US Army Corps
Of Engineers®
Charleston District

Draft

ENVIRONMENTAL ASSESSMENT

MYRTLE BEACH STORM DAMAGE REDUCTION PROJECT

Reach 1 - North Myrtle Beach

Horry County, South Carolina

March 2017

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1.0 Purpose and Need

1.1 Project Authorization

The Myrtle Beach Project was authorized for construction by Section 101 of the Water Resources Development Act of 1990, Public Law 101-640, dated November 28, 1990 (WRDA 90). "(20) MYRTLE BEACH, SOUTH CAROLINA.-The project for storm damage reduction, Myrtle Beach, South Carolina: Report of the Chief of Engineers, dated March 2, 1989, at a total cost of $59,730,000, with an estimated first Federal cost of $38,820,000 and an estimated first non-Federal cost of $20,910,000, and an average annual cost of $1,215,000 for periodic nourishment over the 50-year life of the project, with an estimated annual Federal cost of $790,000 and an estimated annual non-Federal cost of $425,000." Section 934 of the Water Resources Development Act of 1986 (WRDA86), Public Law 99-662, authorized the Government to extend the Federal participation in periodic beach nourishment until 2046.

The authorized U.S. Army Corps of Engineers (USACE) project required the construction of a protective beach in three Reaches, North Myrtle Beach (Reach 1), Myrtle Beach (Reach 2), and Garden City/Surfside Beach (Reach 3). The total project Reach was 25.3 miles (Figure 1). Periodic nourishment is required every 10 years at Reach 1, and every 8 years with one 10-year effort at Reaches 2 and 3. In addition, each Reach also has different sponsors. Reach 1 Sponsor is the City of North Myrtle Beach, Reach 2 Sponsor is the City of Myrtle Beach, and Reach 3 Sponsor is Horry County. For the current project, funding is available for Reach 1 (North Myrtle Beach) and Reach 3 Garden City/Surfside Beach. The Reach 1 project is funded through the Flood Control and Coastal Emergencies (FCCE) funds through P.L. 114-254, Further Continuing and Security Assistance Appropriations Act of 2017. These funds are specifically for the restroation of Federal Coastal Storm Damage Reduction projects damaged or destroyed by floods and coastal storm. An EA, FONSI, and environmental clearances for the upcoming renourishment on Myrtle Beach Reach 3 were completed in 2016; at the time, Reach 1 was not included because funding for Reach 1 was not available. The proposed Reach 1 project is an emergency repair to the project to repair damages from Hurricane Matthew, Hurricane Joaquin and other small storms that have occurred since the last renourishment.

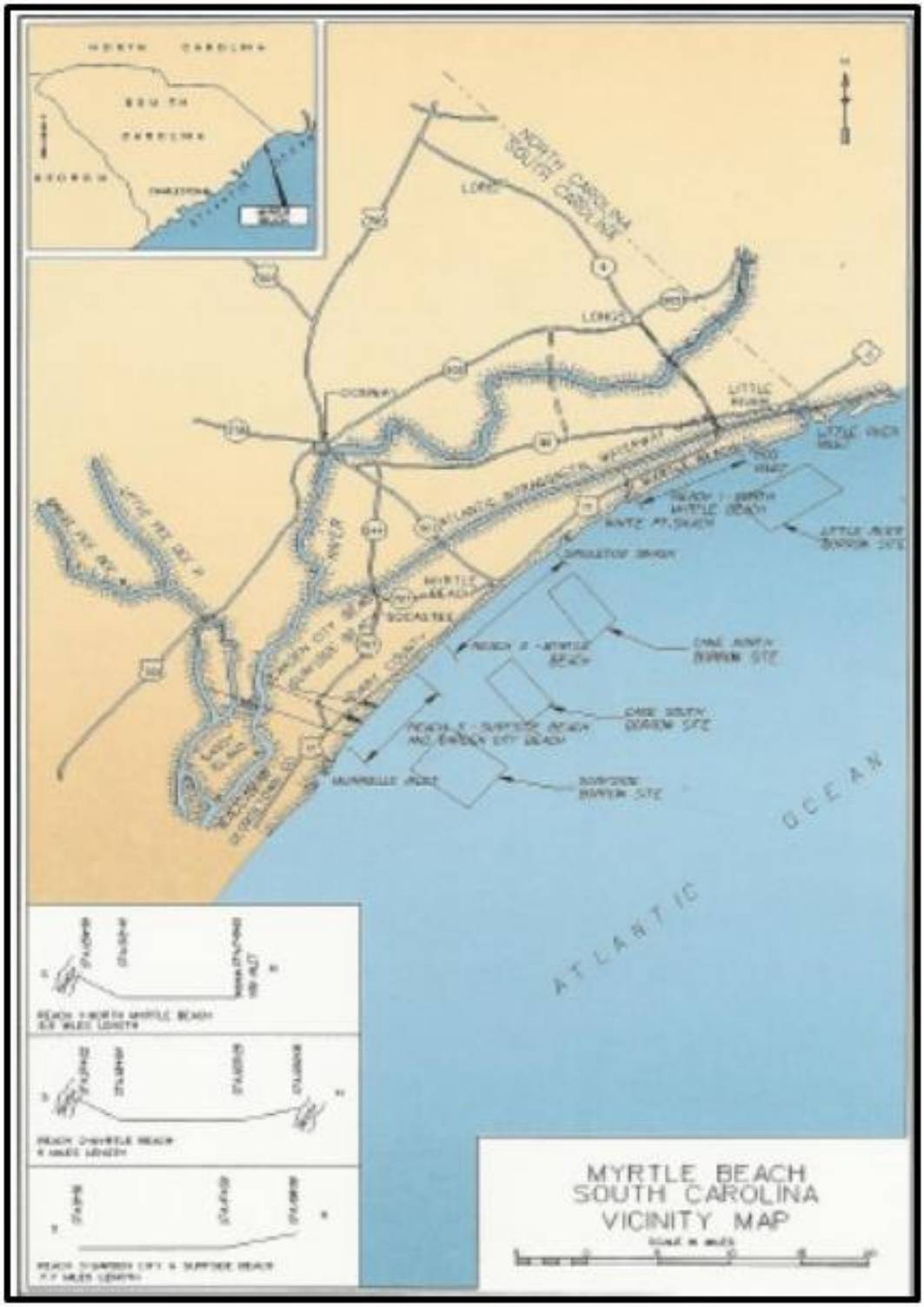

Figure 1. Myrtle Beach Shore Protection Project

1.2 Renourishment Trigger

Two hurricanes (Hurricane Matthew and Hurricane Joaquin) classified as Significant Storms have adversely impacted the North Myrtle Beach Reach 1 Coastal Storm Risk Management Project. There is widespread erosion across North Myrtle Beach Reach 1 due to the two named storms and multiple smaller storm events since the last full renourishment. Damage from the Hurricane Joaquin and Matthew included sustained damage to the protective berm with variant levels of sand dune scarping. The project sustained an 80% loss of the primary dune along the northern third of the project, with some area exposed to the relic revetment. There were multiple breaches of the primary dune in two dozen locations with 25% of the primary dune loss at the southern quarter of the project.

During inspections following the passing of Hurricane Matthew, the North Myrtle Reach 1 beach and dunes appeared to have suffered additional loss of sand, vegetation and sand fencing. The beach profile was generally uneven, sloped and scarped with a significant number of berms and breaks in design grade. The berm had completely eroded in many areas and many storm water outfall lines were exposed within the tidal zone with several sections disjoined or separated.

As a result of these extraordinary storms, the project suffered significant erosion of the beach and dune system. The North Myrtle Beach, Reach I Coastal Storm Risk Management Project is below its authorized level of protection, and damage to public and private infrastructure, and potential risk to life and safety of residents and visitors, is likely if another storm occurs before the project can be rehabilitated. The no action alternative would place lives and significant commercial and private infrastructure at risk.

1.3 Environmental Compliance

This Environmental Assessment (EA) updates the position of the USACE, Charleston District regarding the environmental effects associated with the nourishment of North Myrtle Beach, South Carolina (Reach 1 of the Myrtle Beach Project).

USACE has previously described the affected environment and evaluated environmental effects with the Myrtle Beach Storm Damage Reduction Project in its Feasibility Report on Storm Damage Reduction (USACE, 1987), Environmental Assessment Beach Erosion Control Study (USACE, 1987b), Environmental Impact Statement (USACE, 1993a), General Design Memorandum (USACE, 1993b), and Environmental Assessment (2007) (Appendix 7. The 1993 Environmental Impact Statement (EIS) and 2007 EA are incorporated in this document by reference and can be found in their entirety in Appendix 7. An EA and Finding of No Significant Impact (FONSI) for Reach 3 (Garden City/Surfside) of the Myrtle Beach Project were prepared and finalized in 2016. At that time funding was not available for North Myrtle Beach (Reach 1). The findings of that EA/FONSI remain valid for Reach 3. Pursuant to the National Environmental Policy Act of 1969 (NEPA), this EA describes the affected environment and evaluates new information from the previous environmental documentation regarding North Myrtle Beach (Reach 1). Its purpose is to determine if the proposed nourishment action involves a substantial change to the project that is relevant to environmental

concerns, or whether there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, either of which would require a supplemental EIS (see 1502.9(c) of Title 40, CFR).

The USACE identified and reviewed new information to determine if any resources should be re-evaluated or if the new information would alter effects determinations. While this EA further supports and elaborates on the analyses and information presented in existing NEPA documents, it does not change the substance or conclusions of any of those prior NEPA analyses. Pursuant to 43 Code of Federal Regulations (CFR) Part 46 (Implementation of the National Environmental Policy Act of 1969), the analyses are still deemed valid and are incorporated by reference. No new information was identified that would lead to a determination of significantly different impacts or would necessitate a major revision of the impacts analyses previously prepared or related to the Myrtle Beach Storm Damage Reduction Project and required preparation of a supplemental EIS.

The USACE has integrated the process of NEPA compliance with other environmental requirements, including the Coastal Zone Management Act (CZMA), Endangered Species Act (ESA), Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), and National Historic Preservation Act (NHPA).

1.4 Incorporation by Reference

This document is intended to communicate new environmental information and update the coordination between a number of Federal and State regulatory agencies. All other findings from the aforementioned documents are still valid, however are not reiterated in this EA. Specific details for the project are provided in the following reports and are hereby incorporated by reference in accordance with NEPA (Appendix 7):

US Army Corps of Engineers. 1993. Final Environmental Impact Statement for the Myrtle Beach and Vicinity Shore Protection Project, Horry and Georgetown Counties, South Carolina. USACE Charleston District. January 1993.

US Army Corps of Engineers. 2007. Final Environmental Assessment: Myrtle Beach Storm Damage Reduction Project. North Myrtle Beach, Myrtle Beach, and Horry County, SC. July 2007.

2.0 Description of the Proposed Action

The Myrtle Beach project consists of three reaches which have previously been constructed simultaneously for initial construction and periodic nourishment. Currently, funding has only been made available for Garden City/Surfside (Reach 3) and North Myrtle Beach (Reach 1). An EA was prepared and a FONSI was signed for Garden City/Surfside (Reach 3) in 2016. Construction has not been carried out on Reach 3 at this time, but is now anticipated to occur in same time frame as Reach 1. The change to the Reach 3 schedule and other small project modifications to address changes to the base line condition of Reach 3 will be analyzed under NEPA in a separate Supplemental Information Report document. Therefore, this Environmental Assessment will only

evaluate the effects related to this North Myrtle Beach (Reach 1) of the Myrtle Beach Storm Damage Reduction Project.

The authorized project at (North Myrtle Beach (Reach 1) consists of a protective storm berm and advanced nourishment berm. The protective storm berm reduces damages which will occur during severe storm events. The advanced nourishment berm acts as a buffer for the protective storm berm against long term erosional forces. The protective storm berm has a top elevation of 9.0 NAVD 88 and a crest width of 20 feet. The fore slope of the protective berm is 1 vertical to 20 horizontal down to natural ground. The advance nourishment berm sits adjacent the protective storm berm. The advance nourishment berm has a top elevation of 6.0 NAVD 88 and a crest width of approximately 150 feet. The fore slope of the advance nourishment is 1 vertical to 5 horizontal down to elevation 2.0 NAVD 88 then a fore slope of 1 vertical to 20 horizontal down to the bottom (Figure 2). Reach 1 limits include the portion of beach from station 1749+65 at Hog Inlet to station 1294+99 near 48th Ave. south. The length of Reach 1 is approximately 45,500 linear feet or 8.6 linear miles of shoreline. The length of the dune and beachfill for the proposed renourishment is approximately 3.3 miles, which does not include the entirety of Reach 1. The 3.3 miles that will be renourished represent 3 hotspots within the project that have suffered extreme damage. Other sections of the Reach 1 project are largely intact. Project maps depicting the plan view of the project extent, and show the three hotspots that will be renourished, can be found in Appendix 1. At each location, the plan included dune grass, dune fencing, and dune walkovers.

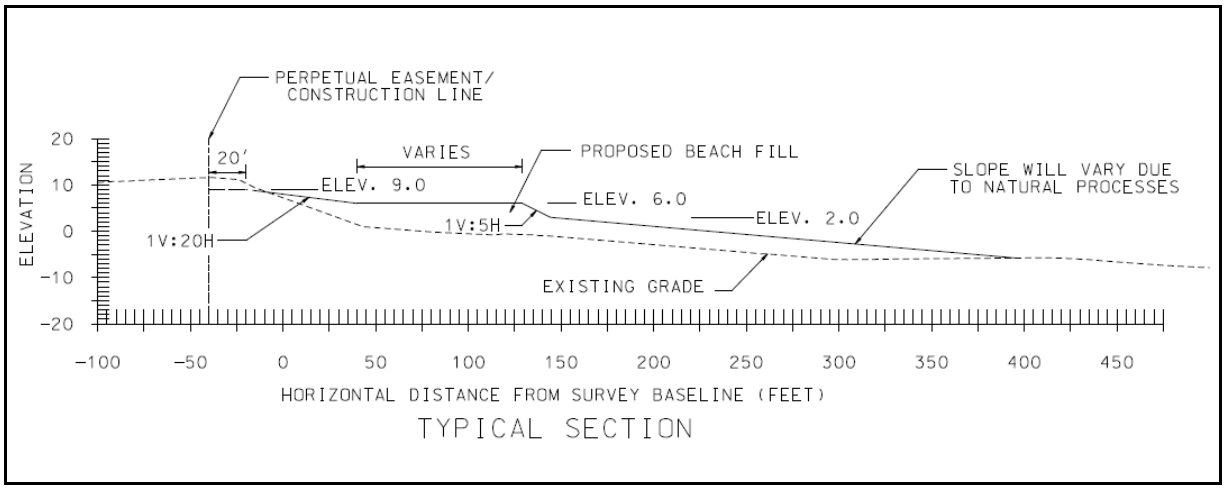

Figure 2. Representative profile for Reach 1

The project would be constructed with a hopper dredge, booster pump, and land-based heavy equipment (i.e. bulldozers and front-end loaders); however, the use of a cutterhead dredge does not remain a possibility. SC Department of Natural Resources (SCDNR) and Coastal Carolina University (CCU) have monitored project impacts and previously recommended the continued use of a hopper dredge of borrow areas associated with the Myrtle Beach project to minimize benthic impacts and foster quicker benthic recovery.

The borrow area for Reach 1 was identified in the March 1993 General Design Memorandum for the project as the Little River borrow. Portions of it have been used in the past for the 1998 and 2007/2008 nourishment projects, and will be used for the next beach fill placement. Bathymetric data collected in August 2016 indicates that the seafloor within the borrow site slopes from -28 feet to -35 feet MLLW. Seaward of the Federal 3-mile line, bathymetric data show the residual dredging footprint from the previous nourishment contract that was completed in 2008. Geotechnical data indicate that the upper 1.5 to 2.5 feet of strata is a relatively homogenous sand-bearing deposit. Three zones were identified within Little River borrow as having the thickest deposits of suitable beach-fill material. The location of Zones 1, 2, and 3 are shown in Figure 6. For Zone 1, the mean phi size of the sand is 1.31 (medium-grained); the mean percent passing the #200 sieve is 1.9%; and the average usable depth (below ocean bottom) is 2.6 feet. In Zone 2, the mean phi size of the sand is 1.42 (medium-grained); the mean percent passing the #200 sieve is 3.0%; and the average usable depth (below ocean bottom) is 2.4 feet. In Zone 3 the sand has a mean phi size of 1.71 (medium-grained); the mean percent passing the #200 sieve is 2.7%; and the average usable depth (below ocean bottom) is 2.2 feet. Rough order of magnitude estimate of available beach fill material within Zones 1 through 3 is approximately 2.4 million cubic yards. Based on the volume calculations from 2007, there is sufficient quantity of material within the site to complete the proposed renourishment of Reach 1. The dredge will remove the sand to a depth not to exceed 10 feet within the borrow areas.

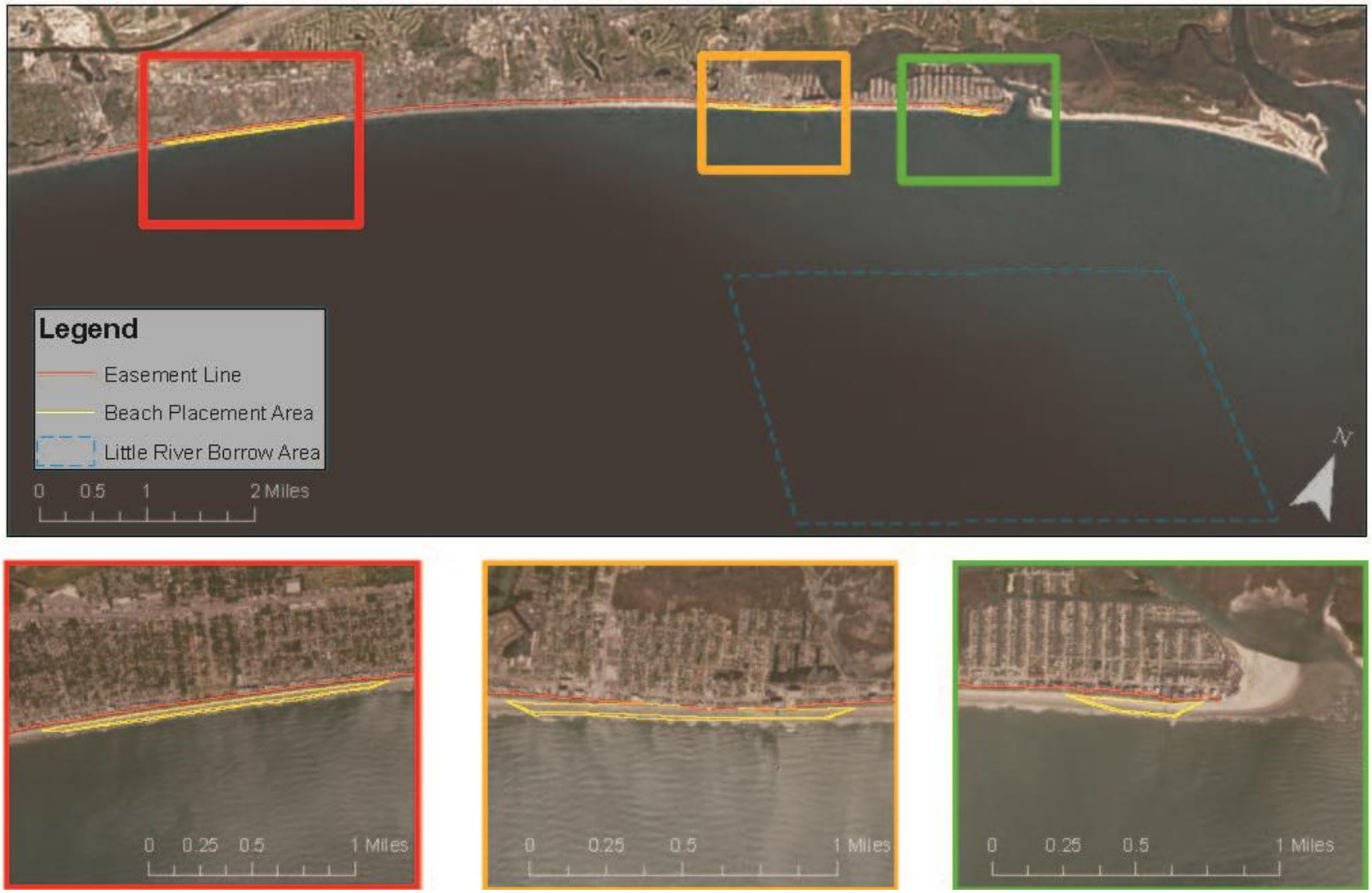

Figure 3. North Myrtle Beach (Reach 1) Project Extent and Little River Borrow Area

Coastal Carolina University performed bathymetric monitoring associated with the 2007 renourishment. Their results indicated that the borrow area used in 2007 accreted approximately 696,640 cy within 1 year post-construction with 50% of the site experiencing an elevation change of >0.5 ft and no areas experienced elevation changes of >1ft (Figure 4) (McCoy et al., 2010). SCDNR performed monitoring of the physical characteristics of the infill following construction. Results from Little River and Cane South borrow areas indicate that beach compatible material (e.g., < 10% fines) was accreting. These data indicated that the previously dredged portion of the borrow area may have recharged with beach compatible material and may be able to be used again because the borrow areas are roughly the same distance from shore and have no large estuarine sources of fine grained material. While the historic data indicate that the borrow area has sufficient quantity for this periodic nourishment effort, detailed borrow area investigations were completed to determine if the previously dredged areas have recharged with beach-compatible material.

Figure 5 shows the locations of vibracores that were drilled in 2006 by USACE, and the 2016 vibracores that were drilled by USACE contractor, American Vibracore Services (AVS). A geotechnical analysis was conducted using the subsurface data from both explorations and laboratory gradations to determine the amount of suitable beach fill material available for the nourishment project. The intent of this effort was to maximize the most efficient use of the borrow area for the continued longevity of the project. Upon completion of the geotechnical evaluation, USACE identified three potential dredging zones for the current project that meets the suitability requirements for the beach (Figure 6). The results of the geotechnical borrow area analysis are described in Section 4.8, and in Appendix 4.

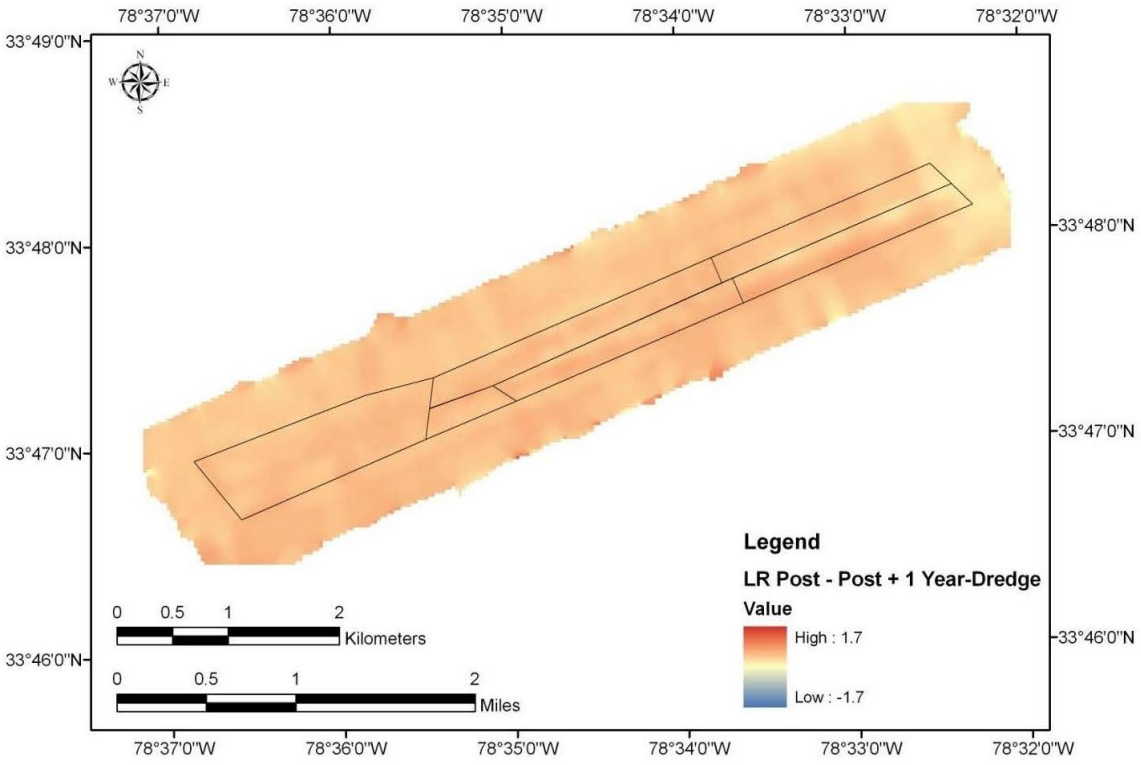

Figure 4. Little River borrow area post dredging +1 year change map (CCU 2009)

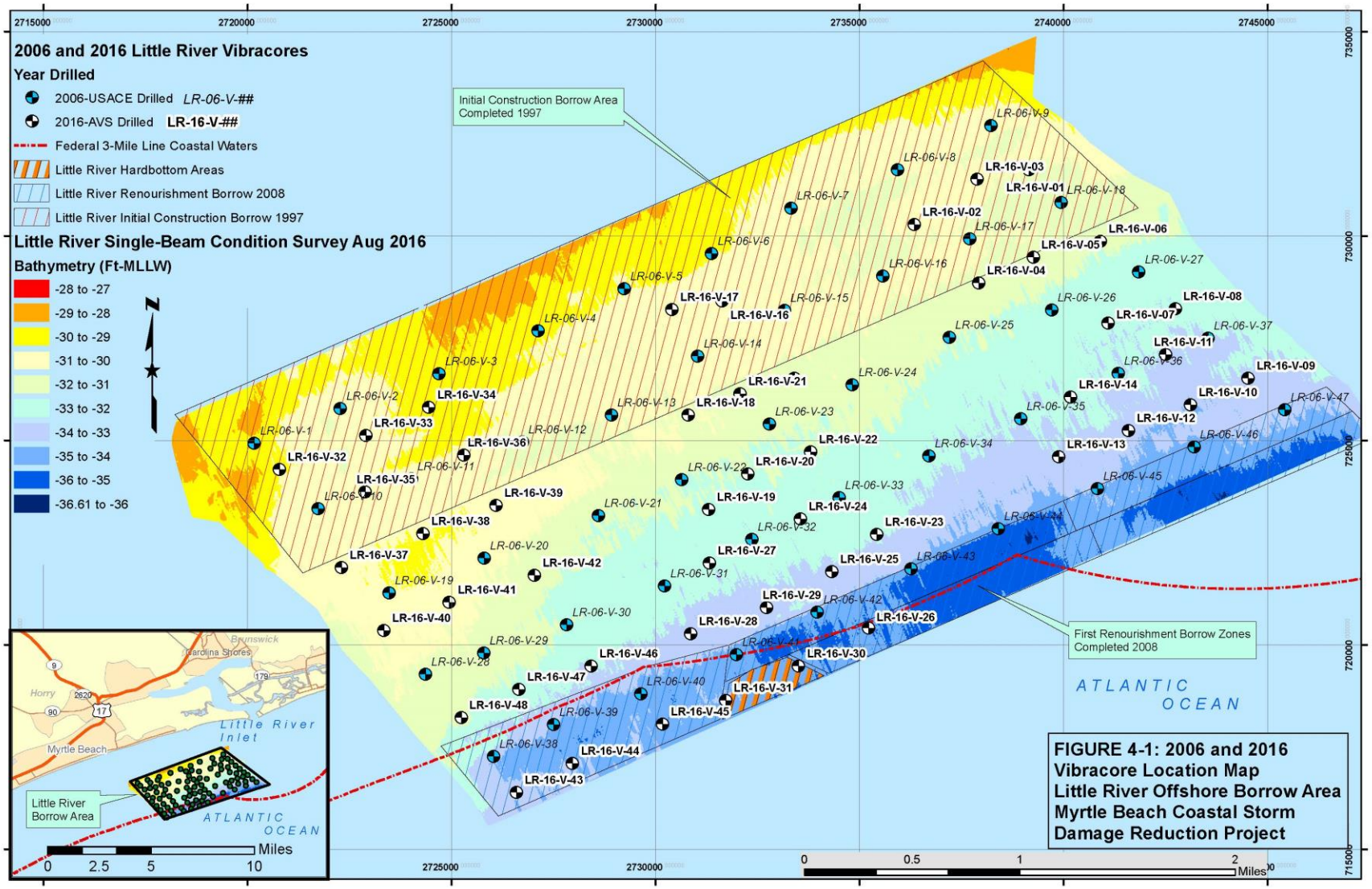

Figure 5. Vibracore Locations in Little River Borrow Area

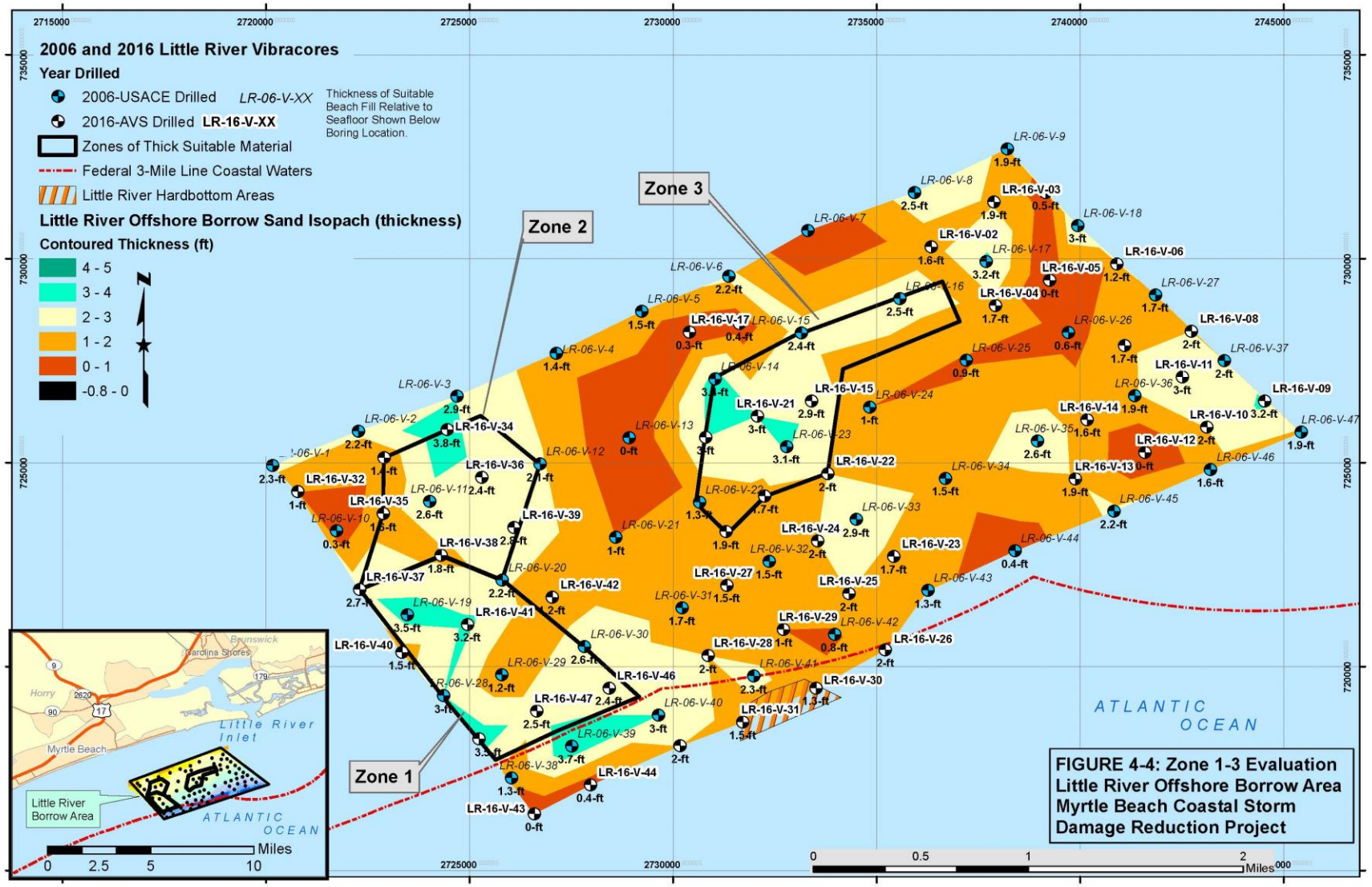

Figure 6. Refined Borrow Area for North Myrtle Beach Renourishment Project

All work is expected to be completed in the general timeframe of July 2017 - June 2018. The dredge will operate 24 hours per day, 7 days per week during construction. Both Reach 1 and Reach 3 will be constructed on the same contract and the combined time for construction of both Reaches is anticipated to be roughly 10 to 11 months. Sand fencing will be placed along the landward edge of the nourishment fill to promote dune growth (Figure 6). Native vegetation will be planted to further expedite dune formation and stabilization, as well as creating beach dune habitat. Fencing will be installed according to sea turtle friendly design standards specified in the SC Department of Health and Environmental Control – Office of Ocean and Coastal Resource Management (SCDHEC- OCRM) "How to Build a Dune" brochure (Figure 7). Similar sand fencing was completed in the 1998 project and the 2007/2008 project. Work is expected to take place only during daylight hours and a limited amount of equipment, such as small backhoes and tractors, is expected to be used on the beach. Sand fencing will be installed per the USACE Charleston District's standard design with 5.5-foot spacing between panels. The planting matrix will consist of the following plants: bitter panicum (*Panicum amarum "Northpa"*), sea oats (*Uniola paniulata*), seashore elder (*Iva imbricate*), and saltmeadow cordgrass (*Spartina patens*). Sweet grass (*Muhlenbergia "filipes")* will be planted on the toe of the backside of the dune system. The plants will be spaced two feet on center, and rows will be spaced at two to four feet depending on which plant species is in the row. Fertilizer will be placed in the hole at the time of planting.

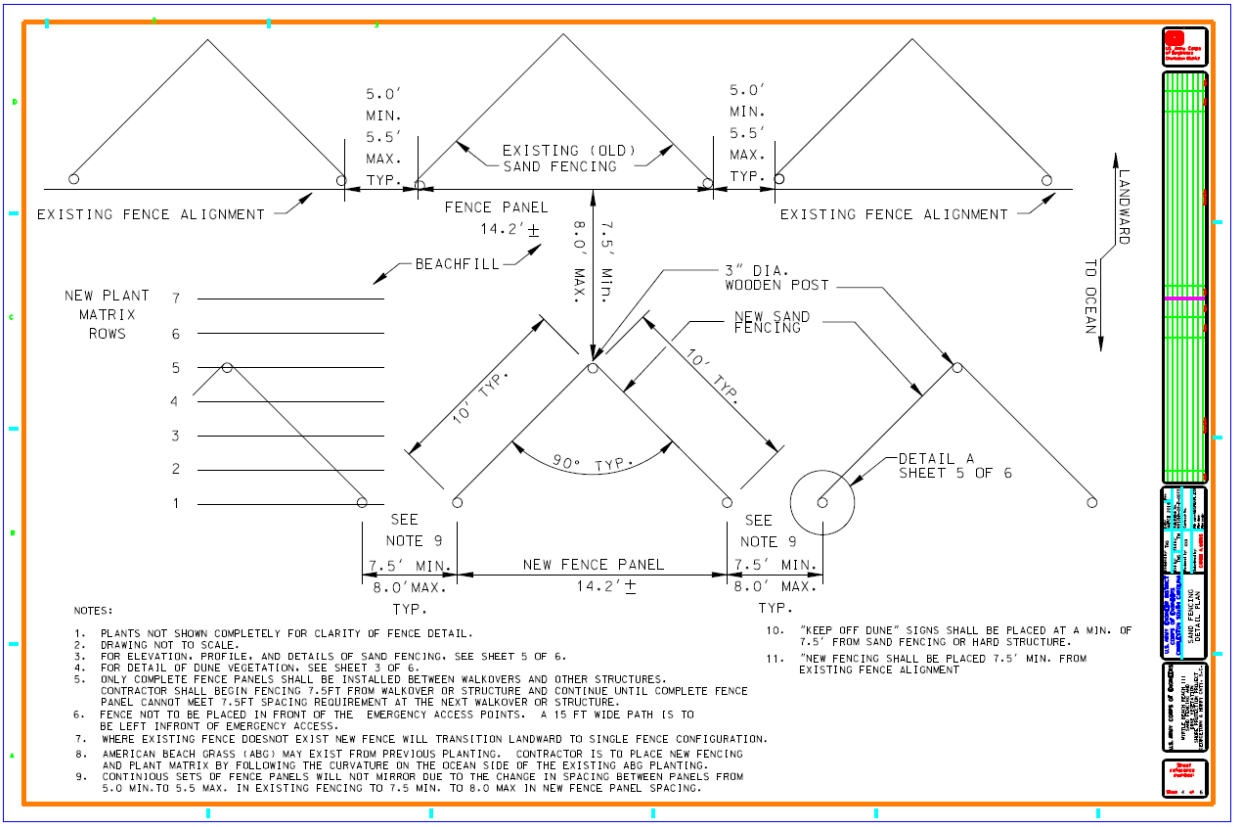

Figure 7. Sand Fencing Typical Design

This project will both protect infrastructure and restore and preserve dry sand and dune habitat used by shorebirds and endangered species, such as nesting sea turtles. Impacts of beach nourishment projects are relatively well understood. When projects are designed properly and the appropriate mitigation measures are incorporated, the impacts are limited to a minimal temporal and spatial extent.

3.0 Alternatives Analysis

As previously mentioned, an agency assessment was performed in accordance with NEPA in the early 1990's and documented within an Environmental Impact Statement (USACE, 1993a). This document fully evaluated the alternatives for the Storm Damage Reduction Project. Since the project is authorized for 50 years of Federal involvement, these alternatives are still considered valid and were not reevaluated in the 2007 Environmental Assessment, nor will they be reevaluated here. This section serves to re-evaluate the precise source of material since options are available within the existing larger borrow area.

3.1 No Action

Due to the erosion that has occurred along the Grand Strand and because of the Federal Government's commitment to renourish the beach when necessary over the life of the project, the No Action alternative was rejected.

3.2 Use Previously Un-dredged Sand from State Waters

Sufficient sand exists in the Little Riverborrow area to dredge only virgin sites in state waters. However, this alternative was eliminated from further analysis for the following reasons:

1. USACE would like to avoid dredging entirely new areas of sand within a designated borrow area if previously dredged areas have recharged with beach-compatible sands.
2. May involve greater impact to benthic habitat.
3. Does not fully consider the potential for increased erosion of the beaches due to climatological changes and effects from sea level rise. Increased erosion could increase the amount of material needed for future beach nourishments, which may not be available from un-dredged portions of the Little River borrow area.

3.3 Use Previously Un-dredged Sand from the OCS

In addition to the reasons mentioned in Section 3.2, not enough sand exists to only use previously un-dredged areas in the Little River borrow area within the OCS portion of the borrow area; therefore, this alternative was eliminated from further consideration

3.4 Use Sand from Previously Dredged Portions of Borrow Area

Not enough sand exists to only use previously dredged areas in the Little River borrow area; therefore, this alternative was eliminated from further consideration.

3.5 Combination of Previously Dredged and Un-dredged Sand from State Waters

This is the most environmentally acceptable alternative because it maximizes the opportunity to use sand that has recharged within the previously dredged areas of the Little River borrow area. It also has the least environmental impacts because it minimizes impacts to previously undredged benthic habitat.

4.0 Environmental Consequences

4.1 Water Quality

Temporary degradation of water quality will occur at both the dredging site (i.e., offshore impacts) and the nourishment site (i.e., onshore impacts) due to re-suspension of silt material. Regarding beach placement impacts, multiple studies have been conducted on past beach nourishment projects to determine the extent and duration of elevated suspended solids levels down current of a dredge's discharge pipe along the placement site. In general, elevated concentrations were limited to within an area 1,300 to 1,650 feet of the discharge pipe in the swash zone. Given that the beach fill material proposed for this project has a low amount of fine-grained sediment, it is expected that the turbidity plume generated at the placement site would be comparable to those reported in similar projects: concentrated within the swash zone, dissipating between 1,000 to 2,000 feet alongshore; and short term, only lasting several hours.

Regarding offshore impacts from dredging operations, studies of past hopper dredge projects indicate that the extent of the sediment plume is generally limited to between 1,650 to 4,000 feet from the dredge and that elevated turbidity levels are generally short-lived (on the order of an hour or less). The length and shape of the plume depend on the hydrodynamics of the water column and the sediment grain size. Usually, this plume is mostly the result of overflow of the hopper bin and not at the suction end of the dredge's drag arm. Monitoring studies done on the impacts of offshore dredging indicate that sediments suspended within the water column during offshore dredging are generally localized and rapidly dissipate or settle out when dredging ceases (Naqvi and Pullen 1982, Bowen and Marsh 1988, Van Dolah et al. 1992). Given that the dominant substrate at the borrow sites is sand, it is expected that any disturbed sediment would settle rapidly and cause less turbidity and oxygen demand than finer-grained sediments. No appreciable effects on dissolved oxygen, pH, or temperature are anticipated, because the dredged material has low levels of organics and low biological oxygen demand. Additionally, dredging activities would occur within the open ocean where the hydrodynamics of the water column are subject to mixing and exchange with oxygen-rich surface waters. Any resultant water column turbidity would be short term (i.e., present for approximately an hour) and would not be expected to extend more than several thousand feet from the dredging operation. Accordingly, it is anticipated that the project would have only minor water quality impacts at the offshore borrow areas.

The original nourishment project was granted a water quality certification by the South Carolina Department of Health and Environmental Control (SCDHEC) on November 19, 1993. On March 30, 2007, SCDHEC issued another water quality certification with the following conditions:

1. All necessary measures must be taken to prevent oil, tar, trash, debris, and other pollutants from entering the adjacent waters or wetlands during construction.

2. Only clean sand, free of all potential sources of pollution, must be used for beach nourishment.

3. Sand used for the project must consist of appropriate grain sizes to be compatible for beach nourishment.

4. Sand used must be at least 80% sand.

5. The permittee must adhere to any recommendations of the US Fish and Wildlife Service (FWS) and/or the SCDNR to protect any identified threatened and/or endangered species and the habitats of such species in the area of the proposed project.

SCDHEC has temporarily waived the requirement for water quality certification for beach nourishment projects (see Appendix 5); therefore, a new/updated water quality certification is not needed for this renourishment project. Regardless, USACE is committed to ensuring that all previous conditions will continue to be adhered to during project construction. Section 404 of the Clean Water Act (CWA) governs the discharge of dredged or fill material into waters of the U.S. Although the Corps does not process and issue permits for its own activities, The Corps authorizes its own discharges of dredged or fill material by applying all applicable substantive legal requirements, including public notice, opportunity for public hearing, NEPA, and application of the section 404(b)(1) guidelines. A 404(b)(1) evaluation was completed for this project in 1997, and the findings of this evaluation are still considered valid.

4.2 Endangered/Threatened Species

Coordination was previously conducted in compliance with the Endangered Species Act (ESA) with the submission of a Biological Assessment (BA) to the FWS in September, 2006. The FWS Biological Opinion (BO) was received in January 2007. Both documents are present in their entirety in Appendix 7. For this renourishment effort, consultation is ongoing with the FWS. A new BA was prepared and submitted to the FWS for the Reach 3 project (Appendix 2) and the USFWS issued a BO in August 2016. Consultation for Reach 1 has been initiated and USACE has requested the existing BO for Reach 3 be amended to include Reach 1. An amendment to the BO is possible due to the similarity and the proximity of the 3 Reaches of the Myrtle Beach Project. The purpose of the Biological Assessment was to evaluate new species and habitat listings since the 2007 project; based on the analysis provided in the BA, the following determinations have been made:

- It has been determined that the proposed project is not likely to adversely affect the manatee.
- It has been determined that the proposed project is not likely to adversely affect Kemp's ridley, leatherback, or hawksbill sea turtles.
- It has been determined that the proposed project will have no effect on the shortnose sturgeon.

- It has been determined that the proposed project is not likely to adversely affect the Atlantic sturgeon.
- It has been determined that the proposed project is not likely to adversely affect the piping plover.
- It has been determined that the proposed project is not likely to adversely affect the rufa red knot.
- It has been determined that the proposed project is not likely to adversely affect seabeach amaranth.
- It has been determined that the proposed project will have no effect on critical habitat for the wintering piping plover.
- It has been determined that the proposed project may adversely affect the nesting loggerhead and green sea turtle and any resulting hatchlings.
- It has been determined that the proposed project will have no effect on critical habitat for the loggerhead sea turtle.
- It has been determined that the proposed project will not adversely modify critical habitat for the North Atlantic right whale.

The following protective measures were presented in the report. Please see Appendix 2 for more details.

West Indian Manatee

When work occurs during the manatee migration period, personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing manatees. The Contractor may be held responsible for any manatee harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these specifications is a violation of the ESA and could result in prosecution of the Contractor under the ESA or the Marine Mammals Protection Act (MMPA). The standard manatee conditions will be implemented from 15 April to 31 October, if construction takes place during these months. The Contractor will be instructed to take necessary precautions to avoid any contact with manatees. If manatees are sighted within 100 yards of the dredging area, all appropriate precautions will be implemented to insure protection of the manatee. The Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than 100 yards of the manatee. Operation of equipment closer than 50 feet to a manatee will necessitate immediate shutdown of that equipment.

North Atlantic Right Whale

Since the construction is anticipated to be scheduled during the right whale migration period, personnel will be advised that there are civil and criminal penalties for harming, harassing, or killing right whales. The Contractor may be held responsible for any whale harmed, harassed, or killed as a result of vessel collisions or construction activities. Failure of the Contractor to follow these

specifications is a violation of the ESA and could result in prosecution of the Contractor under the ESA or the MMPA. The time when most right whale sightings occur in the area is December, January, and February. The Contractor will be instructed to take necessary precautions to avoid any contact with whales. If whales are sighted within 1,000 feet of the borrow area, all appropriate precautions will be implemented to ensure protection of the whale. In addition, the Contractor will stop, alter course, or maneuver as necessary to avoid operating moving equipment (including watercraft) any closer than this distance.

Sea Turtles

If work occurs during the sea turtle nesting period, in order to minimize impacts to nesting sea turtles and emerging hatchlings, a beach monitoring and nest relocation program for sea turtles will be implemented. This program will include daily patrols of sand placement areas at sunrise, relocation of any nests laid in areas to be impacted by sand placement, and monitoring of hatching success of the relocated nests. Sea turtle nests will be relocated to an area suitable to both the FWS and the SCDNR. The USACE will perform any necessary maintenance of beach profile (tilling and shaping or knocking down escarpments) during construction and prior to each nesting season.

During construction of this project, staging areas for construction equipment will be located off the beach to the maximum extent practicable. Nighttime storage of construction equipment not in use shall be off the beach to minimize disturbance to sea turtle nesting and hatching activities. In addition, all dredge pipes that are placed on the beach will be located as far landward as possible without compromising the integrity of the existing or reconstructed dune system. Temporary storage of pipes will be off the beach to the maximum extent possible. Temporary storage of pipes on the beach will be in such a manner so as to impact the least amount of nesting habitat and will likewise not compromise the integrity of the dune systems (placement of pipes perpendicular to the shoreline will be recommended as the method of storage).

During construction of this project, all on-beach lighting associated with the project will be limited to the immediate area of active construction only. Such lighting will be shielded, low-pressure sodium vapor lights to minimize illumination of the nesting beach and nearshore waters. Red filters will be placed over vehicle headlights (i.e., bulldozers, front end loaders). Lighting on offshore equipment will be similarly minimized through reduction, shielding, lowering, and appropriate placement of lights to avoid excessive illumination of the water, while meeting all US Coast Guard and Occupational Safety and Health Administration (OSHA) requirements. Shielded, low pressure sodium vapor lights will be highly recommended for lights on any offshore equipment that cannot be eliminated.

New coordination with the National Marine Fisheries Service (NMFS) with regard to marine species protected under the ESA was not conducted due to the existence of a Regional Biological Opinion (RBO) for the South Atlantic Region. The USACE previously determined that the use of a hopper dredge may adversely affect sea turtles. NMFS has concurred with this determination in their 1995/1997 RBO and July 30, 2009, concurrence, and determined that take resulting from hopper dredging activity will not jeopardize the continued existence of any sea turtle species. The USACE is

notifying NMFS of its intent to utilize the RBO for this proposed renourishment. The RBO addresses dredging operations and provides guidance and requirements on a state by state basis. The RBO and the terms and conditions outlined within it can be viewed via the internet at: http://155.82.164.219/Applications/OPJ/A067_DQM/ODESS/ODESS_Public/documents/1997SADBO.pdf.

The USACE determination is that the proposed project will either have "no effect" or "is not likely to adversely affect" all listed species except for the loggerhead and green sea turtle. Because the beach nourishment work may impact nesting sea turtles or emerging hatchlings, we determined that the proposed project "may effect and is likely to adversely affect" the loggerhead sea turtle; however, we do not believe the proposed project will jeopardize the species.

4.3 Coastal Zone Consistency (CZC)

The Coastal Zone Management Act (CZMA), passed in 1972, provides for the management of the nation's coastal resources by balancing economic development with environmental conservation. The goal of the CZMA is to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." The CZMA applies to many different federal actions including federal agency activities, federal license or permit activities, outer continental shelf plans, and federally assisted state projects. The CZMA promotes cooperation and coordination between states and the federal government in order to promote federal consistency and protect our nation's coastal resources.

The existing Myrtle Beach Storm Damage Reduction Project satisfied the restrictions and guidelines of the South Carolina Coastal Management Program pursuant to the Coastal Zone Management Act (CZMA). The 2007 project also received a Coastal Zone Consistency Determination on April 24, 2006. Since it has been approximately ten years since the last coordination with the agency (SCDHEC-OCRM) that enforces the provisions of CZMA in South Carolina, a letter of intent (Appendix 3), and project information is being provided to SCDHEC- OCRM .

Pursuant to the Act, and to associated Code of Federal Regulations, Title 15, Part 930, the Planning Branch of the Charleston District United States Army Corps of Engineers (USACE) requested concurrence with the determination that the project was consistent to the maximum extent practicable with the enforceable policies of South Carolina Coastal Zone Management Program (SCCZMP). This determination was based on an analysis of the project with the applicable enforceable resource policies of the SCCZMP and included: (1) Wildlife and Fisheries Management, (2) Dredging, (3) Erosion Control, (4) Activities in Areas of Special Resource Significance, (5) Beach and Shoreline Access, and the (6) Geographic Areas of Particular Concern. Additionally, the public participation guidelines as outlined in 15 C.F.R. 930.42, are being met by the USACE and SCDHEC joint public notices inviting public comment for 30 days.

4.4 Coastal Barrier Resources System (CBRS)

Reach 1 (North Myrtle Beach) contains a small part of CBRS Long Pond Unit SC-01. Due to the design of the current project no material will be placed within or taken from the CBRS Long Pond Unit SC-01.

4.5 Essential Fish Habitat (EFH)

An EFH Assessment was completed for the 2007 project as required by the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended through 1996 (Magnuson-Stevens Act). The objectives of this EFH Assessment were to describe how the actions of the USACE, their non-Federal sponsors, and BOEM potentially influence the quality of habitat designated by NMFS and the South Atlantic Fisheries Management Council (SAFMC). The EFH Assessment describes fish, coral, and benthic species common to the sandy borrow and nearshore areas and hardbottom habitats and discusses the potential impacts of the proposed action on those species. The EFH Assessment and the Conservation Recommendations from NMFS are contained in Appendix 7. NMFS responded to the EFH Assessment by letter stating that:

> *Beaches and nearshore areas along the Grand Strand provide habitat for numerous species that serve as prey for finfish and crustaceans that have economic and recreational importance, such as southern flounder (*Paralichthys lethostigma*), Florida pompano (*Trachinotus carolinus*), summer flounder (*Paralichthys dentatus*), red drum (*Sciaenops ocellatus*), spot (*Leiostomus xanthurus*), bluefish (*Pomatomus saltatrix*), white shrimp (*Litopenaeus setiferus*), and blue crab (*Callinectes sapidus*). Sea turtles also are common in the nearshore coastal waters of the project area, and the beach is used by sea turtles, including the threatened loggerhead sea turtle (*Caretta caretta*), for nesting. The influx of transient fauna and heightened biological activity in the late spring and summer through late fall necessitates certain work limitations if significant harm to living marine resources is to be avoided. Ideally, beach nourishment should be restricted to winter months when possible.*
>
> *The South Atlantic Fishery Management Council (SAFMC) provides detailed information on types and locations of EFH in a comprehensive amendment that applies to all fishery management plans prepared by the SAFMC. The amendment was prepared in 1998 as required by the Magnuson-Stevens Act. SAFMC has identified the surf zone of ocean beaches as EFH for sub adult and adult red drum. As juvenile red drum develop into sub adults and adults, they utilize and become concentrated in progressively higher salinity estuarine and beachfront surf zones where their prey is most abundant. Areas of hard bottom habitat also are present within the project area, and the SAFMC has designated hard bottom habitat as EFH for snapper-grouper species and coastal migratory pelagic species. The importance of hard bottom habitat is also addressed in the SAFMC's policy (dated March 2003) on protecting EFH from large-scale coastal engineering projects, which stresses the importance of examining cumulative impacts to this EFH.*

In 2007, NMFS concluded that adverse impacts were likely to result from the nourishment project and provided 4 conservation recommendations. USACE responded to these

recommendations with the following measures to avoid, mitigate or offset adverse impacts of the project:

1. *"To the extent practicable, construction activities will take place in seasons of limited biological activity. Currently, the plan is to begin construction in the month of November, 2007. This date was chosen in an attempt to avoid seasonal activity of certain biological resources. Constraints associated with the cost and time of building this project make it impractical to perform construction only during the December to April window as recommended.*

2. *No-dredging buffers of at least 600 feet have been prescribed around all hard bottom areas within the defined borrow sites. This prohibition extends to mooring, anchoring, laying of submerged pipeline, and lowering of spuds within the exclusion zone. In addition, all areas of the defined Essential Fish Habitat-Habitat Area of Particular Concern known as Hurl Rocks have been given the same protections.*

3. *The Charleston District has gone to great lengths to identify suitable borrow material that is compatible with the existing beach material. Methods employed to identify compatible sands include side scan sonar and vibra-core borings. In addition, it has been stipulated that unsuitable material (clay, mud, and debris) that is inadvertently dredged will be removed from the disposal area and disposed of in an approved land fill.*

4. *As your review has affirmed, the Charleston District has gone to significant lengths and expense to identify and document impacts to EFH before, during, and after the nourishment cycle. After the final report by the South Carolina Department of Natural Resources, if it is determined that significant impacts to EFH have occurred as a result of this project, the Charleston District will consult with NMFS to determine the appropriate action."*

A four-year study by the CCU Center for Marine and Wetland Studies in association with the SCDNR and USACE concluded that offshore habitats had not been significantly impacted by dredging conducted for the initial beach fill (McCoy et al., 2011). The study found that while some areas of hard bottom experienced deposition and burial, other hard bottom habitats were uncovered due to erosion of their surface sediments. Consequently, the dredging and placement activities were found to have only marginally greater impacts on hard bottom habitat than the system's own natural variability (Ojeda et. al, 2001).

The Grand Strand hosts one of the few significant aggregations of nearshore hard bottom habitats in South Carolina, portions of which are considered EFH (e.g., Hurl Rocks), as defined in the Magnuson-Stevens Fishery Conservation and Management Act. Monitoring associated with the 2007/2008 renourishment project was conducted one year pre-nourishment and one year post-nourishment to assess impacts of migrating beach fill on habitat-structuring invertebrate communities in these hard bottom areas (Burgess et al., 2011). Twenty-one sites were established in two parallel strata extending from approximately one kilometer (km) north of the Myrtle Beach State Park to approximately five km south of the park using a Before-After-Impact-Reference design. Stations directly adjacent to the unnourished park shoreline were designated as "reference," and

stations along the nourished beach north and south of the park were designated as "impact." Each station was equipped with a biological monitoring array containing eight settlement tiles and four hard bottom monitoring transects. The tiles were deployed on a steel frame in the fall of 2007 and replaced every six or twelve months through the fall of 2009. The tiles were retrieved and analyzed for total surface cover of various sessile invertebrate taxa. At each site, four 5.0-meter transects were video surveyed, and sessile fauna in the video were identified to the lowest practical taxonomic or structural/functional group. Invertebrate communities on recruitment tiles were dominated by early-successional, fast-growing taxa such as tubiculous polychaetes, bryozoans, hydroids, amphipods, and bivalves.

Both recruitment and video data were analyzed using Analysis of Variance (ANOVA) to determine whether invertebrate recruitment at impact and reference areas responded differently between the before and after time periods. The amount of total surface cover on recruitment tiles was greater after nourishment than before nourishment and was generally greater overall at stations adjacent to nourished sections of the beach. Several specific taxa present in some recruitment tile sub-habitats (e.g., top versus bottom surface, high versus low elevation) showed a pattern of differential recruitment success between the reference and impact areas following nourishment; however, these responses were not consistent across taxa or sub-habitats. Invertebrate communities on natural hard bottoms were dominated by slow-growing, late-successional octocorals and sponges. All of these taxa showed a tendency to increase in density at reference areas following nourishment while decreasing or remaining constant at the impact areas. None of these changes were statistically significant, likely due to very strong spatial and temporal variability in hard bottom communities in the region. Overall, there was little statistically significant evidence to suggest that invertebrate recruitment or community composition were impacted within one year of the completion of nourishment. The SCDNR monitoring report suggested that future efforts to examine the impacts of nourishment on the hard bottoms of the Grand Strand should reduce study complexity (types and configurations of deployments) and increase sample size to improve impact detection.

Since the proposed project is similar in scope and impacts as the 2007 project and based on post-project monitoring, no significant changes to EFH have occurred since the last project, USACE considers the EFH conservation recommendations to still be valid.

4.6 Archeological and Cultural Resources

Federal undertakings will comply with the Archaeological and Historical Preservation Act of 1974 (16 USC 469-469c), the Abandoned Shipwreck Act of 1987 (PL 100-298; 43 USC 2101- 2106), The National Historic Preservation Act of 1966, as amended (54 USC 2106) and the Advisory Council on Historic Preservation's implementing regulations 36 CFR Part 800 (protection of Historic Properties). Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to provide the Advisory Council on Historic Preservation with a reasonable opportunity to comment on a Federal undertaking. The placement of sand on beaches and the use of sand from offshore borrow areas are typically subjected to cultural resources investigations in order to locate potentially significant resources, including historic properties for purposes of NHPA Section 106 review. Previous investigations revealed that there are no historical or archaeological resources within the beach

nourishment zone which would be affected by the placement and movement of sand. In 2006, an archaeological survey was completed for the Little River borrow area. The Litter river borrow area had 3 targets that appear to have little potential to be associated with significant cultural resources. These targets were not recommended for additional underwater investigation or mitigation. In a letter dated April 19, 2007, the State Historic Preservation Officer (SHPO) concurred with this approach and provided a NHPA Section 106 concurrence, which is still considered valid. If any new areas will be dredged, archaeological investigations will occur and the SHPO will be consulted for compliance with Section 106 of the NHPA.

4.7 Beach Benthic Impacts

Due to the handling and pumping activities, the dredged sand would likely be devoid of live benthos. As a result, the recovery of benthos at the placement area would rely on immigration of adult organisms from adjacent undisturbed areas, as well as larval colonization from the water column. However, raising the elevation of the existing beach from intertidal to dry beach would effectively limit the landward extent of water-driven organismal transport. In the longer term, the re-establishment of an elevated beach berm would reduce the extent of the more biologically diverse intertidal zone.

Recovery time of benthos within the surf zone is expected to be more rapid than the offshore borrow area given the dynamic conditions within the nearshore and surf zones. Studies have shown that the recovery time for benthos ranged from approximately two to six months when there is a good match between the fill material and the natural beach sediment. In the case of the proposed project, the fill material would not be substantially different (though slightly coarser) than native material; therefore, it is expected that recovery time would be similar to the two to six month estimate.

In a monitoring program performed along with the 2007 nourishment project (Bergquist et al., 2011a), the Surfside/Garden City section was evaluated to determine the impact on, and recovery of, sediment characteristics and a dominant beach indicator species, the ghost crab *Ocypode quadrata*. The Little River borrow area was not studied due to limited resources at the time, but the results are presented here because the locations of the borrow areas are similar in physical and biological environments and are also within the Long Bay area of South Carolina. The sediment characteristics and ghost crab population densities and size structures were studied at two stations representing nourished beach bounded by two stations representing non-nourished reference beach using a Before-After-Control-Impact (BACI) study design. Sediments became coarser and shellier in both nourished and reference areas following renourishment, suggesting the changes were due to background changes in sediment characteristics rather than to the placement of beach fill. All sediment characteristics post-nourishment were well within the range that is typical for Grand Strand beaches further indicating either a good match of borrow area sediments to pre-nourishment beach sediment or recovery of beach sediment to pre-nourishment conditions within three months. Overall densities of ghost crabs as well as adult, juvenile, and new juvenile size classes indicated few differences in the responses of nourished and reference areas following nourishment. The data collected here indicated that factors other than renouishment may have been more important in

determining changes in ghost crab densities over the course of this study. Two recommendations were suggested based on study outcomes: 1) maintain the careful matching of borrow sediments to the receiving beach, and 2) focus future environmental monitoring efforts on addressing the consequences of the sediment and/or biological changes detected in this and similar monitoring programs. Results of this monitoring effort confirm that impacts of beach nourishment on invertebrate species is short term and relatively minor, especially for ghost crab populations.

4.8 Borrow Area Compatibility Analysis and Selection

USACE performed a geotechnical evaluation of the Little River borrow area in order verify material quality and characteristics and to determine the available volume of high-quality beach fill material for the upcoming nourishment contract. The details of this evaluation can be found in Appendix 4. The analysis consisted of re-evaluating the existing 2006 vibracore data against 2016 bathymetric data, and evaluating 48 vibracores collected in 2016. These new vibracores were collected in December 2016 by American Vibracore Services (AVS) using a pneumatic vibracore machine with a 4-inch diameter steel sampling barrel. The cores were advanced to 20 ft depth or until vibracore refusal was encountered. Generally, the cores met refusal within 5-feet of penetration into the seafloor. The 2016 core locations were surveyed utilizing Real Time Kinematic (RTK) Global Positioning System (GPS) to accuracies within 0.2 feet vertically and horizontally. All cores were split open, photographed, logged and visually classified in accordance with the Unified Soil Classification System. Draft logs were provided to USACE for sample interval selection. Visually classified granular sediment that lie within the possible dredging prism were selected for gradation testing. A total of 120 samples selected for gradation testing to verify field classification (American Society for Testing and Materials [ASTM] D2487), determine particle size distribution (ASTM 6913), and percent shell, limestone and fines passing the #200 sieve. A limited number of silty or clayey sand samples were designated for additional hydrometer analysis (ASTM D422-63). The laboratory and field data were then reconsolidated by USACE and evaluated in-house using gINT and ArcGIS software to determine the vertical and horizontal spatial relationships of the subsurface strata.

Three areas (designated Zones 1 through 3 on Figure 6) were found that have the thickest deposits of suitable beach fill material. Generally within these zones, suitable beach fill lies above -33 to -32 feet MLLW. Below these elevations, the presence of clay and silt deposits are predominant. Additional details of this analysis can found in Appendix 4. The character of materials in Zones 1-3 is summarized as follows:

Zone 1: % Sand (passing #10 Sieve) = 91.5%
% Fines (passing #200 Sieve) = 1.9%
% Shell = 3.8%
% Limestone < 1.0%
Standard Deviation 1.29

Zone 2: % Sand (passing #10 Sieve) = 89.8%
% Fines passing #200 Sieve = 3.0%
% Shell = 3.6%
% Limestone < 1.0%

Standard Deviation 1.43

Zone 3: % Sand (passing #10 Sieve) = 95.3%
% Fines passing #200 Sieve = 2.7%
% Shell = 1.4%
% Limestone < 1.0%
Standard Deviation 1.05

4.9 Borrow Area Benthic Impacts

Understanding the impacts and recovery of borrow sites is important in the long term management of offshore sand resources. An impact analysis was conducted as part of the 2007 project in order to address potential changes that may occur in the project area resulting from excavating material from within the identified borrow areas. This analysis focused on impacts to coastal processes by using the steadystate spectral wave model (STWAVE), and concluded that the wave height changes and effects on coastal processes were not significant.

Dredging of sediments from borrow areas, whether in state waters or within the OCS, will remove benthic marine invertebrates. Polychaetes, amphipods, oliogchaetes, pelecycpods, and decapods are major infaunal assemblages inhabiting the borrow areas. Sessile benthic organisms may be buried by resuspended and redeposited sandy sediments. Hardbottom areas in and adjacent to the borrow areas, that support complex communities described above, have been identified by surveys performed in 2005 and will be avoided.

Recovery of infaunal communities after dredging has been shown to occur through larval transport of recruits from adjacent areas, along with juvenile and adult settlement, but can vary based on several factors including seasonality, habitat type, size of disturbance, and species' life history characteristics (e.g., larval development mode, sediment depth distribution). Although studies have shown that while recovery rates are variable, the abundance and diversity of benthic infauna within the borrow areas frequently returns to pre-nourishment levels relatively quickly, often within post-dredging recovery periods of 1 to 2 years. Most studies indicate that dredging had only temporary effects on the infaunal community, and in some studies, differences in infaunal communities were attributed to seasonal variability or to hurricanes rather than to dredging.

In a study performed following the 2007/2008 nourishment project, the Cane South and Little River borrow areas were evaluated for both surficial sediment composition and benthic community recovery (Bergquist et al., 2011b). The study used a BACI design in order to document the changes in two of the borrow areas used for the renourishment project relative to a non-impacted control site. All areas were sampled multiple times before and after dredging in order to assess the recovery of the resources. Samples were analyzed for percent sand, silt, clay, $CaCO_3$, organic matter content, and sand grain size distribution. The remainder of each sample was analyzed for the benthic community structure. Each benthic infauna sample was sieved, preserved, and identified to the lowest taxonomic level under microscopes.

The borrow areas responded differently to dredging. The Little River borrow area experienced minor changes in sediment composition. The Cane South borrow area saw a significant

increase in silt/clay content, sand phi size, and organic matter after dredging relative to the reference area. After twelve months post-dredging, the differences between the reference area and the borrow area were no longer significant. The changes in sediment composition at both areas were similar to those changes that occurred during the 1996 initial nourishment project. In 1996, Cane South was dredged with a pipeline cutterhead dredge. Jutte et al. (1999) hypothesized that the cutterhead dredge excavates deeper holes which leaves little native surficial sediments and inhibits recovery. A hopper dredge excavates shallow cuts and can leave ridges that can facilitate quicker recovery of the borrow area. The 2007 project used a hopper dredge at all borrow areas which suggests that other factors could play into borrow area recovery, such as season, local sediment characteristics, oceanographic conditions, etc. The changes in sediment characteristics in both borrow areas were smaller than many other southeastern US borrow areas (Bergquist et al. 2011b). This could have to do with the lack of a large estuarine source of fine material. The sediment characteristics measured in the Grand Strand borrow areas during the current study generally fell within the range of values typical of offshore sand deposits in the region (Bergquist et al. 2011b, Jutte et al 1999, 2001a,b).

4.10 Hazardous, Toxic and Radioactive Waste (HTRW)

There are currently no known HTRW producers adjacent to the project site or any entity that discharges toxic effluent nearby. Since the project has been constructed multiple times, there is minimal risk of encountering HTRW on the beach face or in the borrow area.

4.11 Air, Noise, and Aesthetics

These issues were addressed in the 1993 EIS (Appendix 7) and while the findings are still considered valid, they are re-analyzed here to update the documentation. Temporary increases in exhaust emissions from construction equipment are expected during the construction of the proposed project at North Myrtle Beach; however, the pollution produced would be similar to that produced by other large pieces of machinery and would be readily dispersed. All dredges must comply with the applicable US Environmental Protection Agency (EPA) standards. The air quality in Horry and Georgetown Counties, South Carolina, is designated as an attainment area. A conformity determination is not required for this project because of the following reasons: 1) it is located in an attainment area; 2) the direct and indirect emissions from the project fall below the prescribed de minimus levels; and 3) the ambient air quality for the impacted Counties has been determined to be in compliance with the National Ambient Air Quality Standards.

Noise in the outside environment associated with beach construction activities would be expected to minimally exceed normal ambient noise in the project area. However, construction noise would be attenuated by background sounds from wind and surf. In-water noise would be expected in association with the dredging activities. Specifically, noise associated with dredging could occur from (1) ship/machinery noise—noise associated with onboard machinery and propeller and thruster noise, (2) pump noise—noise associated with pump driving the suction through the pipe, (3) collection noise—noise associated with the operation and collection of material on the sea floor, (4)

deposition noise—noise associated with the placement of the material within the barge or hopper, and (5) transport noise—noise associated with transport of material up the suction pipe.

Reine et al. (2012) found that the majority of underwater sounds produced by hydraulic cutterhead dredging operations were of relatively low frequency (< 1000 Hz). Their study was conducted during rock fragmentation and therefore represented a worst case scenario. The source level was estimated to be between 170 and 175 dB re 1uPa@1-m. These sound levels decreased with increasing distance from the source. The authors determined that the area of influence was limited to less than 100 m from the source. At 100 m, received levels were less than 150 dB re 1uPa rms. NMFS is developing new guidelines for determining sound pressure level thresholds for fish and marine mammals. However, based on existing studies, NMFS' current thresholds for determining impacts to marine mammals is between 180 and 190 dB re 1 uPa for potential injury to cetaceans and pinnipeds respectively, and 160 dB re 1 uPa for behavioral disturbance/harassment from an impulsive noise source, and 120 dB re 1 uPa from a continuous source. Reine et al. (2012) found that the 120 dB re 1uPa proposed threshold was exceeded by ambient noises in their study area. Based on reviews by Popper et al. (2006) and Southall et al. (2007), it is unlikely that underwater sound from conventional dredging operations can cause physical injury to fish species.

Aesthetics will not be impacted because the project is the continuation of a long term storm damage reduction project and is only designed to rebuild the originally constructed beach, so the presence of construction equipment both offshore and on the beach would be temporary.

4.12 Irreversible and Irretrievable Commitments

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. Other than the use of fuel, equipment and supplies, there would be no irreversible commitment of resources.

4.13 Cumulative Impacts

Cumulative impacts were fully evaluated in the 2007 EA. The following paragraph summarizes the conclusion of that impact assessment:

> *"A relatively small segment of the South Carolina coastline and nearshore, including the borrow areas, are likely to be affected by the proposed action. The impact area would not increase significantly since portions of the areas proposed for dredging and fill have previously been dredged or had sand deposition. On a statewide scale, the existing and approved placement sites are well distributed in northern, central and southern parts of the state. 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, statewide, and basin basis. Also, for some species, such as sea turtles and seabeach amaranth, beach projects may provide additional habitat or improve existing habitat by replacing beach material lost to erosion. Invertebrates are expected to recover in and adjacent to the borrow areas."*

4.14 Environmental Monitoring

For the 2007/2008 project, coordination with NMFS and SCDNR resulted in an agreement to monitor biological recovery and hard-bottom habitat impacts for two years post-construction. The purpose of this sampling and analysis was threefold:

- Document changes in beach profile and determine the ecological impacts on and recovery rates of sediment characteristics and burrowing ghost crabs on nourished beaches.
- Determine the impacts on nearshore hard-bottom habitats and biological recruitment to those habitats.
- Document the impacts on and recovery of native bathymetry, sediment characteristics, and benthic infaunal communities in sand borrow areas

Where funding is possible, USACE will coordinate a monitoring effort to:

1. Determine the impacts of dredging on fish and turtle use of the borrow area and surrounding areas prior to, during and 1 to 1.5 years after dredging, and
2. Perform bathymetric and habitat mapping to assess and identify hard bottom habitats and sand resources within and surrounding the proposed borrow area.
3. Track the movement of nearshore sediments to better understand the evolution of the nourishment project.

5.0 Conclusions

The proposed action does not involve a substantial change to the project that is relevant to environmental concerns, nor are there significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, such that a supplemental EIS is required pursuant to 40 CFR 1502.9(c). Because the proposed nourishment action for the broader project will not significantly affecting the quality of the human environment, the Corps intends to issue a Finding of No Significant Impact (FONSI).

6.0 References

Bergquist, Derk C., Stacie E. Crowe, and Martin V. Levisen. 2011a. The 2007-2009 Grand Strand Renourishment Project: Responses of sediment characteristics and a macroinvertebrate indicator species, *Ocypode quadrata*. Submitted to: US Army Corps of Engineers, Charleston District, Prepared by: Marine Resources Research Institute, Marine Resources Division, SC Department of Natural Resources.

Bergquist, Derk C., Stacie E. Crowe, and Martin V. Levisen. 2011b. The 2007-2009 Grand Strand Renourishment Project: Physical and biological responses of the Little River and Cane South Borrow Areas to dredging. Submitted to: US Army Corps of Engineers, Charleston District, Prepared by: Marine Resources Research Institute, Marine Resources Division, SC Department of Natural Resources.

Burgess, Dany E., George H.M. Riekerk, and Derk C. Bergquist. 2011. The 2007-2009 Grand Strand Renourishment Project: Impact of sand migration on invertebrate communities associated with nearshore hardbottom habitats. Submitted to: US Army Corps of Engineers, Charleston District, Prepared by: Marine Resources Research Institute, Marine Resources Division, SC Department of Natural Resources.

Bowen, P.R., and G.A. Marsh. 1988. *Benthic Faunal Colonization of an Offshore Borrow Pit in Southeastern Florida*. Misc. Rept. D-88-5. U.S. Army Corps of Engineers, Dredging Operations Technical Support program, Vicksburg, MS.

Hackney, C.T., M.H. Posey, S.W. Ross, and A.R. Norris. 1996. A review and synthesis of data on surf zone fishes and invertebrates in the south Atlantic Bight and the potential impacts from beach nourishment. USACE, Wilmington District, Wilmington, North Carolina. 111 p.

Jutte, P.C., R.F. Van Dolah, and M.V Levisen. 1999. An environmental monitoring study of the Myrtle Beach renourishment project: physical and biological assessment of offshore sand borrow site, Phase I—Cherry Grove borrow area. Final Report, prepared by the South Carolina Marine Resources Research Institute, South Carolina Marine Resources Division, Charleston, SC for the US Army Corps of Engineers, Charleston District. 79pp.

Jutte, P.C. and R.F. Van Dolah, 2000. An assessment of benthic infaunal assemblages and sediments in the Joiner Bank and Gaskin Banks borrow areas for the Hilton Head renourishment project. Final Report, Marine Resources Research Institute, South Carolina Department of Natural Resources. 34 pp + appendices.

Jutte, P.C., R.F. Van Dolah, and P.T. Gayes, 2002. Recovery of benthic communities following offshore dredging, Myrtle Beach, South Carolina. Shore & Beach, 70(3), 25-30.

McCoy, Clay, Jenna Hill, Paul Gayes, Jeff Marshall, Shinobu Okano, Brian Johnson, Matthew Howe, Shannon Klotsko. 2010. 2007 – 2010 Grand Strand Beach Nourishment Study: Final Report. Submitted to: US Army Corps of Engineers, Charleston District, Submitted by: Burroughs and Chapin Center for Marine and Wetland Studies, Coastal Carolina University. September 2010.

Minerals Management Service, 1996. Environmental Assessment for Issuance of a Noncompetitive Lease for Surfside Borrow Area, Myrtle Beach, South Carolina Shore Protection Project.

Naqvi, S.M., and C.H. Pullen. 1982. *Effects of beach nourishment and borrowing on marine organisms*. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Misc. Rept. 82-14. Vicksburg, MS.

Popper, A., Carlson, T., Hawkins, A., and B. Southall. 2006. Interim criteria for injury of fish exposed to pile driving operations: a white paper, available at http://www.wsdot.wa.gov/NR/rdonlyres/84A6313A-9297-42C9-BFA6-750A691E1DB3/0/BA PileDrivingCriteria.pdf.

Reine, Kevin J., Douglas Clarke and Charles Dickerson. 2012. Characterization of underwater sounds produced by a hydraulic cutterhead dredge fracturing limestone rock. ERDC-TN-DOER-XXX. January 2012.

Southall, B.I. Bowles, A.E., Elison, W.T., Finneran, J.J., Gentry, R.L., Greene, C.R.J., Kastak, D., Ketten, D.R., Miller, J.H., Hachtigall, P.E., Richardson, W.J., Thomas, J.A., and P. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquatic Mammals 33:411-521.

U.S. Army Corps of Engineers, 1987. Myrtle Beach and Vicinity Shoreline Protection Project, Horry and Georgetown Counties, South Carolina Final Feasibility Report on Storm Damage Reduction.

U.S. Army Corps of Engineers, 1993a. Myrtle Beach and Vicinity Shoreline Protection Project, Horry and Georgetown Counties, South Carolina Final Environmental Impact Statement.

U.S. Army Corps of Engineers, 1993b. General Design Memorandum: Myrtle Beach, South Carolina Shore Project Project.

Van Dolah, R.F., P.H. Wendt, R.M. Martore, M.V. Levisen, and W.A. Roumillat. 1992. A Physical and Biological Monitoring Study of the Hilton Head Beach Nourishment Project. Final Report, prepared for the Town of Hilton Head Island and the South Carolina Coastal Council.