered |
| Savanna cowbane | *Oxypolis ternata* | FSC |
| Seabeach amaranth | *Amaranthus pumilus* | Threatened |
| Venus flytrap | *Dionea muscipula* | FSC |
| *Nonvascular Plants* | | |
| Savanna campylopus | *Campylopus carolinae* | FSC |

[1]Green turtles are listed as threatened, except for breeding populations in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

KEY:

| Status | Definition |
| --- | --- |

Endangered - A taxon "in danger of extinction throughout all or a significant portion of its range."

Threatened - A taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range."

FSC - A Federal species of concern--a species that may or may not be listed in the future (formerly C2 candidate species or species under consideration for listing for which there is insufficient information to support listing).

T(S/A) - Threatened due to similarity of appearance (e.g., American alligator )--a species that is threatened due to similarity of appearance with other rare species and is listed for its protection. These species are not biologically endangered or threatened and are not subject to Section 7 consultation.

Species with 1 asterisk behind them indicate historic records:

* Historic record - the species was last observed in the county more than 50 years ago.

## 4.00 ASSESSMENT OF IMPACTS TO LISTED SPECIES

### 4.01 General Impacts

Dredging and disposal of sediment have the potential to adversely affect animals and plants in a variety of ways. These include actions of the dredging equipment (i.e., cutting, suction, sediment removal, hydraulic pumping of water and sediment); physical contact with dredging equipment and vessels (i.e., impact); physical barriers imposed by the presence of dredging equipment (i.e., pipelines); and placement of dredged material in various disposal locations (i.e., covering, suffocation). Potential impacts vary according to the type of equipment used, the nature and location of sediment discharged, the time period in relation to life cycles of organisms that could be affected, and the nature of the interaction of a particular species with the dredging activities.

All the proposed work will occur in the following areas: 1. Morehead City Harbor (including Brandt Island), located at the confluence of the Newport River and Bogue Sound; 2. within the Atlantic Ocean, and 3. along the ocean beaches of Bogue Banks (from Ft. Macon State Park to Indian Beach) in Carteret County. Any potential impacts on endangered and threatened species would be limited to those species, which occur in habitats provided by these areas. Therefore, the proposed work will not affect any listed species, which generally reside in freshwater, forested habitats, including the eastern cougar, American alligator, red-cockaded woodpecker, and rough-leafed loosestrife.

Species which could be present in the project area during the proposed action are the finback whale, humpback whale, North Atlantic right whale, sei whale, sperm whale, West Indian manatee, piping plover, roseate tern, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, shortnose sturgeon, and sea-beach amaranth.

Dredging and disposal methods associated with the proposed action are similar to current maintenance dredging methods. These methods have been addressed in a number of previous environmental documents, including biological assessments and biological opinions rendered regarding endangered and threatened species. The accounts, which follow, will summarize this information as it applies to the proposed action.

4.02 Species Accounts

4.02.1 Eastern Cougar, American Alligator, Red-cockaded woodpecker and Rough-leaved Loosestrife.

These are all terrestrial, freshwater, woodland species. Since this habitat type is not present in the areas to be affected by the proposed action, these species are unlikely to occur.

Effect Determination. It has been determined that the proposed action is not likely to adversely affect any of these species or their habitat.

4.02.2 Roseate Tern

Roseate terns breed primarily on small offshore islands, rocks, cays, and islets. Rarely do they breed on large islands. They have been reported nesting near vegetation or jagged rock, on open sandy beaches, close to the waterline on narrow ledges of emerging rocks, or among coral rubble (USFWS 1999b). This species is primarily observed south of Cape Hatteras, particularly at Cape Point within Cape Hatteras National Seashore, during the months of July and August.

Effect Determination. Bogue Banks is most likely too large and too developed an island to provide appropriate habitat for the roseate tern. Additionally, the roseate tern has not been seen in the project area since 1995 (Personnel Communication, Dave Allen, NC Wildlife Resources Commission, August 27, 2002). For these reasons it has been determined that the project is not likely to affect these species.

4.02.3 Piping Plover

a. Status. Threatened

b. Occurrence in Immediate Project Vicinity: The Atlantic Coast piping plover population breeds on coastal beaches from Newfoundland to North Carolina (and occasionally in South Carolina) and winters along the Atlantic Coast from North Carolina south, along the Gulf Coast, and in the Caribbean (USFWS 1996a). Since being listed as threatened in 1986, the population has increased from ~800 pairs to almost 1350 pairs in 1995, although most of this increase may be attributable to an increase in surveying intensity. Piping plovers nest above the high tide line on coastal beaches, sand flats at the ends of sand spits and barrier islands, gently sloping foredunes, blowout areas behind primary dunes, sparsely vegetated dunes, and washover areas cut into or between dunes (USFWS 1996a). Feeding areas include intertidal portions of ocean beaches, washover areas, mud flats, sand flats, wrack lines, and shorelines of coastal ponds, lagoons, or salt marshes. Loss and degradation of habitat due to development and shoreline stabilization have been major contributors to the species' decline.

The project area beaches proposed for the placement of material from either Brandt Island or maintenance of Morehead City Harbor receive heavy use by the public. Such use disturbs foraging and nesting shorebirds and, consequently, degrades its potential as piping plover habitat. Since project beaches are wintering area for the species, the major threats to its continued occupation of the area during the winter months would be continued degradation of beach foraging habitat. Similar degradation of beaches elsewhere could be a contributing element to declines in the state's nesting population.

c. Current Threats to Continued Use of the Area. The current public use of the beaches of Bogue Banks (including Fort Macon State Park) suggest that the potential for successful nesting of this species on project-affected beaches would be extremely low because of erosion, heavy recreational use, and an abundance of predators, including wild and domestic animals as well as feral cats.

d. Project Impacts.

(1) Habitat. Most piping plovers at Bogue Banks have been observed at the west end of Emerald Isle as predominantly a migratory and winter resident (D. Allen, NCWRC, February 2000, pers. comm.). During a 1991 USFWS International Piping Plover Census (winter), four piping plovers were observed, and during a 1996 winter census, one individual was observed. However, both Bogue and Beaufort inlets contain intertidal flats exposed at low tide that are prime feeding and roosting habitat for a variety of shorebirds and colonial waterbirds including pelicans, cormorants, terns, and gulls. These areas may be used by piping plovers as well.

Additionally, according to USFWS (Personnel Communication, Ms. Tracy Rice, USFWS, August 16, 2002) piping plovers have been observed at the Rachel Carson National Estuarine Research Reserve, Bogue Inlet shoals, Hammocks Beach State Park, Shackleford Banks shoreline of Beaufort Inlet, and in Emerald Isle at the Pointe. The proposed action will place maintenance material within the active inlet area (Fort Macon State Park) only within the winter months (from about 16 November 03 to 31 March 04).

(2) Food Supply. Foraging area around Beaufort Inlet could be affected since disposal is proposed in this area during the winter months. Along other areas of the highly eroded beaches, piping plover foraging may be altered as beach food resources may be affected by sand disposal events. Beach disposal during construction will be conducted for up to 16 continuous months, which would save up to $2.25 million. However, only a portion of the beach is affected at any point in time (approximately 4-5,000 feet per month). Once disposal passes that point, recovery can begin to occur. All of Fort Macon State Park, Atlantic Beach, and a portion of Pine Knoll Shores to be nourished, will be nourished during the colder months when recruitment of beach organisms on which piping plovers feed is at its lowest. The remainder of Pine Knoll Shores and Indian Beach (including Salter Path) will be nourished during the warmer months.

The Section 933 project would be a one-time placement of maintenance material on Bogue Banks and re-nourishment or future maintenance is not provided under this authority.

(3) Relationship to Critical Periods in Life Cycle. Beach placement of sand derived from maintenance dredging of Morehead City Harbor and Brandt Island is expected to occur on a year-round basis. Therefore, it will occur within the nesting season of the piping plover (April 1 through July 31).

No disposal is proposed in the active inlet areas within the active nesting season, and nesting is not expected to occur in the eroded beachfront where disposal is planned.

(4) Effect Determination. Because beach disposal may temporarily impact foraging habitat and disrupt nesting that may be attempted along the eroded beach front, it has been determined that the project may affect the piping plover.

4.02.4 West Indian Manatee

a. Status. Endangered.

b. Occurrence in Immediate Project Vicinity. The manatee is an occasional summer resident off the North Carolina coast. The species can be found in shallow (5 ft to usually <20 ft), slow-moving rivers, estuaries, saltwater bays, canals, and coastal areas (USFWS 1991). The West Indian manatee is herbivorous and eats aquatic plants such as hydrilla, eelgrass, and water lettuce (USFWS 1999a). During winter months, the U.S. manatee population confines itself to the coastal waters of the southern half of peninsular Florida and to springs and warm water outfalls as far north as southeast Georgia. They are sighted infrequently in southeastern North Carolina with most records occurring in July, August, and September, as they migrate up and down the coast (Clark 1993). However, scattered records of this species in the region span all seasons. Manatee population trends are poorly understood, but deaths have increased steadily. A large percent of mortality is due to collisions with watercrafts, especially of calves. Another closely related factor in their decline has been the loss of suitable habitat through incompatible coastal development, particularly destruction of sea grass beds by boating facilities.

Manatees are rare visitors to the Bogue Banks Region. From 1983 to 1999, there were only 7 known observations in the project area (Personnel Communication, Ms. Tracy Rice, USFWS, August 16, 2002). The following sightings were provided by USFWS: in 1983 off Shackleford Banks, in 1992 at Barden Inlet, in August 1994 off Atlantic Beach and the USCG Station at Fort Macon, in June 1998 at Hammocks Beach State Park, and in 1999 in the Newport River and along the Beaufort Waterfront. Each sighting in the project area has been of a single manatee.

Numbers of manatees using the region are not known but are presumed to be very low. More research is needed to determine the status of the species in North Carolina and identify areas (containing food and freshwater supplies), which are critical for supporting summer populations.

c. Current Threats to Continued Use of the Area. Current threats to this species in the Bogue Banks area cannot be clearly assessed due to our lack of knowledge regarding its population, seasonality, distribution, and the habitat components in the project area that may be critical for its continued occupation of the area. Cold winter temperatures may probably keep the species from overwintering in the project area.

d. Project Impacts.

(1) Habitat. Impacts to estuarine and nearshore ocean habitat of the area should be minor and should be similar to those already occurring under the proposed action. The effect of these impacts on the value of the area to the manatee is unknown. With the current state of knowledge on the

habitat requirements for the manatee in North Carolina, it is impossible to determine the magnitude of such impacts.

(2) Food Supply. Foods, which are used by the manatee in North Carolina, are unknown. In Florida, their diet consists primarily of vascular plants. The proposed action will involve minimal change to the physical habitat of the estuary and overall estuarine and nearshore productivity should remain high throughout the project area. Therefore, potential food sources for the manatee should be unaffected.

(3) Relationship to Critical Periods in Life Cycle. Since the manatee is considered to be an occasional summer resident of the North Carolina coast, the proposed action should have little effect on the manatee since its habitat and food supply will not be significantly impacted. The presence of a hopper dredge in the nearshore ocean waters should pose no more of a threat to manatees than normal commercial ship traffic. However, in order to maximize protection of the manatee, if a manatee is observed within 100 yards of operations, all operations will cease until the manatee has left the area.

(4) Effect Determination. Because of the indicated measures, and rare occurrence of manatees in the harbor, the proposed action is not likely to adversely affect the manatee.

4.02.5 Finback Whale, Humpback Whale, North Atlantic Right Whale, Sei Whale, and Sperm Whale

a. Status. Endangered

b. Occurrence in Immediate Project Vicinity. These whale species all occur infrequently in the ocean off the coast of North Carolina. Of these, only the North Atlantic right whale and the humpback whale routinely come close enough inshore to encounter the project area. Humpback whales are often found in protected waters over shallow banks and shelf waters for breeding and feeding. They migrate toward the poles in summer and toward the tropics in winter and visit the North Carolina coast during seasonal migrations, especially between December and April. They eat schooling fish such as herring and can consume up to 1.5 tons per day of krill. North Atlantic right whales swim very close to the shoreline and are often noted only a few hundred meters offshore (Schmidly 1981). They feed primarily on copepods and euphausids. While it usually winters in the waters between Georgia and Florida, the North Atlantic right whale can on occasion be found in the waters off North Carolina. Sighting data provided by the North Atlantic Right Whale Program of the New England Aquarium indicates that 93 percent of all North Carolina sightings between 1976 and 1992 occurred between mid-October and mid-April (Slay 1993). The number of North Atlantic right whales documented in the vicinity of Morehead City during a single season ranges from 2 to 25 (USACE 1989).

These species all occur infrequently in the ocean off the coast of North Carolina. Their occurrence in the state's waters is usually associated with spring or fall migrations. Due to their restriction to oceanic environments, the only aspects of the proposed action, which might result in an encounter with these species, will be the operation of the hopper dredge in outer Morehead City Harbor channels (Range A).

c. Current Threats to Continued Use of the Project Area. None.

d. Project Impacts.

(1) Habitat. None.

(2) Food Supply. Productivity of the nearshore ocean will not be diminished by the proposed dredging; therefore, the food supply of these species should be unaffected.

(3) Relationship to Critical Periods in Life Cycle. The presence of a hopper dredge in the nearshore ocean waters should pose no more of a threat to migrating whales than normal commercial ship traffic. However in order to maximize protection of the right and humpback whales, 100 percent daytime whale observer coverage will be from December 1 through March 31 in accordance with previous biological opinions rendered by NMFS (NMFS 1997).

(4) Effect Determination. Of the five species of whales being considered, only the North Atlantic right whale and humpback whale would normally be expected to occur within the project area during the construction period. Therefore, the other species of whales are not likely to be affected. Since sections of this beach area have received fill material in the past, this project will not significantly alter nearshore physical conditions. Furthermore, the presence of a hopper dredge in this area should pose no more of a collision threat to migrating whales than normal commercial ship traffic. However, to reduce the potential for accidental collision, a whale observer with at-sea large whale identification experience will be present on the hopper dredge during hopper dredge use (January 1 through March 31) to conduct daytime observations.

Since existing habitat conditions and food supplies will be maintained and whale observer coverage will be implemented, it has been determined that the continued maintenance of the harbor will not likely adversely affect the above listed species of whales.

4.02.6 Green, Hawksbill, Kemp's Ridley, and Leatherback Sea Turtles

a. Status. Green turtles are listed as threatened, except for breeding populations in Florida and on the Pacific Coast of Mexico, which are listed as endangered. Hawksbill, Kemp's Ridley, and Leatherback Sea Turtles are listed as endangered.

b. Occurrence in Immediate Project Vicinity. In North Carolina, the green sea turtle and the Kemp's ridley sea turtle are known from estuarine and oceanic waters, whereas the hawksbill and leatherback sea turtles are normally associated solely with oceanic waters (Schwartz 1977). All of these species are found in North Carolina offshore waters throughout the year and can be present in inshore waters April through December (Epperly et al 1995).

Neither the hawksbill or leatherback sea turtle is observed in North Carolina with much frequency. Along the Southeast US coastline, these species are only occasionally observed migrating through North Carolina waters. However, in the summer of 2002, one leatherback nested at Cape Hatteras National Seashore (Godfrey 2002). The Kemp's ridley sea turtle is commonly observed migrating within North Carolina inshore waters during the spring and fall, but has been documented to nest only once in North Carolina. A Kemp's ridley nested on Oak Island in 1992 (Godfrey 2002). Although green turtle crawls have been documented at Emerald Isle Beach (R. Boettcher, 2000, pers. comm.), no nests have been observed within the project site and the green sea turtle is not considered to be a regular nester within the project area.

Like the Kemp's ridley, greens are commonly observed migrating within North Carolina inshore waters during the spring and fall.

c. Current Threats to Continued Use of the Area. The primary threats facing these species worldwide are the same ones facing them in the project area. Of these threats, the most serious seem to be loss of breeding females through accidental drowning by shrimpers (Crouse, et al., 1987) and human encroachment on traditional nesting beaches. Other threats to these sea turtles include excessive natural predation in some areas and excavation of dredged material with a hopper dredge. With the exception of hopper dredges, none of the dredge plants (i.e., pipeline dredges) proposed for use in the construction of this project are known to take sea turtles.

d. Project Impacts.

(1) Habitat. The placement of dredged material on the beaches from Fort Macon State Park to Indian Shores will not impact any hawksbill, leatherback, green, and Kemp's ridley sea turtles. The entire Kemp's ridley population nests on the approximately 15 miles of beach in Mexico between the months of April and June (USFWS 1991). Green sea turtle nesting is primarily limited to Florida's east coast (300 to 1,000 nests reported annually, but has been observed as far north as North Carolina. The hawksbill sea turtle nests primarily in tropical waters in south Florida and the Caribbean. Leatherback sea turtles nest primarily in Florida.

(2) Food Supply. The principal food sources for these sea turtle species are crustaceans, mollusks, other invertebrates, fish, and plant material (Schwartz 1977). Dredging will temporarily remove some of these resources from the channel bottom. Impacts on Bogue Sound habitat will be minor as dredging will only affect a limited portion of the estuary (i.e., only the existing Morehead City Harbor navigation channels and Brandt Island). Most of this area is currently experiencing periodic maintenance dredging. Therefore, the project should not significantly affect the food supply of the species in the sound.

(3) Relationship to Critical Periods in Life Cycle. Removing sediment from Brandt Island and the navigation channels in Morehead City by dredging (use of pipeline and hopper dredges) could take up to about 16 continuous months. Placement of this dredged material on Bogue Banks should not impact these turtles since they do not regularly nest in North Carolina. However, all of these species migrate within North Carolina waters throughout the year, mostly between April and December.

The Section 933 project would be a one-time placement of maintenance material on Bogue Banks and re-nourishment or future maintenance is not provided under this authority.

(4) Effect Determination. The hawksbill, leatherback, and Kemp's ridley sea turtles do not regularly nest along North Carolina coasts. The green sea turtle nests sporadically in North Carolina but has not been observed nesting in the project area. Therefore, beach nourishment activities will not affect any of these sea turtle species. However, all of these species migrate within North Carolina waters throughout the year, mostly between April and December. Pipeline and hopper dredges will be used to dredge material from the existing Brandt Island and existing navigational channels located within these migratory waters and transport it to the shore. Pipeline dredges have not been known to take sea turtles. Construction activities are planned to occur up to 16-months in order to save up to $2.25 million. Hopper dredges would be used only from 1 January to 31 March of any year. However, because sea turtles may

be found in the offshore area within this time period, hopper dredging activities may occur during low levels of sea turtle migration.

Hopper dredges move rapidly over the bottom sediments and can injure or kill juvenile turtles lying on the sea bottom. To reduce these impacts, we anticipate taking certain precautions as prescribed by NMFS and USACE under standard hopper dredging protocol. We anticipate maintaining observers on hopper dredges for the periods prescribed by NMFS to document any takes of turtle species and to ensure that turtle deflector dragheads are used properly. We will abide by the provisions of the September 25, 1997 Regional Biological Opinion for The Continued Hopper Dredging Of Channels And Borrow Areas In The Southeastern United States.

Despite these precautions, the chance of impacting migrating sea turtles with a hopper dredge still exists. Therefore, it has been determined that the proposed project may affect the hawksbill, leatherback, Kemp's ridley, and green sea turtles.

4.02.7 Loggerhead Sea Turtle

a. Status. Threatened

b. Occurrence in Immediate Project Vicinity. The loggerhead turtle utilizes the Bogue Banks upper beach fronts for its seasonal (May to September) nesting events. Off the Carolina coast these turtles commonly occur at the edge of the continental shelf when they forage around coral reefs, artificial reefs, and boat wrecks. Research has shown that the turtle populations have greatly declined in the last 20 years due to a loss of nesting habitat along the beachfront and by incidental drowning in shrimp trawl nets. It appears that the combination of poorly placed nests coupled with unrestrained human use of the beach by auto and foot traffic has impacted this species greatly.

Loggerhead turtles are known to regularly nest from Bogue Inlet to Beaufort Inlet, including the entire stretch of the project site. Along the Bogue Banks beaches where disposal will occur, there has been a total of 385 loggerhead sea turtle nests from 1990 to 2001 (Godfrey 2002), or an average of about 35 nests per year. This represents an average of about 1.5 nests per mile which is low compared to other developed nourished beaches, including Debidue Island (SC) which has typically averaged ten per mile over the past ten years with nourishment in 1990 and 1998 (SCUTE 1999, CSE 2001). In 2002, a total of 19 loggerhead turtle nests occurred on Bogue Banks (Mihnovets 2002). The first nest of the season was laid on May 17 in Pine Knoll Shores and the last nest was laid on August 2 in Emerald Isle (Mihnovets 2002). Hatching occurred between late July and early December. The majority of nests along Bogue Banks are believed to have been found in Atlantic Beach (nourished 1986 and 1994) and in western Emerald Isle where the beach is wider. There has been relatively little nesting activity in the project area of Pine Knoll Shores, Indian Beach, and eastern Emerald Isle over the past five years because of the severely eroded condition of the beach, the succession of hurricanes, and the frequent beach scraping. Like the Kemp's ridley and green sea turtles, loggerheads are known to frequently use coastal waters as travel corridors (Wynne 1999) and have been observed migrating along the North Carolina coast (Epperly et al 1995).

c. Current Threats to Continued Use of the Area. The primary threats facing these species worldwide are the same ones facing them in the project area. Of these threats, the most serious seem to be loss of breeding females through accidental drowning by shrimpers (Crouse, et al., 1987) and human encroachment on traditional nesting beaches. Other threats to the loggerhead include excessive natural predation in some areas, utilization of eggs as food by humans, and excavation of dredged material with a hopper dredge. With the exception of hopper dredges, none of the dredge plants proposed for use in the construction of this project are known to take sea turtles.

d. Project Impacts.

(1) Habitat. Most of the predominantly sandy dredged material taken from Brandt Island or the Morehead City Harbor navigation channels will be placed on area beaches. For Bogue Banks, these include the beaches from Fort Macon State Park westward through Indian Beach (including Salter Path).

Loss of nesting habitat is also a threat to sea turtles. Most of the Bogue Banks beaches have experienced severe erosion because of frequent hurricanes passing over or near the area since 1996 (Bertha, Fran, Bonnie, Dennis, Floyd and Irene). In many locations the dunes have been eroded away, and no locations are available for nesting. The proposed project may place up to 6.3 million cubic yards of sand from Brandt Island and the Morehead City Harbor navigation channels onto the beaches, which would restore much of the turtle-nesting habitat lost. The dredged material to be placed on the beaches should average > 90 percent sand. Most of the remaining consists of fine grain particles (silt and clay), which will not remain on the beach. These fines may temporarily lead to a darkening of the beach. If this darkening persisted it could raise the temperature of nests in the area, and change the sex ratio of the hatchlings. However, this condition should quickly disappear due to natural sorting process on the beach. If sand compaction in the renourishment area exceeds 500 cone penetrometer units (CPUs), tilling will be performed, and scarps over 18 inches will be graded.

(2) Food Supply. Loggerhead sea turtles feed on benthic invertebrates including mollusks, crustaceans, and sponges (Morrimen 1982). They have also been found to eat fish, clams, oysters, sponges, jellyfish, shrimp, and crabs when near shore. Dredging will temporarily remove some of these resources from the channel bottom. Impacts on Bogue Sound habitat will be minor as dredging will only affect a limited portion of the estuary around the port. Most of this area is currently experiencing periodic maintenance dredging. Therefore, the project should not significantly affect the food supply of the species in the sound.

(3) Relationship to Critical Periods in Life Cycle. Removing sediment (silt and sand) from Brandt Island and the navigation channels in Morehead City by dredging (pipeline and hopper dredges) could take up to about 16 continuous months. Nesting area around the inlets should not be affected since disposal is proposed in these areas only during the winter months. Beach disposal during construction will be conducted for up to 16 continuous months, which would save up to $2.25 million. We will abide by the provisions of the September 25, 1997 Regional Biological Opinion for The Continued Hopper Dredging Of Channels And Borrow Areas In The Southeastern United States.

Hopper dredges would be used only from 1 January to 31 March of any year. Pipeline dredges would be used year round. However, only a portion of the beach is affected at any point in time (approximately 4-5,000 feet per month). Once disposal passes that point, recovery can begin to occur. All of Fort Macon State Park, Atlantic Beach, and a portion of Pine Knoll Shores to be nourished, will be nourished during the colder winter months when nesting does not occur. The remainder of Pine Knoll Shores and Indian Beach (including Salter Path) will be nourished during the warmer months; therefore, monitoring of nesting activities in this beach nourishment zone would be required. This will include daily surveys beginning at sunrise from May 1 until September 15. Following established protocols, any nests that require relocation will be moved within 6 hours of nest discovery to an approved location. Information on nest relocation and hatching success of all nests will be recorded.

The Section 933 project would be a one-time placement of maintenance material on Bogue Banks and re-nourishment or future maintenance is not provided under this authority.

(4) Effect Determination. The proposed project could potentially affect loggerhead sea turtles in three ways. First, hopper-dredging activities proposed offshore may occur in areas used by migrating turtles. However, NMFS and the US Army Corps of Engineers (USACE) hopper dredge protocol will be followed to reduce these impacts. Second, nourishing the beach with the fill material may affect nesting activities by altering nesting habitat. If the beach becomes too hard through the compaction of deposited nourishment sediments by construction equipment, it could present a physical barrier to turtle nest digging. Furthermore, beach nourishment may influence physical characteristics of beaches such as sand-grain size and shape, silt-clay content, sand compaction, moisture content, porosity/water retention, gas diffusion rates, and color of sand grains, which could alter the temperature of the beach. These factors could reduce reproductive success of nests laid in nourished areas (Crain et al 1995, Ackerman 1996). The USACE plans to alleviate impacts to nesting sea turtles in the project area by implementing steps that are now common practice or commonly listed as conditions on permits (to be determined by regulatory agencies), such as sediment quality monitoring, compaction tests, leveling scarps in the fill, and monitoring for nests. The third way the project could potentially affect loggerhead sea turtles is by increasing the area of stable dry beach (nesting habitat) and reducing the frequency of dune escarpments and beach scraping.

By planning to perform much of the project during off-season months, monitoring beach hardness, and relocating nests found in unsuitable habitat, impacts to nesting loggerhead sea turtles will be minimized. In addition, NMFS and ACOE hopper dredge protocol will be followed to minimize impacts to migrating loggerheads caused by dredges.

We will abide by the provisions of the September 25, 1997 Regional Biological Opinion for The Continued Hopper Dredging Of Channels And Borrow Areas In The Southeastern United States.

However, because of the possibility of missing a sea turtle nest during the nest monitoring program, inadvertently breaking eggs during relocation, or taking a migrating loggerhead with a hopper dredge, it has been determined that the project may affect the loggerhead sea turtle.

4.02.8 Shortnose Sturgeon

a. Status. Endangered

b. Occurrence in Immediate Project Vicinity. This species ranges along the Atlantic seaboard from southern Canada to northeastern Florida (USFWS 1999c). The shortnose sturgeon feeds on invertebrates and stems and leaves of macrophytes. From historical accounts, it appears that this species was once fairly abundant throughout North Carolina waters, however, many of these early records are unreliable due to confusion between this species and the Atlantic sturgeon (*Acipenser oxyrhynchus*). Because of the lack of suitable freshwater spawning areas in the project area and the requirement of low salinity waters by juveniles, any shortnose sturgeons present would most likely be non-spawning adults. This species ranges along the Atlantic seaboard from the Saint JohnS River in New Brunswick, Canada, to the Saint Johns River, Florida. The distribution of the shortnose sturgeon in the Newport and White Oak Rivers is not known. No known records of the shortnose sturgeon have been documented in the project area.

c. Current Threats to Continued Use of the Area. Pollution, blockage of traditional spawning grounds, and over fishing is generally considered to be the principal causes of the decline of this species. The prohibition on taking any sturgeon in North Carolina should help to protect the species from commercial and recreational fishing pressure.

d. Project Impacts.

(1) Habitat. Spawning habitat for the shortnose sturgeon should lie well outside of the project area and should not be affected by this project. Habitat conditions suitable for juveniles and adults could occur within the project area. The presence of juvenile shortnose sturgeon is not likely due to high salinity. Adults are found in shallow to deep water (6 to 30 feet) and will be expected to occupy the river channel during the day and the shallower areas adjacent to the channel during the night.

(2) Food Supply. The shortnose sturgeon is a bottom feeder, consuming various invertebrates and occasionally plant material. Adult foraging activities normally occur at night in shallow water areas adjacent to the deep-water areas occupied during the day. Juveniles are not known to leave deep-water areas and are expected to feed there.

All estuarine bottoms dredged as a part of maintenance will suffer temporary declines in benthic fauna populations in comparison to adjacent undisturbed areas. Existing channel bottoms will continue to be dredged at the same frequency as under existing conditions and will be expected to continue to support benthic populations similar to the existing populations.

Because most of the available shallow water feeding areas adjacent to the channel will not be affected by the project and channel benthic populations should continue to have their existing levels of production, it is believed that the food supply of the shortnose sturgeon will remain essentially at current levels after project construction.

(3) Relationship to Critical Periods in Life Cycle. Because of the mobility of adult and juvenile shortnose sturgeon and infrequent occurrence in the harbor, direct mortality as a result of dredging is not likely to occur.

(4) Effect Determination. Because no known shortnose sturgeon have been documented in the project area, it has been determined that the proposed action is not likely to affect any of this species or its habitat. It is unlikely that the shortnose sturgeon occurs in the project area (F. Rohde, 2000, pers. comm.). However, should it occur, its habitat would be only minimally altered by project construction and maintenance. This species feeds on a wide variety of invertebrates and while some food resources may be initially affected by either burial associated with beach nourishment, most invertebrates will quickly reestablish from adjacent unaffected areas. Although hopper dredges have been known to impact shortnose sturgeons, this species is not likely to be present in the project area and, therefore, impacts from dredges are not anticipated to occur. Because of the unlikelihood of shortnose sturgeon

being present in the project area and because of the precautions being taken with the hopper dredges, it has been determined that the actions of the proposed project are not likely to adversely affect the shortnose sturgeon.

4.02.09 Seabeach Amaranth

a. Status. Threatened

b. Occurrence in Immediate Project Vicinity. Seabeach amaranth is an annual herb that occurs on beaches, lower foredunes, and overwash flats (Fussell 1996). Weakley (1986) found that in North Carolina the plant is most common on overwash flats on accreting ends of barrier islands. This species occupies elevations ranging from 0.2 to 1.5 m above mean high tide (Weakley and Bucher 1992). Historically, seabeach amaranth was found from Massachusetts to South Carolina. But according to recent surveys (USACE 1992-2002), its distribution is now restricted to North and South Carolina with several populations on Long Island, New York. The decline of this species is caused mainly by development of its habitat, such as inlet areas and barrier islands, and increased ORV and human traffic, which tramples individuals (Fussell 1996). Seed dispersal of seabeach amaranth is achieved in a number of ways, including water and wind dispersal (USFWS 1995).

Seabeach amaranth usually grows between the seaward toe of the dune and the limit of the wave uprush zone. Greatest concentrations of seabeach amaranth occur near inlet areas of barrier islands, but in favorable years many plants may occur away from inlet areas. It is considered a pioneer species of accreting shorelines and stable foredune areas.

Since 1991, the USACE has surveyed Bogue Banks for seabeach amaranth. The following numbers of plants were found on Bogue Banks: 1991 - 490 plants, 1992 - 2,557 plants, 1993 – 3,762 plants, 1994 – 1,181 plants, 1995 – 14,776 plants, 1996 – none, 1997 – 81 plants, 1998 – 3,973 plants, 1999 – 218 plants, 2000 – 20 plants, 2001 – 347 plants, and 2002 – 2,001 plants. Please note these numbers include Emerald Isle, which is not within the project area. Between 1996 and 1999, six hurricanes (Bertha, Fran, Bonnie, Dennis, Floyd, and Irene) have affected this area. Seabeach amaranth populations on Bogue Banks have fluctuated because of these named storms.

c. Current Threats to Continued Occurrence in the Project Area. Beach erosion is probably the primary threat to the continued presence in the area since the population was thriving prior to the recent frequent occurrence of hurricanes. However beach bulldozing and sand fencing by private interests may have affected the population.

d. Project Impacts.

(1) Habitat. Beach disposal will not occur in the inlet areas where amaranth most commonly occurs. The area proposed for beach disposal is not currently conducive to the growth of seabeach amaranth due to the high erosion and inundation throughout its habitat. Disposal would restore much of the habitat requirements for seabeach amaranth. Indeed, new populations have been observed to follow sand placement on other beaches where sand has been disposed by USACE.

(2) Relationship to Critical Periods in Life Cycle. Beach disposal during construction will be conducted up to a continuous 16-month period, which would save up to $2.25 million. However,

only a portion of the beach is affected at any point in time (approximately 4-5,000 feet per month). Once disposal passes that point, recovery can begin to occur. All of Fort Macon State Park, Atlantic Beach, and a portion of Pine Knoll Shores to be nourished, will be nourished during the colder months when the plants have not germinated. The remainder of Pine Knoll Shores and Indian Beach (including Salter Path) will be nourished during the warmer months. While such disposal is not an ideal management practice for the species, the restoration of the habitat is of prime importance. The project area would be included in the USACE monitoring program during the seabeach amaranth growing season for the life of the beachfill.

The Section 933 project would be a one-time placement of maintenance material on Bogue Banks and re-nourishment or future maintenance is not provided under this authority.

(3) Effect Determination. While beach renourishment will restore much of the habitat lost to erosion, disposal on a portion of the beaches in the growing season during project construction may slow population recovery over the short term. Therefore, the project may affect seabeach amaranth.

## 5.00 COMMITMENTS TO REDUCE IMPACTS TO LISTED SPECIES

The following list is a summary of environmental commitments to protect listed species related to the construction and maintenance of the proposed project. These commitments address agreements with agencies, mitigation measures, and construction practices.

1. Hopper dredging activities will comply with the dredging window (1 January to 31 March), turtle deflecting draghead, observers, and whale protective measures in NMFS 1997.

2. In order to determine the potential taking of whales, turtles and other species by hopper dredges, observers will be on board the hopper dredges during construction. To the maximum extent feasible, the observers will record all species captured along with length and weight and any unusual circumstances that might have led to the species capture.

3. If a manatee is observed within 100 yards of operations, all operations will cease until the manatee has left the area.

4. Since disposal on the beaches would occur year round during construction, monitoring of sea turtle nesting activities in beach nourishment areas is required. This will include daily surveys beginning at sunrise from May 1 until September 15. Any nests that require relocation will be moved within 6 hours of nest discovery. Information on nest relocation and hatching success of all nests will be recorded. If sand compaction in the renourishment area exceeds 500 cone penetrometer units (CPUs), tilling will be performed. The beach will be monitored for escarpment formation prior to each nesting season. If an escarpment exceeds 18 inches, then it will be leveled.

## SUMMARY EFFECT DETERMINATION

It has been determined that the project, as currently proposed, may affect the piping plover, green sea turtle, loggerhead sea turtle, hawksbill sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and seabeach amaranth.

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# ATTACHMENT E

# CUMULATIVE IMPACT ASSESSMENT MOREHEAD CITY HARBOR SECTION 933

**Environmental Assessment, Morehead City Harbor Section 933, Carteret County, North Carolina**

**Cumulative Impact Assessment**
**Morehead City Harbor 933**

The Council on Environmental Quality (CEQ) defines cumulative impact as:

*the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (*40 CFR 1508.7). This analysis follows the 11-step process outlined by the Council on Environmental Quality (CEQ) in there 1997 publication Considering Cumulative Effects Under the National Environmental Policy Act.

## 1. Significant Cumulative Effects Issues

This assessment of cumulative impacts will focus on impacts of placement of sand material on the beach (whether for beach nourishment or disposal of dredge maintenance material) on significant coastal shoreline resources. In making this assessment, we have reviewed an Environmental Report prepared for and published by the U. S. Department of the Interior, Minerals Management Service, entitled "Use of Federal Offshore Sand Resources for Beach and Coastal Restoration in New Jersey, Maryland, Delaware, and Virginia," dated November 1999 (DOI 1999) and the US Army Corps of Engineers Dare County Beaches (Bodie Island Portion) Final Feasibility Report and EIS on Hurricane Protection dated September 2000, which included a comprehensive assessment of state wide cumulative impacts. In discussing the potential cumulative impacts of beach nourishment, we consider time crowded perturbations, and space crowded perturbations, as defined below, to be pertinent to this action.

? ***Time crowded perturbations** – repeated occurrence of one type of impact in the same area;*
? ***Space crowded perturbations** – a concentration of a number of different impacts in the same area;*

## 2. Geographic Scope

This analysis will focus on cumulative impacts within the project area since all affected beaches under the 933 proposal have received fill in the past (by the Corps or by the locally funded beach nourishment project) and the proposed action does not represent an increase in the area of North Carolina Beaches affected by sand placement as described in the previously referenced Dare County Beaches EIS. However cumulative impacts of beach nourishment/disposal on a statewide scale will also be assessed herein.

## 3. Time Frame

This analysis considers known past, present and the reasonably foreseeable future, sand placement on a statewide scale and project vicinity scale over a 50-year period of analysis from 1965 to 2015. This time period was selected to include the first US Army Corps of Engineers, Wilmington District, beach nourishment projects in 1965 and includes the first Wilmington District placement of dredged material within the project area (in the vicinity of Fort Macon) in about 1979. While historic accounts of local shore protection efforts including sand placement on Wrightsville Beach dating back to mid 1930s were considered in this assessment, no attempt was made to quantify these actions since detailed data was not available. Projections were extended to 2015, which represents a reasonably foreseeable future.

At the project vicinity scale the cumulative assessment considers past periodic beach disposal of Morehead City Harbor maintenance material about every 8 to 10 years along portions of Atlantic Beach and Fort Macon since about 1979 and local beach nourishment along Pine Knoll Shores, Salter Path, Indian Beach, and Emerald Isle by local interests in 2001/2002, 2002/2003, and 2003/2004. Note, Phase 3 (2003/2004) may be delayed until the NCDCM and US Army Corps of Engineers, Wilmington District, Regulatory Division, issues the required permits for the proposed Bogue Inlet Channel Relocation Project. If these permits are obtained, the approximately 1,000,000 cubic yards of material would be excavated from Bogue Inlet and placed from Pinta Drive (Milepost 18) to Shipwreck Lane in Emerald Isle. If the proposed Bogue Inlet Channel Relocation Project is not authorized, then the approximately 1,000,000 cubic yards of material would be dredged from the previously authorized offshore borrow areas. This assessment assumes continued periodic beach disposal of maintenance material along Atlantic Beach and Fort Macon and construction of the proposed project, to extend this area to include Indian Beach, Salter Path and Pine Knoll Shores for a one-time event under Section 933 in 2003/2004. The cumulative analysis also considers the potential that a future beach nourishment project could be constructed along this length of beach since this is the subject of an ongoing feasibility level study.

## 4. Actions Affecting Beach Resources

The major sources of beach impacts are local beach maintenance activities (which include local beach nourishment), disposal of dredged material from maintenance of navigation channels, berm construction with no maintenance (933 project) and beach nourishment (berm and dune construction with long term periodic maintenance). Of particular concern are shorebirds and fisheries resources that occur on or adjacent to ocean beaches. These resources are also impacted by natural events and anthropomorphic activities that are unrelated to disposal of sand on the beach as discussed below.

**Local Maintenance Activity:** Under the existing condition the project area is subjected to repeated and frequent maintenance disturbance by individual homeowners and local communities following major storm events. These efforts are primarily made to protect adjacent shoreline property. Such repairs consist of dune rebuilding using sand from beach scraping. Limited fill and sandbags are generally used to the extent allowable by CAMA Permit. Local efforts can also include beach nourishment such as that conducted along Pine Knoll Shores, Salter Path Indian Beach, and Emerald Isle by local interests in 2001/2002, 2002/2003, and 2003/2004. Note, Phase 3 (2003/2004) may be delayed until the NCDCM and US Army Corps of Engineers, Wilmington District, Regulatory Division, issues the required permits for the proposed Bogue Inlet Channel Relocation Project. If these permits are obtained, the approximately 1,000,000 cubic yards of material would be excavated from Bogue Inlet and placed from Pinta Drive (Milepost 18) to Shipwreck Lane in Emerald Isle. If the proposed Bogue Inlet Channel Relocation Project is not authorized, then the approximately 1,000,000 cubic yards of material would be dredged from the previously authorized offshore borrow areas. While locally funded beach nourishment activities are not wide spread, they also occur along other developed North Carolina beaches. These frequent maintenance efforts could keep the natural resources of the barrier island ecosystems from reestablishing a natural equilibrium with the dynamic coastal forces of the area.

**Beach Disposal:** Maintenance material from dredging in the vicinity of Morehead City Harbor has historically been disposed along about 6 miles of beach including the Town of Atlantic Beach and Fort Macon. Throughout North Carolina, maintenance dredging of navigation channels places sand along about 22 miles of the 320 miles of beachfront along the North Carolina shoreline (about 7 percent). We currently use about 50 percent of the length of beach that is approved for this purpose and do not anticipate significant increases in beach disposal in the foreseeable future.

Beach quality sand is a valuable resource that is highly sought by beach communities to provide wide beaches for recreation and tourism, as well as to provide hurricane and wave protection for public and private property in these communities. When beach quality sand is dredged from navigation projects, it has become common practice of the USACE to make this resource available to beach communities, to the maximum extent practicable. Placement of this sand on beaches merely represents return of material, which eroded from these beaches, and is, therefore, replenishment with native material. The design of beach placement sites is very simple; generally it extends the elevation of the natural berm seaward. Widths of beach placement zones generally reflect the wishes of the local government relative to the choice between a long, narrow beach or a shorter, wider beach.

**Beach Nourishment:** Beach nourishment activities typically include the construction and long-term (50 year) maintenance of a berm and dune. The degree of cumulative impact would increase proportionally with the total length of beach nourishment project constructed. The first federal North Carolina beach nourishment projects were constructed at Carolina and Wrightsville Beaches in 1965, and totaled about 6.4 miles. An additional 3.8 miles of federal beach nourishment project was constructed in 1975 at Kure Beach. Figure Eight Island, a private beach community also conducts periodic nourishment along about 2 miles of ocean beach. An additional 14 miles of Dare County Beaches is approved for construction starting in 2004. Most of the remaining developed North Carolina beaches (including the proposed project area) are currently under study by the Wilmington District for potential future beach nourishment projects. Previous studies (Dare County EIS, dated September 2000) have speculated that about 88 miles or ~28 percent of the North Carolina coast could have private or federal beach nourishment projects by 2015.

**Berm Construction under Section 933**. The proposed project will include the area of Fort Macon and Atlantic Beach (about 6 miles) that is currently used for disposal of dredged sand from Morehead City Harbor and extend the length an additional 7 miles for a one time event to also include the reach of Pine Knoll Shores, Salter Path and Indian Beach a total of about 13 miles. A detailed project description is found in Section 1.03 of the EA. About 9 miles of Brunswick County Beaches have also received sand under another section 933 project.

**Other factors affecting Beach Resources**. Many factors unrelated to placement of sand on the beach may affect beach resources including, benthic resources, shorebirds populations and ocean fish stocks. The factors can be a result of natural events such as natural population cycles or as a result of favorable or negative weather conditions including droughts, floods, La Niña, El Niño, major storms or hurricanes to list a few. These global events have far greater impacts on these resources at the population level than relatively local activities such as placement of sand on a given ocean beach. A primary anthropogenic factor affecting shorebird populations is beach development resulting in a loss or disturbance of nesting habitat and invasion of domestic predators. Primary man induced factors affecting fish stocks are over fishing and degradation of water quality due to pollution. When examining the cumulative effect of space crowded perturbations these other factors far outweigh the potential incremental effects of beach placement of sand on shorebird or fish populations.

## 5. Significant Resources

Based on scoping comments from resource agencies and others, the primary concern with the beach disposal is the potential for indirect impacts to fish and birds due to potential reductions on food resources due to impacts on beach invertebrates. Discussion of all significant resources considered in this assessment is included in Section 4.00 of the EA.

## 6. Resource Capacity to Withstand Stress and Regulatory Thresholds

In a 1999 Environmental Report on the use of federal offshore sand resources for beach and coastal restoration, U. S. Department of Interior, Minerals Management Service provided the following assessment of potential impacts to beach fauna from beach disposal.

*Because benthic organisms living in beach habitats are adapted to living in high energy environments, they are able to quickly recover to original levels following beach nourishment events; sometimes in as little as three months (Van Dolah et al. 1994; Levison and Van Dolah 1996). This is again attributed to the fact that intertidal organisms are living in high energy habitats where disturbances are more common. Because of a lower diversity of species compared to other intertidal and shallow subtidal habitats (Hackney et al. 1996), the vast majority of beach habitats are recolonized by the same species that existed before nourishment (Van Dolah et al. 1992; Nelson 1985; Levison and Van Dolah 1996; Hackney et al. 1996).*

While the proposed beach disposal may adversely impact intertidal macrofauna, these organisms are highly resilient and any effects will be localized, short-term, and reversible.

## 7. Baseline Conditions

The following EA sections describe the status of significant resources that may be affected by this and other similar projects that are pertinent to this analysis.

4.02 Water Resources
4.04 Marine Resources
4.05 Essential Fish Habitat
4.06 Terrestrial Resources
4.11 Recreational and Commercial Fishing

## 8. Cause and Effect Relationships

The following EA sections describe impacts of the proposed action on significant resources. Cause and effect relationships described in the EA are consistent with those that would be expected other similar projects that are pertinent to this analysis.

5.02 Water Resources
5.04 Marine Resources
5.05 Essential Fish Habitat
5.07 Terrestrial Resources
5.11 Recreational and Commercial Fishing

Concern for fishery resources have been raised regarding turbidity impacts. These impacts are fully discussed in the EA sections listed above, and were considered in preparation of this cumulative impact analysis. Of particular concern to the agencies is a cumulative degradation of habitat with an associated loss of benthic food resources for fish and birds. These are primary issues addressed in this analysis.

## 9. Magnitude and Significance of Beach Impacts

The impacts of beach disposal on North Carolina beaches are considered to be similar to those described herein in Section 5.00. The degree of cumulative impact would increase proportionally with the total length of beach impacted. The most likely beach projects to increase the length on North Carolina beach disposal are beach nourishment projects.

As shown on Chart 6-2 below the North Carolina ocean beach (320 miles) can be divided based on the potential that a beach nourishment project will be proposed for them. The Coastal Area Management Act (CAMA) applies to all 20 North Carolina Coastal Counties. Proper beach nourishment or disposal or local maintenance as described above is generally regulated under CAMA and USACE permitting authorities alone, and for this analysis, are labeled CAMA regulated. Approximately 37 percent of North Carolina beaches are in this category. It could reasonably be expected that any developed and eroding beach in this category is likely experiencing local maintenance and may be considered for disposal or nourishment in the future.

Other North Carolina ocean beach areas are unlikely to be considered for beach disposal. The Coastal Barrier Resources Act (CBRA) of 1982 (PL 97-348) and the Coastal Barrier Improvement Act of 1990 (PL 101-591) restrict federal expenditures in those areas comprising the Coastal Barrier Resources System (CBRS). These are beaches within the CBRS (19 percent), or beaches that are owned and managed by either the state (4 percent) or Federal Government (40 percent), primarily as National or State Parks, or developed and/or regulated by CAMA (37 percent).

The large majority of existing or projected disposal and nourishment projects described below are federal, with less than 2 percent of the activities conducted by private groups. While most CBRS lands are undeveloped because no federal funds may be expended, local maintenance activities could be expected in any developed portions. For example, North Topsail Beach is located within CBRS lands, but individual landowners still repair dunes by beach scraping. Federal and state parks allow highly restricted disposal under special use permit and conduct disposal only as required to protect resources, such as at Pea Island. Only about 10 percent (on National/Federal and State Parks) of all existing or projected disposal/nourishment in North Carolina are on beaches within this category. Of that number, 8 percent are potential nourishment projects in the early planning stage, which are highly speculative but included for worst-case analysis.

This analysis quantifies these impacts in terms of the percent of North Carolina beach affected on an annual and total basis by sand disposal for maintenance of federal navigation channels, and existing, proposed or potential beach nourishment projects. Activities of others are also considered.

**Statewide Impacts.** The following analysis of statewide impacts were determined based on a cumulative impact analysis conducted for the Dare County Beaches (Bodie Island) FEIS in 2000. Areas that were proposed for construction at the time of that analysis but have been constructed are now listed herein as existing projects.

**Existing Federal Disposal Activities**:
Average/year – 8 miles or 3 percent of total NC ocean beach (320 miles).
Minimum for any year – 4 miles or 1 percent of total NC ocean beach.
Total beach affected is 22 miles or 7 percent of total NC ocean beach.

**Existing Local Disposal Activities, 1135 and 933**:
One-time events with no maintenance, constructed since 2000 assessment. Local Bogue Banks Permit - 17 miles, Wilmington Harbor -7 miles, 1135-2 miles.
Total beach affected is 26 miles or 8 percent of total NC ocean beach.

**Existing Beach Nourishment:**
Average of 3 miles per year (USACE project only) or 1 percent of NC ocean beach.

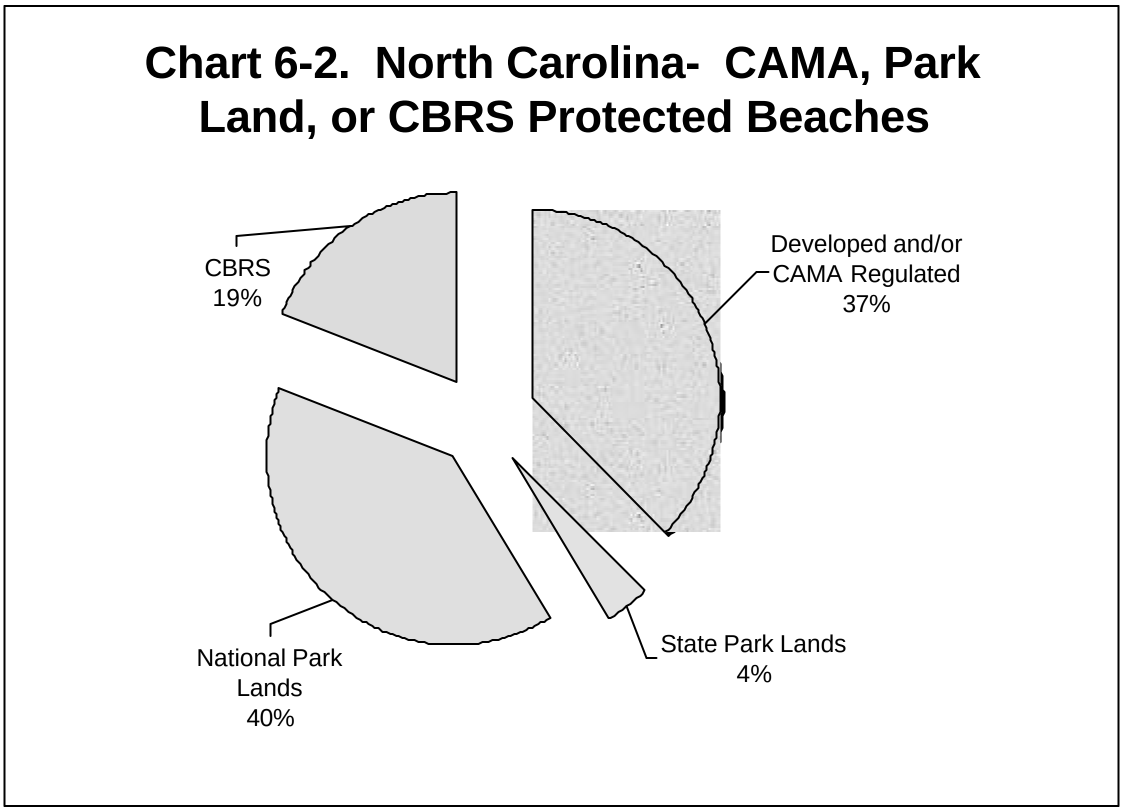
- Minimum of 0 (possible that no beach nourishment in any given year).

- Total beach affected 13 miles, which is about 4 percent of NC ocean beach.
- Adding proposed work completed since 2000 DCB EIS assessment, Ocean Isle - 5 miles. Total beach affected 18 miles, which is about 5 percent of NC ocean beach.

**Proposed Beach Nourishment**

(These numbers are highly speculative and subject to change. Includes best guess for projects that are in early study phases, i.e., study requested but not funded, and reconnaissance).

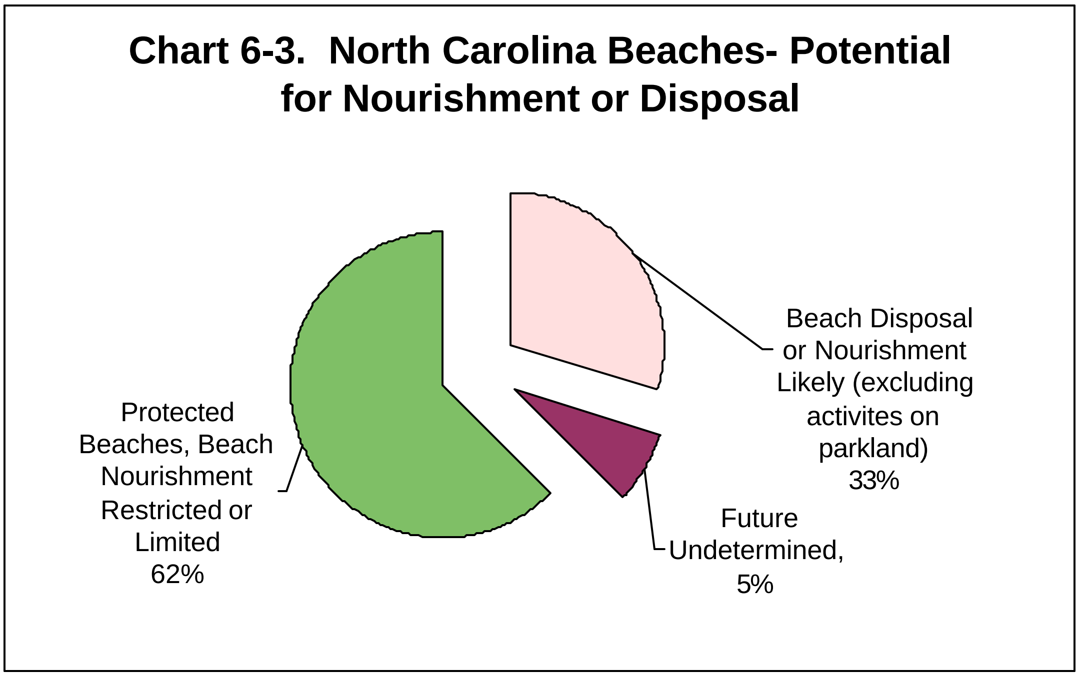
- Average per year of 17 miles or 5 percent of NC ocean beach.
- Minimum would be 0 (possible none would occur in a given year).
- Maximum per year of 42 miles (13 percent)



**Cumulative Impacts**
**(Disposal and nourishment projects existing and future.)**

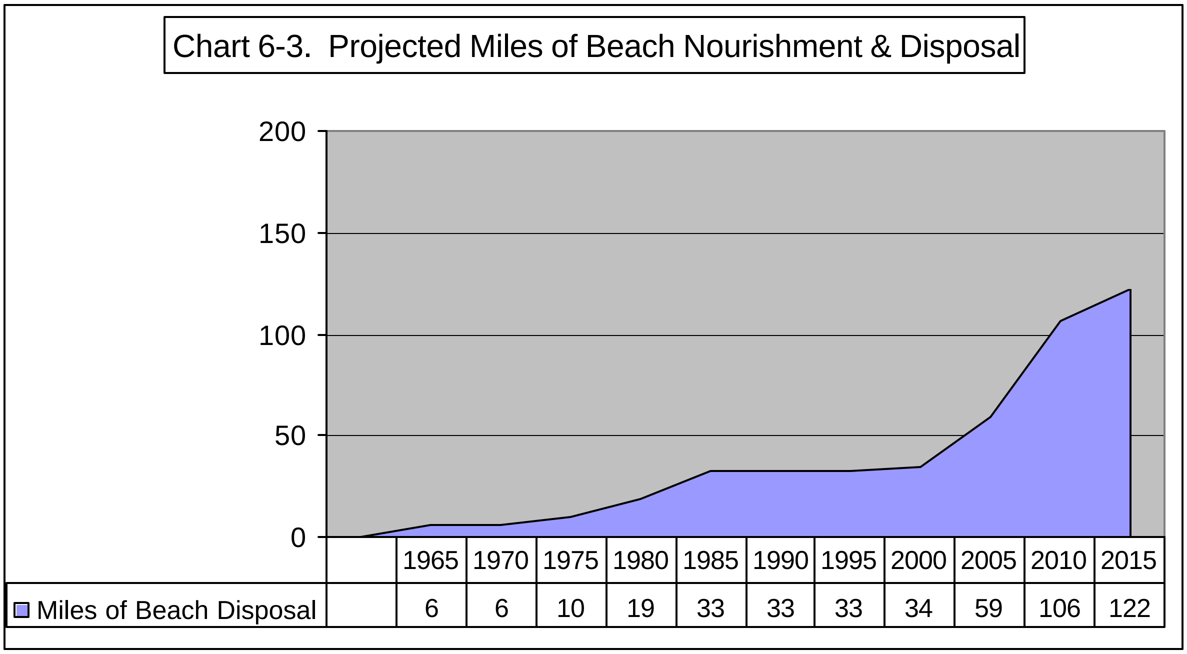
- Average annual impact from existing disposal and nourishment 11 miles, 3 percent of NC beaches.
- Maximum annual impact (worst case) from existing beach disposal and nourishment activities 49 miles, 15 percent of NC ocean beach.
- Average annual impact from existing disposal and nourishment projects and proposed projects 59 miles, 18 percent of NC ocean beach.
- Maximum impact (worst case) from existing disposal and nourishment and potential beach nourishment 122 miles, or 38 percent of NC ocean beach.

Chart 6-3 shows how existing and proposed activities may be distributed statewide.




It is interesting to note that ~5 percent of the North Carolina ocean beach is not regulated beyond CAMA and USACE (for example Hutaff Island located north of Rich Inlet), and is not proposed for beach nourishment or disposal. The future of this area is undetermined. Due to extreme development pressure, however, these are likely to be developed in the future unless additional protection is provided at a state or federal level.

As shown on Chart 6-4, Beach disposal/nourishment activities are relatively limited; however; these activities could potentially increase to 122 miles as early as 2015. Incrementally, the proposed project does not contribute to this increase since is a one time event in an area that has received fill in the past.




**Project Level Impacts**
(13-mile study area)

The approximately 13-mile study area consists of the base disposal plan (i.e., Fort Macon State Park and the Town of Atlantic Beach, which is about 6 miles in length) and the 933 project (i.e., Town of Pine Knoll Shores to Indian Beach (including Salter Path), which is about 7 miles in length).

**a. Existing Local Maintenance:**

- Under existing conditions about 12 miles (92 percent) of the study area is expected to experience frequent local maintenance, including beach scraping and bulldozing, etc. About a mile is within Fort Macon State Park.
- With the study area local maintenance may be reduced along 13 beach miles for a one time event and limited duration.

**b. Existing Disposal Activities:**

- About 6 miles along the eastern end of the study area (i.e., the base disposal plan which includes Fort Macon and Atlantic Beach) receives dredged material on an 8 to 10 year cycle.
- The placement of dredge maintenance material from Brandt Island and the Morehead City Harbor channels along the 13-mile study area is not expected to affect the current disposal schedule.

**c. Existing Beach Nourishment:**

The Local Beach Nourishment project has been conducted on the proposed 933 project area (about 7 miles from Pine Knoll Shores to Indian Beach) and no maintenance is proposed. This work was part of the approximately 17 mile local project extending west to Emerald Isle.

**d. Proposed Beach Nourishment:**

- The entire 13 mile study area is proposed as a component of a potential federal Beach Nourishment project (i.e., The Bogue Banks Shoreline Protection Project).

**e. Cumulative Impacts:**

All areas proposed for sand deposition within the 13-mile study area have had previous beach disposal.

It is possible that the proposed action (i.e., the base disposal plan and the 993 project) will impact beach invertebrates in areas that have not fully recovered from past sand deposition extending recovery time.

It is possible that areas filled under the base disposal plan and the 933 project will be included in a future Federal Beach Nourishment Project .

**Vicinity Impacts**
50 Miles North and South of the project (113 total miles)

**a. Local Maintenance:**
- Under existing conditions ~44 miles or 40 percent of beaches within the project vicinity are developed and are expected to experience frequent local maintenance (i.e., beach scraping, beach nourishment/disposal, etc.).

**b. Disposal Activities:**
- Eight miles or 7 percent of the ocean beach in the project vicinity are currently or have been used for beach disposal of dredged material

**c. Existing Beach Nourishment:**
- About 16 miles (14 percent) of the ocean beach in the project vicinity has been nourished by local interests under the Local Beach Nourishment project.

**d. Proposed Beach Renourishment:**
- Thirty-nine miles (34 percent) of ocean beaches in the project vicinity are under study for a federal beach nourishment project.
- Fifteen miles have not had previous disposal activities or local nourishment.

- One mile by local interests.

**e. Cumulative Impacts:**

- With all proposed and existing disposal and nourishment impacts, potentially 39 miles (34 percent) of ocean beach in the project vicinity may have a federal beach nourishment project within the reasonably foreseeable future.

**Conclusion.**

Relatively small portions of North Carolina beaches (about 15 percent) are presently affected by these activities. With the proposed action, the impact area would not increase since all areas proposed for fill have previously had sand deposition. On a statewide scale the existing and approved disposal sites are well distributed in northern central and southern parts of the state with undeveloped protected beaches (i.e., National/Federal and State Parks and Estuarine Reserves) in between. It is unlikely that cumulative impacts from space crowded perturbation are occurring or will occur due to the construction of this project. The analysis suggests that the potential impact area from the proposed and existing actions is small relative to the area of available similar habitat on a vicinity and statewide basis. These areas are expected to recover food resources, which should continue to be available. It is expected that the risk that the direct and cumulative impacts of the proposed action and other existing similar activities, would reach a threshold with high potential for population level impacts on important commercial fish stocks and birds is low.

## 10. Actions to Reduce Cumulative Impacts

Section 6.14 of the Environmental Assessment includes environmental commitments proposed to minimize project impacts. These actions will also reduce any cumulative impacts.

## 11. Monitoring.

The 933 project is not expected to result in significant cumulative impacts and monitoring is not proposed as a component of this project. To the maximum extent practicable and during the warmer summer months, we will try to reduce direct impacts to intertidal macrofauna by relocation to undisturbed portions of the beach. Several of the incrementally larger beach projects considered in this assessment including Wilmington Harbor, Bogue Banks (local nourishment project) and Dare County Beaches have significant monitoring components that will address beach impact on northern, central and southern North Carolina Beaches. This project is a one-time event, is located within the larger Bogue Banks (local beach nourishment project) and is not appropriate for adaptive management.

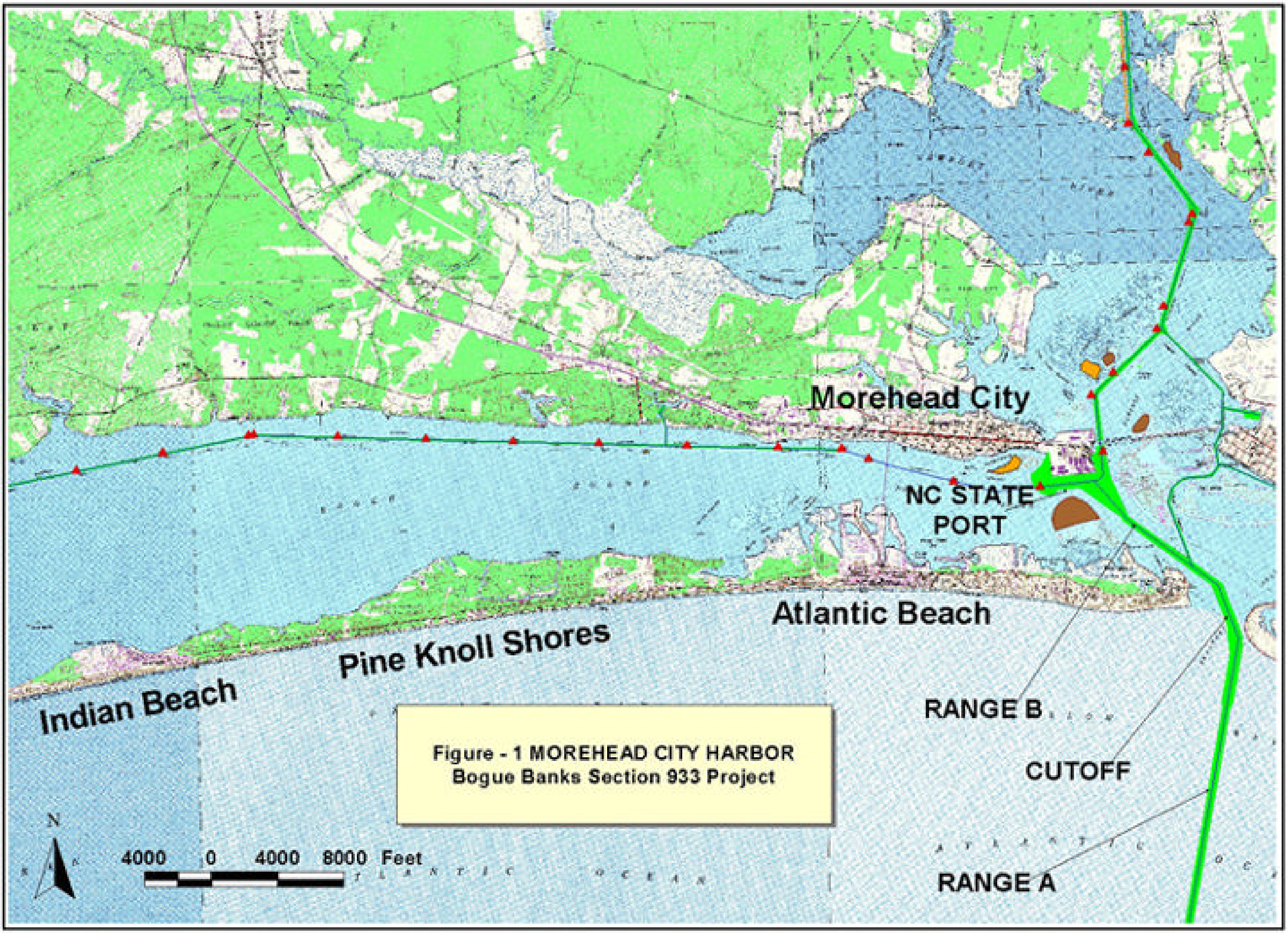



Figure - 1 MOREHEAD CITY HARBOR
Bogue Banks Section 933 Project

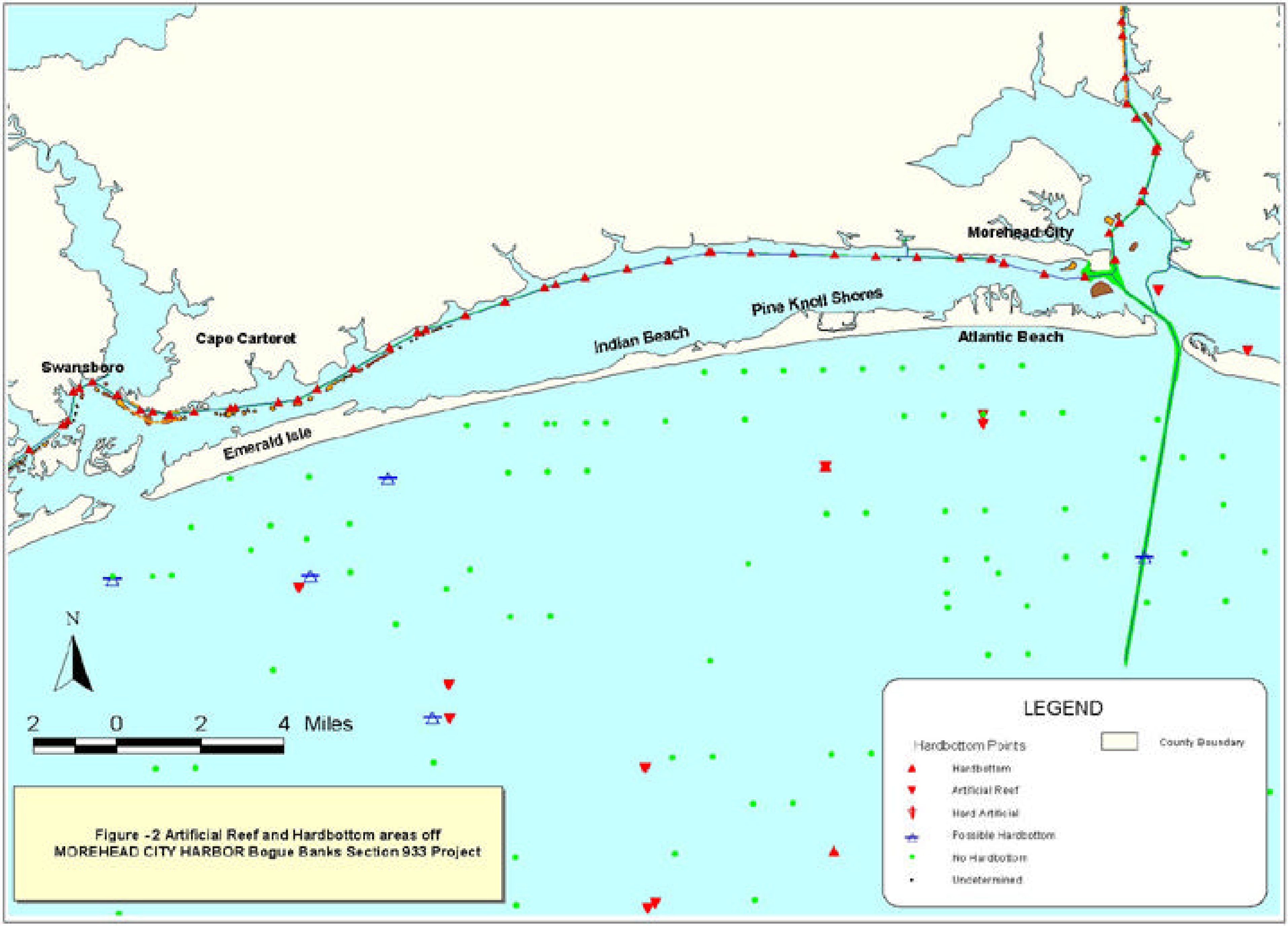



Figure -2 Artificial Reef and Hardbottom areas off
MOREHEAD CITY HARBOR Bogue Banks Section 933 Project


Swansboro
Cape Carteret
Emerald Isle
Indian Beach
Pine Knoll Shores
Atlantic Beach
Morehead City
AR-315
AR-320
AR-342
AR-340
AR-330
AR-345
Figure - 3 Artificial Reefs off MOREHEAD CITY
Bogue Banks Section 933 Project
LEGEND
Artificial Reefs
County Boundary

# MOREHEAD CITY HARBOR
# CARTERET COUNTY, NORTH CAROLINA
# SECTION 933
# EVALUATION REPORT

# APPENDIX A

# CORRESPONDENCE

# Appendix A
# Pertinent Correspondence

NOTE: This appendix includes general correspondence concerning the project.

**Table of Contents**

**EXHIBIT 1**

North Carolina
Department of Environment and Natural Resources
Division of Water Resources

Michael F. Easley, Governor
William G. Ross, Jr., Secretary
John Morris, Director

NCDENR

February 22, 2001

Mr. Steve F. Aiken
US Army Corps of Engineers
Wilmington District
PO Box 1890
Wilmington, NC 28402-1890

Dear Mr. Aiken:

The State of North Carolina supports the interest of Carteret County in a study for a potential Section 933 Project for use of spoil material from Morehead City Harbor on Bogue Bank beaches.

Please contact us for any assistance that we can provide in getting this study under way. Financial participation by the State of North Carolina in the study and in an eventual Section 933 Project will be determined through the State's budget decision process.

We will look forward to working with Carteret County and with the Corps of Engineers on this study.

Sincerely,

John

John N. Morris

cc: Mr. Frank Rush

**EXHIBIT 2**

Board of Commissioners
Doug Brady, Chairman
Jonathan Robinson, Vice-Chairman
Bettie Bell
David Wheatly
Jimmy LaShan
Pam Stell
Mac Wells

January 22, 2001

Mr. John Morris, Director
NC Division of Water Resources
Archdale Building
512 N. Salisbury Street
Raleigh, NC 27611

Dear John:

At its January 8, 2001 meeting, the Carteret County Board of Commissioners approved the attached resolution requesting a Section 933 project for eastern Bogue Banks. We understand that the State of North Carolina must submit such requests to the US Army Corps of Engineers on behalf of local governments, and hereby request that the State submit a formal request to the Corps for a Section 933 project that would utilize dredge spoils currently stored on Brandt Island to nourish Bogus Banks beaches in the winter of 2003-2004.

I have been in contact with Steve Aiken In the Corps' Wilmington District office over the past few months regarding the potential Section 933 project. According to the attached letter from Mr. Aiken, a request for such a project must be made as soon as possible in order to provide enough time for the Corps to complete the required studies and secure the necessary permits to place the sand on the beach strand In 2003-2004. As you know, Carteret County continues to pursue a long-term Shore Protection Project through the Corps. We are currently In the Feasibility Phase, and estimate that Initial nourishment under the Shore Protection Project would not occur until FY 2008-2009 or later. The Section 933 project would provide an Interim solution to the erosion problems on eastern Bogue Banks until the long-term Shore Protection Project is constructed.

Although details of the project are very preliminary, Mr. Aiken has indicated that the Corps plans to pump out approximately 6 million cubic yards of dredge spoils from the Brandt Island site in 2003-2004. A portion of this material will be placed on the beach In Atlantic Beach and Fort Macon State Park free of charge, as, 4 represents the Corps' least cost disposal method. The remainder of the dredge spoils would be placed as far west on Bogue Banks as feasible, beginning at the eastern town limits of the Town of Pine Knoll Shores. Mr. Aiken has indicated that it appears to be feasible to pump this additional material to a substantial portion, if not a6, of Pine Knoll Shores' 4.5 miles of beachfront. You will note that Carteret County is also requesting that a portion of this additional material be placed on 2.5 miles of beachfront in the Town of Indian Beach and the Village of Salter Path at the same time If feasible. All three of these areas of Bogue Banks are faced with severe erosion problems, and the implementation of a Section 933 project would provide much needed storm protection and recreational benefits.

The attached summary sheet contains some of the preliminary estimates for volume, placement, and cost of such a project. You will note that the placement of 4 million (of the 6 million total cubic yards) cubic yards along the 7 miles of beach In Pine Knoll Shores, Indian Beach, and Salter Path would yield approximately 107 cubic yards per linear foot. Based on a total of 4 million cubic yards, the total estimated cost of this project is approximately $19.2 million. Under the current cost-sharing formula(the State provides 75% of the non-federal share), the total State share for this project would be approximately $5.1 minion. Please note that this contribution would not be due to the Corps until FY 2003-2004. Carteret County would provide the remainder of the non-federal share, approximately $1.7 minion, In FY 2D03-2004.

Carteret County appreciates the State's assistance as we address the beach erosion problems on Bogue Banks. Your agency has been supportive of our efforts to date, and we hope to continue to receive your . support for this and other requests. Please contact me If you need any additional information about Carteret County's Section 933 request. I will be happy to provide any assistance necessary to move this project forward.

Thanks again for of your help.
Sincerely,

Frank A. Rush, Jr.
Assistant to the County Manager
.
copy:
,
State Senator Patrick Ballantine
State Senator Scott Thomas
State Representative Jean Preston
State Representative Ronnie Smith
US Representative Waiter B. Jones
US Senator Jesse Helms
US Senator John Edwards
Robert Murphy, County Manager
Colonel James DeLony, US Army Corps of Engineers
Steve Aiken, US Army Corps of Engineers
John Sutherland, NCDENR Water Resources
David Walker, Atlantic Beach Town Manager
Joe Stroud, Atlantic Beach Mayor
Betty Carr, Pine Knoll Shores Town Administrator
Reese Musgrave, Pine Knoll Shores Mayor
Buck Fugate, Indian Beach Mayor

Board of Commissioners

Doug Brady, Chairman
Jonathan Robinson, Vice-Chairman
Battle Bell
David Wheatly
Jimmy Lashan
Sam Stall
Mac Wells

**RESOLUTION REQUESTING THAT THE STATE OF NORTH CAROLINA REQUEST A SECTION 933 PROJECT TO PLACE BEAUFORT INLET DREDGE SPOILS ON BOGUS BANKS**

WHEREAS, the beaches of Bogue Banks are in need of nourishment to provide storm protection for valuable properties and an attractive recreational beach for visitors to Carteret County, and

WHEREAS, the US Army Corps of Engineers is scheduled to pump out the Brandt Island dredge spoil disposal site (which holds material dredged from Beaufort Inlet) In the winter of 2003-2004, and

WHEREAS, Carteret County believes it is essential that dredge spoils derived from navigation dredging activities be placed back on the beaches of Bogue Banks, and

WHEREAS, the Corps estimates a volume of approximately 6 million cubic yards of sand Is available for placement on the beaches of Bogue Banks from this pump-out, and

WHEREAS, the beaches of Fort Macon and Atlantic Beach will receive a portion of this sand free of charge because it represents the Corps' least cost disposal area, and

WHEREAS, the Corps has alerted Carteret County to the possibility of placing the balance of this sand on the beaches of Pine Knoll Shores and, If feasible, Indian Beach and Salter Path If a Section 933 project Is authorized and funded, and

WHEREAS, a Section 933 project in FY 2003-2004 would provide additional sand for these areas of Bogue Banks after proposed locally funded projects occur in FY 2001-2002 and before the projected date of the initial nourishment under the Shore Protection Project in FY 2008-2009, and

WHEREAS, the additional cost to pump sand from Brandt Island beyond Atlantic Beach Is estimated at approximately $19.2 million (preliminary estimate), and

WHEREAS, under a Section 933 project, the Corps would provide 65% of the funding, and the State of NC has historically provided an additional 26.25% of the funding, leaving the Carteret County share at 8.75%, and

WHEREAS, this cost-sharing arrangement would result in an estimated local cost of $1.7 million, and no financial. commitment is necessary until FY 2003-2004, and

WHEREAS, the State of NC must make the formal request for a Section 933 project on behalf of Carteret County, and

WHEREAS, the Carteret County Beach Preservation Task Force has passed a resolution urging Carteret County to request that the State of NC formally request a Section 933 project for Bogue Banks,

NOW, THEREFORE; BE IT RESOLVED by the Carteret County Board of Commissioners that Carteret County hereby requests that the State of NC formally request that the US Army Corps of Engineers undertake a Section 933 project to place Beaufort Inlet dredge spoils on Bogue Banks when Brandt Island is pumped out in the winter of 2003-2004. The County Manager is hereby authorized to submit this request to the State of North Carolina.

Adopted this 8 the day of January, 2001.

ATTEST:

Robert Mur

Jlis 8 1 Q
**Brandt Islar**
**to the**

W. Douglas Brady, Chairman

**EXHIBIT 3**

Board of Commissioners

Battle H. Bell, Chair
Doug Brady
Lynda Clay
Jack Dawsey
Raymond N. Muns
Jonathan Robinson, Vice-Chair
David Wheatly

January 6, 2003

Colonel Charles R Alexander
U.S. Army Corps of Engineers
Wilmington District
P.O. Box 1890
Wilmington, North Carolina 28402-1890

Re: Project Cooperation Agreement
Morehead City Harbor Section 933 Project
Bogue Banks, Carteret County

Dear Colonel Alexander:

The purpose of this correspondence is to confirm Carteret County's intent and willingness to execute a Project Cooperation Agreement (PCA) with the U. S. Army Corps of Engineers (USACE) regarding the Section 933 Project that has been developed for Bogue Banks and is scheduled for Federal fiscal year 2004. It is anticipated that the Project will be constructed concurrently with operation and maintenance activities associated with the Morehead City Harbor Federal Navigation Project. The decision to execute a PCA is predicated on the information provided by the Wilmington District and their dedication in formulating a locally preferred plan.

It is the County's understanding as the local sponsor that the. estimated non-federal cost for design and construction of the Section 933 Project is approximately $6.3 million. The federal cost is approximately $11.6 million. It is our understanding that this cost will be finalized with the completion of the Section 933 Report in late January 2003 and is still subject to change once bids are opened in August/September 2003. tinder State statutory provisions guiding the North Carolina Water Resources Development Project Grant Program, local governments are eligible for up to 75 percent of the non-federal share of beach protection projects where public access is allowed and provided for. The County and the N.C. Division of Water Resources, the agency responsible for administering water resource grants, have been in communication regarding the design and cost parameters of the Section 933 Project. The N.C. Division of Water Resources generally supports local funding requests and has already shown strong support for the Section 933 Project, however State funding is dependent upon appropriation decisions by the General Assembly and upon the priority of the Morehead City Harbor Section 933

Project compared to other projects throughout the State. The County anticipates the local cost share to be approximately $1.6 million, assuming successful procurement of a N.C. Water Resources Development Project Grant.

The County, in direct cooperation and agreement with the municipalities of Pine Knoll Shores and Indian Beach, will secure necessary easements, access/parking accommodations, and has a revenue stream dedicated to cover the local, non-federal costs for the Section 933 project. The municipalities of Pine Knoll Shores and Indian Beach have forwarded us correspondences ensuring their abilities and willingness to participate in the Project. The County will also provide all other terms and requirements of local cooperation as may be required for construction of the project. The County is in agreement with the Project as presented in the Evaluation Report dated January 2003, and intends to sign a PCA when and as required.

The Morehead City Harbor Section 933 Project will be a tremendous asset for the County, State, and Country in preserving, protecting, and improving the recreational benefits, environmental habitats, economic well-being, and shore protection capabilities associated with wide and healthy beaches. The USACE's support and assistance in expediting the approval of the Morehead City Harbor Section 933 Project is most greatly appreciated. Please do not hesitate to contact the County's Shore Protection Office if you require any assistance or additional information.

Sincerely,

Bettie Bell
Chairperson, Carteret County Board of Commissioners

Cc: Mayor Buck Fugate, Indian Beach
Mayor Bob Gallo, Pine Knoll Shores
John Morris, N.C. Division of Water Resources
The Honorable Walter B. Jones, Jr., United States Congress
The Honorable Elizabeth Dole, United States Senate
The Honorable John R. Edwards, United States Senate

# MOREHEAD CITY HARBOR
# CARTERET COUNTY, NORTH CAROLINA
# SECTION 933
# EVALUATION REPORT

# APPENDIX B

# FEDERAL STANDARD -
# BASE DISPOSAL PLAN

# APPENDIX B
# FEDERAL STANDARD - BASE DISPOSAL PLAN

The purpose for the Brandt Island pump-out is to create capacity for future maintenance dredging of Morehead City Harbor. In addition to this general purpose, there exist specific criteria for the disposal of material on adjacent area beaches:

a. minimize scarping;
b. minimize trapped/ponded water on beach;
c. minimize lateral and offshore losses due to excessive berm width; and
d. minimize losses into entrance channel.

These criteria address the Federal standard as defined in 33 CFR Part 335 where identified alternatives should "represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards..." Therefore, considering the above factors, the disposal fill should:

a. be placed at the natural berm elevation, which historic surveys and monitoring have demonstrated to be +7 ft NGVD;
b. have acceptable berm widths to minimize risk of channel shoaling;
c. have transitions at the lateral extents to tie in with the adjacent shoreline

The total volume of material available for the November 2003 Brandt Island Pumpout and Inner Harbor maintenance is approximately 4.8 Million cubic yards (M cy). The distribution of the 4.8 M cy consists of 4.0 M cy presently in the Brandt Island Disposal Facility and an additional 0.8 M cy estimated dredging of the Inner Harbor for November 2003.

It is assumed that all of the material will be removed as part of the Least Cost Disposal action. Actual quantity removed will depend on available funding. Based on previous beach nourishment experience in NC and at Bogue Banks, it is also assumed that an average of 10% losses will occur during dredging, pumping and placement operations (which is an accepted standard loss rate for this type of material being dredged, pumped and placed via pipeline dredge). Therefore, it is estimated that the resulting volume of material that will remain on the beach is approximately 4.3 M cy.

Beach nourishment design practice distinguishes between a "construction" profile and a "design" profile because as a practical matter, dredges and earth moving equipment cannot distribute sand below the approximate mean low water (MLW) elevation (i.e., below water). Therefore, sand for beachfill is placed in a construction profile, which includes a wider berm than ultimately desired. This sand quickly re-distributes along the profile nourishing the below water areas to the depth of closure resulting in the design profile (which includes the design berm width). Design berm widths ranging from 50 ft to 200 ft were analyzed for this analysis. The upper and lower bounds are based on historic beachfill experience. Comparison of the design template to existing beachfill conditions as determined through recent surveys resulted in required volumes per linear ft and associated construction width. The minimum 50-ft design berm results in an average construction berm of 140 ft with an average of 88 cubic yards per linear ft being placed along the beach. The large 200-ft design berm, comparable to that placed along Fort Macon during the 1994 beach disposal operation, results in an average construction berm width of 341 ft with an average of 199 cubic yards per linear ft being placed along the beach. Table 1 summarizes all berm widths evaluated with resulting construction berm widths and unit volume requirements.

Previous disposal experience at Fort Macon has indicated placement of large berm widths near the inlet may result in negative impacts (i.e., excessive shoaling) on the adjacent channel. During the 1994 disposal operation, approximately 1.15 M cy were placed in the vicinity of Fort Macon, resulting in an average construction berm width of 340 ft and transition angles of 10 to 12 degrees. These large transition angles and the offshore extent of the fill exposed to the inlet's currents contributed to the rapid loss of material from the disposal areas. While the disposal of Morehead City harbor dredged material on the east end of Bogue Banks has substantially improved the condition of this section of the island, the disposal practice, which creates inordinately wide beaches with very sharp transition angles, is not the most efficient use of the material (USACE 2001, Summary of Morehead City Harbor Section 111 Study). The analysis of the performance of the three major disposal operations on the east end of Bogue Banks revealed rapid loss of material from the disposal areas. Significant portions of the material placed on the Fort Macon shoreline in 1978 and 1994 appeared to be transported directly into Beaufort Inlet within a few years following disposal. The return of this material to Beaufort Inlet may be partly responsible for the increase in dredging required to maintain the Morehead City Harbor project, but a definitive conclusion in this regard is not possible due to the increased shoaling rates associated with the incremental increases in project depth since 1978.

For the fixed volume of 4.8 M cy to be removed from Brandt Island and the Inner Harbor and pumped throughout the project area, the lowest cost for a contiguous beachfill placement for each berm width was evaluated. The least cost for all cases (berm widths), resulted from starting placement at Fort Macon and extending westward. Figures 1 and 2 display the cumulative volume and cumulative cost, respectively for uniformly placing the 4.8 Million cy from Fort Macon until the location where material ran out. Figure 1 shows that a 50-ft berm could be spread uniformly from Fort Macon through most of Pine Knoll Shores, while the 200-ft berm could only be placed approximately halfway through Atlantic Beach.

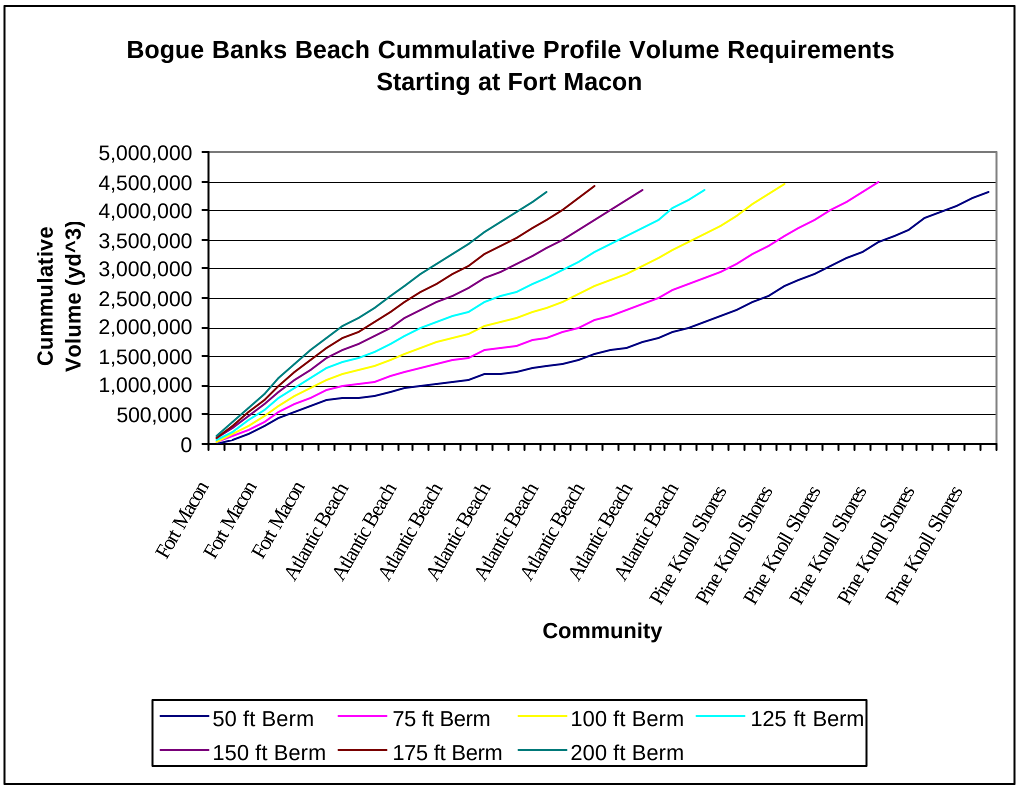



**Figure 1. Cumulative volume requirements for various berm widths**

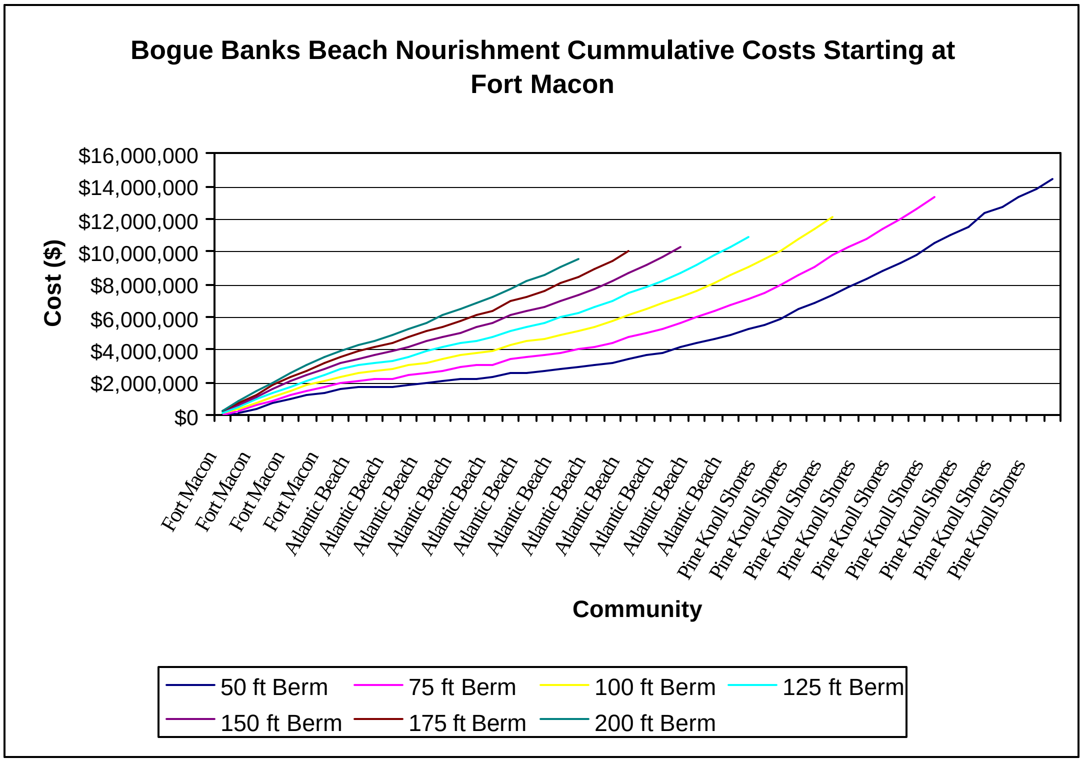



**Figure 2. Cumulative costs of placing material**

As indicated in Table 1, the least cost for pumping 4.8 M cy of sand onto the beach is $9.488M for the 200-ft design berm width. However, this is not a practical engineering alternative due to the high risk of fill loss and increase in channel shoaling. Therefore, to minimize risk of entrance channel shoaling and adjacent fill losses, we suggest significantly reducing the berm width. The acceptable berm width was determined by comparing the average volume of material placed per ft along the beach to recently constructed beachfills with acceptable performance. Several USACE projects along beaches that were classified as being in relatively "poor" shape have required unit volumes on the order of 140 cubic yards per ft and have thus had acceptable performance.

**Table 1. Berm volumes and costs**

| Design Berm width (ft) | Brandt Island and Inner Harbor (4.8 Million Cubic Yards) | | | |
|---|---|---|---|---|
| | Length | Avg Const Berm (ft) | Avg Vol/ft (c.y./ft) | Cost |
| 50 | 50,000 | 140 | 88 | 14,341,248 |
| 75 | 42,250 | 175 | 104 | 12,705,694 |
| 100 | 36,500 | 209 | 120 | 11,540,078 |
| 125 | 32,000 | 240 | 138 | 10,741,541 |
| 150 | 28,000 | 275 | 157 | 10,164,736 |
| 175 | 25,000 | 309 | 178 | 9,765,095 |
| 200 | 22,250 | 341 | 199 | 9,488,025 |

From an engineering perspective, a Base Disposal Plan berm width of near 125 ft design width is ideal because the required volume/linear foot (138 cy/lf) is consistent with normal beach nourishment practices for stability on the beach. Environmental staff indicated that and environmentally acceptable berm width based on needs for sea turtle nesting was a design berm width of 150 ft (construction berm width of 275 ft). Though this width is slightly larger than the preferred width for stability on the beach, it is only 25 ft larger in design (35 ft in construction) and will meet sound engineering practice especially considering the needs for construction of a berm as wide as possible.

This Base Disposal Plan (150 ft design berm) will start in Fort Macon at Station 15+25, leaving no sand placed within approximately 2,250 ft of the jetty (Figure 3). Station 0+00 is located 725 ft west of the jetty. The fill will transition for approximately 1,500 ft towards the west to achieve a full 150 ft berm at Station 30+00. Assuming all of the 4.8 M cubic yards available is placed from this location westward with consideration of the fishing piers, the 150 ft design berm will end approximately 900 ft east of the Atlantic Beach/Pine Knoll Shores border at Station 305+00 (Figure 4). The presence of a fishing pier in the vicinity of the Atlantic Beach / Pine Knoll Shores border prevents placement of the materia l throughout Atlantic Beach (Figure 5). It is recommended the Base Disposal limits consist of all of Fort Macon and Atlantic Beach for economic analyses associated with the Section 933 Study.

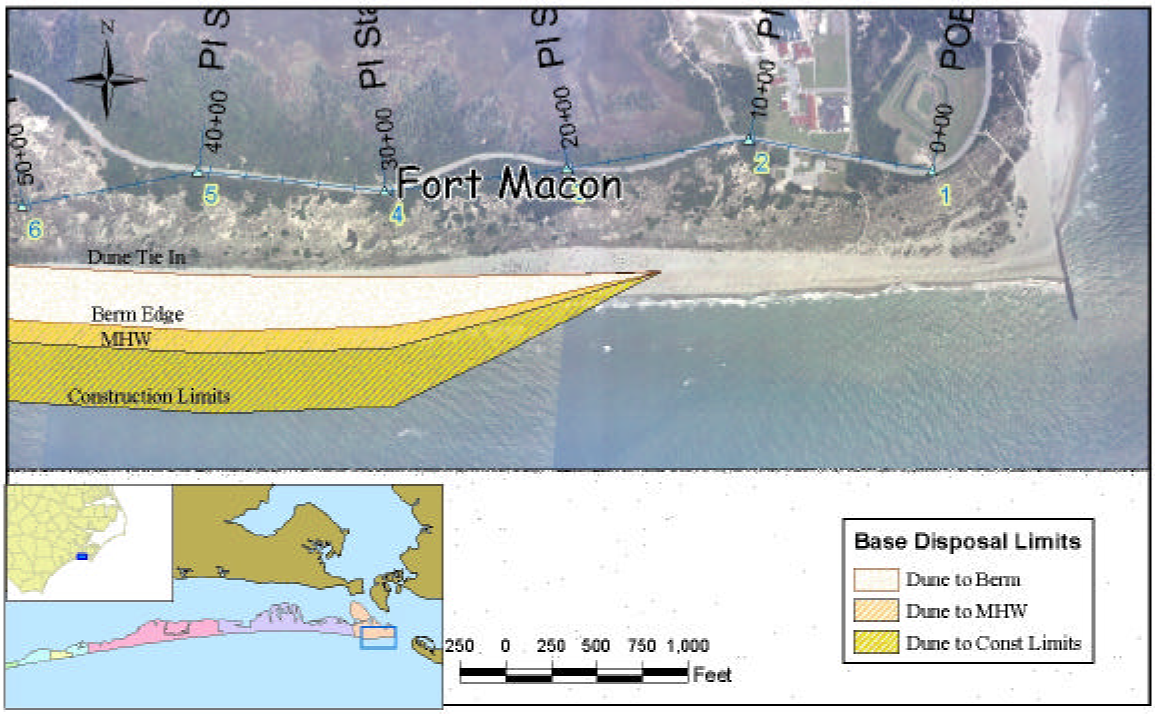



**Figure 3. Base Disposal Limits in the vicinity of Fort Macon.**

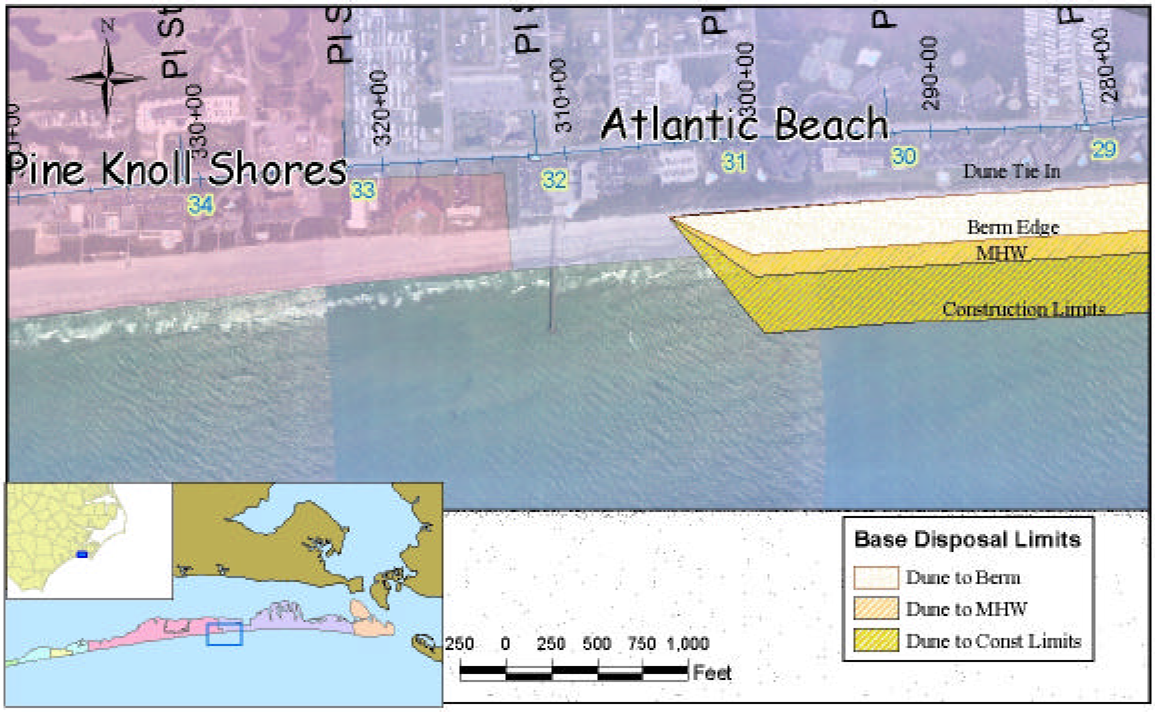



**Figure 4. Base Disposal Limits in the vicinity of Atlantic Beach and Pine Knoll Shores border**

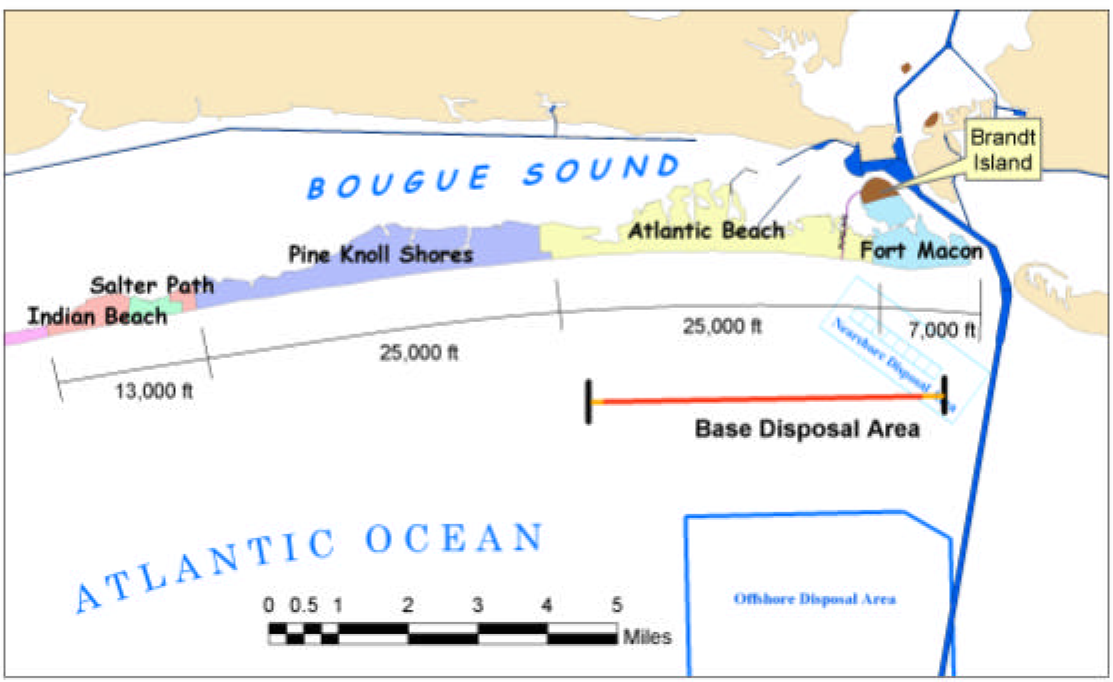



**Figure 5. Morehead City Section 933 Base Disposal Plan Location.**

**MOREHEAD CITY HARBOR**
**CARTERET COUNTY, NORTH CAROLINA**
**SECTION 933**
**EVALUATION REPORT**

# APPENDIX C

# C Coastal Analysis

Detailed investigations of the geomorphologic conditions and coastal processes associated with Bogue Banks, North Carolina were conducted through a combination of field data analysis and numerical modeling. Numerical simulations of wave transformations, tidal circulation, sediment transport, and storm-induced beach profile response along Bogue Banks were conducted to evaluate and compare engineering alternatives to reduce storm damages in the vicinity of Morehead City Harbor.

The purpose of this chapter is to summarize the technical details of the coastal analysis and to describe the hydraulic conditions that will be used to evaluate the Base Disposal and Recommended Plans as described in the Main Report. First, the existing beach conditions (beach profiles and shoreline positions) and representative coastal processes (waves, water levels, sediment transport) will be described. Next, simulations of storm conditions, storm-induced beach profile response modeling, shoreline response modeling, and the generation of frequency-of-occurrence relationships for select response parameters will be discussed. Finally, the inputs into the storm damage model are presented.

## Existing Conditions

Bogue Banks is a barrier island with a southward facing ocean shoreline stretching approximately 25 miles between two large tidal inlets, Bogue Inlet to the west and Beaufort Inlet to the east. The Banks are surrounded by Bogue Sound on the north and Onslow Bay of the Atlantic Ocean on the south. The island is made up of the Fort Macon State Park, the Towns of Atlantic Beach, Pine Knoll Shores, Indian Beach, and Emerald Isle and the unincorporated area of Salter Path (Figure C-1). Morehead City Harbor is located in the Beaufort Inlet complex between Bogue Banks to the west and Shackleford Banks to the east. Brandt Island is located north of Fort Macon State Park in the Inner Harbor section of Morehead City Harbor.

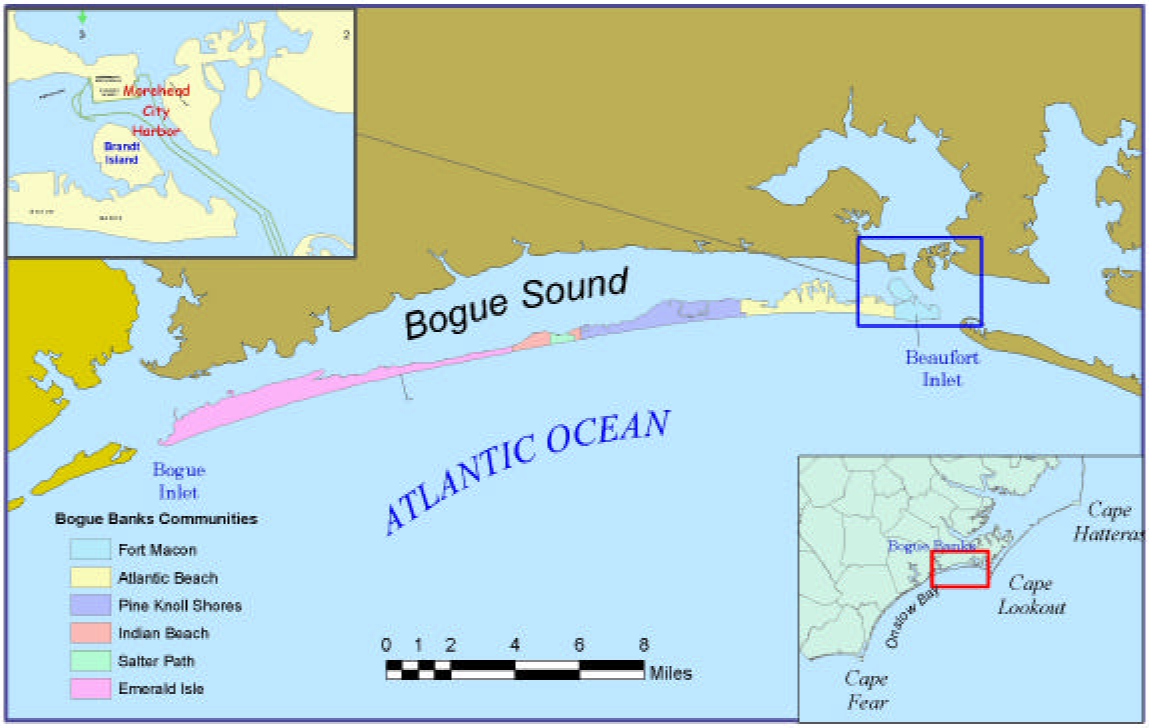



Figure C-1. Bogue Banks Location Map.

Existing and historical conditions at Bogue Banks, North Carolina were characterized utilizing aerial photographs, bathymetric and topographic survey data, National Ocean Service (NOS) water level data, NOS LIDAR data, Wave Information Studies (WIS) wave hindcast data and coastal processes models. Historical shoreline positions, delineated from aerial photographs, LIDAR data, and beach profile data document the range in shoreline conditions and relative beach stability in the Bogue Banks area over an extended time period. Recent bathymetry and topographic surveys served as input for coastal processes model grids. NOS water level data were used to drive coastal process models and to define water level datum relationships for the area. Coastal process models were used in this investigation to characterize wave and current conditions for existing conditions, develop storm conditions used in the storm damage analysis, and to characterize performance of alternatives designed to reduce storm damage potential.

### Beach Profile Characteristics

During the Fall of 2001, beach profile data were collected along 129 transects at approximately 1000 ft spacing throughout the island (Figure C-2). Dune crest elevations typically exceeded +14 ft NGVD, indicating a healthy dune system. The average berm elevation is approximately +7 ft NGVD with an average nearshore slope of 1V:25H. The existing berm widths however are very narrow, allowing the toe of the dune to be inundated and exposed to direct wave attack during moderate storm surge events. The beach profile data were utilized with the structure database and historic shoreline change rates to develop representative reaches as shown in Figure C-3.

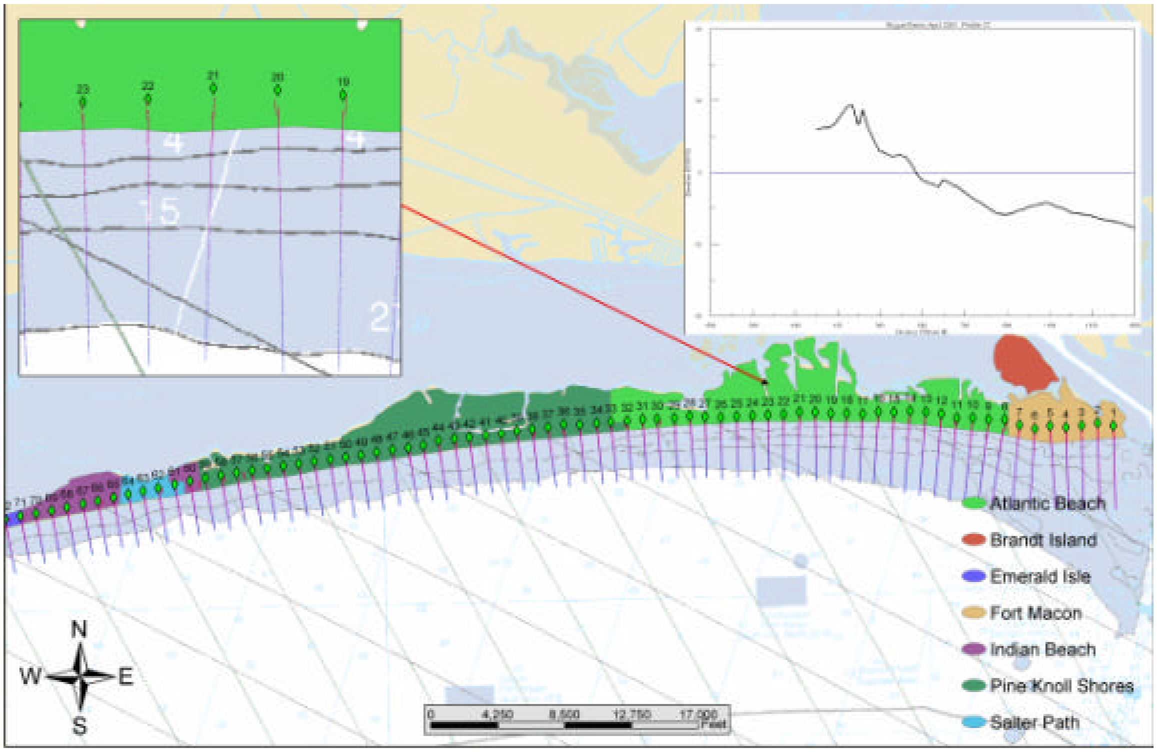



Figure C-2. Bogue Banks April 2001 Beach Profile Survey Layout.

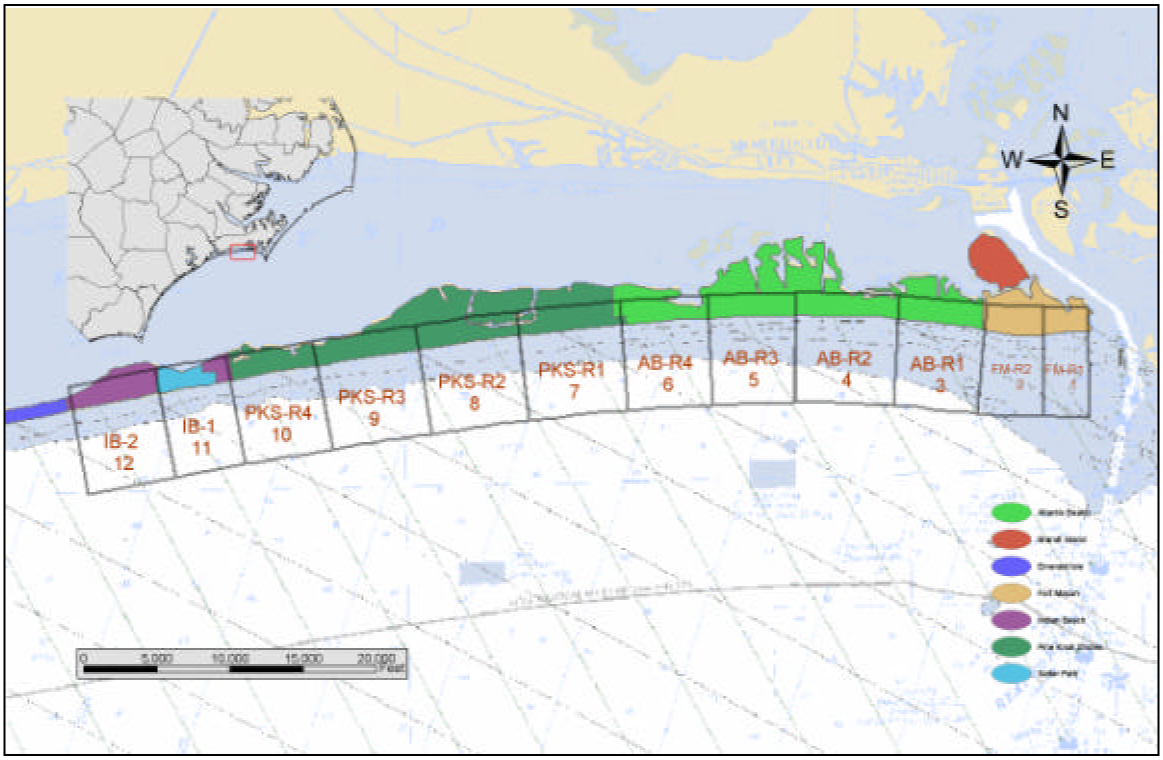



Figure C-3. Representative Reach Locations.

Representative beach profiles were developed for each of the representative reaches by combining the 1000-ft spaced profiles together. Significant care was taken to maintain important features such as the berm and nearshore bar. Figures C-4 through C-7 show the representative beach profile conditions developed. The profiles were utilized as input into the storm damage modeling for existing conditions.

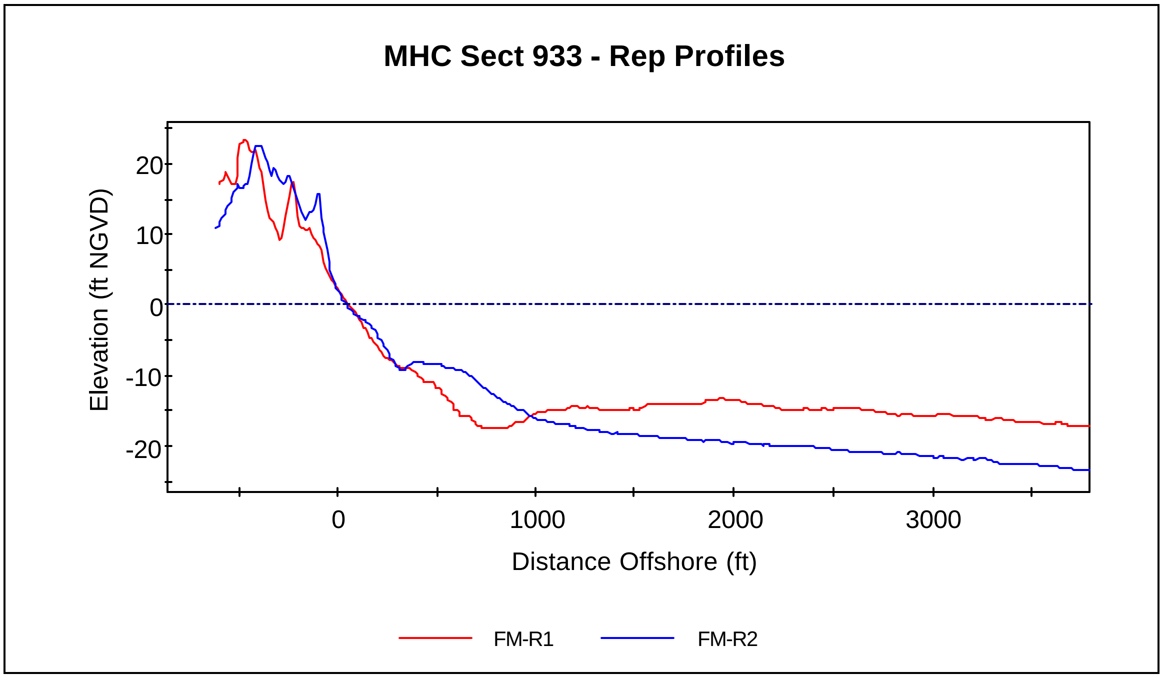



Figure C-4. Representative Beach Profiles at Fort Macon.

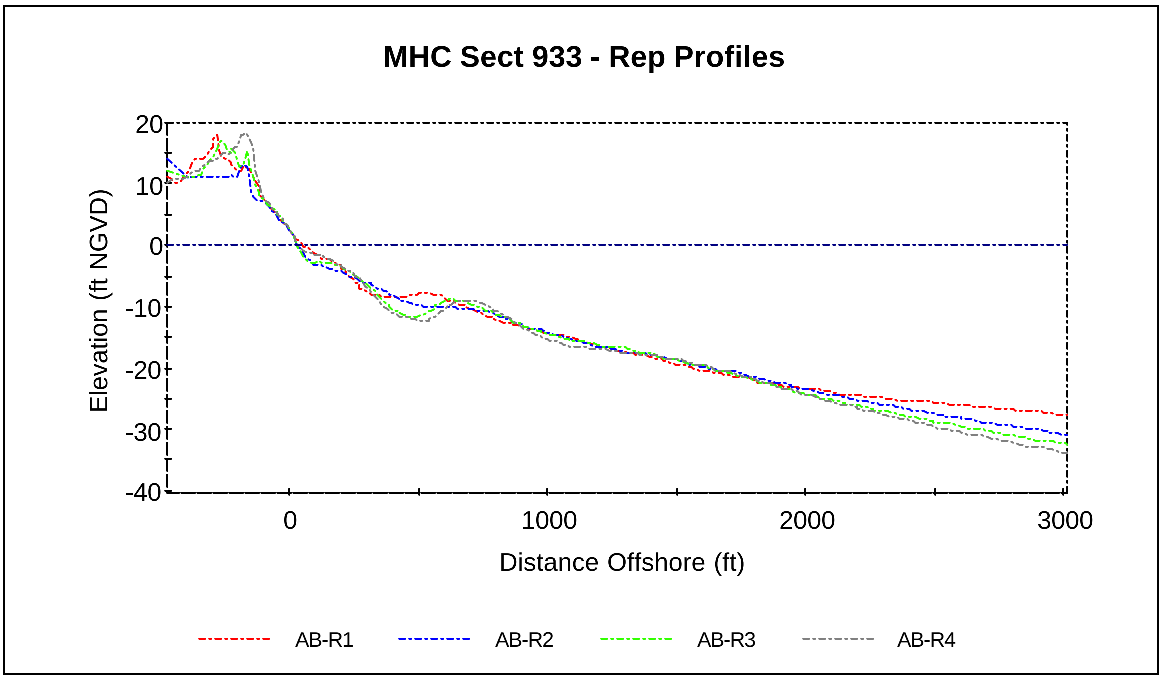



Figure C-5. Representative Beach Profiles at Atlantic Beach.

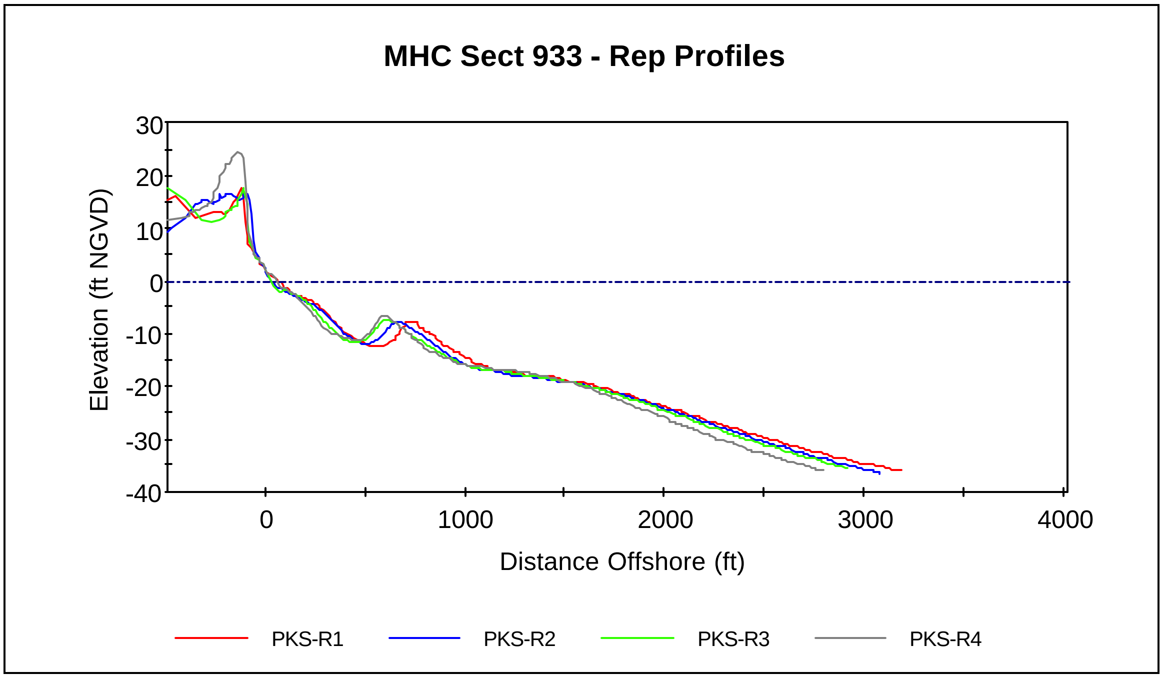



Figure C-6. Representative Beach Profiles at Pine Knoll Shores.

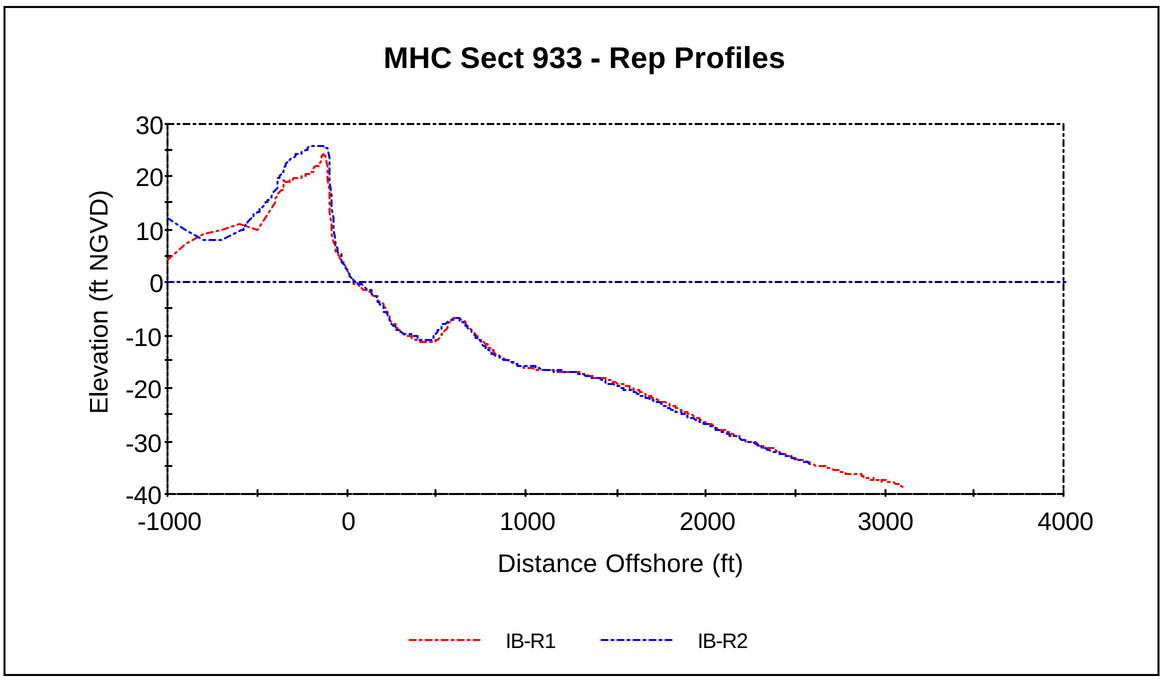



Figure C-7. Representative Beach Profiles at Indian Beach.

## Shorelines

A detailed examination of historic and recent shoreline conditions was performed to compute shoreline change rates and to serve as input into the sediment transport analysis. All shorelines utilized were projected to the North Carolina State Plane (NAD 83) coordinate system, interpolated to previously established shore-perpendicular transects, and added to the shoreline geodatabase. A Geographic Information System (GIS) was utilized to help visualize the range in shoreline conditions.

**Shoreline Database**

Shoreline positions were developed for numerous dates through analysis of NOS T-sheets, aerial photography, beach profiles, and LIDAR data. Table C-1 displays the shoreline dates and corresponding sources available for use in shoreline change analysis.

Table C-1. Shoreline Data Inventory.

| Date | Type | Source |
|---|---|---|
| 03/30/43 | NOS T-Sheet | NC DCM |
| 08/16/59 | NOS T-Sheet | NC DCM |
| 05/11/78 | Beach Profile Survey | USACE |
| 12/08/80 | Interpreted Aerial Photography | NC DCM |
| 08/25/86 | Beach Profile Survey | USACE |
| 06/17/92 | Interpreted Aerial Photography | NC DCM |
| 09/02/97 | LIDAR | NOS CSC |
| 08/02/98 | LIDAR | NOS CSC |
| 06/10/99 | LIDAR | NOS CSC |
| 06/20/00 | Beach Profiles and Scatter | UNC |
| 08/08/00 | LIDAR | NOS CSC |
| 04/30/01 | Beach Profile Survey | USACE |
| 5/15/2002 | Beach Profiles and Scatter | UNC |
| 8/15/2002 | Beach Profiles and Scatter | UNC |

The shoreline position extracted for each data set was the Mean High Water (MHW) contour. The MHW contour was derived through both aerial photography interpretation and topographic survey data analysis. The North Carolina Department of Environmental and Natural Resource Division of Coastal Management (NC DCM) shoreline database for the Bogue Banks area was provided to the USACE. Shoreline positions derived for the database were commonly done through interpretation of aerial photography. The database consists of a series of baselines parallel to the shore and shore perpendicular transects as shown in Figure C-8. There are 73 transects spaced every 50 meters for each baseline. The Bogue Banks area consists of 13 baselines from Bogue Inlet to Fort Macon. Shoreline positions at each of the transects were referenced in the original database as distance from the seaward most location of the transect. The relative distances along each transect from one shoreline date to another provides a quick means of evaluating shoreline change. Additionally, geographic coordinates were computed for each transect value by projecting the distance along the transect azimuth from the transect origin. This geo-referenced shorelines improved visualization of the relative shoreline conditions, especially when viewed along with recent aerial photography as shown in Figure C-9.

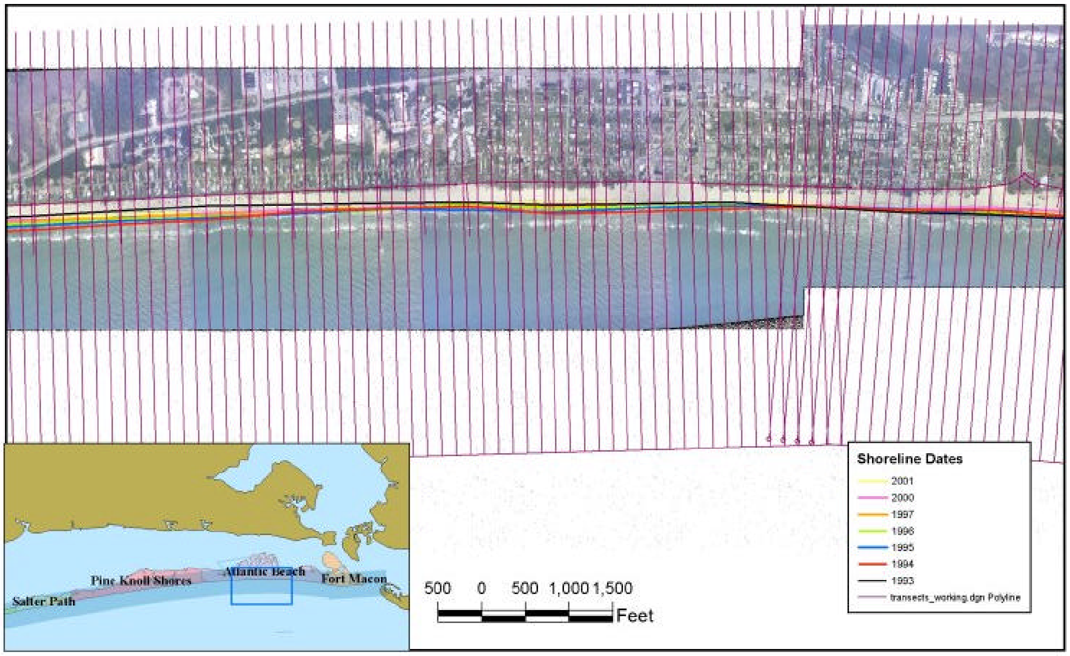



Figure C-8. NC CZM Transect Locations along Bogue Banks.

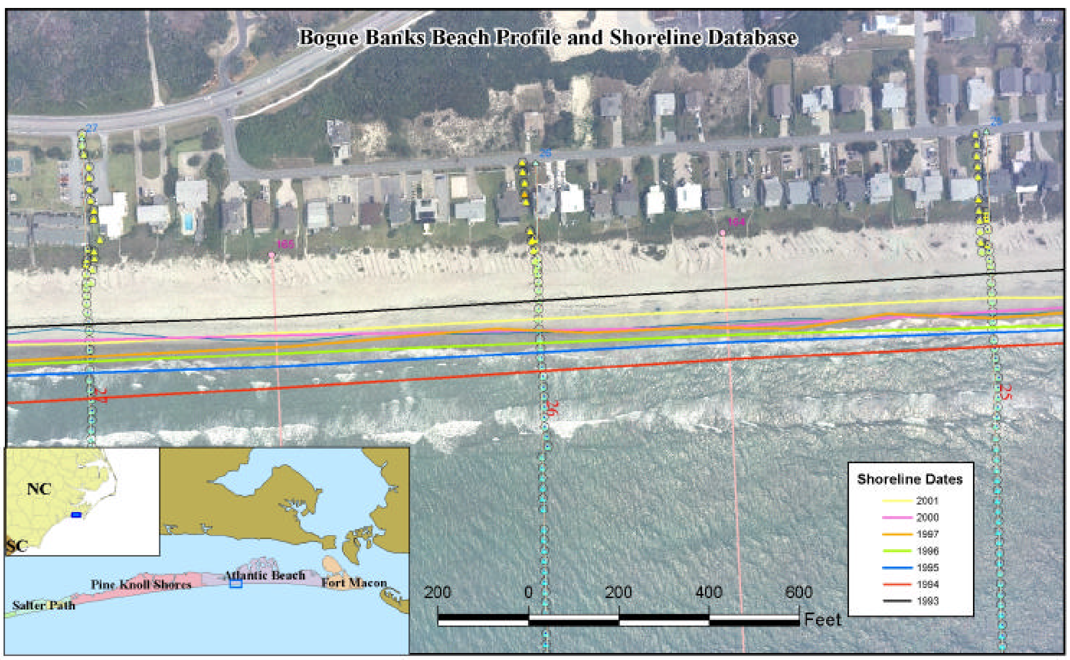



Figure C-9. Recent Shoreline Conditions on July 2002 Imagery Along Atlantic Beach, NC.

In addition to the CZM shoreline database, several recent shorelines were derived through analysis of topographic survey data. Historical beach profile survey data have been conducted by the Corps of Engineers from Fort Macon through Atlantic Beach semi-annually since 1986. Several beach profile surveys were conducted for the entire island, including the years 1978 and 2001. The beach profiles are typically spaced approximately 1,000 ft alongshore. The MHW elevation is +2.21 ft above NGVD. The distance of the MHW contour from the profile origin along each profile was computed. The shoreline positions were then projected (using known profile origin and azimuth) and interpolated onto the CZM transects.

Scatter data sets were also utilized to compute shoreline positions. Three topographic LIDAR data sets were obtained from the NOS Coastal Services Center. Each survey provides a high density coverage from the water line typically through the second row of houses. Figure C-10 displays the August 2000 LIDAR data overlaid on July 2002 imagery. The SHOALS Toolbox software (contained in the Surfacewater Modeling Software) was utilized to extract the MHW contour from the high density data. The MHW contour was interpolated to the transect lines and added to the geodatabase.

Figure C-10. Oblique view August 2000 LIDAR surface overlayed on July 2002 Imagery.

Prior to the construction of the local beachfill (July 2000, Pine Knoll Shores through Indian Beach), Carteret County contracted UNC-Chapel Hill Institute of Marine Science Personnel to conduct quarterly surveys along Bogue Banks. The survey was conducted utilizing a combination of ATV and Jet boat equipment with RTK capabilities. In addition to surveying defined profile lines, multiple shore-parallel lines were surveyed to better define the berm and nearshore conditions. SMS was utilized to extract the MHW contour for each survey. Figure C-11 displays three surveys in the vicinity of the local beachfill.


Figure C-11. Shoreline position (MHW) data derived from survey data displaying influence of local beachfill.

**Shoreline Change Rates**

Rates of erosion/accretion were computed for all communities of Bogue Banks using various shoreline position data sets derived from aerial photography, LIDAR data, and beach profile data with dates ranging from 1978 to present. North Carolina's Division of Coastal Management updates shoreline change rates from aerial photographs every 6 years. Erosion maps for Bogue Banks are available for Bogue Banks for 1980, 1986, and 1992. Updated rates using 1998 shorelines are expected to be released to the public by CNC CZM early 2003. The resulting erosion rates are computed as changes from a baseline set of photos (i.e., 1978). The Corps of Engineers performed similar analyses in a study to evaluate the effects of the Morehead City Harbor dredging activities (Section 111, June 2001). Both analyses utilized an end point method to compute the shoreline change rates. Figure C-12 displays the NC CZM published shoreline change rates for 1992.

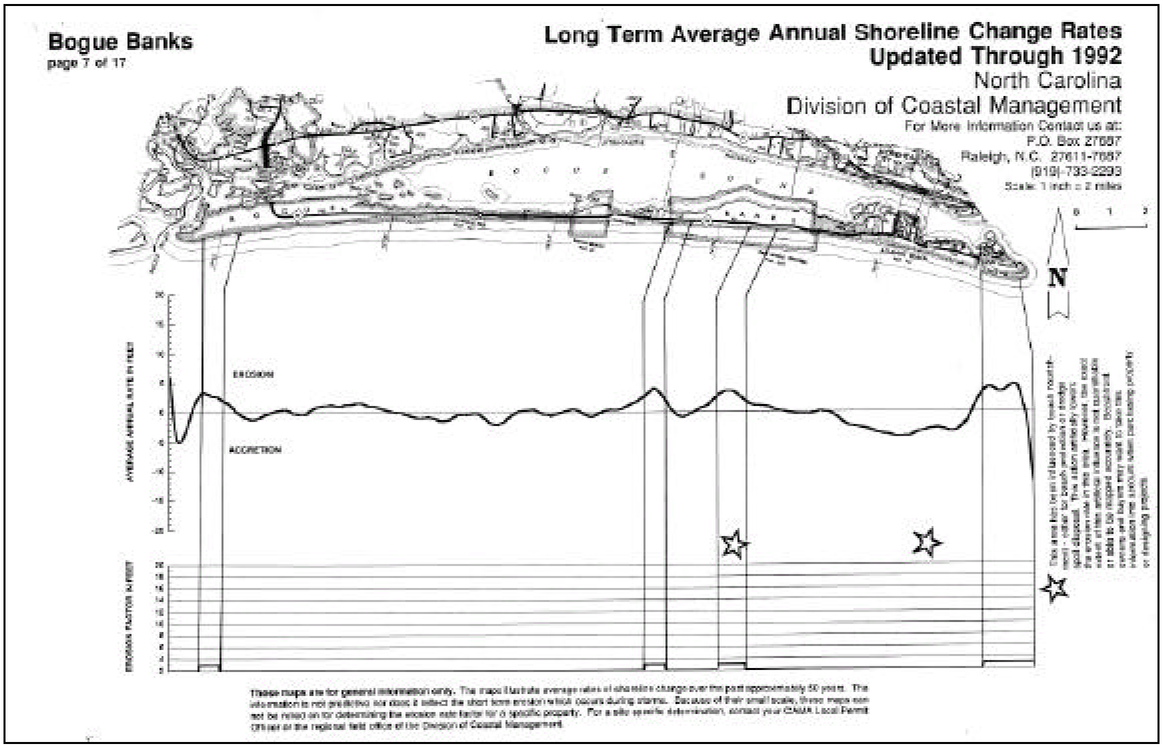



Figure C-12. NC DCM Published Shoreline Change Rates for Bogue Banks.

A detailed shoreline change analysis was performed for this study, incorporating recent LIDAR data and beach profile data with the objective of computing true "background" erosion rates in the vicinity of previous beachfill activities (i.e., Brandt Island pumpout to Atlantic Beach). Shoreline change rates were computed by performing a least-squares fit through select shoreline dates as shown in Figure C-13. A computer program was developed to rapidly compute shoreline change rates for user-specified shoreline data and baseline locations. This utility improved the effectiveness of computing "background" erosion rates by selecting locations and dates before or after beachfill placement.

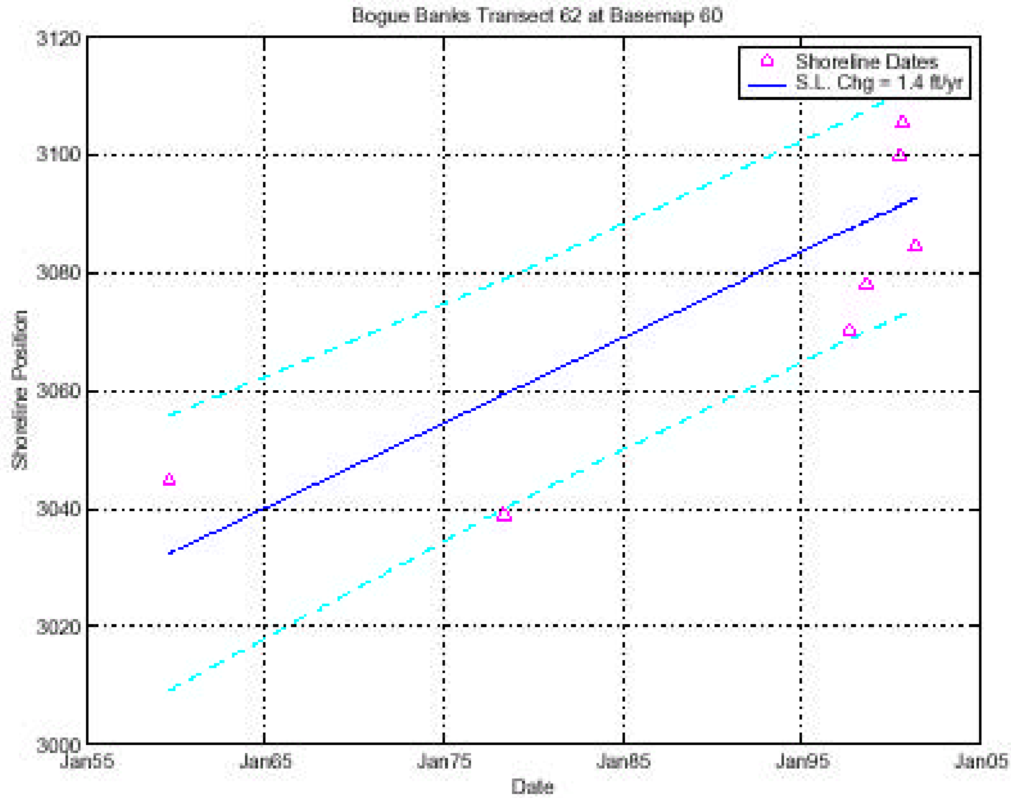



Figure C-13. Shoreline change rate calculated at single transect utilizing least-squares fit along Atlantic Beach.

The various data sources and methods confirm relatively low shoreline change over the past 5-20 years. Highest erosion rates (2 to 3 ft/yr) were found along Fort Macon State Park, Pine Knoll Shores, and Emerald Isle-East. Some reaches were found to be relatively stable (0-1 ft/yr), with only minor erosion (e.g., Emerald Isle-West, Salter Path, Indian Beach, and Atlantic Beach (background)), and some were accreting (Emerald Isle near Bogue Inlet and Atlantic Beach due to nourishment). Figure C-14 displays the shoreline change rates computed and utilized in the storm damage analysis.

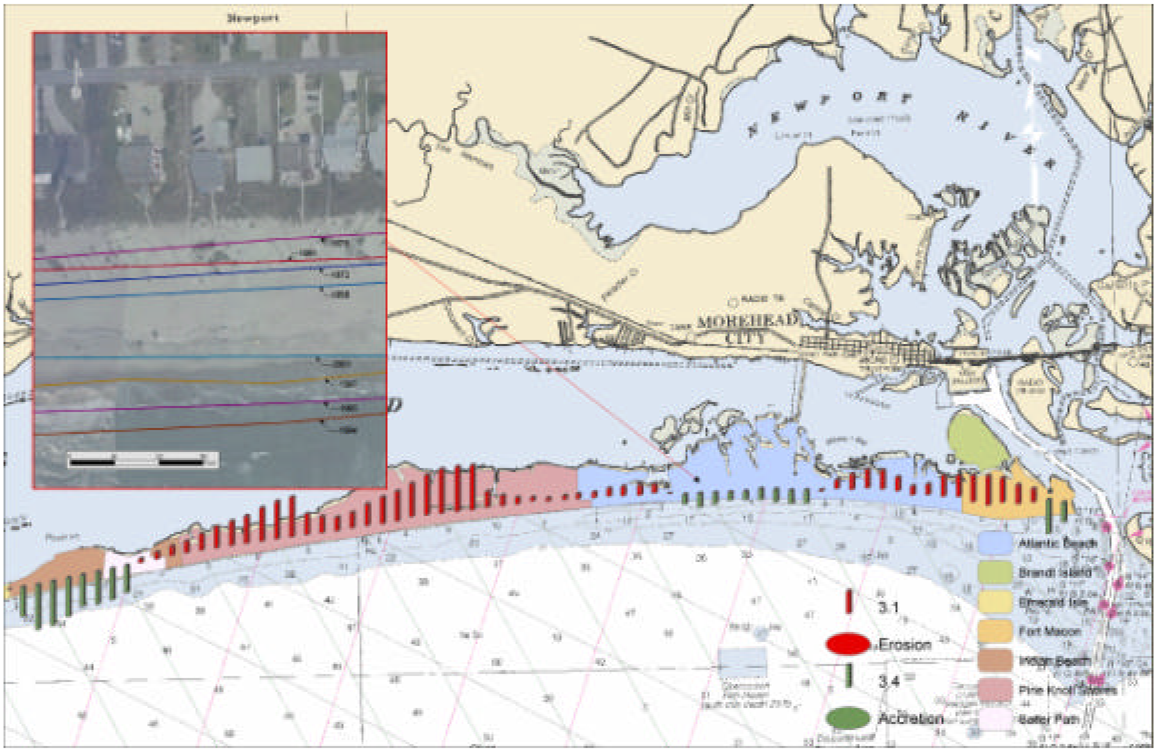



Figure C-14.  Shoreline Change Rates (ft/yr) along Bogue Banks.

### Coastal Processes

Detailed investigations of the coastal processes associated with Bogue Banks were conducted through a combination of field data analysis and numerical modeling. Numerical simulations of wave transformations, tidal circulation, and sediment transport at Bogue Banks were conducted to provide a better understanding of existing conditions and to evaluate and compare alternatives to improve storm protection and beachfill stability in the vicinity of the study area.  This approach provides an objective means for comparing the performance of alternatives.

#### Water Levels

Water level fluctuations in the vicinity of Bogue Banks are primarily due to astronomical tides, storm surge, and wave-induced setup.  Tidal datum relationships have been developed through field data collection at a water level gage located near Atlantic Beach. Storm surge and wave setup values were computed through numerical modeling efforts. The datum relationships were utilized to derive the MHW shoreline position and other key features along the shoreline.  Time series of water levels for storm events were utilized to assess potential storm-induced damage due to inundation.

*Tides*

The mean tidal range measured at the Triple S pier on Atlantic Beach by the National Oceanic and Atmospheric Adminstration (NOAA), National Ocean Service (NOS) is 3.7 feet with a mean spring tide range of 4.3 feet. Mean Low Water (MLW) and Mean High Water are –1.75 ft NGVD and +2.21 ft NGVD, respectively. The ocean tides are semidiurnal with almost equal high and low tides during successive tide cycles. Inside the inlet, the mean tide range is 3.0 feet at the State Port at the Duke University Marine Laboratory. Figure C-15 displays the tidal datum relationships developed for the Triple S Pier gage. The National Geodetic Vertical Datum 1929 (NGVD) was utilized to reference all elevation data throughout this report. An important relationship to note is that Mean High Water (MHW) is +2.21 ft NGVD for the study area.

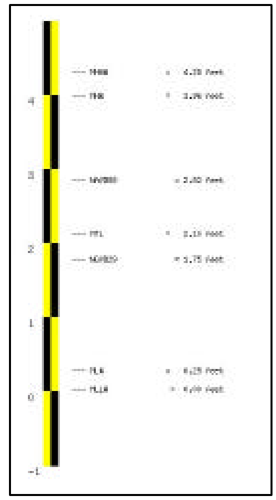



Figure C-15.

*Storm Surge*

Tidal surges from storms ("Storm Surge") add to the astronomically produced tides for a total still-water superelevation. Storm surge time series were developed for all significant hurricanes in the Atlantic Ocean from 1890 to 1990 as part of the Dredging Research Program (DRP-1-17, Scheffner, 1994). The ADCIRC model was used to update the hindcast to include recent hurricanes from 1990 to present, including named hurricanes Bertha, Fran, Dennis, Floyd, Bonnie and Irene. Time series of storms surge were coupled with astronomical tide data to serve as input to SBEACH for the storm damage assessment. Frequency-of-occurrence relationships were also developed for both storm surge and total water level.

**DRP Storm Surge Database**

The tropical storm database, consisting of surge elevation and current hydrographs corresponding to selected WIS and nearshore stations along the east and Gulf coasts of the United States and Puerto Rico, was developed as part of the Dredging Research Program (Scheffner and others, 1994). The database was constructed by numerically simulating 134 historically based hurricanes that have impacted the eastern and Gulf coasts of the United States during the period 1886 to 1989. The source of data for these simulations is the National Oceanic and Atmospheric Administration's National Hurricane Centers HURDAT (HURricane DATabase), described by Jarvinen, Neumann, and Davis (1988).

Figure C-16 displays the station locations where storm surge data are available in the vicinity of the study area. The offshore nodes correspond to Wave Information Study (WIS) stations with the corresponding nearshore station locations selected to provide most accurate storm surge values. Stations 405 and 406 were utilized for this study. Significant tropical events were extracted from the database based on storm surge values exceeding select threshold conditions. For the 100-plus years of coverage, 37 events were identified using a minimum storm surge threshold of 1 ft. In addition to the tropical storm surge database, extratropical storm surge values were calculated for the same locations for the dates from 1976 to 1993. Instead of the storm specific time series, a continuous hourly time series was developed for the non-tropical season times of the year (September through March). Discrete event time series were extracted from the continuous time series using a combination of storm surge and wave height threshold criteria along with visual analysis to identify the start/stop times. There were 23 extratropical events identified over the 16-years of data coverage.

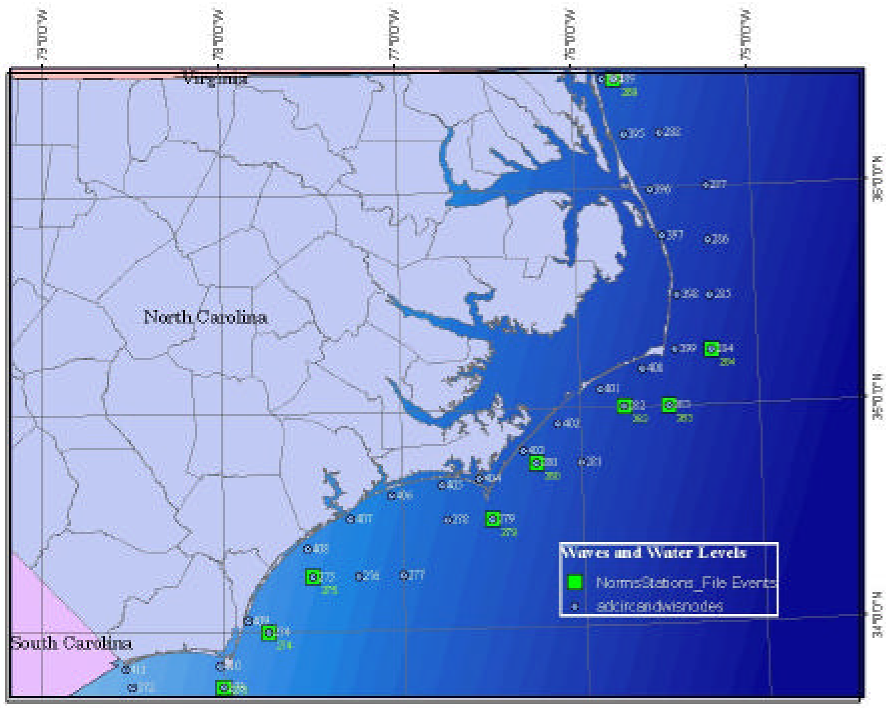



Figure C-16. Storm Surge Model Output Locations from DRP database.

## Recent Hurricane Storm Surge Modeling

The magnitude of the recent hurricanes to impact North Carolina since the mid-1990's required the storm surge database to be updated. Generation of hurricane storm surge values required two major tasks, each using a numerical model. In the first task, hurricane-induced wind and atmospheric pressure fields are generated to replicate those hurricanes (Bertha, Fran, Dennis, Floyd, Bonnie and Irene) that have impacted the study area. Using these wind and pressure fields, storm-surge events are simulated in the second task using a long-wave hydrodynamic model to obtain water-surface levels.

### Wind and Atmospheric Pressure Model

The Planetary Boundary Layer (PBL) wind field model was selected for simulating hurricane-generated wind and atmospheric pressure fields. The PBL hurricane wind model requires a series of "snapshots" for input consisting of a set of meteorological storm parameters defining the storm at various stages in its development or at particular times during its life. These parameters include latitude and longitude of the storm's eye, track direction and forward speed measured at the eye, radius to maximum winds, central and peripheral atmospheric pressures, and an estimate of the geostrophic wind speed and direction. Some meteorological storm parameters were obtained from the hurricane database developed by the National Oceanic and Atmospheric Administration (NOAA)'s National Hurricane Center (NHC). This database summarizes all hurricanes and tropical storms that occurred in the North Atlantic Ocean over the 104-year period from 1886 through 1989. Information contained in this database is provided at 0000, 0600, 1200, and 1800 hr Greenwich Mean Time (GMT) and includes latitude and longitude of the storm, central pressure, and maximum wind speed. Radius to maximum winds is approximated using a function that incorporates the maximum wind speed and atmospheric pressure anomaly. Track directions and forward speeds required by the PBL model are approximated hourly, using cubic spline interpolation technique, from the storm's 6 hr latitudinal and longitudinal positions provided in the database.

Hourly wind and atmospheric pressure fields are computed for each snapshot and interpolated using a nonlinear blending algorithm that produces a smooth transition from one snapshot to the next. Hourly wind and pressure fields are then interpolated from the PBL grid onto the hydrodynamic grid and subsequently stored for use by the hydrodynamic model.

## Storm Surge Model

The ADvanced CIRCulation (ADCIRC) numerical model was chosen for simulating the long-wave hydrodynamic processes in the study area. Imposing the wind and atmospheric pressure fields computed with the PBL model, the ADCIRC model can accurately replicate hurricane-induced storm-surge levels. The ADCIRC model was developed in the USACE Dredging Research Program (DRP) as a family of two- and three-dimensional finite element-based models (Luettich, Westerink, and Scheffner 1992; Westerink et al. 1992).

ADCIRC is a finite element long-wave hydrodynamic model applied for simulating water-surface elevation and circulation over the entire model domain as a function of tidal forcing, freshwater inflow, wave stress forcing, and wind forcing. The finite element formulation has the advantage of great flexibility in resolution over the calculation domain. Coarse resolution can be specified in areas distant from the local region of interest, and fine resolution can be specified locally to meet project requirements. For instance, channels and structures can be defined for accurate calculation of flow through and around them.

The basis for the model bathymetry was an ADCIRC grid developed by the Corps of Engineers Waterways Experimental Station for the North Atlantic Ocean and the East Coast of the United States. The grid was modified to include only the areas of interest for this project. A finite element mesh was developed for the modeled area, as shown in Figure C-17.

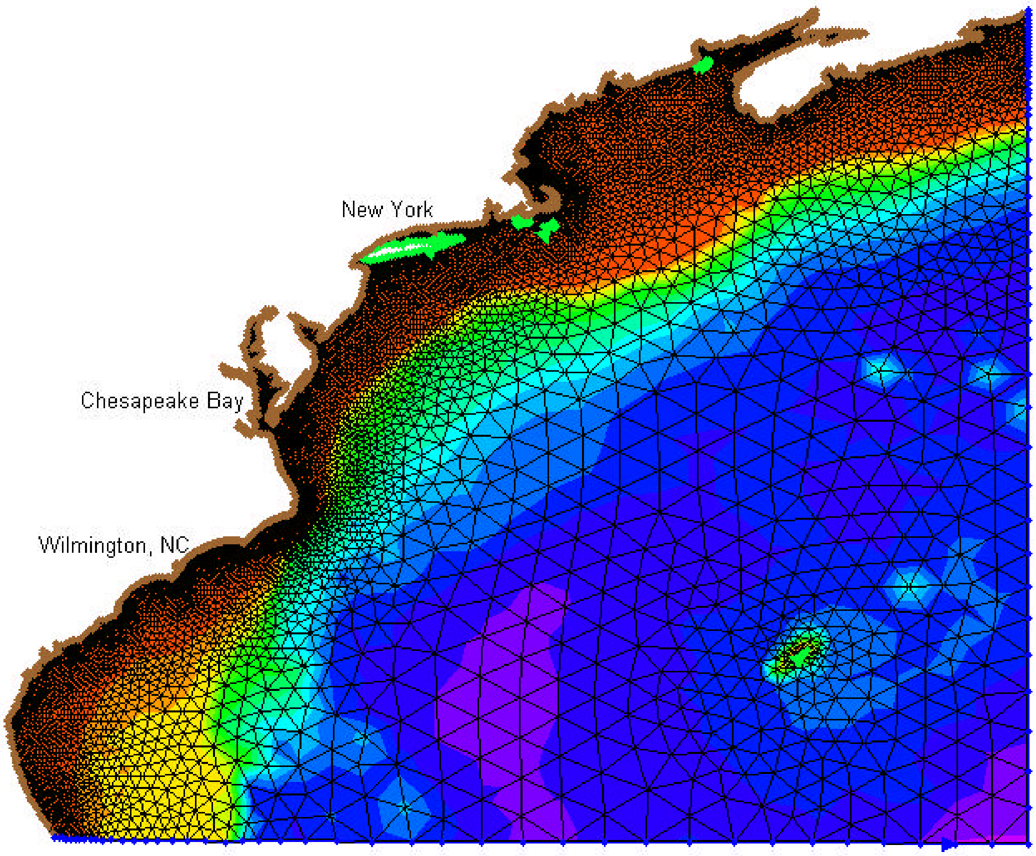



Figure C-17. ADCIRC Model Domain.

The recent storms (Bertha, Fran, Dennis, Floyd, Bonnie and Irene) were simulated with the storm-surge model. Starting and ending times of each storm simulation corresponds to the first and last entry contained in the NHC database for that particular storm. Furthermore, each storm-surge simulation began with the hurricane residing at its initial position listed in the database and concluded at its ending position. Thus, each simulation began when the hurricane was far away from the study area. For all hurricanes, a temporal "ramp" was used to slowly increase, over a 1-day period, wind stresses and pressure gradients from zero to their measured intensity. Using this ramp eliminates spurious modes of oscillation caused by suddenly imposing full-force winds and pressure gradients on the flow field.

All storm-surge simulations were performed independently of tidal action, eliminating the task of extracting surge levels from a time-series of combined tide-and surge-induced water-surface elevations. Figure C-18 displays surge values at select output locations for the Hurricane Fran simulation. Astronomical tide conditions were generated for each event using NOS derived tidal constituents at Triple S Pier and combined with storm-surge values to produce a Total Water Level (TWL) time series. The TWL served as input into SBEACH for storm-induced beach profile response modeling.

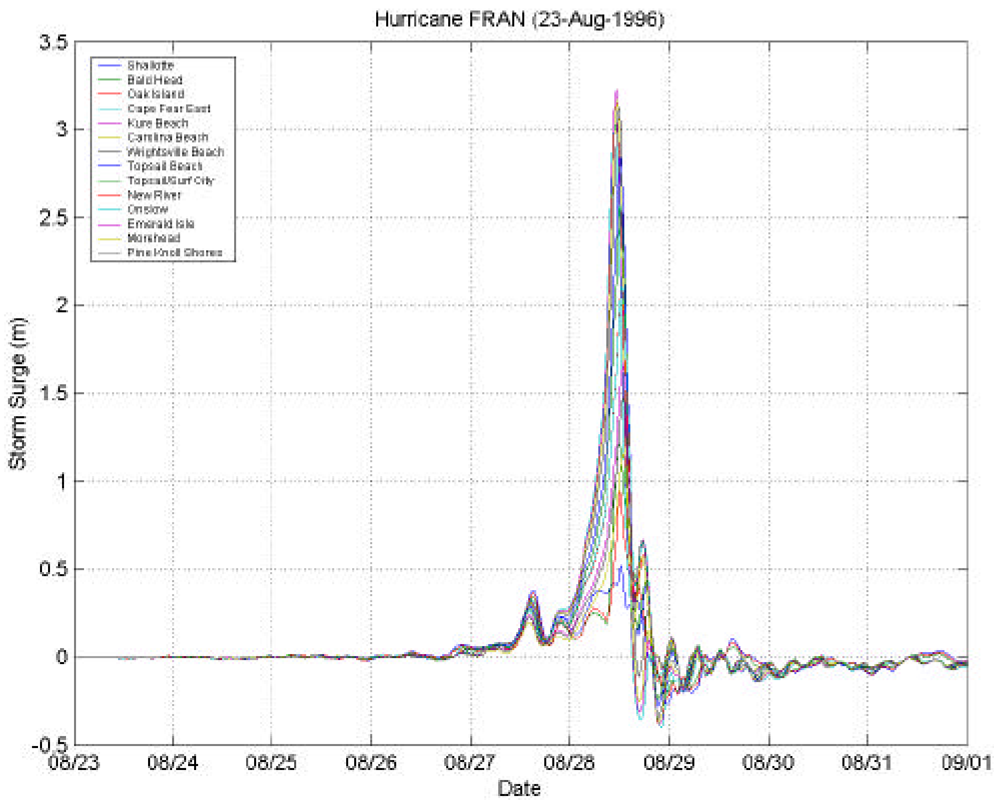



Figure C-18. ADCIRC Model Output for Hurricane Fran Simulation.

Storm-surge elevations computed in this task can be considered as approximations of the historical events. Although the frequencies associated with their maximum surge may be considered relatively accurate, the value of the peak surge may not correspond to historically observed surge elevations. The hydrographs should therefore not be considered hindcast of the historical events due to the fact that the hurricane parameters estimated from the storm database are only approximate; all information necessary to numerically simulate each event is unknown and has not been calibrated. For example, values of central pressure, radius to maximum winds, and far-field pressure are not known and were estimated from available data or observations. Because little data exist for the earlier storms, a consistent approach for selecting storm parameters was developed. This approach may not produce an accurate surge elevation for a particular event; however, it is felt that the final full population of storm data from which storm statistics are computed is representative of the range of historical events and should produce reliable and accurate hurricane stage-frequency relationships.

**Waves**

Wind waves and swell that are generated by local or distant storms are defined as short waves. These surface gravity waves have periods less than about 25 sec. Quantitative information about short waves in the vicinity of Bogue Banks is required in this study for determining storm-induced beach profile responses, simulating wave-induced structural damages, and estimating longshore sediment transport.

Wave heights, frequencies, and directions have been evaluated for this area using various methods. The Wave Information Study (WIS) hindcast with dates from 1976-1995 and recent hindcast from 1995 to 1999 were the main sources to characterize expected long term wave conditions and serve as input to longshore sediment transport analyses. Figure C-19 shows WIS Station locations in the Mid-Atlantic. Station 46 was utilized to characterize offshore wave conditions in the study area. To construct the wave climate, percent occurrence tables (broken down by height, period, and direction) were calculated for the entire hindcast. The Bogue Banks wave climate is illustrated in Figure C-20 as a wave rose with directional resolution of 22.25 deg. Figure C-21 also shows overall distributions by height, period, and direction in a histogram format. The average annual wave height is approximately 1 meter. Wave heights exceeding 1 meter only exist approximately 25 percent of the time. Although the largest percentage of waves are shown to be from the east, wave heights greater than 8 ft are shown to originate from east to southwest, as shown in Figure C-22. Improvements are being made to the WISWAVE model, including improved bathymetry and wind fields. It is expected that ten years of hourly hindcast wave data (1990-1999) will be available Spring 2003 for the Atlantic Coast. Such data are expected to greatly improve confidence in sediment transport magnitude estimates.

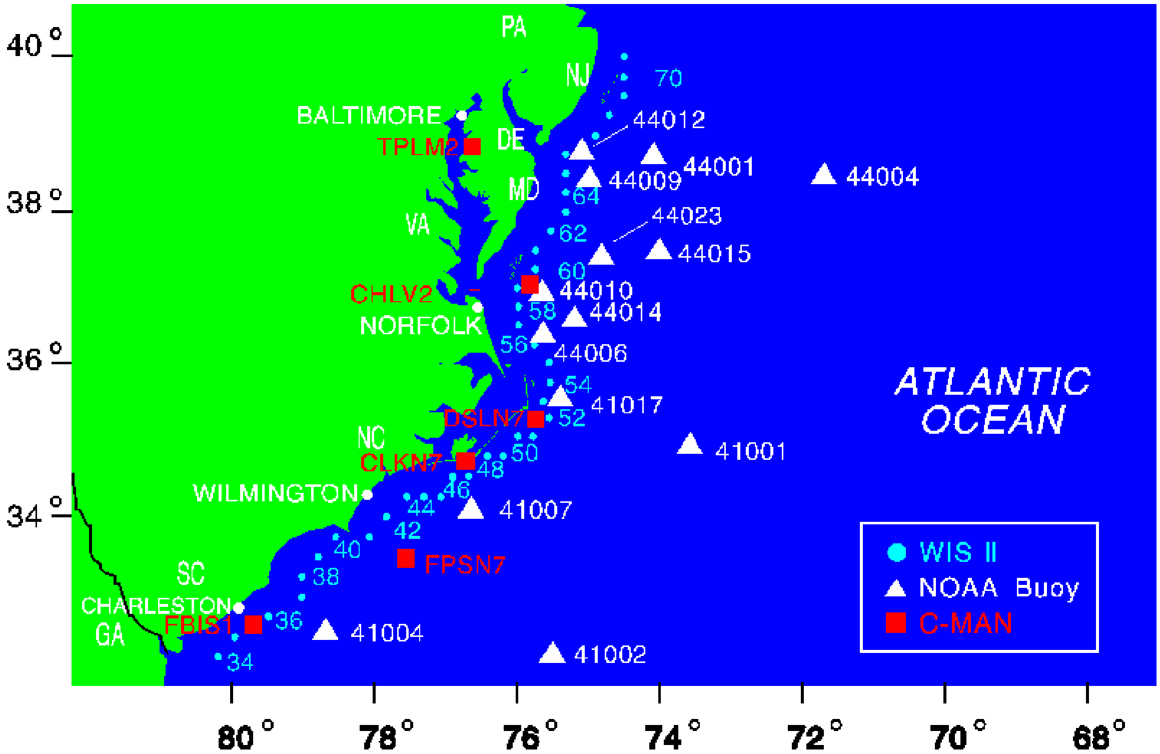



Figure C-19. WIS Station Locations.

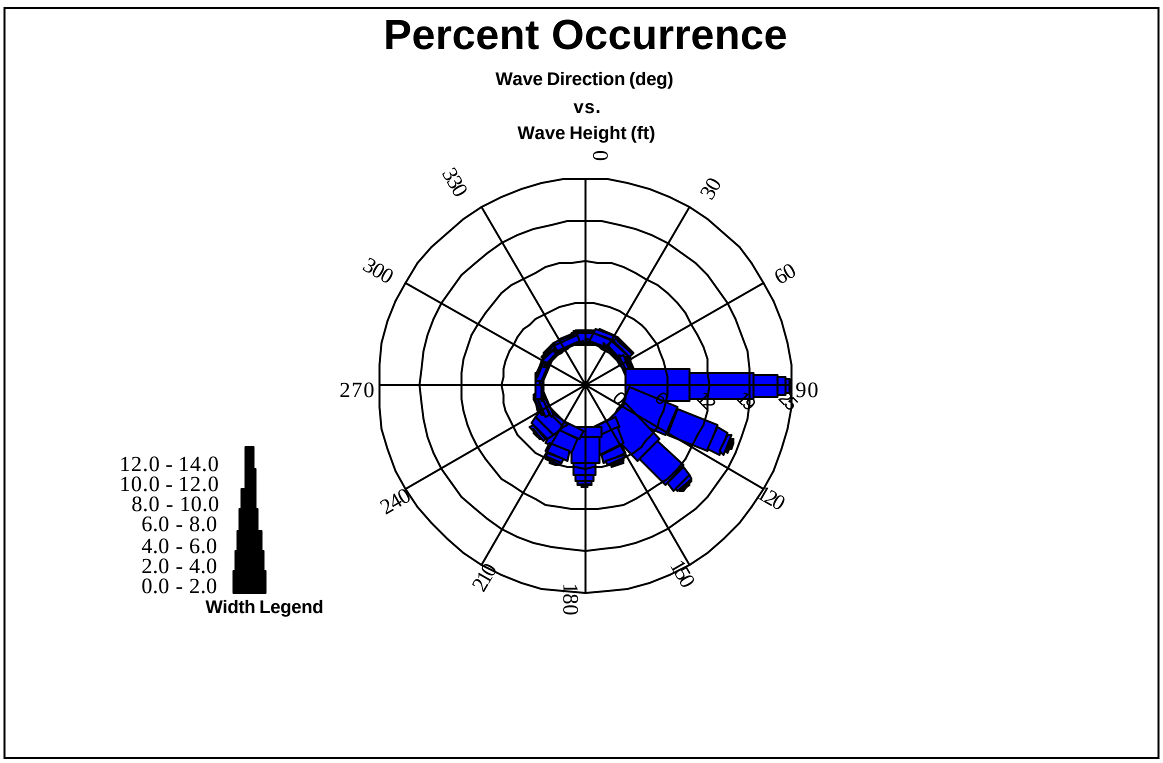



Figure C-20. Wave Rose for WIS Station 46 (1976-1995) Hindcast.

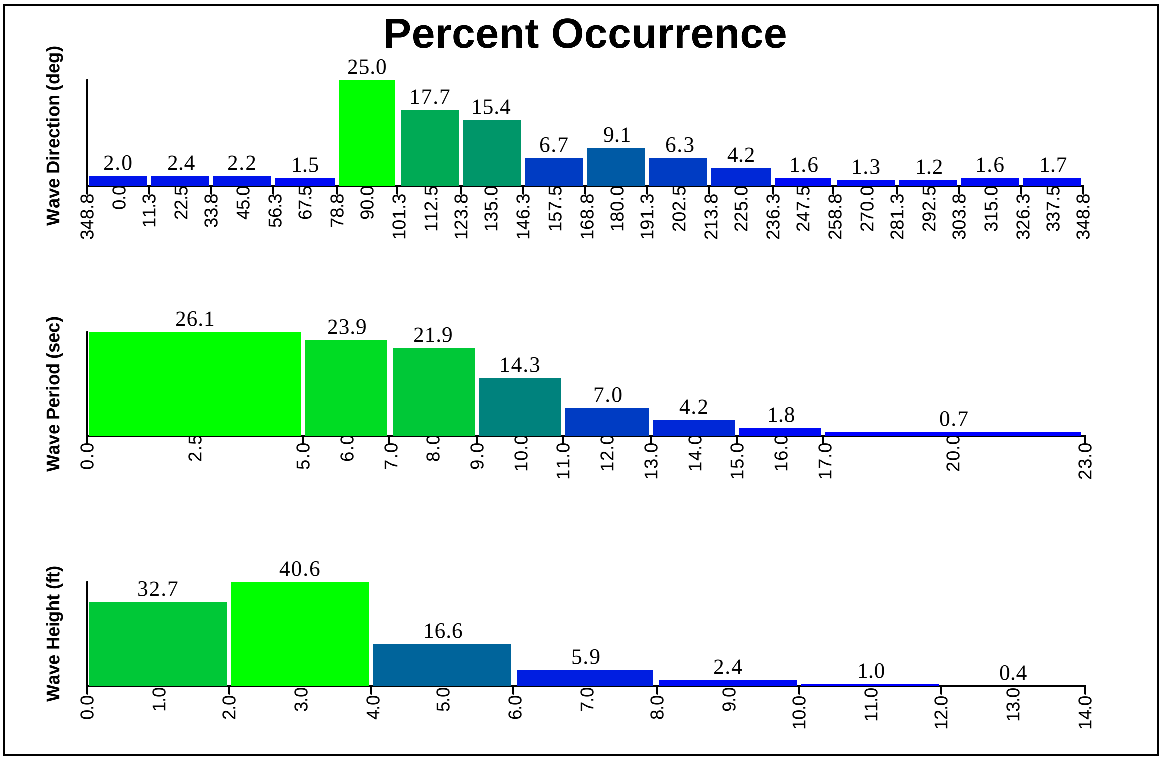



Figure C-21. Wave Histogram for WIS Station 46 (1976 to 1995) Hindcast.

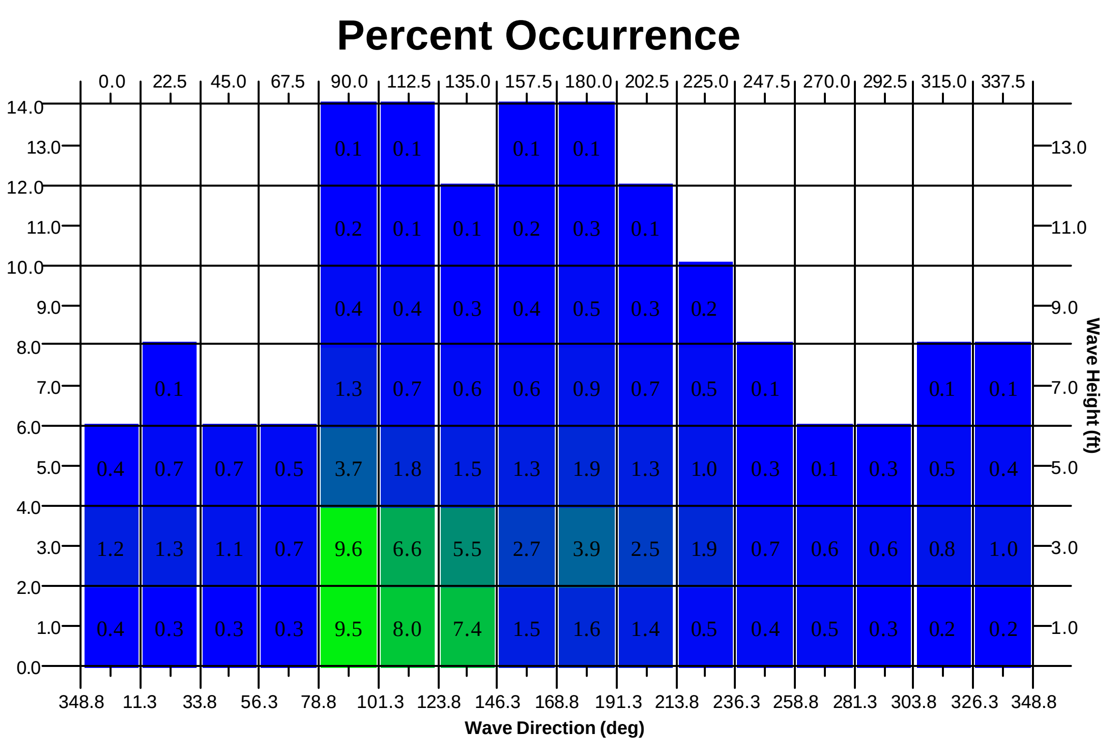



Figure C-22. Block Diagram for WIS Station 46 (1976-1995) Hindcast.

In addition to the long-term wave data, significant events were identified for input to the storm damage analysis. Time series of wave conditions for the extratropical and tropical events corresponding to those discussed in the water level analysis were developed using a combination of WIS data and numerical modeling. Extratropical storm events were extracted from the updated WIS hindcast (1976-1995). Tropical storm events (hurricanes) were included in the updated and recent WIS hindcast efforts (1976-1995, 1995-1999); however, the original WIS hindcast (1956-1975) did not include hurricanes. Therefore, in order to provide corresponding wave conditions to previously identified significant hurricanes, Wilmington District personnel utilized an empirical hurricane wave model to generate wave time series. Figure C-23 displays a typical time series of The combined time series of water levels and wave conditions (height, period, and direction) will serve as input to SBEACH for the storm damage analysis.

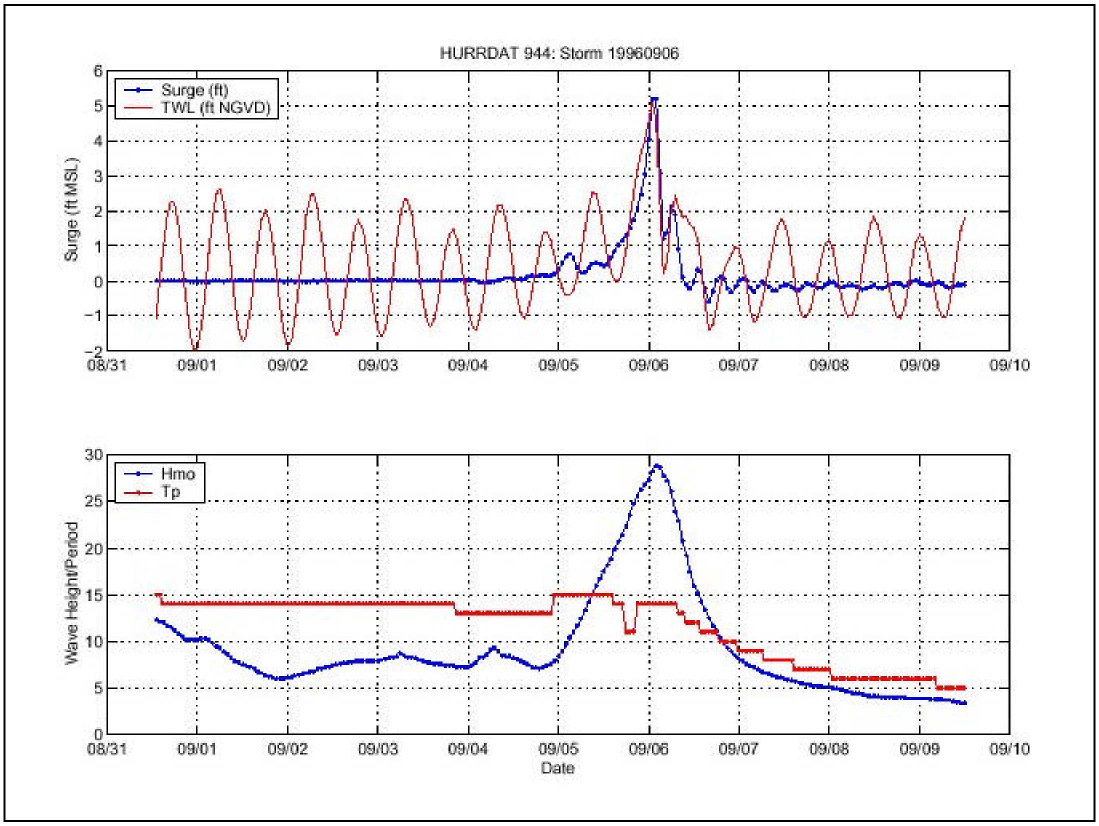



Figure C-23. Example Storm Time Series for Hurricane Event.

**Sediment Transport**

Several studies of potential longshore transport have been previously conducted for this area. The results of the studies are widely scattered and indicate that the magnitudes and direction of transport are solely a function of which wave database was used. Net longshore transport rates are low along Bogue Banks as evidenced by small shoreline change rates and no large accumulations of sand at the end of the cell (western Emerald Isle). The numerical model GENESIS was utilized to compute potential longshore sediment transport rates for existing shoreline conditions.

The model was setup with the origin in the vicinity of Fort Macon in order for the jetty to serve as the eastern-most lateral boundary condition. Model grid azimuth was 262.16 deg north, representative of the average shoreline angle throughout the Island for recent conditions. The model extended 119,250 ft through Emerald Isle near Bogue Inlet where historical shoreline change rates were minimal and a pinned boundary condition was applied. The model was configured using effective grain size and active profile depths representative of existing conditions. Additionally, longshore sediment transport calibration coefficients were established through a calibration and verification effort. Utilizing the April 2001 shoreline and recent WIS hindcast wave data, potential longshore transport rates were determined as shown if Figure C-24. The gradients in transport correlate well to known areas of historical shoreline change. The GENESIS model was not used to evaluate explicit beachfill alternatives, but used primarily to identify potential transport rates that served as input into a more simplified beachfill planform evolution model.

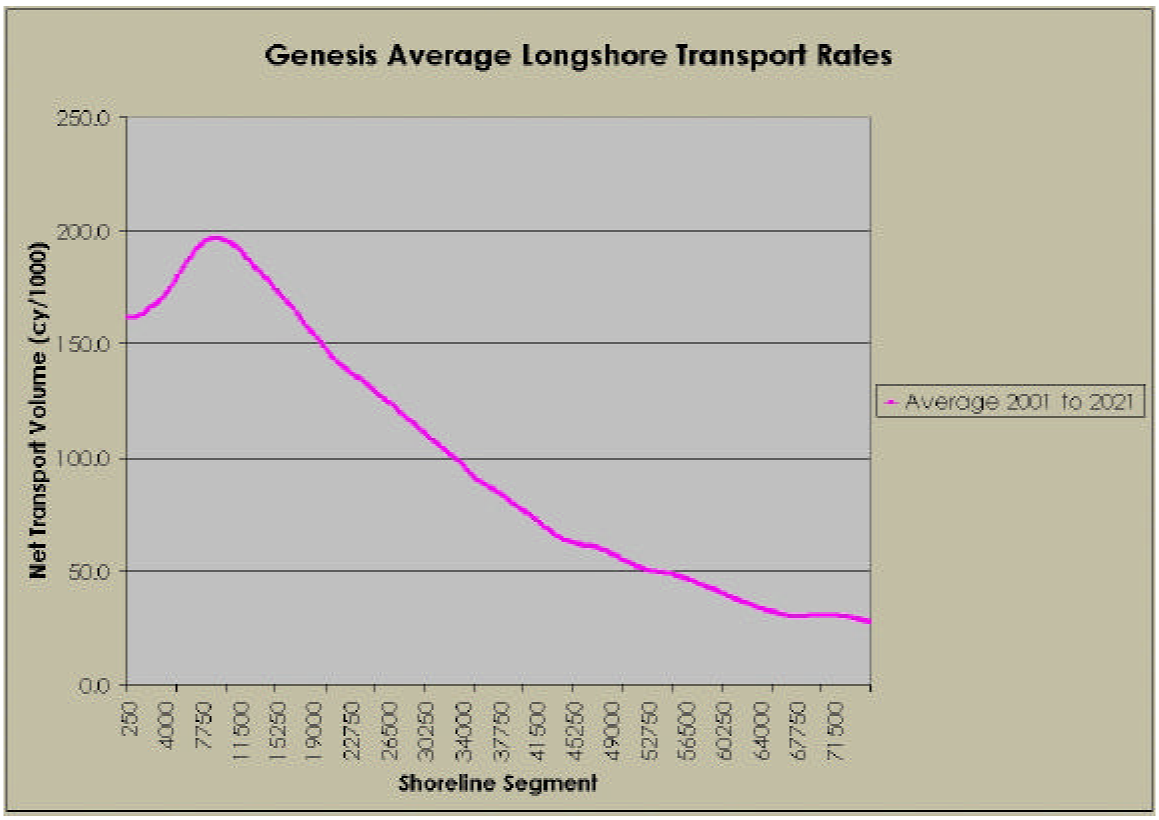



Figure C-24. Potential Net Longshore Transport (yd^3/yr) along Bogue Banks throughout Study Area.

## Beachfill Evolution

Beachfill or beach disposal planform evolution was evaluated for both recent local nourishment activities and potential study alternatives. In general, when sand is placed in conjunction with a beach nourishment or beach disposal project, this project represents an "anomally" to the shoreline planform and the natural processes will tend to smooth out this anomally. The Planform Evolution Model within the Beach Fill Module developed by the Engineering Research and Development Center's Coastal and Hydraulics Laboratory was used to simulate beachfill planform evolution. The model is based on Dean's model developed for thirty-year shoreline projections in the vicinity of beach nourishment projects (Dean, 1989). The model is a rapidly applied model that considers both background erosion rate which is the normal rate in areas that have not been nourished and the shoreline retreat component due to "spreading out" losses from the beach nourishment project. The model also requires input of sediment characteristics and effective wave conditions for longshore transport. The effective wave conditions consist of a single set of wave parameters that result in the same net longshore transport as determined in the GENESIS analysis. Model output consists of shoreline positions at user-specified time intervals along with sediment transport rates. Post-processing of the output was performed to compute shoreline change rates associated with the nourisment/disposal project.

### Local Nourishment Activities

The first phase of the locally funded (Carteret County) beach nourishment project resulted in approximately 1.73 million cubic yards being placed from Pine Knoll Shores to Indian Beach (39,200 ft). The berm-only project averaged less than 45 cubic yards per foot, a very small beachfill. Assuming an active profile of 25 ft would result in an increased berm width of less than 50 ft, not accounting for losses.

The beachfill conditions were specified in the Beach Fill Module along with other necessary parameters and simulations of shoreline evolution were performed through the anticipated construction date (November 2003) and to the anticipated economic life of the project. The resulting shoreline positions were post-processed to compute with-project shoreline change rates. The anticipated berm widths at the base year of construction were incorporated into existing beach profile conditions and were utilized as base conditions for the storm damage analysis.

### Study Alternatives

Similar analyses were conducted for the Base Disposal and Recommended 933 Plans. Figure C-25 displays the Beach Fill Module results for the Section 933 Recommended Plan. While it is common for short beachfills to have larger shoreline change rates than the background erosion rate, the length of the Recommended Plan results in a fairly stable planform with relatively uniform shoreline change rates on the order of –2 ft/year. The with-project shoreline change rates exceed background rates in some locations such as Atlantic Beach, however the distribution of the fill material due to spreading losses results in lower erosion rates in the vicinity of Pine Knoll Shores. The with-project shoreline change rates were utilized as input into the economics analysis (GRANDUC) to compute potential damages, part of which is land loss.

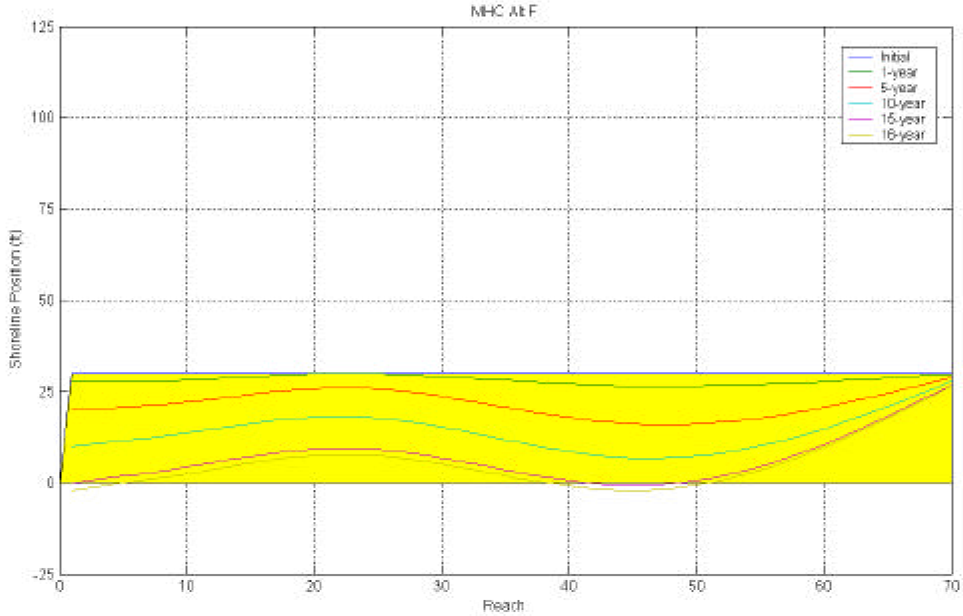



Figure C-25.  Beach Fill Module Results for the Section 933 Recommended Plan.

## Storm Damage Analysis

The economic analysis of storm damages for the range of beach conditions throughout the study area requires development of frequency-of-occurrence relationships for water levels, wave conditions, and erosion distances.  In order to account for risks and uncertainties inherent to the analysis procedure, methods were selected to express storm damages in a probabilistic manner. In other words, the results were required in the form of erosion distance or water levels versus frequency-of-occurrence relationships.

A suite of storm events was used to assess the performance of alternatives in reducing potential damages due to erosion, wave attack, and inundation.  Profiles were developed to characterize the alternatives dimensions and serve as input to the storm damage calculations.  The numerical model SBEACH (Storm Induced BEAch CHange) was used to further transform the waves into the nearshore across proposed alternatives and simulate beach profile change, including the formation and movement of major morphological features such as longshore bars, troughs, and berms, under varying storm waves and water levels.  In addition to computing beach profile response, the wave transformation algorithms within SBEACH were utilized to characterize incident wave conditions and total water levels (including wave setup) for each storm.  Key response parameters from the SBEACH output were extracted for each storm and used to generate frequency of occurrence relationships using the Empirical Simulation Technique (EST) model.  The frequency of occurrence relationships for erosion distances and other parameters serve as input to the GRANDUC model for computation of storm damages.

## SBEACH Analysis

The computer model SBEACH was used to estimate erosion expected to occur during various storm events for the without project condition and the with-project template considered. Additionally, the wave transformation routines in SBEACH provide transformed wave conditions and wave-induced setup values for each simulation. SBEACH simulations were performed for the suite of storm events against the range of beach profile conditions. Input data for the SBEACH model included onshore and offshore survey data, storm water elevations, and storm wave heights and periods as discussed previously. The results from SBEACH modeling (i.e., "response parameters") that are used in storm damage calculations include: distances from the baseline to the point where select vertical feet of erosion occurs (i.e., 0.5, 2, 4 ft), the ground elevations at these erosion points, erosion volumes, maximum dune elevation, maximum wave height at dune crest, and maximum total water level (including wave setup).

### Alternative Profiles

In addition to the representative beach profile conditions developed for existing conditions, a range of with-project alternative profiles were developed. Since the existing dune conditions typically have elevations in excess of what is commonly designed for a storm protection project, all alternatives consisted of berm only plans. Alternative profiles were developed with berm widths ranging from 25 ft to 125 ft at 25 ft intervals for each representative profile. The berm elevation was set at +7 ft NGVD as representative of natural berm elevation found along Bogue Banks. The berm tied into the existing dune conditions at +7 ft NGVD and extended seaward for the defined berm width (i.e., 100 ft) and then sloped seaward to Mean Tide Level (MTL) at a 1V:25H slope that was found to be representative of average nearshore conditions along Bogue Banks. The offset at MTL was maintained along the offshore component of the profile to depth of closure. Figure C-26 displays the existing beach profile conditions along with the range of alternative berm conditions.

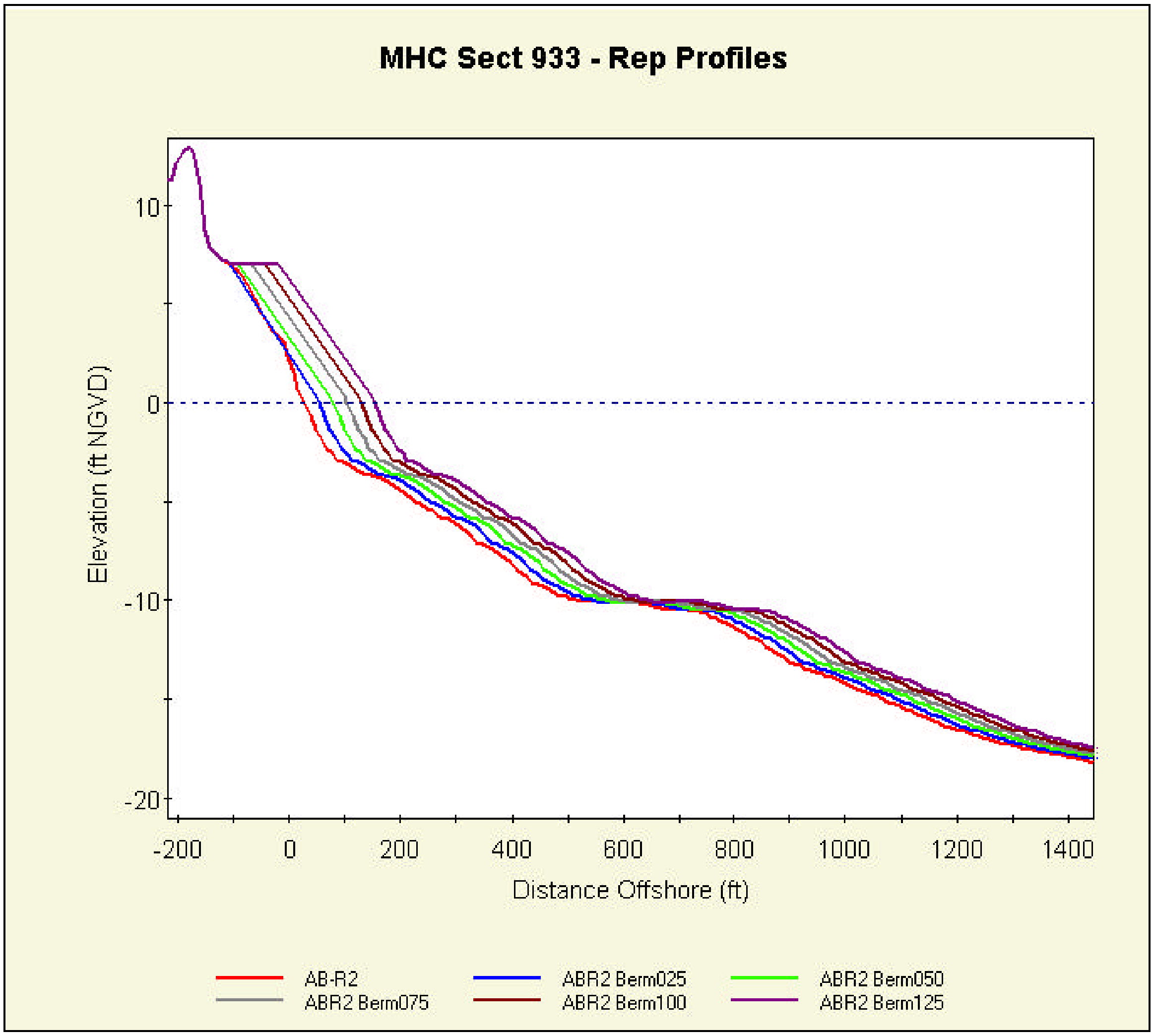



Figure C-26. Alternative Profile Conditions.

**Storm Response Parameters**

Simulation of storm events yields various responses. The parameters that directly impact storm damage include nearshore wave height, total water level, storm surge, wave setup, runup, erosion distances (0.5, 2.0, and 4.0 ft), dune lowering, dune recession, and volumetric changes above MHW. Select parameters were extracted from the SBEACH analysis and used to characterize the performance of the alternatives against each storm event. Figure C-27 displays SBEACH output for an extreme event for existing conditions at Atlantic Beach. The plots display initial and final profile conditions, along with maximum water elevations (includes storm surge and wave setup) and maximum wave height observed throughout the simulation. The profile response over the simulation, as indicated by the difference between initial and final profiles, provides an indicator of the severity of the storm on potential offshore losses.

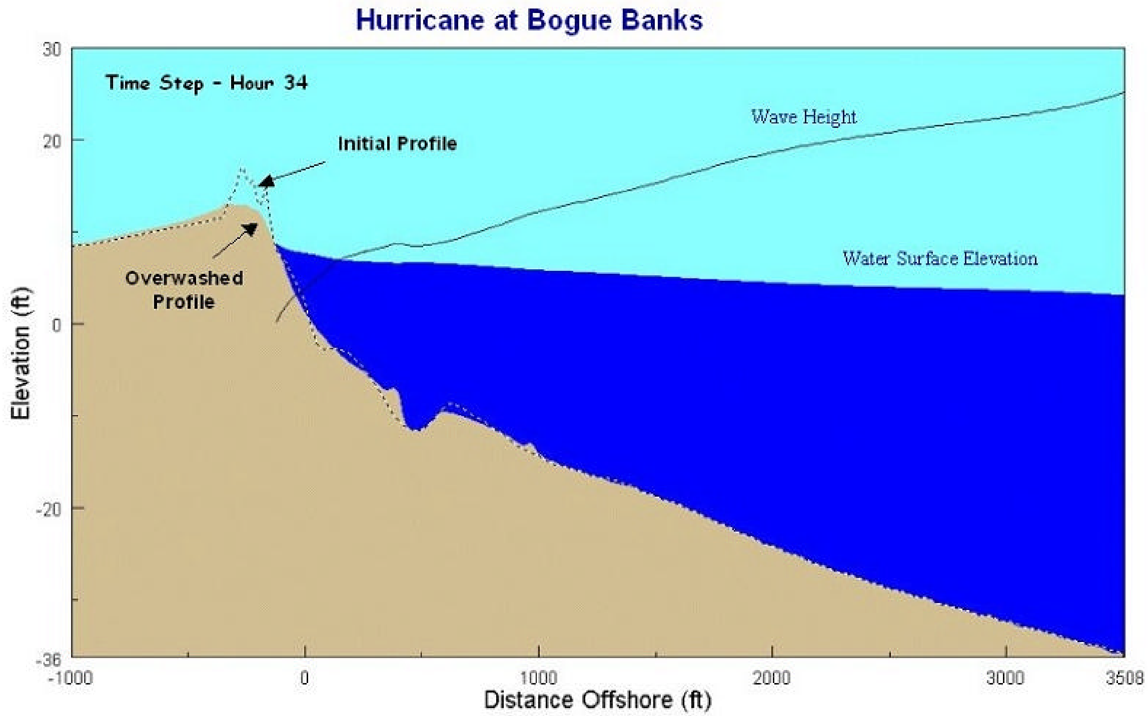



Figure C-27. SBEACH Profile Response Parameters

## EST Analysis

The EST (Empirical Simulation Technique, Scheffner and Borgman, 1992) utilizes observed and computed parameters associated with site-specific historical events as a basis for developing multiple life-cycle simulations of storm activity and the effects associated with each simulated event. The first step in EST is an analysis of historical events that have impacted a specific locale. The storm events analyzed for the Bogue Banks area have been described previously. The storm events simulated were parameterized to define the characteristics of each event and the impacts of that event. Parameters that define the event are referred to as input vectors. Response vectors define storm-related impacts such as total water level and shoreline/dune erosion. These input and response vectors were then used as a basis for generating life-cycle simulations of storm-event activity with corresponding impacts. Results of the multiple repetitions were post-processed to generate frequency-of-occurrence relationships. Because multiple life-cycle scenarios were simulated through the EST, mean values frequencies (or return periods) were computed along with error estimates about the mean.

### Frequency Distributions

The frequency of occurrence relationships for Total Water Level and the 0.5 Erosion Distance are shown in Figures C-28 and C-29 for the Atlantic Beach existing conditions. These relationships were developed for all profile conditions and all response parameters. Select return periods were extracted from each frequency-of-occurrence relationship and provided as input to the GRANDUC model used to calculate storm-induced damages.

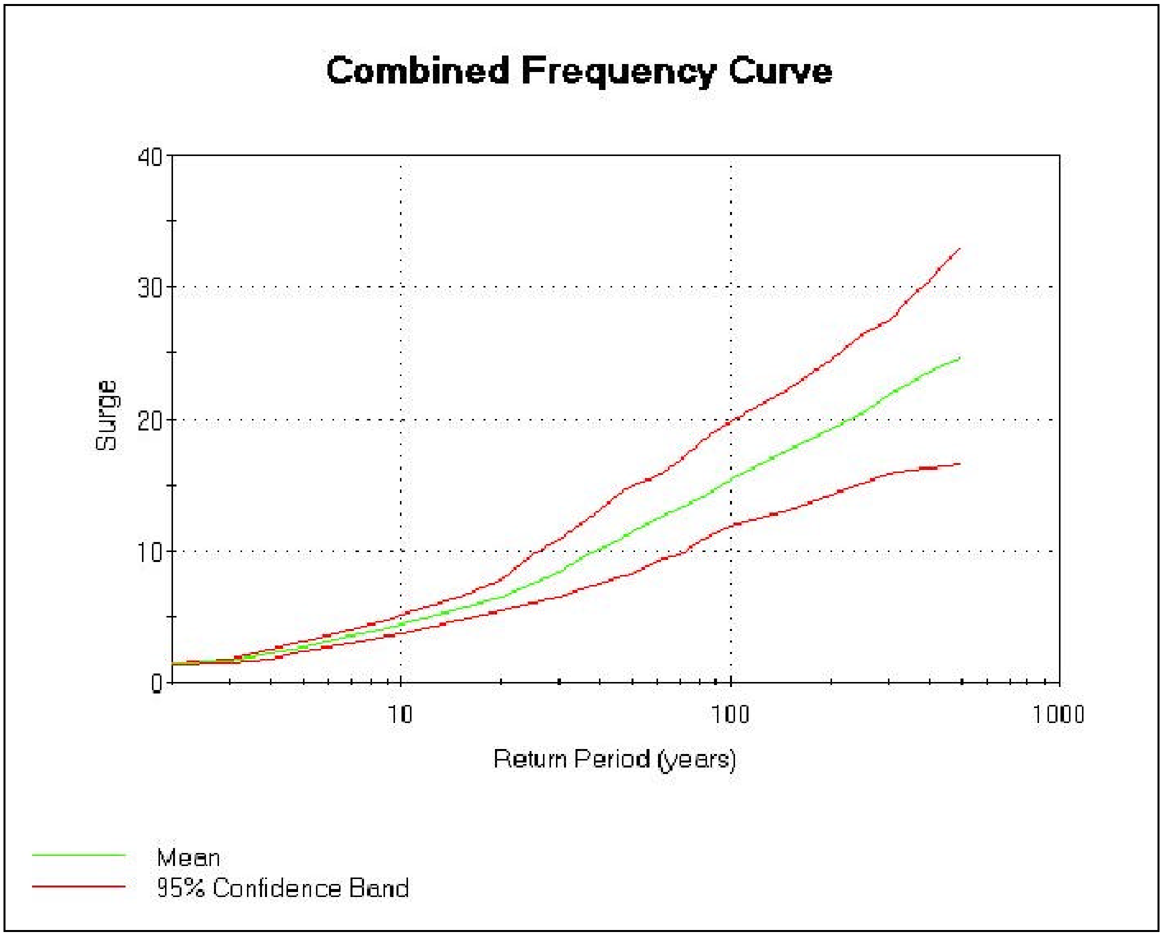


Figure C-28. Frequency-of-Occurrence Relationships for Surge Along Bigue Banks.

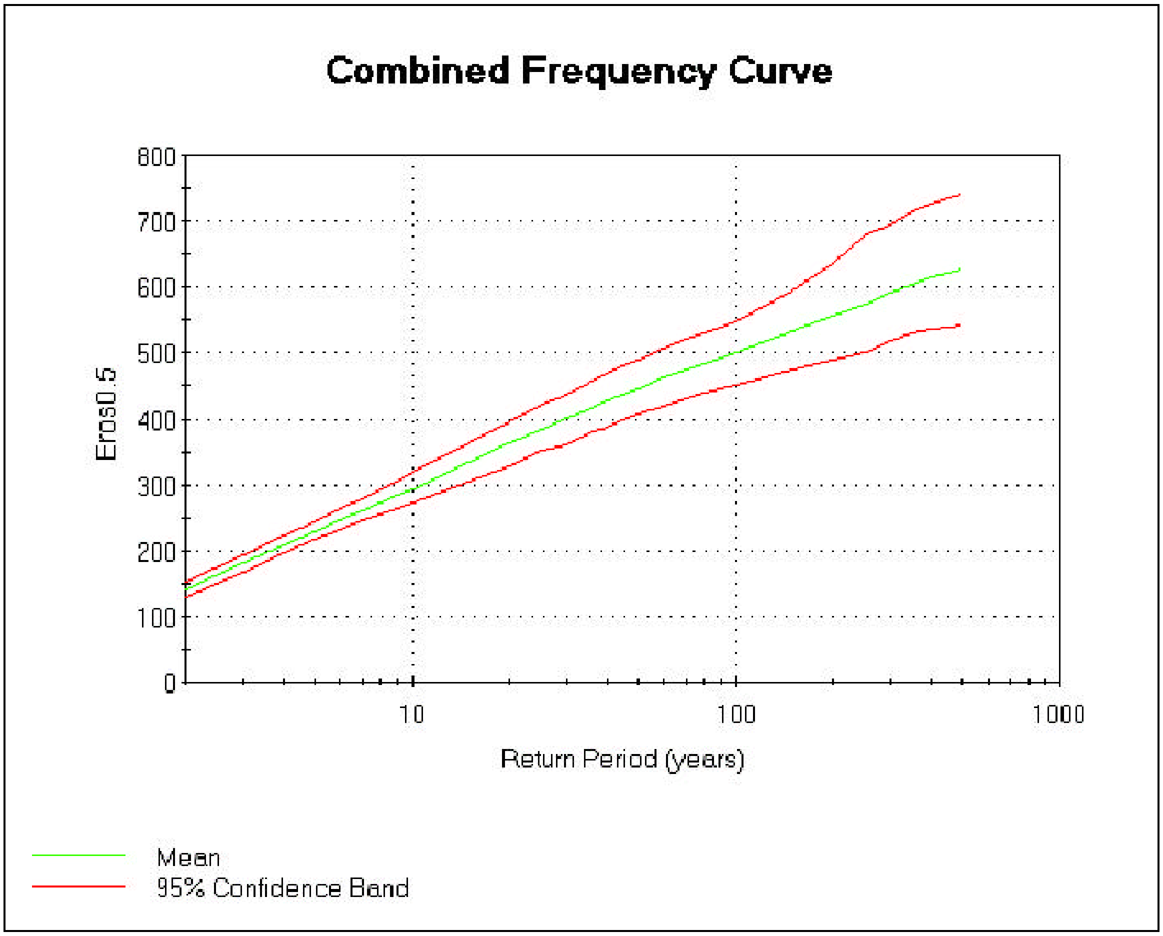



Figure C-29. Frequency-of-Occurrence Relationships for Erosion Distance Indicator (0.5 ft) Along Bogue Banks.

MOREHEAD CITY HARBOR
CARTERET COUNTY, NORTH CAROLINA
SECTION 933
EVALUATION REPORT

# APPENDIX D

# ECONOMIC ANALYSIS

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# ECONOMIC ANALYSIS

## Introduction

The purpose of this study is to investigate the beneficial placement of dredged maintenance material from the authorized pump out of Brandt Island confined dike disposal area, and the maintenance dredging of the Morehead City Harbor navigation project, both of which are scheduled for the Winter of 2003-2004. This study analyzes the deposition of this dredged material along a portion of Bogue Banks beaches beyond the Corps' Base Disposal Plan, referred to as the "Section 933 Study Area." The Section 933 Study Area must be assessed for hurricane and storm damage reduction needs. This study also develops a plan of protection for this area based on the economic, engineering, and environmental feasibility, as well as the requests of the local sponsor.

Located on the central North Carolina coast in Carteret County, the beach communities of Atlantic Beach, Pine Knoll Shores, Indian Beach, and Salter Path, and Fort Macon State Park are collectively referred to as Bogue Banks. Fort Macon and Atlantic Beach fall within the normal Base Disposal Area for disposal operations associated with the maintenance of Morehead City Harbor. Disposal operations in 1986 and 1994 have kept the majority of this shoreline in a satisfactory condition. A much more vulnerable situation exists over the shoreline of the resort communities of Pine Knoll Shores, Indian Beach, and Salter Path. Hurricanes, subtropical storms, progressive erosion, and increasing development over the last several years have raised the potential for damages considerably over this 7.2-mile reach. Numerous structures in this area are highly vulnerable to damage by storm action due to the eroded dune system and loss of natural protection. It is for Pine Knoll Shores, Indian Beach, and Salter Path that this Section 933 economic analysis of the beneficial placement of dredged material from the maintenance of Morehead City Harbor channels is evaluated. Emerald Isle is experiencing similar problems but was not included in the Section 933 evaluation because of volume limitations of the disposal material and increasing distances associated with its transport.

Based on analyses conducted during this study, the most practicable beneficial placement of dredged material for hurricane and storm damage reduction is a beach berm (with transitions) along Pine Knoll Shores and Indian Beach and Salter Path. This is the reach that Carteret County, the non-Federal sponsor, requested to be studied and, as this appendix demonstrates, where a Section 933 project has been determined to be economically justified.

**The Study Area.**

Carteret County is located on the central North Carolina coast. Bogue Banks is a 25.4 miles long south-facing barrier island located on the low-energy limb of the Cape Lookout foreland within Carteret County. It is oriented in an approximate east to west direction between Beaufort and Bogue Inlets, located on the east and west terminuses of the island, respectively. The island is bound to the north by Bogue Sound, a relatively shallow water body through which the Atlantic Intracoastal Waterway passes.

Fort Macon State Park occupies the eastern 1.4 miles of the island. Political subdivisions on the rest of the island include, from east to west: the Town of Atlantic Beach, the Town of Pine Knoll Shores, an unincorporated area known as Salter Path, the Town of Indian Beach, and the Town of Emerald Isle. Hereafter in this analysis, for simplicity, the unicorporated area of Salter Path is included in all references to Indian Beach. The width of the upland portions of the island (the landmass above mean high water) varies from a minimum of approximately 800 feet to a maximum of over 4,000 feet. The narrowest part of the island, which ranges in width from 800 feet to 1,000 feet, is located along the easternmost 2.8 miles of Emerald Isle. The widest part of the island, which measures over 4,000 feet, is located on the westernmost 5.1 miles of the island, also within the corporate limits of Emerald Isle.

A maritime forest area is located on the sound side of Bogue Banks between the east portion of Indian Beach through Pine Knoll Shores. This reach of the island includes the Theodore Roosevelt Natural Area on the sound side, which is the only portion of Bogue Banks included in the Coastal Barrier Resources System. In general, the island has been developed in such a manner as to preserve as much of the natural vegetation from the ocean to the sound as possible.

**Federal Standard - Base Disposal Area.**

Should present plans for sharing sand by Bogue Banks beaches not materialize due to funding problems or other unforeseen reasons, dredged maintenance material from the entrance and inner harbor channels of Morehead City Harbor, as well as the pump out of Brandt Island, would be distributed according to the Base Disposal Plan as determined using the Federal Standard (see Appendix B). The Base Disposal Plan represents the least cost alternative for the government to dispose of navigation dredged material, which is engineeringly feasible and environmentally acceptable. Therefore, all material disposed over the limits of the Base Disposal Area does not have to be economically justified. It is only necessary to demonstrate economic feasibility over those areas outside the Base Disposal Area (i.e., Pine Knoll Shores and Indian Beach).

Under the Base Disposal Plan, the outer harbor would be maintained by hopper dredge and the resultant 1.5 million cubic yards of excavated material would be placed in the Ocean Dredged Material Disposal Site or the previously approved nearshore area.  The pumpout of Brandt Island and the maintenance dredging of the inner harbor by pipeline dredge would be placed from Fort Macon State Park throughout the Atlantic Beach shoreline.   Up to 4.8 million cubic yards (i.e., about 4.0 million from Brandt Island and about 0.8 million from the inner harbor) of beach quality sand may be placed along the shoreline from Fort Macon State Park to Atlantic Beach.  If the North Carolina State Ports Authority does not pay for its share (i.e., 1.2 million cubic yards), this amount could be reduced to 3.6 million cubic yards.

### Section 933 Project.

Alternatively, Carteret County, the non-Federal sponsor, has requested under the Section 933 authority that the dregded material be shared between Fort Macon State Park, Atlantic Beach, Pine Knoll Shores, and Indian Beach.  Working with the sponsor, the Corps of Engineers has formulated a plan that would distribute the dredged material in a uniform 30-ft berm design width stretching from Fort Macon to the Indian Beach/Emerald Isle border.  Because Pine Knoll Shores and Indian Beach fall outside the Base Disposal Area, this portion of the beachfill referred to as the Section 933 Project is the portion that must be economically justified.  That is the purpose of this economic analysis.

## Establishing Property Values

### Structural Inventory

A complete structural inventory of the oceanfront and second row of development along the shoreline of Bogue Banks was completed during the summer of 2001.  This structural database, which is entered into the damage assessment program GRANDUC for this analysis, was collected and compiled by the Planning Services Section (CESAW-TS-PS).  The applicable price level is July 2001, but remains suitable for October 2002 price levels.  That summer, every individual structure along the first two rows of development was field checked, and a staff economist assigned it an estimate of its depreciated replacement value.  Input from local builders and real estate people on structural values and current construction costs and practices went into the analysis.  Factors such as age, condition, pile depth, quality of materials, and type and quality of construction also entered into this value determination.

The structural inventory of the relvant study area is made up of the oceanfront and second  row of development in the towns of Atlantic Beach, Pine Knoll Shores, and Indian Beach.  These first two rows are developed in a fairly continuous way with a wide range of structures including single-family homes, multi-unit condominium buildings, hotels, motels, and commercial buildings of various sorts.  Values and susceptibility to storm damages vary considerably.   Because of substantial variations in every factor that will affect storm damages, it is impossible to select any small areas or segments that could be considered representative of the study area as a whole.  Therefore, an incremental analysis of segments of the beach is required.

The most common type structure found in the primary study area is the single family residential dwelling. These dwellings are typically one, two, or three-story frame or concrete block structures. Most are elevated on pilings but have a partially to fully enclosed ground level. The pilings may be embedded from 8 to 16 feet deep. In compliance with North Carolina State law, structures built since the mid 1970's must have the first floor constructed above the 100-year storm water surface elevation.

There are also many multi-story condominiums within the three-town study area. In addition, there is a large commercial base. Dozens of oceanfront motels and hotels comprise the most valuable of the commercial structures, but other types of commercial development comprised mostly of convenience stores, retail stores, offices, and restaurants are also found along the first two rows of development. Table 1 shows the number of buildings and total structure value of all structures along the oceanfront and second row by town. Altogether, a total of 842 structures were inventoried at a value of about $377 million.

TABLE 1
Structural Inventory by Town

| Town | Number | Oceanfront Structure Value | Second Row Structure Value | Total Structure Value |
|---|---|---|---|---|
| Fort Macon | 1 | $160,000 | $0 | $160,000 |
| Atlantic Beach | 470 | $105,959,000 | $31,768,000 | $137,727,000 |
| Pine Knoll Shores | 258 | $119,791,000 | $27,688,000 | $147,479,000 |
| Indian Beach (Salter Path) | 113 | $77,258,000 | $14,039,000 | $91,297,000 |
| TOTAL | 842 | $303,168,000 | $73,495,000 | $376,663,000 |

**Content Value of the Structural Database.**

Estimates of values of contents of commercial structures in the primary study area are based on interviews with businessmen and insurance agents familiar with the Bogue Banks oceanfront, as well as empirical data collected for past studies. Businesses are entered into the damage model with a code for type of commercial activity. Each type of business has a unique content factor applied to its structural value.

For estimating the value of household contents of residential structures in the study area, 40 percent of the structural value is used. This is based on site-specific responses from Bogue Banks officials, insurance agents, realtors, and home owners familiar with the development along this section of oceanfront. The majority of these properties are rentals but tend to be upscale, often renting for thousands of dollars per week during the summer months. There is a trend towards putting better quality furnishings in these homes as vacation tenants expect the same high quality and thoroughness of furnishings that one would find in second homes. Second home owners, who live in these homes several months of the year, are also better equiping these houses. Forty percent content to structure value is within the usual range of consistency with other beach nourishment studies along the North Carolina coast and is reasonable and appropriate for this study. Sensitivity analyses were done to examine the effects of changes in content value percentages. Using a content to structure value of 30 percent, for example, does not significantly change the outcome of the project's economic feasibility.

**Nearshore Land Value.**

One of the components of hurricane and storm damages is land loss due to long term erosion. Long term erosion is accounted for in each year and in each method of damage calculation. As a structure is lost to long term erosion, the value of the structure is taken as a loss that year, and the structure is taken out of the calculation process for the remainder of the period of analysis. Land lost to long term erosion is computed by multiplying the expected annual loss of land in acres by the value of nearshore upland. The value of nearshore land was determined through an analysis of recent sales of interior lots with no view of the ocean or sound. This value varies from town to town and is highest in Atlantic Beach. This is beacause Atlantic Beach is virtually built-out and there are no undeveloped interior lots. When an interior lot does sell for its land value, the price is relatively high and there is usually an older home on the lot that must be demolished. Table 2 shows the nearshore land values per acre and per square foot used for each town.

TABLE 2
Nearshore Land Values by Town

| Area | Value/Acre | Value/Sq.Ft. |
|---|---|---|
| Fort Macon | $175,000 | $4.00 |
| Atlantic Beach | 565,000 | 13.00 |
| Pine Knoll Shores | 300,000 | 7.00 |
| Indian Beach (Salter Path) | 220,000 | 5.00 |

For example, as increments of land erode away in Pine Knoll Shores under the without project condition, $300,000 per acre represents the decrease in value to the oceanfront parcels. These increments of land loss are computed linearly and annually in square feet. In this example, the value of an oceanfront lot 100 feet across by 100 feet deep is about $70,000 when restricted to its nearshore land value. If it is eroding at 5 feet per year, the lot would lose 5 percent, or about $3,500 of its value each year. This linear assumption is reasonable and non-subjective.

## Plan Formulation And Evaluation

### Existing Conditions.

Over recent years, hurricanes, subtropical storms, progressive erosion, and increasing development have greatly increased the potential for damages over the entire length of Bogue Banks. Except for the lands designated as public parks, the oceanfront is practically built-out and numerous structures are left vulnerable to damage by storms due to the eroded dune system and loss of natural protection. In an effort to combat shoreline erosion, a locally funded beach nourishment project is ongoing over much of the study area. This project proposes to place approximately 4.5 million cubic yards of sand over Pine Knoll Shores, Indian Beach, Salter Path, and Emerald Isle, approximately 16.8 miles of ocean shoreline. The project is planned to be completed in three phases over a three-year period. The first phase has been completed with the nourishment of 6.6 miles of beach in Pine Knoll Shores and Indian Beach with approximately 1.7 million cubic yards of sand. The second phase will place 1.8 million cubic yards of sand on three miles of Emerald Isle (and potentially .7 miles of Indian Beach that was not able to be completed in Phase I) in the winter months of 2002/2003. And the final phase, if implemented, would place 1million cubic yards of sand on 6.7 miles of Emerald Isle in the winter of 2003/2004.

These one-time, locally funded nourishment efforts are not large enough to be considered anything other than stop-gap measures. The Section 933 Project, another one-time nourishment effort, is to be added seaward of the remainder of the locally funded beachfills in Pine Knoll Shores and Indian Beach. It too is expected to have a limited life and not be a permanent solution to the erosion problems of these communities.

**The Without Project Condition.**

This report presents two areas of beach placement. The Base Disposal Area would be along Fort Macon and Atlantic Beach, which is a distance of 32,000 feet. This area of least cost disposal will receive up to 4.8 million cubic yards of sand from Brandt Island and the normal maintenance cycle of Morehead City Harbor. Critical to this study is the estimate of the vulnerability to damages from coastal storms along the beaches of Bogue Banks associated with the Base Disposal Plan placement of material only on Fort Macon and Atlantic Beach. This alternative would amount to the "without project condition" and forms the basis for evaluating the degree of damage reduction that would be provided by the alternative, Section 933 Project on Pine Knoll Shores and Indian Beach.

In most cases, the without project condition is usually more akin to a “no action” plan. However, in the case of Morehead City Harbor maintenance, Base Disposal Plan includes pumping material to Fort Macon and Atlantic Beach. The alternative is to deposit some or all of the Brandt Island material along the 25,000 linear feet of oceanfront at Pine Knoll Shores and 13,000 linear feet of Indian Beach under the Section 933 authority.

Carteret County and the State of North Carolina have already committed large sums of money to studying long-term Federal nourishment projects along Bogue Banks. In the interim, the locally funded beach nourishment project described above is ongoing over much of the study area. Additionally, the State would likely help the locals governments battle erosion using the traditional emergency measures, including sandbagging, beach scraping, and piecemeal relocation. However, these measures are not expected to provide substantial reductions in storm damages over the long-term and, thus, would be the equivalent of a no action plan.

**General Methodology.**

To analyze this 12-mile long stretch of coastline from Fort Macon to Indian Beach that comprises the overall study area, the shoreline of three Bogue Banks beach communities is divided into segments according to similar development patterns, existing dune dimensions, and erosion rates. Fort Macon, Atlantic Beach, Pine Knoll Shores, and Indian Beach are divided into a total of 12 segments. These average about 6,000 feet in length, with six comprising Fort Macon and Atlantic Beach (ie., Base Disposal Area), and six comprising Pine Knoll Shores and Indian Beach (i.e, Section 933 Project). The costs versus benefits of a nourishment project for each segment are then evaluated incrementally.

Expected storm and erosion related damages are first computed for the Base Disposal Plan, and then again for the Section 933 Project. Both of these beach fill plans would prevent the progressive erosion of the shoreline, reduce damages caused by erosion, flooding, and wave impact during coastal storms, decrease storm related emergency expenditures, and increase the quality of recreational opportunities in the area.

Normally with beach nourishment evaluations, the plan formulation process involves the assessment of the degree of storm damage reduction provided by a wide range of beach fill configurations. However, with a Section 933 analysis, only one beach fill alternative must be demonstrated to be economically feasible taking into full account the benefits foregone from the normal Base Disposal Plan. Given the structural data base for the primary study area, the level of storm damage reduction for this beach fill configuration is determined by simulating hundreds of 20-year life cycles. This is accomplished through the use of the model, GRANDUC, which incorporates risk and uncertainty principles into the analysis.

Through a random selection process, a particular 20-year simulation may include several severe storms or perhaps none. All of the 20-year life cycle simulations are run for the existing conditions, then again for a particular plan. Then, the average storm damage reduction potential afforded by a particular design configuration is computed. These damages are then estimated at an expected annual amount. The storm damage reduction potential for a particular plan is computed in terms of the "net benefits" afforded by the plan. Normally, net benefit is defined as the difference in the expected annual benefits associated with a particular fill configuration and the average annual cost for that configuration. Plan formulation and evaluation using GRANDUC is based on the present value of the net benefits before annualizing.

**Interest Rate and Period of Analysis.**

The interest rate for the analysis is 5-7/8 percent and a 20-year Period of analysis is used. October 2002 price levels are applied. The "base year" used for the economic analysis is 2004. The period of analysis for the Section 933 Project has been selected to be 20 years. This is based on a 10-year physical life for the Section 933 Project and doubling this time period for the period of analysis of the project. This period approximates the time over which benefits would be realized for the Section 933 Project, plus the additional length of time it would take for the beach profile to reach equilibrium with the without project condition's profile.

**Alternative Plans.**

Initially, the without project condition, or in this case, the Base Disposal Plan, for Fort Macon and Atlantic Beach was evaluated. The alternative is the Section 933 Project, which is the only plan considered in great detail. As explained above, only one plan need be evaluated in determining economic feasibility. Although the

Recommended Plan was the only plan analyzed in detail, there were several plans initially assessed which would have provided protection for a number of different combinations of areas within the Study Area and the Base Disposal Plan Area. These plans were used as tools to assist in the initial determination of the one plan to evaluate in more detail.

**Refinement of Erosion-Damage Relationship.**

Before describing estimates of potential damages, an explanation of one of the critical, underlying relationships that go into the damage calculations, namely, the erosion-damage curve is offered. The historical effects of long-term and storm related erosion on oceanfront structures along the beaches of North Carolina are not well documented. Very little data exists on how these structures react to storm forces of varying degrees of intensity. This lack of data has lead to the designing of erosion-damage curves comprised largely through professional judgment. The state of the art of modeling these relationships is improving, however, following the hurricanes of 1996-1999 along the North Carolina coast. Researchers like Spencer Rogers of North Carolina Sea Grant have begun collecting and analyzing data and publishing papers on this subject. In his report "Erosion Damage Thresholds in North Carolina," Mr. Rogers derived storm induced damage curves based on observed changes over time in coastal construction in North Carolina The curves used in the Morehead City Harbor Section 933 Study are derived from these erosion-damage curves and are based on field data including the following structure identities:

- Oceanfront or not
- Number of stories
- On piles or not, long or short piles
- Size of the under house enclosure (none, small, partial, fully enclosed)
- Type of enclosure (none, finished, unfinished)
- High or low existing dune
- Structure type (commercial or residential)

For this analysis, these data were collected for every structure along the oceanfront and first row of development back from the oceanfront, along with their elevation and depreciated replacement value. The following further describes the four-character coding scheme of structure types used for this study, which was originally developed by a North Carolina State University team of researchers including Mr. Rogers. These codes are assigned upon field inspection of each structures and matched with both an appropriate erosion-damage curve and an inundation-damage curve.

## Building Inventories

### Four character scheme used for Bogue Banks database:

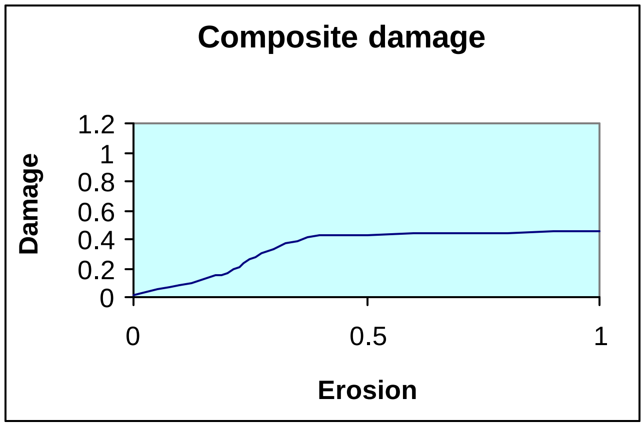
1. Number of stories (1,2,3)
2. On piles or not (P or N)
3. Size of underhouse enclosure (N=none, S=small (300 ft$^2$ or less), P=partial (300 ft$^2$ to full), F=fully enclosed)
4. Type of enclosure (N=none, F=finished, U=unfinished)

### Yielding the following list of structure types:

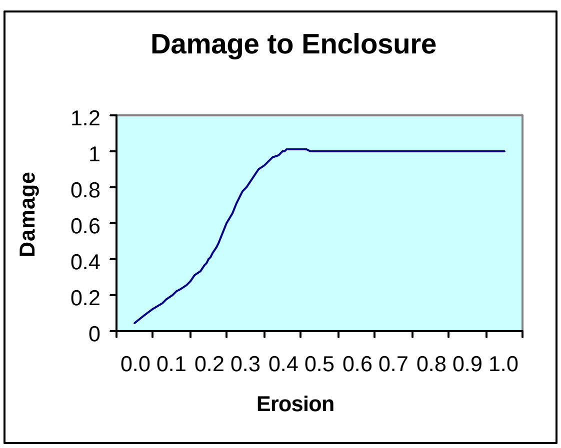
| Type | Description |
|---|---|
| 1NNN | One story on grade or low/crawl space foundation |
| 1PNN | One story elevated on piles, no enclosures below |
| 1PSF | One story elevated on piles, enclosed finished area below (enclosure less than or equal to 300 ft$^{2)}$ |
| 1PPF | One story elevated on piles, enclosed finished area below (enclosure greater than 300 ft$^2$ but less than full) |
| 1PFF | One story elevated on piles, enclosed finished area below (full enclosure) |
| 1PSU | One story elevated on piles, unfinished enclosure below (enclosure less than 300 ft$^2$) |
| 1PPU | One story elevated on piles, unfinished enclosure below (enclosure greater than 300 ft$^2$ but less than full) |
| 1PFU | One story elevated on piles, unfinished enclosure below (full enclosure) |
| 2NNN | Two story on grade or low/crawl space foundation |
| 2PNN | Two story elevated on piles, no enclosures below |
| 2PSF | Two story elevated on piles, enclosed finished area below (enclosure less than 300 ft$^2$) |
| 2PPF | Two story elevated on piles, enclosed finished area below (enclosure greater than 300 ft$^2$ but less than full) |
| 2PFF | Two story elevated on piles, enclosed finished area below (full enclosure) |
| 2PSU | Two story elevated on piles, unfinished enclosure below (enclosure less than 300 ft$^2$ |
| 2PPU | Two story elevated on piles, unfinished enclosure below (enclosure greater than 300 ft$^2$ but less than full) |
| 2PFU | Two story elevated on piles, unfinished enclosure below (full enclosure) |

The erosion-damage curves used for this analysis are compilations of curves assigned for each part of the structure. For example, the curve 1 below is a compilation of curves 2 and 3 with weight given in proportion to the value assigned to each part of the structure. This example is for a 1PF, which is a 1-story house on piling with a full enclosure. It is further described as having long pilings and on low elevation. The enclosure is given a value of 40% of the entire structure and the rest of the structure is given a value of 60% of the entire structure value. These percentages were then used to weight the damage curves for the home and the enclosure and derive a composite damage curve.

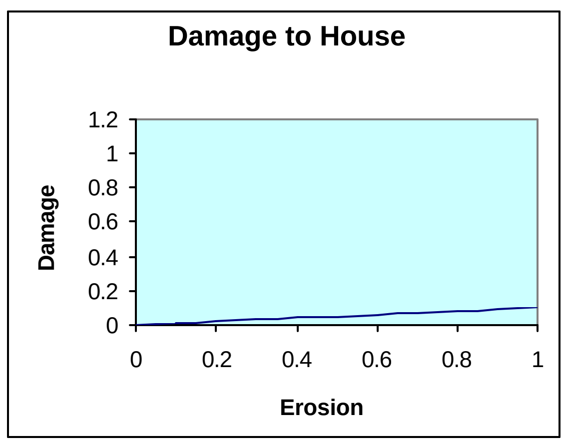
**Curve 1**




**Curve 2**



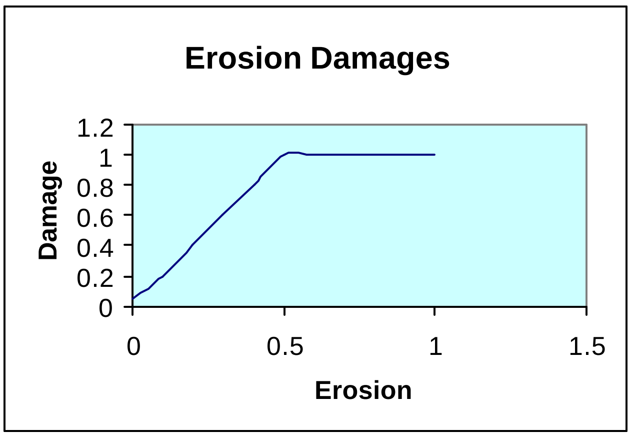

**Curve 3**




The use of construction dates estimated during the data collection assisted in determining of whether or not a structure was on long or short pilings. The North Carolina coastal construction codes changed in 1986 to require longer pilings than the 8 feet below grade to either-5 feet NGVD or 16 feet below grade, whichever is shallower. We developed our damage curves to distinguish between structures with long or short pilings because the storm damages are different for the two. The curves were different for high and low dune elevation as well (12 feet is the limit).

Another consideration for curve assignment is whether the structure is in the oceanfront row or the second row. Those residential oceanfront structures with enclosures were typically assigned some variation of curves 1 or 2 above, depending on their age, length of piling, and size and quality of enclosure. Oceanfront homes with no enclosure, on a low dune, and pilings embedded 16 feet were assigned curve 3, which produces relatively minor damages. Oeanfront structures are most vulnerable to erosive forces and are usually built to the higher building code standard. Residential structures along the second row of development were also assigned an erosion-damage curve specific to their building characteristics, which often include shorter pilings. In this case, the structures were often assigned a more aggressive erosion-damage curve like curve 4 shown below.

**Curve 4**




The erosion indicator, or erosion depth threshold, is a vertical measurement that is used to look at erosion through structures. As the land erodes by this vertical amount though a structure, damage accrues to the structure. An erosion indicator of 0.5 feet was used for this analysis. Sensitivity analyses were done to examine the effects of changes in content value percentages, erosion indicators, and assignment of erosion curves from the simplest to curves that are composites of damages to different parts of the structure.

**Benefit Categories.**

Three categories of benefits will be analyzed for the initial evaluation of the structural plans over the 12-mile study area. These benefit categories include: (1) hurricane and storm damage reduction, including land loss; (2) emergency costs and other damage reduction; and (3) recreation. Expected storm and erosion related damages are computed for three conditions: (1) existing conditions; (2) the Base Disposal Plan conditions; and (3), the Section 933 Project conditions. The benefits for the Section 933 Project for which economic justification must be demonstrated, are the difference between Pine Knoll Shores' and Indian Beaches existing damages and the damages with the 933 Project in place. The benefits for the Base Disposal Plan are also calculated to compute benefits foregone, which are added to the cost side of the Section 933 Project.

**Potential Hurricane and Storm Damages.**

Hurricane and storm damages are calculated under these three conditions for damages to structures and contents, roadways, and land lost due to long-term erosion. Land lost to long-term erosion is computed by multiplying the expected annual loss of land by the value of nearshore upland shown in table 2. Table 3 displays by segment the expected annual hurricane and storm damages, along with residual damages. Again, the residual damages illustrate how little the Base Disposal Plan helps in reducing hurricane and storm damages on Bogue Banks.

TABLE 3
Expected Annual Hurricane and Storm Damages by Town

| TOWN | Existing | BD Plan | 933 Plan |
|---|---|---|---|
| Fort Macon | $90,638 | $6,874 | $9,656 |
| Atlantic Beach | $4,365,381 | $2,495,970 | $3,198,587 |
| Pine Knoll Shores | $12,008,057 | $12,008,057 | $4,750,681 |
| Indian Beach | $2,534,965 | $2,534,965 | $842,311 |
| TOTAL (Residual) | $18,999,040 | $17,045,866 | $8,801,234 |

**Hurricane and Storm Damage Reduction Benefits.**

Expected annual hurricane and storm damage reduction benefits for the Section 933 Project amount to the difference between damages under the 933 plan and the Base Disposal (BD) Plan for Pine Knoll Shores and Indian Beach. As shown in table 4, the hurricane and storm damage reduction benefits are estimated at $8,950,000 (($18,912,000 - $4,751,000) + ($2,535,000 - $842,000)). The residual expected annual damages along the Section 933 study area are about $5,593,000. The decrease in Atlantic Beach and Fort Macon hurricane and storm damage benefits from the Section 933 Project (i.e., $705,000) will be added to the cost side of the Section 933 Project as a benefit foregone later in the appendix.

TABLE 4
Expected Annual Hurricane and Storm
Benefits for the Section 933 Project

| TOWN | Expected Annual H&S Damages Existing | BD Plan | 933 Plan | Expected Annual H&S Benefits 933 Plan |
|---|---|---|---|---|
| Pine Knoll Shores | $12,008,057 | $12,008,057 | $4,750,681 | $7,257,376 |
| Indian Beach | $2,534,965 | $2,534,965 | $842,311 | $1,692,654 |
| TOTAL | $14,543,022 | $14,543,022 | $5,592,991 | $8,950,031 |

**Testing the Economic Feasibility of the Section 933 Project.**

Plan formulation is generally based on costs versus hurricane and storm damage reduction benefits. Therefore, before describing other benfits accruing from the Section 933 Project, a plan formulation test of basic economic feasibility based soley on hurricane and storm damage reduction is appropriate at this point. As mentioned earlier, the 12-mile long stretch of coastline from Fort Macon through Indian Beach was divided into 12 segments averageing about 6,000 feet in length. Table 5 and 6 show this process of incrementally evaluating the economic feasibility of each segment. First, table 5 shows the economics of the Base Disposal Plan, including costs of pipelining and hoppering the dredged material. Although this is least cost disposal plan and does not require a positive benefit-to-cost ratio (BCR), it is interesting to note that its overall BCR is 1.3, and its hurricane and storm damage reduction benefits do outweigh its costs. More importantly, these calculations are needed to compute benefits foregone in support of the economics of the Section 933 Project and to ensure that the project is not extended beyond what the benefits will support. Benefits in table 5 and 6 are in present value form so they are comparable to first costs.

TABLE 5

<u>Base Disposal Plan Economic Feasibility by Segment</u>

| Seg-ment | Length (in feet) | Ave. Unit Cost-Pipeline-Base Plan | Volume (cu. Yd) | Volumetric Placement Cost | Mob/Demob (Divided Linearly) | Ocean Disposal Costs (Divided Linearly) | Total Costs Base Plan-(No Contingencies, etc. Included) | P.V. Benefits-Base Plan | Incremental Benefit Cost Ratio-933 Plan |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3000 | $2.18 | 427,740 | $932,473 | $187,500 | $365,625 | $1,485,598 | $110,521 | 0.1 |
| 2 | 4000 | $1.93 | 813,042 | $1,569,171 | $250,000 | $487,500 | $2,306,671 | $860,067 | 0.4 |
| 3 | 6000 | $1.73 | 802,132 | $1,387,688 | $375,000 | $731,250 | $2,493,938 | $7,053,784 | 2.8 |
| 4 | 7000 | $2.11 | 836,118 | $1,764,209 | $437,500 | $853,125 | $3,054,834 | $4,428,195 | 1.4 |
| 5 | 6000 | $2.51 | 882,272 | $2,214,503 | $375,000 | $731,250 | $3,320,753 | $2,853,216 | 0.9 |
| 6 | 6000 | $2.91 | 1,038,696 | $3,022,605 | $375,000 | $731,250 | $4,128,855 | $7,326,072 | 1.8 |
| 7 | 7000 | | | | | | | | |
| 8 | 7000 | | | | | | | | |
| 9 | 7000 | | | | | | | | |
| 10 | 6000 | | | | | | | | |
| 11 | 5000 | | | | | | | | |
| 12 | 6000 | | | | | | | | |
| Total | 70000 | | 4,800,000 | $10,890,650 | $2,000,000 | $3,900,000 | $16,790,650 | $22,631,855 | 1.3 |

Similarly, table 6 examines the segment-by-segment economic feasibility of the Section 933 Project after adding the hurricane and storm damage reduction benefits foregone to the cost side. Table 6 demonstrates that every segment throughout the Section 933 Project Area (segments 7-12) is economically justified. Segment 10 is divided in half to accommodate the best estimate of where the pipeline operation would end and the hopper operation would begin.

TABLE 6

<u>Section 933 Project Economic Feasibility by Segment</u>

| Segment | Length (in feet) | Ave. Unit Cost-Pipeline-Total Plan | Ave. Unit Cost-Hopper to IB-Total Plan | Volume (cu. yd) | Volumetric Placement Cost | Mob/Demob (Divided Linearly) | Total Cost-Total Plan (No Contingencies, etc. included) | P.V. Benefits -Base Plan | P.V. Benefits-Total Plan | Costs of Benefits Foregone | Total Cos -933 Plan (No Contingencies, etc. included) | Incremental Benefit Cost Ratio-Total Plan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3000 | $2.18 | | 159,571 | $347,865 | $93,750 | $441,615 | $110,521 | $103,327 | $7,194 | $448,809 | 0.2 |
| 2 | 4000 | $1.93 | | 458,750 | $885,388 | $125,000 | $1,010,388 | $860,067 | $835,032 | $25,035 | $1,035,423 | 0.8 |
| 3 | 6000 | $1.73 | | 250,406 | $433,202 | $187,500 | $620,702 | $7,053,784 | $4,930,409 | $2,123,375 | $2,744,077 | 1.8 |
| 4 | 7000 | $2.11 | | 209,642 | $442,345 | $218,750 | $661,095 | $4,428,195 | $1,811,495 | $2,616,700 | $3,277,795 | 0.6 |
| 5 | 6000 | $2.51 | | 312,018 | $783,165 | $187,500 | $970,665 | $2,853,216 | $871,613 | $1,981,603 | $2,952,268 | 0.3 |
| 6 | 6000 | $2.91 | | 443,329 | $1,290,087 | $187,500 | $1,477,587 | $7,326,072 | $5,906,367 | $1,419,705 | $2,897,292 | 2.0 |
| 7 | 7000 | $3.33 | | 808,456 | $2,692,158 | $218,750 | $2,910,908 | $0 | $9,013,190 | $0 | $2,910,908 | 3.1 |
| 8 | 7000 | $3.83 | | 954,648 | $3,656,302 | $218,750 | $3,875,052 | $0 | $36,038,399 | $0 | $3,875,052 | 9.3 |
| 9 | 7000 | $4.30 | | 865,555 | $3,721,887 | $218,750 | $3,940,637 | $0 | $18,793,214 | $0 | $3,940,637 | 4.8 |
| 10A | 3000 | $4.66 | | 337,624 | $1,573,328 | $93,750 | $1,667,078 | $0 | $8,394,110 | $0 | $1,667,078 | 5.0 |
| 10B | 3000 | | $8.07 | 387,390 | $3,126,237 | $235,715 | $3,361,952 | $0 | $11,853,882 | $0 | $3,361,952 | 3.5 |
| 11 | 5000 | | $8.29 | 530,322 | $4,396,369 | $392,860 | $4,789,229 | $0 | $13,258,858 | $0 | $4,789,229 | 2.8 |
| 12 | 6000 | | $8.60 | 582,289 | $5,007,685 | $471,425 | $5,479,110 | $0 | $6,354,294 | $0 | $5,479,110 | 1.2 |
| Total | 70000 | | | 6,300,000 | $28,356,019 | $2,850,000 | $31,206,019 | $22,631,855 | $118,164,190 | $8,173,612 | $39,379,631 | 3.0 |

**Potential Emergency Costs and Other Damages.**

In this analysis, emergency costs prevented refer to expected annual expenditures that residents and governments are experiencing under the without project condition that the Section 933 Project would preclude. Other damages prevented include storm damages that are not covered under the National Flood Insurance Program, but represent financial drains on public and private storm victims that a large beach nourishment project could prevent. The categories lumped into this benefit called emergency costs and other damages prevented include (1) beach scraping/pushing; (2) sandbagging: (3) emergency costs incurred by the North Carolina Department of Transportation; (4) damages to public property; (5) damages to private property other than structures and contents; and, (6) post-storm recovery expenses. the difference in expected annual totals of emergency costs and other damages attributable to the existing condition, the Base Disposal Plan, and the Section 933 Project are displayed by towns in table 7. These are based on actual FEMA damage survey reports submitted by the towns following the recent hurricanes in North Carolina.

TABLE 7
Expected Annual Emergency Costs and Other Damages by Town

| TOWN | Existing | BD Plan | 933 Project |
|---|---|---|---|
| Fort Macon | $0 | $0 | $0 |
| Atlantic Beach | $94,000 | $10,000 | $10,000 |
| Pine Knoll Shores | $90,000 | $90,000 | $10,000 |
| Indian Beach | $50,000 | $50,000 | $8,000 |
| TOTAL (Residual) | $234,000 | $150,000 | $28,000 |

These emergency costs and other damage reduction benefits do not amount to much, largely because Bogue Banks has luckily dodged most of the recent North Carolina hurricane landfalls. However, these expenses are included in an effort to identify all potential damage reduction benefits.

**Emergency Costs and Other Damages Reduction Benefits.**

Just as with hurricane and storm damage reduction benefits, expected annual emergency costs and other damages reduction benefits over the Section 933 Study Area (i.e., Pine Knoll Shores and Indian Beach) amount to the difference between damages under the Section 933 Project and the Base Disposal (BD) Plan as shown in table 8. This amounts to expected annual emergency costs and other damage reduction (EC) benefits of $122,000 (($90,000 - $10,000) + ($50,000 - $8,000)). For these benefits, there are no benefits foregone.

TABLE 8
Emergency Costs and Other Damages Reduction Benefits

| | Expected Annual EC Damages | | | Expected Annual EC Benefits |
|---|---|---|---|---|
| TOWN | Existing | BD Plan | 933 Plan | 933 Plan |
| Pine Knoll Shores | $90,000 | $90,000 | $10,000 | $80,000 |
| Indian Beach | $50,000 | $50,000 | $8,000 | $42,000 |
| TOTAL | $140,000 | $140,000 | $18,000 | $122,000 |

**Recreation Benefit Analysis.**

The existing recreation demand for beach activities along Bogue Banks is generated primarily by seasonal residents and visitors in the area, who either own a second home or occupy rental units. As erosion threatens the homes and motels in these beach communities, it also threatens the recreation opportunities enjoyed by owners and seasonal visitors to the beach. Erosion in the last several years has severely narrowed the beach at Pine Knoll Shores and Indian Beach. This problem is expected to continue in the absence of a Federal beach fill project for these two towns. The Section 933 recreation analysis will compare the overall value of recreational experiences of continuing with the Base Disposal Plan versus the overall value of recreation experiences if the Section 933 Project were implemented.

The value of any improvement in the quality of recreation experience along these beaches will be analyzed using the unit-day value method. The unit-day method assigns a point value to various aspects of the recreation experience to determine the change in recreation values as a result of a project. Recreational values for the without project condition reflect a narrow, eroded beach having a pronounced escarpment and little width for picnicking, fishing, playing beach games, and sunbathing. The beach will likely be especially narrow or nonexistent at high tide.

One would expect recreation in the area protected by the Section 933 Project would have better recreation opportunities and a higher experience value for the new section of beach being nourished. The Section 933 Project would provide a berm of adequate width to accommodate the peak seasonal use expected by the towns of Pine Knoll Shores and Indian Beach. The recreational experience under this project condition would provide excellent conditions for swimming, fishing, sunbathing, walking, beach games, and other recreational activities. Recreation benefits for the plan of improvement are the difference in the value of a recreation experience per user day with the project and without it, times the estimated annual beach visitation for each town. Converting the point values to FY2002 unit-day values, and multiplying by the effected visitation will yield the recreation benefit attributable to the plan. A recreation benefits foregone adjustment may prove necessary if it is determined that Atlantic Beach and Fort Macon would suffer a decline in unit-day value if Section 933 Project were implemented.

The procedure used to estimate recreation benefits for the Section 933 analysis is explained in the following four steps. First, the maximum daily visitation for each town is estimated. With no pre-existing visitation estimates of Carteret County beaches use, the projected maximum daily visitation is based on filling all of the dwellings available to the beach users. This is accomplished in table 9.

TABLE 9

Estimate of Daily Peak Visitation by Town

| | | Pine Knoll Shores | | Indian Beach | | Salter Path | |
|---|---|---|---|---|---|---|---|
| Type of Accomodations | Ave.No.People per Unit | Number of Units | Estimated Peak Visitation | Number of Units | Estimated Peak Visitation | Number of Units | Estimated Peak Visitation |
| Single Family Houses | 5 | 950 | 4750 | 64 | 320 | 135 | 675 |
| Mobile Homes | 3.5 | 0 | 0 | 0 | 0 | 9 | 31.5 |
| Multi-Family Houses | 12 | 8 | 96 | 0 | 0 | 0 | 0 |
| Condos / Apartments | 4 | 982 | 3928 | 345 | 1380 | 51 | 204 |
| Motel/Hotel Rooms | 4 | 650 | 2600 | 0 | 0 | 32 | 128 |
| RVs/Tent Spaces | 3.5 | 0 | 0 | 424 | 1484 | 0 | 0 |
| Day Use (Public Parking) | 2 | 195 | 975 | 56 | 280 | 75 | 375 |
| | | | | | | | |
| Total Estimated Peak Visitation | | | 12,349 | | 3,464 | | 1,414 |
| Rounded to | | | 12,300 | | 3,500 | | 1,400 |

Assumptions: New public parking added at PKS & IB;
Average number of people/unit is consistent with Land Use Plan;
Calculations for day use include a turnover factor of 2.5 for each parking space.

Second, this maximum daily visitation is used only for July 4, traditionally the heaviest beach usage day of the year. Therefore, the rest of the beach season must be defined and daily visitation adjusted for weather and occupancy rates. The bottom line is the estimated annual beach visitation for each town as shown in table 10. The seasonal factor in table 10 is based on Carteret County's monthly occupancy rates.

TABLE 10
Weighted Annual Visitation by Town

| Month | Type | No. of Days | Seasonal Factor* | Visitation Factor | PKS | IB (w/SP) |
|---|---|---|---|---|---|---|
| Jan | Weekend | 8 | 0.047 | 0.64 | 2,960 | 1,179 |
| Feb | Weekend | 8 | 0.0548 | 0.64 | 3,451 | 1,375 |
| Mar | Weekday | 21 | 0.0897 | 0.5 | 11,585 | 4,615 |
| | Weekend | 10 | 0.0897 | 0.64 | 7,061 | 2,813 |
| Apr | Weekday | 21 | 0.1832 | 0.5 | 23,660 | 9,426 |
| | Weekend | 8 | 0.1832 | 0.64 | 11,537 | 4,596 |
| | Holiday | 1 | 0.1832 | 0.64 | 1,442 | 575 |
| May | Weekday | 21 | 0.2846 | 0.5 | 36,756 | 14,643 |
| | Weekend | 9 | 0.2846 | 0.64 | 20,163 | 8,033 |
| | Holiday | 1 | 0.2846 | 0.64 | 2,240 | 893 |
| Jun | Weekday | 21 | 0.6517 | 0.5 | 84,167 | 33,530 |
| | Weekend | 9 | 0.6517 | 0.64 | 46,172 | 18,394 |
| Jul | Weekday | 22 | 1.00 | 0.5 | 135,300 | 53,900 |
| | Weekend | 8 | 1.00 | 0.64 | 62,976 | 25,088 |
| | Holiday | 1 | 1.00 | 1 | **12,300** | **4,900** |
| Aug | Weekday | 21 | 0.7346 | 0.5 | 94,874 | 37,795 |
| | Weekend | 10 | 0.7346 | 0.64 | 57,828 | 23,037 |
| Sep | Weekday | 21 | 0.284 | 0.5 | 36,679 | 14,612 |
| | Weekend | 8 | 0.284 | 0.64 | 17,885 | 7,125 |
| | Holiday | 1 | 0.284 | 0.64 | 2,236 | 891 |
| Oct | Weekday | 23 | 0.218 | 0.5 | 30,836 | 12,284 |
| | Weekend | 8 | 0.218 | 0.64 | 13,729 | 5,469 |
| Nov | Weekday | 19 | 0.1009 | 0.5 | 11,790 | 4,697 |
| | Weekend | 10 | 0.1009 | 0.64 | 7,943 | 3,164 |
| | Holiday | 1 | 0.1009 | 0.64 | 794 | 316 |
| Dec | Weekend | 8 | 0.0486 | 0.64 | 3,061 | 1,219 |
| Total | | 299 | | | 739,425 | 294,568 |
| Multiply by weather factor of .75 | | | | | 554,568 | 220,926 |
| ANNUAL BEACH VISITATION, Rounded to | | | | | 555,000 | 221,000 |

* Seasonal factor is based on Carteret County's monthly occupancy rates.

Next, the value of the recreation beach where it has changed is compared to the former value of the beach under without project conditions using the unit-day value method. The unit-day method assigns a point value to various aspects of the recreation experience to determine the change in recreation values as a result of the project. This is shown in table 11. With and without project beach profiles were generated for the purpose of assigning point values for the various quality categories in table 11. A beach width of 100 feet or greater is considered adequate to achieve the maximum allowable points that a wide beach would bring. That is, point changes are only taken for reaches of the beach that fall below 100 feet wide under the without project condition, and once the width is reestablished at 100 feet, points are maximized. In other words, a 150-foot wide beach is esthetically no more valuable than a 100-foot wide beach. The 30-foot wide berm to be constructed with the Section 933 Project will extend the beach fill seaward from the existing profile, with an elevation of 7 feet NGVD, approximately the elevation of the natural vegetation line along the Bogue Banks beaches. Berm width is measured seaward along the top of the berm from the point where the top of berm intersects the natural profile. Seaward of the designed berm width, the with-project profile parallels the existing profile out to the closure depth of –27 feet NGVD. This design will give the beach a much wider appearance than the 30-foot design width so that claiming maximum allowable points for a wide beach is a reasonable assumption.

TABLE 11
Unit-Day Value Point Assignment by Towns
(PKS = Pine Knoll Shores;
IB = Indian Beach including Salter Path)

| **Category** | **BDP** | | **933 Project** | | **Remarks** |
|---|---|---|---|---|---|
| | **PKS** | **IB** | **PKS** | **IB** | |
| **Recreation Experience** | 5 | 5 | 8 | 8 | The natural, high foredune setting of Bogue Banks precludes overwash and the migration of beaches landward. For this reason, the without project condition would ultimately lead to a sharp interface between vertical, 25-foot high dune scarps and a small, almost non-existent beach platform. This would almost entirely preclude four wheel drive access, surf fishing, picnicking, sunbathing, launching small sailboats, accessing the ocean for swimming and surfing, and other recreational activities. The with project condition will allow numerous general activities. |
| | | | | | |
| | | | | | |

| Category | BDP | | 933 Project | | Remarks |
|---|---|---|---|---|---|
| | PKS | IB | PKS | IB | |
| **Availability of Opportunity** | 2 | 2 | 2 | 2 | The beach towns are evaluated independently. However, there are only two bridges that connect the island to the mainland. If the beaches of Atlantic Beach were inaccessible, one would have to drive further west along Bogue Banks or drive to the Emerald Isle bridge. If all of Bogue Banks was inaccessible, then one could visit by boat to Shackleford Banks and Hammock's Beach, located to the east and west of Bogue Banks, respectively. By automobile only, the next accessible beaches are N. Topsail to the SW and Nags Head to the NE. |
| **Carrying Capacity** | 5 | 5 | 8 | 8 | Again, the natural, high foredune setting of Bogue Banks precludes overwash and the migration of beaches landward and had reduced the capacity of the beach under without project conditions. Under with project condtions, there would be plenty of capacity. |
| **Accessibility** | 6 | 6 | 10 | 9 | The roadway infrastructure for Bogue Banks is generally comprised of Hwy 58 that is situated along some the highest topography on the island. With few exceptions, the shore parallel and perpendicular roads seaward of Highway 58 should remain in good shape unless the frontal dune is completely compromised. Under with project conditions, additional public access and parking sites will improve assessibility. |
| **Environmental Quality** | 5 | 5 | 11 | 10 | The without project condition would lead to exposed septic tanks, broken stairs, and other debris along the beach. Also, the steep scarp with little or no beach would preclude turtle nesting activity, limit foraging bird activity, and would essentially represent a sharp line of submerged environments to maritime forest. |
| **TOTAL** | 23 | 23 | 39 | 37 | |

Finally, the with and without project unit-day point difference is converted to dollars and multiplied by the annual beach visitation to arrive at a recreation benefit attributable to the total Section 933 Project. The total expected annual recreation benefit for all four areas for the Section 933 Project is $2,102,000, as shown in table 12. However, the additional recreation benefit above that of the Base Disposal Plan is $1,009,000.

TABLE 12
Expected Annual Recreation Benefits by Town

| | Pine Knoll Shores | Indian Beach (w/SP) | TOTAL |
|---|---|---|---|
| Estimated Annual Beach Visitation | 555,000 | 221,000 | 776,000 |
| BDP (i.e., Existing Conditions) FY02 unit-day value points | 23 | 23 | |
| BDP FY02 unit-day value | $3.96 | $3.96 | |
| Expected Annual BDP value of recreation | $2,197,800 | $875,160 | $3,072,960 |
| Section 933 Project FY02 unit-day value points | 39 | 37 | |
| Section 933 Project FY02 unit-day value | $5.32 | $5.11 | |
| Expected annual Section 933 Project value of recreation | $2,952,600 | $1,129,310 | $4,081,910 |
| Expected Annual Recreation Benefit for Sec. 933 Project | $754,800 | $254,150 | $1,008,950 |

It is an important distinction that the recreation benefits for this project analysis stem from improving the quality of the recreation experience, not from drawing more people. In general, the supply of beach exceeds the demand for beach recreation along this 10-mile stretch of beach. The project would not be the draw; it merely enhances the experience for persons using the beach in the vicinity of their house or motel.

Because a beach width of 100 feet or greater is considered adequate to achieve the maximum allowable points and this width is achieved throughout Fort Macon and Atlantic Beach by both the Base Disposal Plan and Section 933 Project, there would be no benefits foregone attributable to recreation. In other words, the beneficial impact for recreation of either plan throughout Fort Macon and Atlantic Beach would be the same.

**Benefits Foregone.**

Benefits foregone were evaluated for the shoreline within the Base Disposal Plan (Fort Macon and Atlantic Beach) that would not receive the entire dredge disposal due to the proposed Section 933 Project. There are no benefits foregone related to emergency costs or recreation, only hurricane and storm damage reduction. As shown in table 6, the total expected annual benefits forgone are estimated at $705,400 (i.e., $8,173,612 in present value terms). This amount is added to the cost side of the Section 933 Project to account for the lower level of protection that the Base Disposal Plan would have offered Atlantic Beach and Fort Macon.

**Benefits During Construction.**

Benefits during construction (BDC) are those benefits that accrue to the project before its completion. In other words, as the beach fill is constructed, the benefits to the newly improved shoreline are essentially claimable from that time forward. In the case of the Section 933 Project, BDC begin accumulating as as the segments of the overall project are built. It is assumed that benefits accrue as expenditures for placement of the dredged material occur. The Section 933 Project is scheduled to be completed within 16 months. This monthly breakdown of the expected annual benefits is shown in table 13. Benefits foregone are subtracted from the total expected annual benefits before computing the monthly expected annual benefits (i.e., \$8,367,000 / 12 = \$697,250). Also, no recreation benefit is included in BDC since the esthetic quality of the beach would be questionable during construction. Therefore, the BDC are based on an expected annual benefit total of \$8,367,000 (\$8,950,000 (H&S Damage Reduction) + \$122,000 (Emegency Costs Reduction) - \$705,000 (Benefits Foregone)). As shown in table 14, BDC for the Section 933 Project amount to \$574,000 on an annual basis.

TABLE 13

Computing Monthly Benfeits for Benefits During Construction

(5-7/8% Interest for 20 Years)

| Period | Month | Monthly Expend. Pipeline* | Monthly Expend. Hopper* | Total Expend.* | % exp. = %benefits | Cumulative % | Monthly Benefits |
|---|---|---|---|---|---|---|---|
| 1 | N-03 | $0 | | | | 0.00% | $0 |
| 2 | D-03 | $2,035,686 | $654,846 | $2,690,532 | 9.49% | 9.49% | $66,155 |
| 3 | J-04 | $2,035,686 | $654,846 | $2,690,532 | 9.49% | 18.98% | $132,310 |
| 4 | F-04 | $2,035,686 | $654,846 | $2,690,532 | 9.49% | 28.46% | $198,465 |
| 5 | M-04 | $2,035,686 | | $2,035,686 | 7.18% | 35.64% | $248,518 |
| 6 | A-04 | $2,035,686 | | $2,035,686 | 7.18% | 42.82% | $298,572 |
| 7 | M-04 | $2,035,686 | | $2,035,686 | 7.18% | 50.00% | $348,625 |
| 8 | J-04 | $2,035,686 | | $2,035,686 | 7.18% | 57.18% | $398,678 |
| 9 | J-04 | $2,035,686 | | $2,035,686 | 7.18% | 64.36% | $448,732 |
| 10 | A-04 | $2,035,686 | | $2,035,686 | 7.18% | 71.54% | $498,785 |
| 11 | S-04 | $2,035,686 | | $2,035,686 | 7.18% | 78.71% | $548,839 |
| 12 | O-04 | $2,035,686 | | $2,035,686 | 7.18% | 85.89% | $598,892 |
| 13 | N-04 | $2,035,686 | | $2,035,686 | 7.18% | 93.07% | $648,946 |
| 14 | D-04 | $0 | $654,846 | $654,846 | 2.31% | 95.38% | $665,047 |
| 15 | J-05 | $0 | $654,846 | $654,846 | 2.31% | 97.69% | $681,149 |
| 16 | F-05 | $0 | $654,846 | $654,846 | 2.31% | 100.00% | $697,250 |
| Totals | | $24,428,232 | $3,929,076 | $28,357,308 | 100.00% | | |
| | | | | | | | $697,250 |

*Placement Costs Only--includes no Mob and Demob.

TABLE 14

Expected Annual Benefits During Construction

(5-7/8% Interest for 20 Years)

| PERIOD | MONTH | MONTHLY BENEFITS | PERIODS | FACTOR | BDC |
|---|---|---|---|---|---|
| 1 | N-03 | $0 | 15.5 | 1.078642 | $0 |
| 2 | D-03 | $66,155 | 14.5 | 1.073387 | $71,010 |
| 3 | J-04 | $132,310 | 13.5 | 1.068157 | $141,328 |
| 4 | F-04 | $198,465 | 12.5 | 1.062953 | $210,958 |
| 5 | M-04 | $248,518 | 11.5 | 1.057774 | $262,876 |
| 6 | A-04 | $298,572 | 10.5 | 1.05262 | $314,282 |
| 7 | M-04 | $348,625 | 9.5 | 1.047492 | $365,182 |
| 8 | J-04 | $398,678 | 8.5 | 1.042388 | $415,578 |
| 9 | J-04 | $448,732 | 7.5 | 1.03731 | $465,474 |
| 10 | A-04 | $498,785 | 6.5 | 1.032256 | $514,874 |
| 11 | S-04 | $548,839 | 5.5 | 1.027226 | $563,782 |
| 12 | O-04 | $598,892 | 4.5 | 1.022222 | $612,201 |
| 13 | N-04 | $648,946 | 3.5 | 1.017241 | $660,134 |
| 14 | D-04 | $665,047 | 2.5 | 1.012285 | $673,217 |
| 15 | J-05 | $681,149 | 1.5 | 1.007353 | $686,157 |
| 16 | F-05 | $697,250 | 0.5 | 1.002445 | $698,955 |
| TOTAL | | | | | $6,656,008 |
| | | | | I&A | 0.086302 |
| ANNUAL | EXPECTED | | BDC | | $574,427 |

## Economic Results

**Benefit Summary.**

Expected annual benefits for the Section 933 Project are summarized in table 15.

TABLE 15

Expected Annual Benefits

| | |
|---|---|
| Hurricane and Storm Damage Reduction | $8,950,000 |
| Emergency Costs and Other Damages Reduction | $122,000 |
| Recreation | $1,009,000 |
| Benefits During Construction | $574,000 |
| TOTAL | $10,655,000 |

**Cost Summary.**

The first cost figures for the total Section 933 Project and the Base Disposal Plan are shown in table 16. The difference, or $16,354,000, is the amount that requires economic justification. Benefits forgone associated with the Base Disposal Plan will be added to the costs requiring economic justification during the computation of expected annual costs. The first costs for the Section 933 Project were computed using a construction schedule of 16 months and both pipeline and hopper dredges. This was determined to be the best way to balance costs, environmental resources, and to put the project in place quickly so that structures on the beach will not continue to be vulnerable to storm damages. These estimates of construction time periods become the basis for the Interest During Construction (IDC) calculations.

TABLE 16
First Cost Summary

| Description | Sand Placement Location | Costs |
|---|---|---|
| **TOTAL SECTION 933 PROJECT+ MODIFIED DISP PLAN:** | | |
| Mobilization & Demobilization | | $2,850,000 |
| Pumpout Brandt Island & Inner Harbor | Fort Macon & Atlantic Beach | $3,929,074 |
| Pumpout Brandt Island, Inner Harbor, & Entrance Channel | AB, PKS, & IB | $24,428,234 |
| Embankment Replacement | | $1,750,000 |
| Beach Tilling | | $137,600 |
| Planning Engineering & Design | | $375,000 |
| Construction Management | | $100,000 |
| SUBTOTAL before Contingencies | | **$33,569,908** |
| Contingencies (10%) | | $3,357,093 |
| **TOTAL Section 933 Project + Modified Disposal Plan** | | **$36,927,000** |
| **BASE DISPOSAL PLAN:** | | |
| Mobilization & Demobilization | | $1,750,000 |
| Pumpout Brandt Island & Inner Harbor | Atlantic Beach and Fort Macon | $10,752,000 |
| Mobilization & Demobilization | | $250,000 |
| Dredge Entrance Channel | Near Shore Disposal Area | $3,900,000 |
| Embankment Replacement | | $1,750,000 |
| Beach Tilling | | $130,400 |
| Planning Engineering & Design | | $120,000 |
| Construction Management | | $50,000 |
| SUBTOTAL before Contingencies | | **$18,702,400** |
| Contingencies (10%) | | $1,870,600 |
| **TOTAL Base Disposal Plan** | | **$20,573,000** |
| **SECTION 933 PROJECT (To Be Justified):** | | **$16,354,000** |

Interest During Construction. The cost of tying up construction capital during a period of time in which no immediate benefits are produced is accounted for in table 17 as the item "interest during construction" (IDC). IDC costs are added to construction and other initial costs to determine investment costs. Average annual costs are determined based on investment costs which include IDC. IDC is based on $17,104,000, which includes the extra first costs ($16,354,000) and extra study costs ($750,000) associated with the Section 933 Project. The amount of IDC due to constructing the Section 933 Project instead of the Base Disposal Plan is $708,000, as shown in table 17.

Table 17

Interest During Construction

| | | | | |
|---|---|---|---|---|
| PROJECT: | | **Morehead City Harbor Section 933** | | |
| INTEREST RATE: | | | | 0.05875 |
| NUMBER OF PERIODS: | | | | 38 MONTHS |
| NET CONSTRUCTION COST = | | | | $17,104,000 |
| | | **IDC=** | | **$708,081** |
| PERIODS | MONTH | FACTOR | EXPENDITURE | PW AMT. |
| 0.5 | J-02 | 1.200989 | $35,000 | $42,035 |
| 1.5 | F-02 | 1.195138 | $35,000 | $41,830 |
| 2.5 | M-02 | 1.189316 | $35,000 | $41,626 |
| 3.5 | A-02 | 1.183521 | $35,000 | $41,423 |
| 4.5 | M-02 | 1.177755 | $35,000 | $41,221 |
| 5.5 | J-02 | 1.172017 | $35,000 | $41,021 |
| 6.5 | J-02 | 1.166307 | $35,000 | $40,821 |
| 7.5 | A-02 | 1.160625 | $35,000 | $40,622 |
| 8.5 | S-02 | 1.15497 | $35,000 | $40,424 |
| 9.5 | O-02 | 1.149343 | $35,000 | $40,227 |
| 10.5 | N-02 | 1.143744 | $40,000 | $45,750 |
| 11.5 | D-02 | 1.138171 | $20,000 | $22,763 |
| 12.5 | J-03 | 1.132626 | $50,000 | $56,631 |
| 13.5 | F-03 | 1.127108 | $50,000 | $56,355 |
| 14.5 | M-03 | 1.121617 | $40,000 | $44,865 |
| 15.5 | A-03 | 1.116152 | $40,000 | $44,646 |
| 16.5 | M-03 | 1.110715 | $40,000 | $44,429 |
| 17.5 | J-03 | 1.105303 | $40,000 | $44,212 |
| 18.5 | J-03 | 1.099918 | $40,000 | $43,997 |
| 19.5 | A-03 | 1.094559 | $10,000 | $10,946 |
| 20.5 | S-03 | 1.089227 | $10,000 | $10,892 |
| 21.5 | O-03 | 1.08392 | $20,000 | $21,678 |
| 22.5 | N-03 | 1.078639 | $0 | $0 |
| 23.5 | D-03 | 1.073384 | $580,000 | $622,563 |
| 24.5 | J-04 | 1.068155 | $1,440,000 | $1,538,143 |
| 25.5 | F-04 | 1.062951 | $1,440,000 | $1,530,649 |
| 26.5 | M-04 | 1.057772 | $1,440,000 | $1,523,192 |

| | | | | | |
|---|---|---|---|---|---|
| | 27.5 | A-04 | 1.052618 | $934,000 | $983,146 |
| | 28.5 | M-04 | 1.04749 | $930,000 | $974,166 |
| | 29.5 | J-04 | 1.042387 | $930,000 | $969,420 |
| | 30.5 | J-04 | 1.037308 | $930,000 | $964,697 |
| | 31.5 | A-04 | 1.032255 | $930,000 | $959,997 |
| | 32.5 | S-04 | 1.027225 | $930,000 | $955,320 |
| | 33.5 | O-04 | 1.022221 | $930,000 | $950,665 |
| | 34.5 | N-04 | 1.017241 | $930,000 | $946,034 |
| | 35.5 | D-04 | 1.012285 | $930,000 | $941,425 |
| | 36.5 | J-05 | 1.007353 | $1,370,000 | $1,380,073 |
| | 37.5 | F-05 | 1.002445 | $1,710,000 | $1,714,181 |
| total | | | | $17,104,000 | $17,812,081 |

**Expected Annual Costs and Comparison of Benefits and Costs.**

Table 18 shows the expected annual costs of the Section 933 Project that requires economic justification to be $2,178,000. When compared to expected annual benefits of $10,655,000, the result is a benefit-to-cost ratio of 4.9. This computation is based on an interest rate of 5-7/8 percent amortized over a 20-year period of analysis, and includes IDC and benefits foregone.

TABLE 18
Expected Annual Costs and Comparison of Benefits and Costs

| **Total Project Summary** | **Total 933 Project** | **Base Disposal Plan** | **Difference to be Justified** |
|---|---|---|---|
| **Total Initial Construction:** | $36,927,000 | $20,573,000 | $16,354,000 |
| Interest During Construction | $708,000 | $0 | $708,000 |
| **Total Investment Cost** | $37,644,000 | $20,573,000 | $17,062,000 |
| **Expected Annual Cost:** | | | |
| I&A-20 years | | | $1,473,000 |
| Annual Benefits Foregone | | | $705,000 |
| **Total Expected Annual Cost** | | | $2,208,000 |
| **Total Benefits:** | | | $10,655,000 |
| **Net Benefits:** | | | $8,477,000 |
| **Benefit-to-Cost Ratio:** | | | 4.9 |

**Effectiveness of the Section 933 Project.**

For the Section 933 Project study area, the effectiveness of the Section 933 Project at reducing hurricane and storm damages over Pine Knoll Shores and Indian Beach is about 62 percent (1 – ($5,593,000 / $14,543,000)). The residual expected annual damages along the Section 933 Study Area shoreline are estimated at $5,593,000. When the additional shorelines of Fort Macon and Atlantic Beach are considered with the Section 933 portion, the overall effectiveness of the beach fill from Fort Macon through Indian Beach goes to 54 percent (1 – ($8,801,000 / $18,999,000)). Either plan compares favorably to the Base Disposal Plan’s effectiveness of only about 10 percent (1 – ($17,046,000 / $18,999,000)), which leaves about $17,046,000 in expected annual hurricane and storm damages. Again, this large difference is due to fact that the Section 933 Project addresses the areas where the damage potential is the greatest, namely, Pine Knoll Shores and Indian Beach.

## Socioeconomic Conditions

### Base Socioeconomic Conditions.

From 1990 to 2000, the population of Carteret County grew at a rate of 13% (i.e., 1990 population was 52,407 and 2000 population was 59,383) as shown in table 19. About 40 percent of the residents live in one of the county's municipalities. With its overwhelming economic emphasis on tourism, retail sales in Carteret County comprise the most important source of jobs and income for the county's economy. In 1993, total farm income for Carteret County was over 18 million dollars, with corn, soybeans, and tobacco the leading commodities. In 1995, the manufacturing sector employed about 10 percent of Carteret County workers.

The North Carolina Office of State Budget and Management estimates Carteret County's 1994 employment at 25,000, with about 35 percent in trade and 21 percent in Government employment. In 1997, per capita income in Carteret County was estimated at $21,624, somewhat higher than the North Carolina per capita income of $20,217.

The 1990's were a decade of rapid growth for the Carteret County beaches. The populations of the towns and Carteret County since 1990 are shown below. The total permanent population for the three principal towns in 2000 is estimated at 3,400. However, peak daily population in the summer can swell to more than 160,000 for the entire county.

TABLE 19
Population Statistics
Carteret County, North Carolina

| Town/County | 1990 Population | 2000 Population |
|---|---|---|
| Atlantic Beach | 720 | 789 |
| Pine Knoll Shores | 1,360 | 1,524 |
| Indian Beach | 153 | 95 |
| Morehead City | 6,046 | 7,691 |
| Carteret County | 52,407 | 59,383 |

**Projected Socioeconomic Conditions.**

Carteret County population projections for 2000 – 2020 are shown below in table 20.

TABLE 20
Population Projections
Carteret County, North Carolina

| County | 2005 Population | 2010 Population | 2020 Population |
|---|---|---|---|
| Carteret | 65,633 | 69,358 | 76,341 |

Source: Office of State Planning, State of North Carolina.

In the summer months, a large portion of the homes along Bogue Banks are available as summer rentals to vacationers. Almost 2 million people, including those residing in the Research Triangle area of North Carolina, live within a two-hour drive of these beaches. During the summer months, the population of Carteret County is estimated to exceed 160,000 people. In the off-season months, it drops to 59,000, which includes about 789 permanent residents in Atlantic Beach (2000), 1,524 in Pine Knoll Shores, 95 in Indian Beach and 7,691 in Morehead City.

# MOREHEAD CITY HARBOR
# CARTERET COUNTY, NORTH CAROLINA
# SECTION 933
# EVALUATION REPORT

# APPENDIX E

# BEACH ACCESS/PARKING ANALYSIS AND REQUIREMENTS

## APPENDIX E
## BEACH ACCESS/PARKING ANALYSIS AND REQUIREMENTS

The construction of a Section 933 project is dependent in part upon the sponsor fulfilling the requirements as outlined in the "933 PROJECT REQUIREMENTS" section of the report. The stipulations (ER 1165-2-130, 15 June 1989, and ER 1105-2-100, 22 April 2000) that the beaches receiving the material must be open to the public and provide reasonable access has been carefully scrutinized. The Corps' regulations require that in order to be deemed "public" beaches, the sponsor must provide public access points every one-half mile with sufficient public parking within one-quarter mile. The regulations also refer to sufficient parking in terms of accommodating "projected use demands," and are further defined as sufficient to accommodate the lesser of the peak hour demand or the beach capacity. Finally, in computing parking requirements, the number of beach users not requiring parking is to be deducted from the design figure.

**Beach Capacity vs. Peak Hour Demand**

A determination was made that the maximum capacity of the 933 project area is significantly greater than the peak hour demand, which is assumed to be equivalent to peak hour usage, therefore peak hour usage was used to determine parking requirements. The following outlines the process and assumptions used to come to this conclusion.

This analysis assumes that visitors will each require 100 square feet of beach per visit. Because some visitors spend only part of the day at the beach, a turnover rate of 2 visitors per day per 100 square feet of beach is used as an adjustment. The smallest alternative project design considered proposes a 25-foot berm, resulting in 145 feet width of usable beach. Using this most conservative design template, the maximum project area would include 38,000 feet of shoreline of Indian Beach, Salter Path and Pine Knoll Shores. This would result in 5,510,000 square feet with an instantaneous capacity of 55,100, and using a turnover rate of 2, a maximum daily beach capacity of 110,200. This number is considered a conservative estimate because the other alternative design templates evaluated would result in an even larger beach capacity.

In an effort to ascertain data on peak hour usage, aerial photos were taken of the 933 project area between 11:15 and 11:40 a.m., EDT, on July 4, 2002. The aerial photos showed 828 people on the beaches of Pine Knoll Shores and 395 people on Indian Beach. The photos also identified tents and umbrellas on the beach; however, we were not able to discern whether an individual was underneath either of these items. Therefore, we made the assumption that there was an average of two (2) people under each tent, and an average of 1.5 persons under each umbrella. These additional numbers resulted in an adjusted peak hour usage total of 1,255 people on the beach within the Town of Pine Knoll

Shores and 760 people on Indian Beach and Salter Path beaches.

The 4th of July is assumed to be the peak day of the year for visitors on beaches. However, because the 4th of July fell on a Thursday, the peak hour usage was perhaps not accurately reflected, assuming that a higher number of visitors would have been present if the holiday had fallen on a weekend. Therefore, the numbers were adjusted accordingly. An increase of 14.2% was used as the adjustment. This adjustment was calculated to be the average percent difference in the volume of traffic crossing the Emerald Isle and Atlantic Bridges on Friday, July 5th, compared to Thursday, July 4th. The traffic survey data was provided by the Department of Transportation. Using the 14.2% adjustment the Pine Knoll Shores beaches would have had a peak hour usage of 1,433 and Indian Beach and Salter Path would have 868.

The projected growth rate of the peak hour usage over the life of the project was determined using the State of North Carolina Demographics Office data that projects a North Carolina average annual growth rate of 1.8% between 2000 and 2010. This rate was thus adopted as the project annual growth rate for the peak hour usage over the 10-year life span of the project with a base year of 2004 and continuing through 2014. The projected peak hour beach use demands for 2014 will therefore become 1,760 for Pine Knoll Shores and 1,075 for Indian Beach.

**Table 1.**

| **Beach Usage** | | | | |
|---|---|---|---|---|
| | *# of People in Photos* | *# Adjusted For Tents/Umbrellas.* | *Total # visitors on beach (14% Ad.j)* | *Yr 2014 Peak Hour Demand* |
| PKS | 828 | 1255 | 1433 | 1760 |
| IB | 395 | 760 | 868 | 1075 |

The capacity and usage of existing public parking for the 933 project area was evaluated using the 4 July 2002 aerial photography. The Town of Pine Knoll Shores had a total of 60 public parking spaces within one-quarter mile of the Iron Steamer public beach access while Indian Beach and Salter Path had a total of 111 at their two public beach access sites. The aerial photos indicated 22 of the 60 parking spaces available were filled in Pine Knoll Shores and 37 of the 111 parking spaces were occupied in Indian Beach.

Assuming that the number of parking spaces utilized would have also increased if the holiday had fallen on a Saturday, the number of parking spaces utilized was also adjusted by the 14.2% used previously. This results in an adjusted usage of 25 spaces for Pine Knoll Shores and 42 for Indian Beach. Assuming 2 persons per car, Pine Knoll Shores had a peak hour usage (peak hour demand), by those requiring parking, of 50 persons, and Indian Beach had 84 (Table 2). Dividing the peak hour usage for these visitors by the total number of visitors calculated from above (1,433 for Pine Knoll Shores and 868 for Indian Beach) leads to an estimate of 3.5% for Pine Knoll Shores and 9.7% for Indian Beach as the percentage of visitors that are considered "day-users" of the beach. These are the visitors that require public parking in order to access the beach (Table 3).

**Table 2.**

| **July 4th Parking** | | | | |
|---|---|---|---|---|
| | *Spaces Available on July 4th* | *# of Spaces Occupied on 4th* | *14% Weekend Adjustment* | *Peak Hour Demand (2/car)* |
| PKS | 60 | 22 | 25 | 50 |
| IB | 111 | 37 | 42 | 84 |

**Table 3.**

| **Day Users on July 4th** | | |
|---|---|---|
| | *Peak Hr Usage/Total # Visitors* | *% Day Users* |
| PKS | 50/1433 | 3.5% |
| IB | 84/868 | 9.7% |

Since these photos were taken an additional 130 spaces have been added to Pine Knoll Shores for a total of 190 spaces. An average of 2 persons per car on the peak day was assumed for the public parking spaces. Therefore, the current public parking provides a maximum capacity, at any one point in time, for 380 persons for Pine Knoll Shores and 222 persons for Indian Beach. These capacities clearly meet the criteria for providing adequate parking for the current demand (Table 4).

**Table 4.**

| **2002 Parking Analysis** | | | |
|---|---|---|---|
| | *Current # of Spaces Available* | *Peak Hour Capacity (2/car)* | *Peak Hour Demand* |
| PKS | 190 | 380 | 50 |
| IB | 111 | 222 | 84 |

By projecting the current peak hour demands through the project life by the same 1.8% annually, the demand for Pine Knoll Shores grows to 62 persons and Indian Beach grows to 104, leading to requirements of 31 spaces for Pine Knoll Shores and 52 spaces for Indian Beach (Table 5). The Corps requires parking to be associated with public access sites. The parking must be within one-quarter mile of the access site and must be of sufficient quantity to meet the projected use demands, based on peak hour usage. Therefore, using the current data available, existing parking (Pine Knoll Shores = 190 spaces, Indian Beach = 111 spaces) currently meets the projected use demands (Pine Knoll Shores = 31 spaces, Indian Beach = 52 spaces).

**Table 5.**

| **2014 Parking Analysis** | | | |
|---|---|---|---|
| | *2002 Peak Hour Demand* | *2014 Peak Hour Demand* | *# of Spaces Required in Year 2014* |
| PKS | 50 | 62 | 31 |
| IB | 84 | 104 | 52 |

An alternative assessment, although admittedly simplistic, can be done by observing the percentage of spaces not occupied at the “peak hour” (63% for Pine Knoll Shores, and 67% for Indian Beach) and the conclusion made that because there were unoccupied parking spaces (more supply than peak usage) at that time, the parking for the project areas meets peak capacity requirements.

However, it is important to keep in mind that meeting peak hour capacity does not alleviate the sponsor’s obligation to provide parking within one-quarter mile of each access site. The details of which are discussed under the “Parking Criteria” section following below.

<u>**NOTE**</u> *In determining the peak hour demand for Pine Knoll Shores it became apparent that the aerial photography may not accurately represent the true demand for parking at Pine Knoll Shores. This is due to several factors. The first being that none of the parking spaces currently claimed by Pine Knoll Shores were available on the 4th of July except for the Iron Steamer’s 60 spaces. Since additional spaces have been added, the measurement made is already dated since increased supply will ultimately lead to increased demand and usage.*

*Furthermore, the Iron Steamer’s 60 spaces were unavailable during the construction of the private beach nourishment project, and had only been reopened to the public within a month of the 4th of July. Therefore, for many months prior to the photographs, there effectively was no public parking (per Corps’ definitions) available, and therefore, with no “supply” available, the usage would have similarly decreased. It is assumed that a majority of the public was still unaware of the opening of the Iron Steamer and therefore would not have made the effort to seek out this parking option.*

*Additionally, the percentage of Pine Knoll Shores “day-users” calculated using the data from these photographs resulted in a number significantly lower than what the Corps’ has traditionally found to be the average for beach studies. Indian Beach was in the range that the Corps would expect (9.7%), as was Emerald Isle (15.0%) and Atlantic Beach (13.8%), whereas Pine Knoll Shores was at 3.5%.*

*And finally, Pine Knoll Shore’s 1996 Land Use Plan, developed as required by the North Carolina Coastal Area Management Act (CAMA), estimates their peak day, day-visitor populations to be in excess of 50,000 persons, as estimated by the Pine Knoll Shores Police Department. It was noted in the 1996 Land Use Plan that the average daily traffic count (ADT) west of the Atlantic Beach Bridge in 1994 was 23,300 automobiles. If one automobile averages two persons, 46,600 persons would have entered Bogue Banks heading west on N.C. 58. It was assumed in the 1996 Land Use Plan that a considerable amount of this traffic enters Pine Knoll Shores on a daily basis. However, such a huge discrepancy between the Corps’ findings and the Town’s estimates leads to a* *question of the validity of the numbers.*

**Parking Analysis Methodology**

Parking is a component of the recreation analysis, which uses the Unit Day Value (UDV) evaluation method to generate recreation benefits. This is discussed in further detail in the recreation analyses section within the economic analysis (see Appendix D) .

According to ER 1105-2-100, the estimation of visitation must be based on data , either at the existing project or by comparisons with other similar resources. Because the study area has recently completed a project very similar in nature to the one that is being proposed, it was deemed appropriate to look at the visitation on the existing area as the basis of our estimations.

The determination of peak hour demand ideally would involve gathering survey data from visitors on the beach. This would more closely identify the number and percentage of permanent residents, short-term renters, hotel guests, campers, and day users and their requirements (demands) for parking and access. The survey would also attempt to measure the demand not only from those at the beach, but those who would have come to the beach but did not do so based on a perceived parking availability problem. This type of survey requires peak day/peak hour data collection, and therefore will not be able to be conducted for this study. Therefore this report's findings will be used to assess the adequacy of parking.

**Access and Parking Requirements**

Sponsors must comply with the Section 933 requirements as outlined in Section I of the attached report as well those requirements detailed below:

1. For those areas to be included as part of the project, access must be provided a minimum of every one-half mile or either an item of local cooperation specifying such a requirement and public use throughout the period of analysis of the project must be included in the project recommendations, or the cost sharing must be based on private use (the sponsor must pay 100%).

2. Access every one-half mile implies parking and parking must be within one-quarter mile of any access site for which the sponsor wishes to take credit.

3. Sufficient parking must be provided to accommodate the lesser of beach capacity or peak hour demand. Peak hour demand will be calculated and separately applied to each Town, City, Village, etc., within the project area. If the project area does not include the entire limits of a Town, for example, only that portion which will receive the project will need to be included in the calculation. For example, if a Town is 6 miles long and the entire Town will be included in the

project, then the peak hour demand will be measured for the entire 6 miles. If, however, only 4 of the 6 miles of the Town will be included in the project, only the 4 miles need be considered in determining peak hour demand. The development of the peak hour demand will be conducted by the Corps of Engineers.

4. Because Federal investment is distributed throughout the 933 project area, the number of parking spaces must similarly be reasonably distributed. The following guidelines will be followed which are intended to provide the sponsor flexibility in their planning efforts to best fit the needs of their communities' unique situations, while ensuring that the general public is provided complete access to the beaches that have been nourished using Federal funds.

A. A percentage of the peak hour demand shall be distributed throughout the area from which it was calculated (see #3). This percentage will be determined by the length of the project. Every two (2) miles of the area shall contain the same percentage of the total peak hour demand. For example, a project area ten miles long, with a peak hour demand of 250 parking spaces would require a minimum of 20% of these spaces (50) to be located within each 2 miles of the project area. Two miles was selected as a criteria both because Corps' beach renourishment projects are typically not undertaken for projects under two miles in length, and also because no Town, City, etc., along the North Carolina barrier islands is less than two miles (Indian Beach/Salter Path was considered one "town").

B. A minimum of ten parking spaces must be associated with every access site claimed. The average area of a residential, ocean-front lot, within North Carolina would accommodate this minimum of ten parking spaces. In order to meet the spirit of the regulations to provide public access to those beaches receiving Federal funding for a Section 933 project, it was decided that the sponsor should provide this minimum.

5. The sponsor will be held responsible for the number of parking spaces committed to over the period of analysis of the project. If, for whatever reason, the parking spaces are no longer made available to the general public on an equal basis during the period of analysis of the project, the sponsor will be responsible for ensuring that the Corps parking criteria are still met. Failure to do so would result in sections of the project reverting to private beach status and therefore those sections in non-compliance would no longer qualify for Federal cost sharing.

6. The sponsor may also choose to provide public transportation to other beach access sites that do not meet the minimum requirement of 10 parking spaces. The intent of the Corps' criteria is to ensure access to the public on an equal basis for those sections of beach receiving Federal cost sharing. If a transportation option is chosen by the sponsor for certain sections of the beach, this intent must still be met by some combination of parking and transportation.

For example the plan would have to ensure that access is provided year-round and accommodates demand. The details outlining the specifics of what exactly the sponsor would commit to providing must be documented in an overall beach access and parking plan for the project which must be submitted and approved by the Corps of Engineers.

7. Handicap access and parking must be considered and implemented as required by State and Federal regulations. Section 504 of the Rehabilitation Act and the Architectural and Transportation Barriers Act ensure reasonable accommodation and accessibility for all individuals with disabilities to properties and programs that receive or benefit from Federal financial assistance.

8. Parking and access commitments made to meet the above criteria must either be in place, or be incorporated as a condition of the Project Cooperation Agreement (PCA). These commitments must be fulfilled prior to construction. Requests for exceptions to these criteria must be formally submitted to the project manager along with a detailed description of the situation and reasons why the exception is being sought.

**Existing and Proposed Parking and Access Sites**

The current and proposed future access/parking sites in the Section 933 project area are depicted in the sponsor's public beach access plan (Appendix E-9 - Exhibit 1). There are currently 8 public access sites and 301 public parking spaces within the project area. These sites are depicted in blue on the sponsor's map. The sponsor has committed to providing 8 additional access sites for a total of 16 access sites in the project area. These proposed access sites are depicted in red on the sponsor's map. Access sites are to be acquired in fee or as perpetual easements.

Some access sites will not have the minimum required number of parking spaces associated with them as the sponsor intends to provide public transportation as an alternative to parking for these access sites. This is an acceptable option as mentioned in #6 above. In addition, the Corps will accept an alternative plan that would provide a minimum of two parking spaces for those access sites that currently have no parking available, in lieu of a transportation plan. This would only apply to the "off-peak" season (November 1 – March 31). This modification to the requirements was determined to be acceptable due to a significant decrease in demand during the off-peak season of 82%. A similar decrease of 80% of the required 10 parking spaces was deemed reasonable during this time period.

The details of the sponsor's proposed public transportation strategy are outlined in their plan. The plan as currently proposed is acceptable to the Corps. Any changes to this plan or any new issues will need to be resolved prior to signing of the Project Cooperation Agreement. The Corps understands that the sponsor is adopting the public transportation strategy as an interim solution to their parking issues and will be actively working to replace the transportation system through the acquisition of additional parking.

The sponsor's current access and parking plan meets the Corps' parking and access criteria as previously detailed. A small section of Indian Beach fell outside of the requirements for access, but was granted an exception due to environmental considerations (See Appendix E – Exhibit 2) and therefore will be cost shared 65% Federal, 35% non-Federal.

**Cost Sharing Percentage**

Cost sharing of the portion of the project cost above the cost of the base disposal plan can be approved at the following percentages:

1) Those sections of the project area, which fully comply with Section 933 requirements are referred to as public shores and are cost shared 65% Federal, 35% non-Federal sponsor for the amount above the base disposal plan.

2) Those sections of the project area that do not meet all Section 933 requirements, are not eligible for Federal cost sharing and are referred to as private shores. Placement of dredged material at these locations may only take place at 100% sponsor funding and must meet the requirements as described in Section I of the attached report. Currently the westernmost 1900 feet of Indian Beach (Station 700+00 to Station 681+00) does not meet the access criteria. The local sponsor acknowledges this deficiency and does not intend to pursue the option of 100% sponsor funding for this area at this time. This decision effectively reduces the current 933 Project Area from 7.2 miles to approximately 6.8 miles. If the access and parking criteria are met prior to the signing of the PCA, this area could be increased to its full potential of 7.2 miles.

The current beach access and parking plan proposed by the sponsor (see Exhibit 1) would result in the following cost sharing percentages for the Recommended Plan.

Federal Cost Sharing
933 Project Area (6.8 miles)

Federal Share:

| | | |
|---|---|---|
| Public Shores | 6.8 miles/6.8 miles x 65% | = 65.0% |
| Private Shores | 0.0 miles/6.8 miles x 0% | = 0.0% |
| Total Federal Share: | | = 65.0% |

Sponsor Share:

| | | |
|---|---|---|
| Public Shores | 6.8 miles/6.8 miles x 35% | = 35.0% |
| Private Shores | 0.0 miles/6.8 miles x 100% | = 0.0% |
| Total Sponsor Share: | | = 35.0% |

These values are based on sponsor-provided measurements and will be subject to change if more, less, or different access sites are decided upon prior to signing of the Project Cooperation Agreement. Once all access and/or parking sites are obtained by the sponsor, and prior to signing the PCA, the Corps will gather more specific measurements using GIS and or survey data of these sites to make a final determination on project cost sharing.

# EXHIBIT 1

## PUBLIC TRANSPORTATION AND PARKING/ACCESS PLAN
## SECTION 933 PROJECT

## Objective

The volume of accesses and parking facilities located along Bogue Banks meet the peak hour demand for beach visitation in accordance with the U.S. Army Corps of Engineers (USACE) Engineering Regulations 1105-2-100 and 1165-2-130. The non-federal sponsor fully intends to provide additional points of access, and to fulfill parking stipulations delineated in these regulations by employing a method of public transportation that will be used in consort with permanent parking facilities. By providing additional accesses and adequate parking accommodations, public use will be provided on equal terms for all beach visitors and therefore, the public shall be able to access all portions of the beach that encompass the Section 933 Project area. Based on the coverage described below, full federal cost share participation should be recommended for the entire proposed Section 933 Project reach.

## Current and Proposed Facilities

Detailed maps of Indian Beach (IB) and Pine Knoll Shores (PKS) are enclosed as Figures 1 and 2, respectively. The Shore Protection Office and IB are in the process of securing the Ocean Club and Sea Isle Plantation-west accesses that will have associated parking located north of Highway 58 and within 0.25-mile of each respective access point. The IB and Salter Path accesses have 36 and 75 parking spaces, respectively. One issue that will require clarification is the USACE's access/parking position for the State-owned property in Salter Path. This oceanfront reach is a natural area with a central access accompanied by the 75 parking spaces referenced above. Because the oceanfront encompassed by the park is an undisturbed natural area for public use, the entire reach of the project for the State-owned property should receive full federal cost share funding. Moreover, the entire park should be considered as an "access" because the oceanfront is essentially owned by all of the public and residents of North Carolina. Therefore, the adjacent access points that are required per ER 1105-2-100 and 1165-2-130 shall be from the easternmost and westernmost boundaries of the State-owned park.

PKS has six accesses with associated parking that are denoted in Fig. 2. The access at the Sheraton borders the towns of PKS and Atlantic Beach, and parking is located within the Sheraton parking lot that is technically within the town limits of Atlantic Beach. The Shore Protection Office and PKS are also in the process of securing six additional accesses within Pine Knoll Shores that will not have associated parking, but will be served by a public transportation system. The distances between access sites (from east to west) is listed in Table 1.

**Table 1**
**Distances Between Public Access Sites**

| **Public Access** | **Distance Between Access Points (E to W) in miles** |
|---|---|
| Sheraton | 0.00 |
| Ameri-Suites | 0.36 |
| Hammer Park | 0.51 |
| PIKSCO | 0.50 |
| PKSA | 0.26 |
| Ocean Terrace | 0.55 |
| Iron Steamer | 0.50 |
| Maritime West | 0.50 |
| Ramada | 0.50 |
| Beacon's Reach (E) | 0.18 |
| Beacon's Reach (W) | 0.49 |
| Trinity Center | 0.47 |
| Sea Isle Plantation (W) | 0.35 |
| Salter Path | 0.57 |
| Indian Beach | 0.58 |
| Ocean Club | 0.40 |

The exact locations of proposed areas of access/parking and details concerning the public transportation system may be slightly modified before the non-federal sponsor enters into the Project Cooperation Agreement. However, it is the non-federal sponsor's intention to meet the access/parking stipulations in full prior to signing the PCA

## Pine Knoll Shores Public Transportation Plan

The public transportation system will utilize a contracted shuttle service to ferry visitors to all of the accesses in the Pine Knoll Shores project area. The cost of the shuttle service shall be paid by the non-federal sponsor and will operate on a regular schedule delineated as follows.

Peak Season (April 1 – November 1):

Hours: 8:00am to 6:00pm, 7 days a week

Frequency: The shuttle will provide access to each access site every 30 minutes.

Vehicle: 12+ person, handicap-accessible van/bus with capability to accommodate beach umbrellas, fishing gear, etc.

Signage: Signs at each access site will clearly define the times that the shuttle is expected to stop at that location. They will also highlight the fact that the service is being provided free of charge, and provide specifics as to what the shuttle can accommodate in regards to number of people and types of beach supplies. A phone number for the shuttle will also be included on the sign for any extraordinary circumstances.

Off-Peak Season (November 1 – March 31):

| | |
|---|---|
| Hours: | 8:00am to 6:00pm, 7 days a week |
| Frequency: | Shuttle will be available on an on-call basis only. Shuttle will arrive within 15 minutes of contacting shuttle service. |
| Vehicle: | Handicap-accessible vehicle capable of accommodating fishing gear, surf boards, etc. |
| Signage: | Signs at each access site will clearly define the number to contact the shuttle, what times the shuttle is available, what the shuttle can accommodate in regards to number of people and types of beach supplies, how long they should expect to wait, and any costs that will be associated with the service. |

The time period selected to represent the "peak season" is substantiated by reviewing the occupancy tax collections for the past 10 years (Fig. 3). Analyses of occupancy tax collections provide a good proxy of beach visitation trends throughout the year

## Monitoring/Adaptation of Transportation Plan

The non-Federal sponsor will monitor both the use of their public transportation system, as well as the amount of usage at their public parking facilities. A report of this data will be transmitted to the Corps of Engineers on an annual basis. The data will be analyzed by the Corps of Engineers to determine if any modifications to the transportation plan are warranted. Any changes proposed by the non-Federal sponsor would require written request to be approved by the Corps of Engineers.

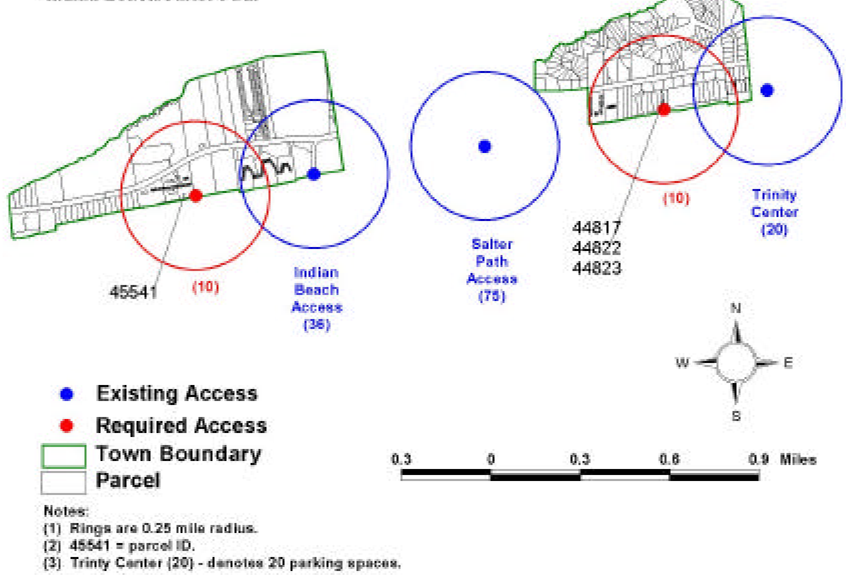
The non-Federal sponsor may decide in the future to incorporate additional parking at those access sites which currently have none. If two (2) or more parking spaces are included for each of those six access sites which currently have no parking, the Corps of Engineers has approved the off-peak portion of the transportation plan outlined above to be discontinued. The sponsor will notify the Corps of Engineers in writing of their intent to pursue this alternative prior to discontinuation of the off-peak shuttle service. If the sponsor provides the Corps' criteria of 10 parking spaces associated with each access, the entire transportation plan may be discontinued.

## Public Awareness Plan

The sponsor intends to pursue several approaches to make the public aware of the public parking and access sites available as well as the details of the Pine Knoll Shores transportation plan. Those approaches include:

1. CAMA signs will be provided at each public access site. Signs will be posted on the main road (58) as well as at the access site itself if the site is off of the main road.
2. Large green signs at each access site where the shuttle will stop outlining those items discussed within the transportation plan.
3. Large public parking signs at each parking space or parking lot which will be included as part of the project.
4. Brochures will be developed outlining all of the parking sites, access sites, as well as outlining the specifics of the shuttle service. It may also serve as an education tool to inform the public about the project. These brochures will be placed at locations such as the Visitor Center, Town Hall, Hotels, and tourist attractions such as the PKS Aquarium.
5. The brochure material will also be placed on Pine Knoll Shores and Carteret County's websites.
6. The shuttle used during peak season will display signage to increase visibility of the program.

**Fig. 1**
**Indian Beach/Salter Path**



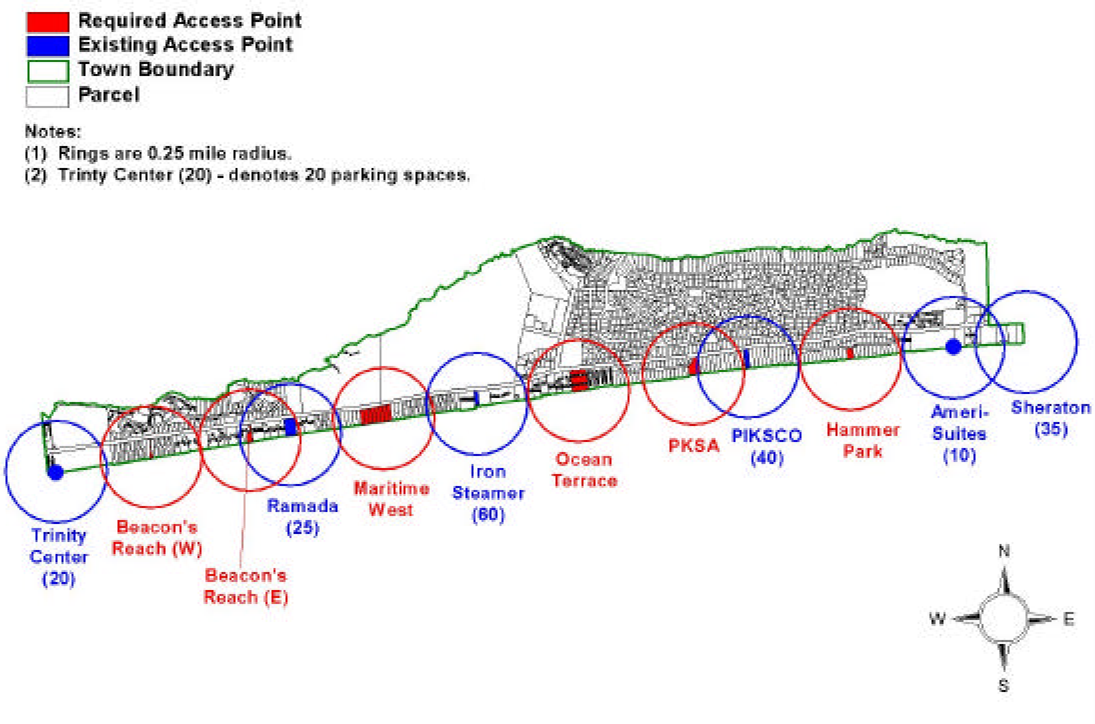




**Fig. 2**
**PINE KNOLL SHORES**

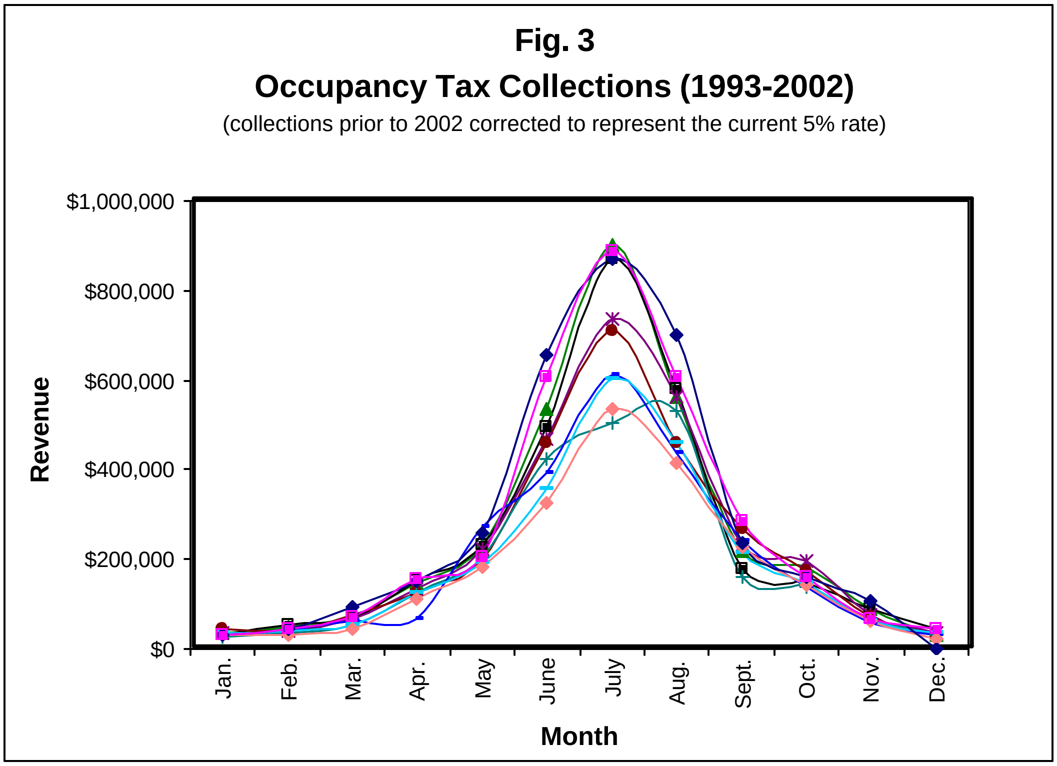


Fig. 3
Occupancy Tax Collections (1993-2002)
(collections prior to 2002 corrected to represent the current 5% rate)
Revenue
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.
Month

# EXHIBIT 2

## State Owned Property in Salter Path

**<u>Terms in Deed of Gift to North Carolina</u>**

STATE OF NORTH CAROLINA, COUNTY OF CARTERET
Book 439, Page 335

The deed of gift made the 3rd day of June 1980 states in part the following restrictions, which shall be binding upon the Grantee, its successors and assigns:

> "2. The property shall be maintained in its natural state insofar as possible.
>
> 3. The property shall be made available primarily for the purposes of scientific study and research, and secondarily for recreational purposes, but provided that these activities shall be conducted in such a fashion as to avoid significant damage to the topography or the flora and fauna of the property."

# MOREHEAD CITY HARBOR
# CARTERET COUNTY, NORTH CAROLINA
# SECTION 933
# EVALUATION REPORT

# APPENDIX F

REAL ESTATE PLANAPPENDIX F
**REAL ESTATE PLAN**

1. THE REAL ESTATE REPORT

This report is tentative in nature and is to be used for planning purposes only. Although the report is written based on specific data from Wilmington District, some minor modifications to the plan may occur thus changing the final acquisition areas and/or administrative and land cost.

The Project Sponsor (PS) is Carteret County, in cooperation with the State of North Carolina.

The author of this report has inspected the Project areas.

2. AUTHORITY

This study was conducted under the authority of Section 145 of the Water Resources Development Act of 1976, P.L. 94-587, as amended by Section 933 of the Water Resources Development Act of 1986, P.L. 99-662, and other laws, 33 U.S.C. § 426j. Projects carried out under this authority are commonly referred to as "Section 933 projects."

3. PROJECT DESCRIPTION

The removal of fill materials from Brandt Island Disposal Area at Morehead City Harbor and the newly dredged material from the harbor is beneficial for use in nourishment of beach communities that have experienced severe storm damage and have erosion problems. In prior years, material removed from Brandt Island Disposal Area was placed along Fort Macon and Atlantic Beaches, a distance of approximately 32,000 feet, under authority of a previously approved project. This area is identified on exhibit A as the Least Cost Disposal Area.

The communities of Pine Knoll Shores, Indian Beach and Salter Path have suffered the effects of six named storms since 1996. These areas are being evaluated for eligibility under Section 933 and are shown on the attached exhibit A as the 933 Project area. The areas proposed for nourishment with cost sharing authority of Section 933 include approximately 25,000 feet along Pine Knoll Shores and 13,000 feet of Indian Beach (including Salter Path). Disposal of the material along this 38,000 feet reach would result in a beach fill with a minimum placement of 75 cubic yards per linear foot. Placement of fill will be to elevation 7 feet above mean sea level. This will be a one-time placement of sand with no periodic nourishment. The project will result in the reduction of erosion and substantially reduce the storm damage potential.

4. REAL ESTATE ACQUISITION

The requirements for lands, easements, rights-of-way and relocations, and disposal/borrow areas (LERRD's) will include the rights to place dredged material in a berm design to aid in the control of erosion over wash during storms. The placement of sand will be within the limits identified on exhibit "A" as the "933 Project Area." The project sponsor will be required to provide a Perpetual Beach Storm Damage Reduction Easement across properties that are located within the project area except for those lands that are below MHW. A copy of the Perpetual Beach Storm Damage Reduction Easement is attached as exhibit "B". A permit from the State of North Carolina is not required for placement of sand seaward of mean high water (MHW). However, the sponsor must provide a letter to the State notifying of the intent to place sand on land seaward of MHW. The material will be pumped through an existing perpetual pipeline easement acquired in 1993 for the Morehead City Harbor Improvement Project, Brandt Island to Atlantic Beach. Under the current project plans, no need for additional pipeline easements, temporary work area easements for staging or construction has been identified.

There are 259 tracts that are privately owned along the project area. Existing easements are in place that were acquired from the fee owners at no cost by the sponsor for a local, non-federally funded project. The easements incorporate the standard language in the Perpetual Beach Storm Damage Reduction Easement. A Gross Appraisal was not performed for this study, but historically appraisals for beach projects have estimated the easements to have zero value due to offsetting benefits.

After review of the existing easements, CESAS-RE has determined that if all sand is placed within the limits of the existing easement, no additional easements should be necessary. However, after completion of project design and surveys, should it be determined that sand will be placed outside the existing easement area, the PS will be responsible for providing any additional real estate interest required.

Access to the beach will be by public access points that are located along the beach area. Should the local sponsor be required to obtain additional public access areas, these areas should be acquired as easements for the term of years identified in the Project Cooperation Agreement (PCA) for which the local sponsor is responsible for providing public access for the project. Acquisition of public beach access is not considered a creditable expense towards project cost.

5. UTILITY RELOCATION

There will be no utility relocations.

6. EXISTING PROJECTS

The Morehead City Harbor Improvement Project, Brandt Island to Atlantic Beach, approved in 1986, is located east of the proposed project.

7. ENVIRONMENTAL IMPACTS

No adverse environmental impacts are expected.

8. PROJECT SPONSOR RESPONSIBILITES AND CAPABILITIES

Carteret County will be the Project Sponsors (PS). The PS has the responsibility to acquire all real estate interests required for the Project, should any additional real estate interest be identified. The PS shall accomplish all alterations and relocations of facilities, structures and improvements determined by the government to be necessary for construction of the Project.

Title will not be vested in the United States Government. The government will require access rights be provided by the PS for entry to the Project. Prior to advertisement of any construction contract, the PS shall furnish to the government an Authorization for Entry for Construction (Exhibit "C") to all lands, easements and rights-of-way, as necessary. The PS will also furnish to the government evidence supporting their legal authority to grant rights-of-way to such lands.

The PS shall comply with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved 2 January 1971, and amended by Title IV of the Surface Transportation Uniform Relocation Assistance Act of 1987, Public Law 100-17, effective 2 April 1989, in acquiring real estate interests for the Project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act(s). An assessment of the Non Federal Sponsors Real Estate Capability has been prepared with the cooperation of the Project Sponsor and is attached as exhibit D.

9. GOVERNMENT OWNED PROPERTY

There are no Government owned lands within the proposed project limits.

10. MINERAL RIGHTS

There are no known mineral activities within the scope of the proposed Project.

11. PUBLIC LAW 91-646, RELOCATION ASSISTANCE BENEFITS

Public Law 91-646, Uniform Relocation Assistance provides entitlement for various payments associated with federal participation in acquisition of real property. Title II makes provision for relocation expenses for displaced persons, and Title III provides for reimbursement of certain expenses incidental to transfer of property. There will be no relocation of persons or Title III costs associated with the project.

12. REAL ESTATE ESTIMATE

The estimated real estate costs include land and improvement values, damages, mineral rights, resettlement cost, and federal as well as non-federal administrative costs.

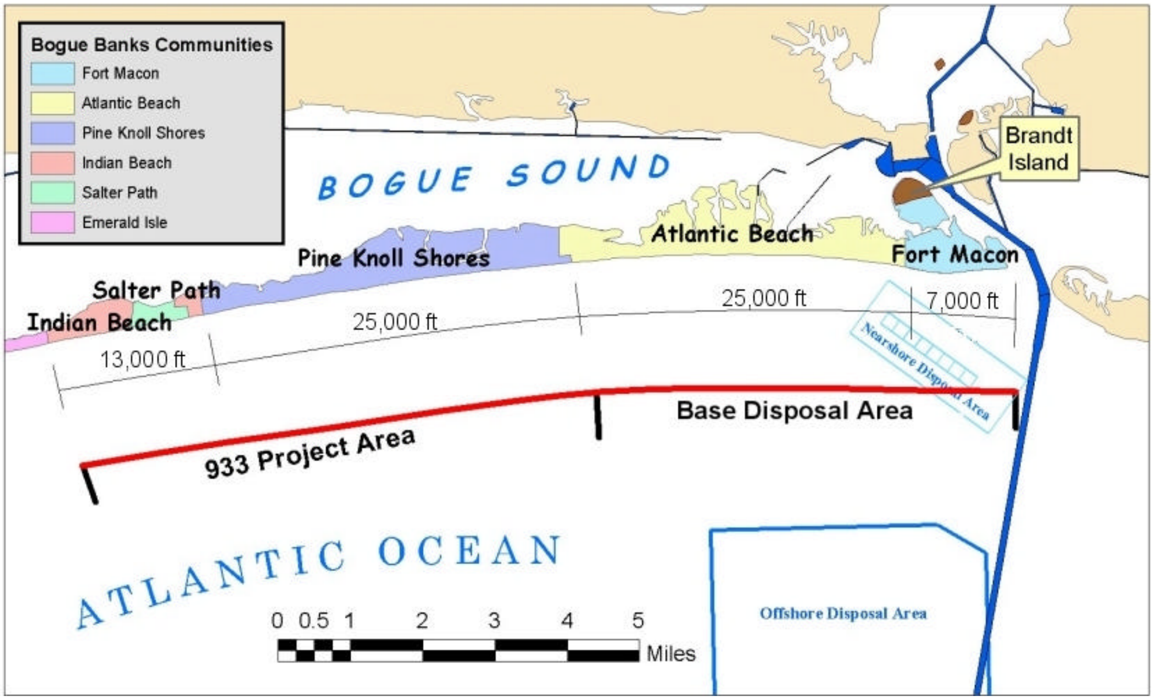
A 25% contingency is applied to the estimated total of these items. A Code of Accounts is at Exhibit "E".

**Estimate (Includes Residential & Commercial Properties)**

| | | | |
|---|---|---|---|
| a. Lands | | | $ -0- |
| b. Improvements | | | -0- |
| c. Mineral Rights | | | -0- |
| d. Damages | | | -0- |
| e. P. L. 91-646 Relocation Costs (Recordation Fees) | | -0- | |
| f. Acquisition Cost - Admin | | | $7,500 |
| Prepare Mapping and RE Certification | | | |
| Federal | ($ 2,500) | | |
| Non-federal | ($ 5,000) | | |
| Sub-Total | | $7,500 | |
| Contingencies (25%) | | | $1,875 |
| **TOTAL** | | | **$9,375** |
| **ROUNDED TO** | | | **$9,500*** |

*** This estimate assumes the fact that the PS will not have to acquire additional easements. Should additional easements be required, the cost will increase accordingly.**

# Exhibit A



Bogue Banks Communities
Fort Macon
Atlantic Beach
Pine Knoll Shores
Indian Beach
Salter Path
Emerald Isle
BOGUE SOUND
Brandt Island
Atlantic Beach
Fort Macon
Pine Knoll Shores
Salter Path
Indian Beach
13,000 ft
25,000 ft
25,000 ft
7,000 ft
Nearshore Disposal Area
Base Disposal Area
933 Project Area
ATLANTIC OCEAN
0 0.5 1 2 3 4 5
Miles
Offshore Disposal Area

# Exhibit B

PERPETUAL BEACH STORM DAMAGE REDUCTION EASEMENT

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tract No. __) for use by the (Project Sponsor), its representatives, agents, contractors, and assigns, to construct; preserve; patrol; operate; maintain; repair; rehabilitate; and replace; a public beach [a dune system] and other erosion control and storm damage reduction measures together with appurtenances thereto, including the right to deposit sand; to accomplish any alterations of contours on said land; to construct berms [and dunes]; to nourish and renourish periodically; to move, store and remove equipment and supplies; to erect and remove temporary structures; and to perform any other work necessary and incident to the construction, periodic renourishment and maintenance of the (Project Name), together with the right of public use and access; [to plant vegetation on said dunes and berms; to erect, maintain and remove silt screens and sand fences; to facilitate preservation of dunes and vegetation through the limitation of access to dune areas;] to trim, cut, fell, and remove from said land all trees, underbrush, debris, obstructions, and any other vegetation, structures and obstacles within the limits of the easement (except_____); [reserving, however, to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns, the right to construct dune overwalk structures in accordance with any applicable Federal, State or local laws or regulations, provided that such structures shall not violate the integrity of the dune in shape, dimension or function, and that prior approval of the plans and specifications for such structures is obtained from the (designated representative of the Project Sponsor) and provided further that such structures are subordinate to the construction, operation, maintenance, repair, rehabilitation and replacement of the project; and further] reserving to the grantor(s), (his) (her) (its) (their) (heirs), successors and assigns all such rights and privileges as may be used and enjoyed without interfering with or abridging the rights and easements hereby acquired; subject however to existing easements for public roads and highways, public utilities, railroads and pipelines.

# Exhibit C

AUTHORIZATION FOR ENTRY FOR CONSTRUCTION

I, *(name of accountable official)* , *(title)* ________________ for *(name of non-Federal sponsor)* ________, do hereby certify that the ________ *(name of non-Federal sponsor)* has acquired the real property interests required by the Department of the Army, and otherwise is vested with sufficient title and interest in lands to support construction of *(project name, specifically identified project features, etc.)* . Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon ____ *(identify tracts)* __ to construct *(project name, specifically identified project features, etc.)* as set forth in the plans and specifications held in the U. S. Army Corps of Engineers'____________________ District Office, *(city and state)*

WITNESS my signature as _______ *(title)* __ for __ *(name of non-Federal sponsor)* ____this ______ day of ________________, 19____________.

BY: ________ *(name)* ________________________

________ *(title)* ________________________

ATTORNEY'S CERTIFICATE OF AUTHORITY

I, ______ *(name)* ________________ , ______ *(title of legal officer)* ___ for ___ *(name non-Federal sponsor)* _____, certify that _______ *(name of non-Federal sponsor)* ____ has authority to grant Authorization for Entry; that said Authorization for Entry is executed by the proper duly authorized officer; and that the Authorization for Entry is in sufficient form to grant the authorization therein stated.

WITNESS my signature as __________ *(title)* _______ for ___ *(name of non-Federal sponsor)* , this___________day of________________, 20_____.

BY: ________ *(name)* ______________________________

________ *(title)* ______________________________

# Exhibit D

**Assessment of Non-Federal Sponsor's**
**Real Estate Acquisition Capability**

I. Legal Authority:

**a.** Does the sponsor have legal authority to acquire and hold title to real property for project purposes? (**yes**/no)

b. Does the sponsor have the power of eminent domain for this project? (**yes**/no)

c. Does the sponsor have "quick-take" authority for this project? (**yes**/no)

d. Are any of the land/interests in the land required for this project located outside the
sponsor's political boundary? (yes/**no**)

e. Are any of the lands/interests in land required for the project owned by an entity
whose property the sponsor cannot condemn? (yes/**no)**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P. L. 91-646, as amended? (yes/**no**)

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such
training? (yes/no)

b. Does the sponsor's in-house staff have sufficient real estate acquisition experience to
meet its responsibilities for the project? (**yes**/no)

c. Is the sponsor's projected in-house staffing level sufficient considering its other work
load, if any, and the project schedule? (**yes**/no)

e. Can the sponsor obtain contractor support, if required in a timely fashion? (**yes**/no)

f. Will the sponsor likely request USACE assistance in acquiring real estate? (yes/**no**)

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site?
(**yes**/no)

b. Has the sponsor approved the project/real estate schedule/milestones? (**yes**/no)

IV. Overall Assessment:

a. Has the sponsor performed satisfactory on other USACE projects?
(yes/no/not applicable)

b. With regard to the project, the sponsor is anticipated to be: **highly capable**/fully capable/moderately capable/marginally capable/insufficiently capable.

V. Coordination:

a. Has this assessment been coordinated with the sponsor? (**yes**/no)

b. Does the sponsor concur with this assessment? (**yes**/no) (If "no", provide explanation)

Prepared by:

John S. Hinely
Realty Specialist

Reviewed and approved by:

Vivian A. Davis
Acting Chief, Real Estate Division

# Exhibit E

Morehead City Harbor Section 933
Carteret County, NC

CODE OF ACCOUNTS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 01A | PROJECT PLANNING | | FEDERAL | | NON-FEDERAL | | TOTALS |
| | Other | | | | | | |
| | Project Cooperation Agreement | $ | | $ | | $ | |
| 01AX | Contingencies (25%) | $ | | $ | | $ | |
| | Subtotal | $ | | $ | | $ | |
| 01B | LANDS AND DAMAGES | | | | | | |
| 01B40 | Acq/Review of PS | $ | 2,500.00 | $ | | $ | 2,500.00 |
| 01B20 | Acquisition by PS | $ | | $ | 5,000.00 | $ | 5,000.00 |
| 01BX | Contingencies (25%) | $ | 625.00 | $ | 1,250.00 | $ | 1,875.00 |
| | Subtotal | $ | 3,125.00 | $ | 6,250.00 | $ | 9,375.00 |
| 01H | AUDIT | | | | | | |
| 01H10 | Real Estate Audit | $ | | $ | | $ | |
| 01HX | Contingencies (25%) | $ | | $ | | $ | |
| | Subtotal | $ | | $ | | $ | |
| 01R | REAL ESTATE LAND PAYMENTS | | | | | | |
| 01R1B | Land Payments by PS | $ | | $ | 0.00 | $ | 0.00 |
| 01R2B | PL91-646,Recordation Fee- PS | $ | | $ | 0.00 | $ | 0.00 |
| 01R2D | Review of PS | $ | | $ | | $ | |
| 01RX | Contingencies (25%) | $ | | $ | 0.00 | $ | 0.00 |
| | Subtotal | $ | | $ | 0.00 | $ | 0.00 |
| | TOTALS | $ | 3,125.00 | $ | 6,250.00 | $ | 9,375.00 |
| | **ROUNDED TO** | | | | | **$** | **9,500.00** |

# MOREHEAD CITY HARBOR
# CARTERET COUNTY, NORTH CAROLINA
# SECTION 933
# EVALUATION REPORT

## APPENDIX G

## GEOTECHNICAL ANALYSIS

## APPENDIX G
## Geotechnical Analysis

## BACKGROUND

Morehead City Harbor dredge material has traditionally been placed in Brandt Island or on the beach at Atlantic Beach and Fort Macon. The material in Brandt Island was sampled and grain size tests were performed in the mid-1980's prior to the initial pump out in 1986. The quality of the material was determined to be suitable for beach disposal. Brandt Island was pumped out again in 1994 with the material being disposed of on the beach.

Material for the Morehead City Inner Harbor is placed in the Brandt Island Disposal Area. The Inner Harbor material was tested and analyzed previously. The overfill ratio of this material ranges between 69 and 86 percent. These results show that the material is adequate for beach placement. The material to be placed on the beach as part of this project is expected to be similar to the material placed previously, as the material in Brandt Island was dredged from the same reaches of the Harbor as material previously pumped out of Brandt Island.

The Morehead City Harbor was dredged in spring of 2002. Material from the Harbor was placed on the beach at Fort Macon and in the Brandt Island Disposal Area. The subsurface investigation and analysis will be performed on the shoals that have formed since the 2002 dredging and that are to be removed from the Harbor under this project. It will be assumed that the material in Brandt Island is the same as the Inner Harbor material tested for this project, since the Inner Harbor material from previous dredging is stored in Brandt Island.

## SUBSURFACE INVESTIGATION

The subsurface investigation will include drilling the shoals in Morehead City Harbor and the material in the Brandt Island Disposal Area, taking beach grab samples, and grain size testing the material collected from these samples.

Morehead City Harbor Drilling. The borings will be performed with the snagboat SNELL using a 3 7/8 inch diameter Alpine vibracore drill machine. It is planned to drill twenty, 10-foot borings in the Harbor area and the connecting channels with the worst shoals. It is expected to take two days to perform the borings, with one additional day is included for weather. Each tube is expected to have approximately 3 soil samples, for a total of 60 samples.

Brandt Island Land Drilling. No borings will be performed on Brandt Island as part of this project. It is assumed that the material in Brandt Island is the same as the Inner Harbor material tested for this project, since the Inner Harbor material from previous dredging is stored in Brand Island.

Beach and Near Shore Grab Samples. Grab samples will be collected from twenty-five profile lines perpendicular to Fort Macon, Atlantic Beach, Pine Knoll Shores, Indian Beach, Emerald Isle, and Bogue Inlet Area. In the foreshore area or beach area, it is estimated six surface samples will be collected from each of the twenty-five profile lines for a total of 150 samples. For each profile, one grab sample will be collected from each of the following six locations: 1) the seaward toe of the dune; 2) the seaward crest of the berm approximately at elevation +7 NGDV; 3) mean high water, approximately at elevation +2.2 NGVD; 4) mean sea level, approximately +0.35 ft NGVD; 5) mean low water, approximately elevation –1.5 NGVD; and 6) at -3 NGDV. In the ocean, it is estimated that an average of 15 surface samples will be collected from each of the twenty-five profile lines for a total of 375 samples. For each profile, one grab sample shall be taken at 2-foot increments of elevation beginning at elevation -4 NGVD through elevation –24 NGVD. The extra samples account for undulations of the ocean bottom. The samples shall be collected from the top one to four inches of ocean bottom.

Lab Testing. Approximately 60 Harbor soils samples and 525 beach and near shore samples are expected to be tested. These samples will be tested for grain size, silt content, and shell content in accordance with ASTM D 422 using a minimum of 12 sieves. Samples will be classified in accordance with the Unified Soils Classification system.

## ANALYSIS AND REPORT PREPARATION

All the samples collected from the Harbor Shoal material and the beach grab samples will be analyzed to determine the material suitability for beach placement. Based on material removed from the Harbor and Brandt Island in the past, it is expected that the material designated for beach placement as part of this project will be suitable.

# MOREHEAD CITY HARBOR
# CARTERET COUNTY, NORTH CAROLINA
# SECTION 933
# EVALUATION REPORT

# APPENDIX H

# PROJECT COSTS

# APPENDIX H
# PROJECT COSTS

## Project Costs

The general approach was to prepare an independent estimate for all items of work necessary to complete the project. The pricing level used was October 2002 because of the extensive data collected and evaluated through this period of time.

The majority of construction cost items were developed using the Corps of Engineers Dredge Estimating Program (CEDEP) along with historical production. The previous Brandt Island pump out by pipeline dredge, October 1993 till January 1994 (with Jan 94 thru Mar 94 for inner harbor deepening), with sand placement on Ft. Macon and Atlantic Beach was evaluated. Additional production and costs by pipeline dredge for recent beach placement projects were evaluated. Historical production and costs for hopper dredging with offshore disposal and sand placement on the beaches was used in the evaluation and preparing the cost estimate.

The dredging plant selected as the basis for the cost estimates is typical for similar projects along the east coast and historical plant for past projects. Pipeline dredging was based on 27 to 30 inch hydraulic cutterhead. Hopper dredging was based on medium class hopper of 2,500 to 3,000 cubic yard capacity for offshore disposal as well as pump out of the hopper to the beach from the near shore.

A reasonable approach for placing sand on the beach was pumping sand from Brandt Island and Inner Harbor to Fort Macon, Atlantic Beach and much of Pine Knoll Shores up to 8 or 9 miles. Hopper dredging of sand in the entrance channels would be placed on the beach by pump out from near shore at western Pine Knoll Shores through Indian Beach. The project should not require dredging of sand from the entrance channels with a hopper; however, it appears to be the most reasonable approach.

Placement of sand on the beach by pipeline dredge would begin after November 15 and continue until completion. Placement of sand on the beach after May 15 would require turtle monitoring until completion. Hopper dredging can only be done in the entrance channel from January 1 through March 31.

The costs for Planning, Engineering and Design as well as Construction Management were furnished by Project Management and coordinated with those responsible for performing activities within these disciplines.

A contingency of 10% was applied to cover potential variations in project requirements that may not be known or defined at the date of this report.

The cost estimate is shown on Table H-1 on the following page.

Prepared by: ________________________________

John C. Caldwell
Civil Engineer

Reviewed by: ________________________________

Charles D. Carmen
Chief, General Engineering Section

## TABLE H-1
## FIRST COST SUMMARY

| Description | Sand Placement Location | Costs |
|---|---|---|
| **TOTAL SECTION 933 PROJECT + MODIFIED DISPOSAL PLAN:** | | |
| Mobilization & Demobilization | | $2,850,000 |
| Pumpout Brandt Island & Inner Harbor | Fort Macon & Atlantic Beach | $3,929,074 |
| Pumpout Brandt Island, Inner Harbor, & Entrance Channel | AB, PKS, & IB | $24,428,234 |
| Embankment Replacement | | $1,750,000 |
| Beach Tilling | | $137,600 |
| Planning Engineering & Design | | $375,000 |
| Construction Management | | $100,000 |
| SUBTOTAL before Contingencies | | **$33,569,908** |
| Contingencies (10%) | | $3,357,093 |
| **TOTAL Section 933 Project + Modified Disposal Plan** | | **$36,927,000** |
| **BASE DISPOSAL PLAN:** | | |
| Mobilization & Demobilization | | $1,750,000 |
| Pumpout Brandt Island & Inner Harbor | Atlantic Beach and Fort Macon | $10,752,000 |
| Mobilization & Demobilization | | $250,000 |
| Dredge Entrance Channel | Near Shore Disposal Area | $3,900,000 |
| Embankment Replacement | | $1,750,000 |
| Beach Tilling | | $130,400 |
| Planning Engineering & Design | | $120,000 |
| Construction Management | | $50,000 |
| SUBTOTAL before Contingencies | | **$18,702,400** |
| Contingencies (10%) | | $1,870,600 |
| **TOTAL Base Disposal Plan** | | **$20,573,000** |
| **SECTION 933 PROJECT COSTS** | | **$16,354,000** |