# INTEGRATED

# FEASIBILITY REPORT

# AND

# ENVIRONMENTAL IMPACT STATEMENT

# COASTAL STORM DAMAGE REDUCTION PROJECT

## SURF CITY AND NORTH TOPSAIL BEACH

## NORTH CAROLINA

## Appendix L

## Final Fish and Wildlife Coordination Act Report

# FINAL
# FISH AND WILDLIFE COORDINATION ACT REPORT
# for
# SURF CITY – NORTH TOPSAIL BEACH, NORTH CAROLINA, SHORE PROTECTION PROJECT

**May 2010**

This constitutes the Final Fish and Wildlife Coordination Act (FWCA) Report of the U. S. Fish and Wildlife Service (Service) for the Surf City-North Topsail Beach (SC-NTB), Shore Protection Project, Pender and Onslow Counties, North Carolina. The project consists of initial construction of a berm and dune system along approximately 9.9 miles of Atlantic shoreline in the central section of Topsail Island with periodic reconstruction of the system at approximately three-year interval over a period of 50 years. Beachfill material would be dredged from offshore, marine sand deposits. This report identifies fish and wildlife resources located in the project area and the potential impacts of the Corps' recommended project on these resources. This report constitutes the Service's report in accordance with Section 2(b) of the FWCA (48 Stat. 401, as amended; 16 U.S.C. 661 - 667d) and is provided in accordance with our FY 2010 Transfer Funding Agreement and Scope of Work.

## Introduction

The Service has coordinated with the Corps on various beach construction efforts on Topsail Island since the 1990s. On March 16, 2001, The Service provided scoping comments on the SC-NTB project. These comments expressed concerns that efforts to reduce storm damage to man-made structures may seriously degrade the habitat values provided by beaches and nearshore marine areas. This concern is most acute in regard to the long-term impacts of engineered structures (e.g., seawalls and artificial beach-dune systems) constructed to allow structures and infrastructure to remain in a fixed location as global sea level rises. On September 9, 2003, the Service provided a Planning Aid Letter that discussed five adverse, environmental impacts of a beach construction effort. The Service provided a Draft FWCA Report in June 2008 with 15 recommendations to avoid or minimize the adverse impacts of the 50-year program of beach construction using offshore sediment (U. S. Fish and Wildlife Service [hereafter USFWS] 2008). Most recently, the DOI provided comments on March 3, 2010, on the Draft Integrated Feasibility Report and Environmental Impact Statement (U. S. Army Corps of Engineers [hereafter USACE] 2009b).

## Project Area and Need

This area represents the central portion of the Topsail Island, a 26-mile long barrier island. The need facing development in the project area is clearly evident from published descriptions of Topsail Island. Pilkey et al. (1998, p. 171) note that Topsail Island has a troublesome geologic setting along its entire length. The island is very narrow and flat with no significant area higher than the 500-year flood elevation. Most of the island lies

on the 100-year floodplain. The U. S. Navy abandoned a missile range on the island because storms and hurricanes repeatedly destroyed buildings and equipment during the mid-1940s and early 1950s (Frankenberg 1997 p. 171). Hurricane Hazel which struck the southern North Carolina coast in 1954 generated a storm surge of 9.5 feet on the island which has an average elevation of nine feet (Pilkey et al. 1998, p. 171). A 1987 evaluation by the North Carolina Department of Emergency Management indicated that the island would be largely underwater in a category 1 or 2 hurricane and would be completely submerged in a category 3 hurricane (Pilkey et al. 1998, p. 173).

The island was severely impacted by two hurricanes within an eight-week period during 1996. Prior to Hurricanes Bertha and Fran, a prominent artificial dune, 12 feet high and 50 feet wide, existed along much of southern Topsail Island (Pilkey et al. 1998, p. 180). Barnes notes (1998, p. 177-178) that large portions of the dunes between Figure Eight Island and Emerald Isle, an area including the current project area, were washed away by the first storm, Bertha, which set the stage for extensive beach erosion and ocean overwash during the second storm, Fran. Hurricane Fran leveled the dune on southern Topsail Island and the entire area was overwashed by the storm surge which deposited up to three feet of overwash sand in some parts of Surf City, (Pilkey et al 1998, p. 180). The storm surge associated with Hurricane Fran, a minimal category 3 storm at landfall, created a storm surge of 8-12 feet along North Carolina's southeastern coast (Barnes, 1998, p. 177).

Since private interests have chosen to develop Topsail Island as an ocean resort community in spite of its history of recurring storm damage, the Service agrees that there is a need to reduce damage to man-made structures in the project area. However, the discussion of the project area and project need is deficient in the lack of any appropriate consideration of global sea level rise. As sea level rises, there are natural geological processes that shift barrier islands landward. These processes allow these areas to persist and maintain natural sandy beaches. When efforts to preserve coastal development seek to prevent the adjustment of coastal areas to sea level rise, the results appear as the chronic erosion, a well recognized problem in the project area. The DEIS correctly notes (USACE 2009b, p. 75) that "substantial portions of the berm and dune system have been lost as the shoreline is being 'squeezed' between the ocean and adjacent development." A basic understanding of the receding shoreline is critical to developing effective, long-term solutions to protecting man-made structures near the ocean.

**The Tentatively Selected Alternative**

After eliminating a non-structural approach from a thorough evaluation, the Corps indentified a course of action identified as the tentatively selected plan (USACE 2009b pp 100-138). This plan consists of a sand dune constructed to an elevation of 15 feet above the National Geodetic Vertical Datum (NGVD, roughly equivalent to mean sea level, fronted by a 50-foot wide beach berm constructed to an elevation of 7 feet above NGVD. The berm and dune project would extend along a reach of 52,150 feet (9.9 miles) from the southern boundary of Surf City northward to the boundary of a Coastal Barrier Resource System Unit in North Topsail Beach. Depending on endpoint

conditions found at the time of construction, up to 2,000 feet of the berm and dune on each end of the project may be replaced with a tapered transition section.

The proposed borrow sites are located between 1 and 6 miles offshore at depths of 35 to 50 feet below mean lower low water (MLLW). Initial construction would require 11.5 million cubic yards of borrow material. Reconstruction would require 1.6 million cubic yards of borrow material at 4 year intervals. In total, about 31.1 million cubic yards of dredge material would be required for the 50-year project.

Several important conservation measures incorporated in the plan are provided (USACE 2009b, pp. 192-194) in Section 10.06.1. These commitments to reduce impacts to listed species include limiting hopper dredging to the period from December 1 through March 31, but only to the "maximum extent practicable." There would also be a commitment to use sediment compatible with the existing beach along with measures to assess and rectify any sediment compaction or escarpment formation.

**Fish and Wildlife Resources in the Project Area**

The general fish and wildlife resources in the area of the SC-NTB project have been discussed in prior reports by the Service (USFWS 2007, pp. 23-26; USFWS 2008, pp. 11-13). These prior reports provide a sufficient basis for the concerns and recommendations discussed in this report.

**Evaluation of Environmental Impacts of the Tentatively Selected Plan**

The Corps has provided a detailed discussion of the anticipated environmental effects of implementing the tentatively selected plan (USACE 2009b, pp. 139 - 185). In general, all the major resources are considered and the likely impacts of initial construction and the early reconstruction events are considered. However, the discussion seems based on the assumption that present environmental conditions will continue throughout the 50 years of the authorized project.

Current planning documents appear to lack a consideration of adverse environmental impacts that could occur in the final decades of the project if sea level rise is greater than currently predicted. For example, the plan assumes a consistent four-year reconstruction cycle throughout the project (USACE 2009b, p. 103). Plans for initial construction (USACE 2009b, pp. 100-101) indicate that a portion of the beachfill would be below mean low water, approximately -1.9 feet NGVD. Placing beachfill below the low tide line is essentially putting sand in the ocean. As sea level rises over the decades of the project, efforts to save the existing ocean front structures would result in a greater portion of imported sediment for each reconstruction event being placed in an area that would be open ocean under natural conditions.

Sediment placed below the natural low tide line is likely to be less stable than that placed on an intertidal or dry beach. Any accelerated loss of imported material is very likely to result in a reduction of the reconstruction interval. Such a reduction could pose a risk to

beach macroinvertebrates that form an important base on the coastal food chain. Literature dating back to the early 1970s along the southeast coast indicates that opportunistic infauna species (ex. *Emerita* and *Donax*) found in the beachfill areas are subject to direct mortality from burial; but recovery often occurs within one year (USACE 2009b, p. 143 and references therein). More frequent reconstruction operations along with post-storm, emergency sand placements would provide less time for these organisms to recover and maintain healthy population levels.

Over time, beach reconstruction at intervals less than four years would pose a risk to sea turtle reproductive success. The Biological Assessments states that, in most cases, sea turtle nesting success decreases during the year following beachfill operations as a result of escarpments obstructing beach accessibility, altered beach profiles, and increased compaction (USACE 2009b, Appendix I, p. 14). In Florida a decrease in nesting success was documented in the year following construction with an increase in loggerhead sea turtle (*Caretta caretta*) nesting success rates during the second season post-construction (Brock 2005 as cited in USACE 2009b, p. I-16). This was attributed to increased habitat availability following the equilibration process of the seaward crest of the berm. This study suggested that, if compatible sediment and innovative design methods are utilized to minimize post-construction impacts documented in previous studies, then the decrease in nesting success without the presence of escarpment formations, compaction, etc. may indicate an absence of abiotic and or biotic factors that cue the female to initiate nesting. That is to say, even constructed beach that appear to offer easy access for nesting sea turtles may lack some unknown factor necessary for nesting.

Overall, the literature indicates that there are inherent changes in beach characteristics as a result of importing beachfill to construct artificial dunes and berms. These changes can result in short-term decreases in sea turtle nesting success and/or alterations in nesting processes. The abundance of important beach invertebrates may be reduced (Peterson et al. 2000). Any decrease in the reconstruction interval on Topsail Island could result in less time for the imported material to assume the natural characteristics of beaches necessary for successful sea turtle reproduction and healthy populations of beach macrofauna.

**Service Recommendations**

The Service offered 15 specific recommendations in the Draft FWCA Report of June 2008 (USFWS 2008, pp. 42-47). The Corps has provided an official response to each recommendation (USACE 2009b, pp. 211-222). These 15 recommendations still form the basis for avoiding and minimizing adverse environmental impacts. This report offers the following additional information on the aspects of the project related to the Service's recommendations

The second recommendation of the Service requested a greater consideration of future sea level rise in assessing the environmental impacts of the proposed 50-year program of beach construction. Sea level in the final decades of the project may have a profound influence on the severity of environmental impacts. In order to provide full consideration

of the direct and indirect physical effects of a range of possible sea level change scenarios, the Corps released Circular No. 1165-2-211 (circular), entitled "Water Resources Policies and Authorities Incorporating Sea-Level Change Considerations Into Civil Works Programs" (USACE 2009a). The circular refers to the work of the U. S. Climate Change Science Program (CCSP 2009) and states that sea-level change can cause a number of impacts in coastal and estuarine zones, including changes in shoreline erosion, inundation or exposure of low-lying coastal areas, changes in storm and flood damages, shifts in extent and distribution of wetlands and other coastal habitats, changes to groundwater levels, and alterations to salinity intrusion into estuaries and groundwater systems (USACE 2009a, p. B-1). It is clear that the natural resources of barriers islands, such as Topsail Island, would benefit from being allow to naturally adapt to sea level rise by gradually move landward and upward on the coastal plain. A 50-year program of beach construction may provide some protection during smaller storms, but the longer-term net benefits are uncertain.

The circular states that sea level change must be considered in every Corps coastal activity as far inland as the extent of estimated tidal influence (USACE 2009a, p. 1). Furthermore, planning studies and engineering designs should consider alternatives that are developed and assessed for the entire range of possible future rates of sea level change (USACE 2009a, p. 2). The circular requires an evaluation of alternatives using "low," "intermediate," and "high" rates of future sea-level change for both "with" and "without" project conditions. The historic rate of sea level change will be considered as the "low" rate. The circular provides guidance in determining the intermediate and high rates of sea level rise.

Planning for the SC-NTB Project is based on a projected rate of sea level rise of 9.6 inches (0.8 of a foot) over the next 100 years (USACE 2009b, p. 212) and notes that this figure is within the likely range of sea level rise reported for all but the most pessimistic scenarios of the Intergovernmental Panel on Climate Change (IPCC). However, the Corps' circular requires a consideration of both the most recent IPCC projections and modified National Research Council (NRC) projections (National Research Council 1987). These projections should be added to the local rate of vertical land movement.

The Corps' circular notes (USACE 2009a, p. B-9) that the NRC report includes a range of possible future sea-level rise scenarios that is much greater than those presented by the IPCC (Intergovernmental Panel on Climate Change [hereafter IPCC] 2007). The 2007 IPCC report has received some criticism for not fully considering the possibility of rapid ice loss in Antarctica due to massive failures of the West Antarctic Ice Sheet. Including the upper scenarios from the NRC report allows planners and engineers to consider the possibility of much greater rates of sea-level rise than those presented in the 2007 IPCC report and to thus accommodate some of the criticism directed at the 2007 IPCC report. Overall, the "high" rate of sea level rise mandated by the recent Corps circular for use in project planning exceeds the upper bounds of IPCC estimates from both 2001 and 2007 to accommodate for the potential rapid loss of ice from Antarctica and Greenland (USACE 2009a, p. 2).

For the current project, the Corps should consider that since 1990, observed sea level has followed the uppermost uncertainty limit of the IPCC Third Assessment Report of 2002 (Rahmstorf 2007). Sea level is expected to rise as the ocean takes up heat and ice starts to melt, until a new equilibrium sea level is reached. Rahmstorf (2007) presents a semi-empirical approach for predicting future sea level rise. Based on temperature increases projected by the IPCC, Rahmstorf (2007) projects that sea level in 2100 may be one-half meter (1.64 feet) to 1.4 meters (4.59 feet) above the 1990 level.

The third recommendation of the Service requested a more comprehensive discussion of any Corps conclusion that the proposed project complied with Executive Order 11988. This EO was enacted to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practicable alternative (USACE 2009b, p. 194). Most of Topsail Island is in the 100-year floodplain (Pilkey et al. 1998, p. 171) and most of the island would be largely underwater in a category one or two hurricane and nearly completely submerged in a category three hurricane (Pilkey et al. 1998, p. 173). Except for some dune areas, the entire SC-NTB project area is subject to hurricane storm surge flooding (USACE 2006b, p. 9).

In considering compliance with EO 11988, the Corps should realize that the most significant environmental impacts of the proposed 50-year program of periodic beach construction are likely to come in the final decades of the project. These adverse impacts would emerge as efforts are made to save existing development as sea level rises. The DEIS states (USACE 2009b, p. 212) that it is likely that the without-project condition (with its diminished dune and berm) would be more sensitive to sea level rise than the with-project condition, and thus the net benefits for the beachfill project would be increased. This statement is based on the premise that resources will be available to effectively protect existing development for decades to come. Since the offshore area, Onslow Bay, is a sediment starved system consisting mostly of a thin patchy veneer of three to six feet of modern sediments covering the low relief Oligocene limestone and siltstone (USACE 2009b, p. 24), fill material may become limited in the final decades of the project.

The Corps responded (USACE, 2009b, p. 195) that beach nourishment has been accepted as a valuable tool in moderating flooding and protecting floodplains. Placement of beachfill will occur in the floodplain of area beaches. This placement will be conducted specifically for its beneficial effect in offsetting erosion and restoring damaged beaches, and is, therefore judged acceptable. The action is expected to have an insignificant effect on the floodplain. The Corps concludes, therefore, that the proposed action is in compliance with the requirements of EO 11988 and with State/local flood plain protection standards.

The Service believes that the 50-year program of sediment disposal will have adverse impacts on the Topsail Island floodplain, especially if the time interval between reconstruction events is reduced in the final decades of the project. Important beach infauna would have less time to recover between reconstruction events. Important

nearshore fishes and shorebirds may lose part of important food resource if infaunal populations are not given sufficient time to recover.

If the Corps has a broad mandate to reduce storm damage and protect human lives in the project area (as opposed to preserving current development and facilitating additional development), then there should be a consideration of whether development on the low lying and flood-prone barrier island represents wise use of this floodplain. As noted by Frankenberg (1997, p. 171) the military abandoned its missile testing operations on Topsail Island because storms and hurricanes repeatedly destroyed buildings and equipment. It is only a matter of time before a storm similar to Hurricane Hazel (1954) strikes. That storm destroyed 210 of the 230 houses in what was then the community of New Topsail Beach (Barnes 1998, p. 100). Past history and the likelihood of more intense storms should be considered in the Corps' compliance with EO 11988.

In determining whether a given course of federal action would comply with EO 11988 there should be a consideration of conditions at the northern end of the island which is within the Coastal Barrier Resource System (CBRS). The CBRS was established by the Coastal Barrier Resources Act (CBRA) of 1982. In the legislation Congress declared (16 U.S.C. § 3501(a)(3)) that "coastal barriers serve as natural storm protective barriers and are generally unsuitable for development because they are vulnerable to hurricanes and other storm damage and because natural shoreline recession and the movement of unstable sediments undermine manmade structures." Furthermore, "certain actions and programs of the Federal government have subsidized and permitted development on coastal barriers and the result has been the loss of barrier resources, threats to human life, health, and property, and the expenditure of millions of tax dollars each year" (16 U.S.C. § 3501(a)(4)).

The CBRA seeks to minimize the loss of human life, wasteful federal expenditures, and damage to fish, wildlife, and other natural resources associated with coastal barriers. The areas placed within the CBRS included "undeveloped coastal barriers." More than seven miles at the northern end of Topsail Island are included within the CBRS. Therefore, Congress has determined that development within certain areas at the northern end of the island pose a risk to human life and such development has the potential for requiring wasteful federal expenditures. The project area for this federal action was excluded from the CBRS due to the level of existing development at the time the CBRS was enacted. It was correctly determined that it would be unfair to retroactively deny federal assistance, including federal flood insurance, to existing property owners in the more developed central and southern parts of the island. The exclusion of all but the northern part of the island from the CBRS was based on the level of existing development, not on any determination that there was less risk to human life or the potential for wasteful federal expenditures. Considering the spatial extent of major hurricanes at landfall, the variation in storm damage between the northern, central, and southern portion of this 26-mile-long barrier island are likely to be slight to none.

Compliance with EO 11988 requires a consideration of whether the SC-NTB project area shares the same characteristics as the CBRS area directly north of project area. If the

project area does have the same level of risk as the adjacent area, does the proposed 50 years of beach construction, which seeks to preserve development, comply with the intent of EO 11988? The Service is not suggesting in any way that the restrictions on federal funding applicable to areas within the CBRS be applied to areas outside the system. We are suggesting that the conditions which led to the inclusion of northern Topsail Island in the CBRS be considered for the current proposal for beach construction in the context of EO 11988. The CBRA and EO 11988 are entirely different factors to be considered by the Corps. That is to say, Congress has declared that federal expenditures for development on the northern part of the island (within the designated CBRA Unit) could contribute to the loss of human life, wasteful federal expenditures, damage to fish, wildlife, and other natural resources. Therefore, when viewed from the perspective of EO 11988, federal expenditures for constructing and maintaining an artificial beach may contribute to additional development directly south of the CBRS Unit and thereby support the "unwise use" of a floodplain.

Unless a storm damage reduction strategy is implemented to provide protection against storms such as Hazel and Fran, the area will continue to have repeated cycles of destruction and rebuilding. The question to be answered in regard to EO 11988 is whether such repeated destruction and rebuilding represents unwise floodplain development which should not be supported by actions of the executive branch. Whether state and local funds would be periodically provided to construct the beach is not the issue, the issue is whether actions by the Corps, as part of the executive branch of the federal government, maintain existing development and support additional development in an inherently dangerous location.

The DEIS states that an Independent External Peer Review (IEPR) will be conducted following the Agency Team Review (USACE 2009b, p. iv). The IEPR will be conducted by a non-USACE national team of experts in the field, and coordinated by the National Planning Center of Expertise in Coastal Storm Damage Reduction, North Atlantic Division, U. S. Army Corps of Engineers. Comments and responses will accompany the report to the Assistant Secretary of the Army for Civil Works (ASA(CW)) and the Office of Management and Budget (OMB). Documentation of IEPR certification will accompany the final report. The Corps should ensure that the IEPR fully considers a low, medium, and high rate of sea level rise over the course of the project life. The long-term viability of existing and future development on the floodplain of Topsail Island under each sea level rise scenario should be fully evaluated in light of the mandate of EO 11988. That is, a determination should be made on whether existing and future development represent the wise use of the floodplain under each sea level rise scenario.

Both the Corps and the IEPR should conduct a broad reevaluation of the merits of structural versus non-structural alternatives for reducing storm damage in the project area. The Corps stated that in analyzing potential measures, the study team considered both structural and non-structural measures in all cases where technically sound and environmentally feasible (USACE 2009b, p. iv). Nonstructural measures, such as removal and relocation, were found to be of greater cost than benefits, and therefore, were not recommended for the purposes of storm damage reduction.

However, the study team's recommendations that accompany all structural recommendations for dune and berm construction include continued and vigilant attention to the need for pro-active hurricane and coastal storm threat education, coastal storm and hurricane warning and evacuation planning procedures, floodplain management, and other non-structural activities directed at both damage reduction and preservation of life and safety. These actions are recommended, although many do not fall within current Corps implementation authorities.

A new evaluation in light of the potential for a high rate of sea level rise may reveal that a program of periodic beach construction will not adequately protect development on the Topsail Island floodplain. The carefully planned implementation of non-structural actions, including phased removal and relocation of buildings, may provide greater long-term economic and social benefits.

**Federally Protected Species**

Recommendations 12 through 15 of the Service's Draft FWCA Report addressed conservation measures for federally protected species. The Corps responded to each recommendation (USACE 2009b, pp. 211-222). Additional consideration of federally protected species is given in the DEIS (USACE 2009b, Appendix I). This appendix represents the Biological Assessment (BA) of the Corps. The species considered in the BA (Table 2, p. I-4) includes all the federally protected species likely to be directly or indirectly impacted by the tentatively selected plan. The BA separates these species into those which could be impacted by in-water dredging activities and those which could be impacted by onshore sediment placement and beach construction. The former group, primarily those found exclusively in a marine environment, is under the jurisdiction of the National Marine Fisheries Service. The latter group, those likely to be impacted by beach construction, is under the jurisdiction of the Service. Protection of sea turtles is divided between these agencies with the Service being responsible for sea turtles when they come ashore to nest. The species considered by the Service include the West Indian manatee (*Trichechus manatus)*, piping plover (*Charadrius melodus*), seabeach amaranth (*Amaranthus pumilus*), and three species of sea turtles, the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*).

The BA accurately states that dredging operations, beach placement of material, and associated construction operations (i.e. operation of heavy equipment, pipeline route, etc.) may adversely affect some species and their habitat (USACE 2009b, p. I-5). 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.

The two most critical factors of any beach construction effort that influence the degree of impacts are the physical compatibility of the material used for beach construction (i.e., the degree of sediment compatibility) and the time of year that the work is conducted. The BA addresses these and other conservation measures in Section 4 of the BA,

Commitments to Reduce Impacts to Listed Species. These commitments are also provided in the DEIS (USACE 2009b, pp. 192-194).

Current plans state that initial construction and each nourishment interval will avoid the sea turtle nesting season (USACE 2009b, p. 193). The proposed dredging and beach construction schedule extends from December 1 through March 31 for both initial construction and each reconstruction event (USACE 2009b, p. 220). If, due to unforeseen circumstances, construction extends into the nesting season, the Corps will implement a sea turtle nest monitoring and avoidance/relocation plan through coordination with Service and the North Carolina Wildlife Resources Commission

Current plans state that beachfill material will comply with grain size and percent weight requirements specified in 15A NCAC 07H .0312, Technical Standards for Beach Fill Projects (USACE 2009b, p. 214). The Technical Standards require compatibility of the native beach with borrow sources in regards to the percentage of silt, granular sediment, gravel, and calcium carbonate (or shell content for projects initiated before implementation of the rules). Furthermore, the Corps intends to perform rigorous boring analyses of proposed borrow areas in order to minimize the risk of placing incompatible material on the beach (USACE 2009b, p. 214). Throughout the duration of construction operations, the Corps will employ full-time construction inspection personnel to perform on-sight inspections of the project operations to assure quality control and compliance with contract specifications. The Corps will receive daily production reports from the contractor that provide detailed information pertaining to the Contractor's daily operations. Corps construction inspection personnel will inspect the beach for any significant amount of incompatible material within the project limits throughout the contract duration, and if any incompatible material is identified within the placement area, the Corps will coordinate with the appropriate agencies to identify the quantity of material and discuss the methods of removal and disposal prior to the sea turtle nesting season.

The Corps summarizes the effects of in-water dredging activities and beach placement activities in a table in Appendix I (USACE 2009b, p. I-37). While in-water dredging is likely to adversely affect the five species of sea turtles, such impacts are considered by the National Marine Fisheries Service. Among the species under the jurisdiction of the Service, including all sea turtles that come ashore to nest, the proposed work is expected to have either no effect or is not likely to adversely affect on these species. The table correctly notes that there is no formally designated critical habitat in the project area.

Overall, based on the information provided in the DEIS and BA, the Service concurs with the Corps determinations that the proposed action is not likely to adversely affect federally listed species or their critical habitat as defined by the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531-1543). Therefore, the requirements of section 7 (a)(2) of the ESA have been satisfied for this project. However, the Corps' obligations under the ESA must be reconsidered if: (1) new information identifies impacts of this action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is modified in a manner that was not considered in

this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

With regard to project modification, the Corps should contact the Service if beachfill must be extended outside the proposed schedule of December 1 through March 31 or the material to be used for the beachfill deviates significantly from the standards proposed in the DEIS. Furthermore, significant placements of beachfill between the scheduled reconstruction operations given in Table 7.11 (USACE 2009b, p. 126) would represent modification of the proposed effort. The Corps should contact the Service if more than 1.6 million cubic yards of material, the standard reconstruction volume, are placed on project area beaches between established reconstruction events.

**Summary of Findings and Position of the Service**

Overall, the DEIS presents an excellent review of the resources in the project area and the potential adverse impacts of offshore dredging and beach construction under present day conditions. However, the DEIS states (USACE 2009b, p. 83) that the planning process is subject to limitations imposed by certain restraints. These restraints include current limits of knowledge, information, and predictive ability. These limitations are critically important in regard to the future rise of sea level and the real possibility of more frequent storms of greater magnitude. Therefore, the Service recommends that the policies outlined in the Corps' July 2009 circular be applied to the current project. Specifically, over the 50 years of proposed beach construction efforts (from approximately 2014 to the early 2060s) the effectiveness of the artificial beach and environmental impacts of maintaining such a beach should be evaluated for a low, intermediate, and high projection of sea level rise. The low projection would be essentially the rate of rise observed in the recent past. For the high projection, and to a lesser extent the intermediate projection, the reconstruction intervals should be carefully evaluated in the final decades of the project. It is very likely that significant sea level rise would result in much shorter reconstruction intervals that would create adverse environmental impacts not considered in the current DEIS.

Barrier islands and spits are inherently dangerous places for any man-made structures such as roads, houses, or utility infrastructure. The islands are subject to the full force of both tropical hurricanes and winter storms (nor'easters). Early residents recognized this fact of coastal living and built their homes as far from the ocean as possible. On the Outer Banks, development was limited to the sound side of the islands until the mid-1880s (Frankenberg 1995, p. 118). Current beach front development occupies an extremely hazardous location as shown by the devastation seen in North Carolina by Hurricane Hazel in 1954 and the Gulf Coast by Hurricane Katrina in August 2005.

The threat to all development on barrier islands is increased by the rise in global sea level. While the causes of sea level rise may be debated, the increase has been well documented (see Appendix B, USACE 2009a) and is likely to continue for many decades, perhaps at an increasing rate of rise. The intensity of hurricanes may also increase as ocean waters become warmer. Therefore, both the threat of damage during

storms and the gradual inundation of the coastline can be expected to continue throughout the proposed 50 years of the beach construction effort and beyond.

While it may appear that even calm ocean waters are destroying the beaches through erosion, this is not correct. Barrier islands are not fixed, stationary landforms. These islands are unconsolidated masses of gravel, sand, and mud surrounded by ocean and estuarine waters. They are characterized by low elevation, narrow width, and fragile vegetation cover (Bush et al. 1996, p. 11).

When global sea level is rising, natural processes push the islands landward and allow them to survive. One of these natural processes is the movement of sand from the beaches across the island to the sound side. From the perspective of a beachfront structure, this process of island overwash appears to represent the destruction of the beach. If artificial dunes block the island overwash process, the sand may be lost to deeper offshore waters rather than contributing to the survival of the island. Pilkey et al. (1998, p. 4) state that "when sea level is rising, as it is today, barrier islands do not stay in one place; they migrate in order to survive."

Therefore, it should be understood that while hurricanes cause tremendous damage to fixed, man-made structures, they do not create long-term damage to barrier islands. In fact, the forces that occur during major storms and are so destructive to man-made structures are necessary for barrier islands to respond to sea level rise and ultimately continue to exist. The wide natural beaches that are so important to the tourist economy are not destroyed as the islands move landward. They merely change location. The current loss of the beach in the project area results from the area being squeezed between a rise ocean and a fixed line of structures.

All man-made structures near the rising ocean are unquestionably in danger. If governments at all levels take no action to hold back the rising ocean, individual property owners will probably undertake short-term efforts (e.g., beach bulldozing, sandbag walls) to save structures near the ocean. These efforts are likely to be ineffective in the long term and the width of the beaches would continue to diminish (USACE 2006a, p. B-32).

Therefore, while government action is not needed to save the beach, action is needed to save beach front development. Government action can be categorized as either non-structural or structural. A non-structural approach involves a number of actions to remove or relocate structures threatened by storms and coastal inundation. This type of response is based on the premise that storm damage is reduced when there is nothing to be damaged. These measures would require consideration of suitable relocation sites and compensation for property owners. The approach would also restore valuable barrier island habitats, such as overwash areas, that have been lost by effort to stop the landward movement of barrier islands.

On the other hand, structural responses consist primarily of construction to either hold existing sand in place (seawalls, groins, jetties, sandbags, etc) or the periodic placement of imported beachfill to replace the sand that has washed away. These approaches

generally produce numerous short-term adverse impacts on fish and wildlife resources. There are design features and construction techniques to minimize the some of the adverse impact of actual beach construction at the present sea level. The use of highly compatible beach fill, a restricted work schedule, and a reconstruction interval of four years would retain most of the habitat functions of the beach and dune communities.

The most significant question with regard to the long-term conservation of fish and wildlife resources is whether beach construction efforts which provide limited security in the short run can be maintained over 50 years and beyond as sea level continues to rise. Over many decades, a greater portion of the beach fill used to reconstruct the beach at its present location will actually be below what would be the natural low tide level. The artificial beach, partially built in the ocean, will wash away in ever shorter time intervals over the life of the project. There is a concern that over many decades the escalating costs of more frequent beach replacement along with diminishing supplies of available beachfill will lead to demands for rock seawalls to protect the ever increasing value of shoreline property. Where seawalls are built, the beach is eventually lost (Pilkey et al. 1980, p. 10).

In light of the findings discussed above, the Service believes that action must be taken to reduce the periodic destruction of man-made structures in the project area. However, implementation of a long-term program of beach construction is not likely to remain effective as sea level continues to rise. The environmental issues surrounding a long-term program of beach and dune construction involve much more than just offshore sediment extraction and beach construction. The most significant issues are the consequences of attempting to hold the island in place as the ocean rises around it. When beachfill no longer provides cost effective protection, rock seawalls would be required to hold back the rising water. Eventually the beaches and salt marshes of the sound would be lost. Pilkey et al. (1998, p. 102) have summarized the issue by stating that "in the long run, North Carolinians must make a decision. They can have beaches or they can have beachfront buildings; they can't have both. If we opt in favor of buildings, the beaches will be lost – and so, ultimately will the buildings."

Our review of the available information regarding this project leads us to believe that the long-term success of the proposed approach is questionable and it is likely that other structural or non-structural measures will need to be implemented during the life of the project. Furthermore, we note that non-structural measures would be more successful at conserving the natural resources of the project area.

The Service again recommends that planning for the current project should give greater consideration to EO 11988 which seeks to avoid federal support for unwise development within floodplains which can result in both high costs for reconstruction and danger to human life and safety. The SC-NTB project is immediately south of a CBRS unit and shares the same storm damage risks as the CBRS unit. Current plans acknowledge (USACE 2009b, p. 129) that structures will continue to be subject to damage from hurricane winds and windblown debris. Damages from flooding and winds are expected to decrease as older structures are replaced with those meeting floodplain ordinances and

wind hazard building construction standards. But even new construction is not immune from storm damage, especially from major hurricanes. Therefore, the Corps should carefully consider whether this federal effort, currently proposed as a 50-years program of beach construction, is in compliance with EO 11988 which seeks to reduce the loss of human life, wasteful federal expenditures, and damage to fish, wildlife, and other natural resources by avoiding unwise development of floodplains.

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